THE LONDON WATER COMPANIES AT THE INTERNATIONAL HEALTH EXHIBITION.

No. I.

Under the energetic organisation of Lieut.-Col. Sir Francis Bolton, the eight London water companies have combined to exhibit, in a pavilion specially set apart for them, a very comprehensive set of drawings, views, and tables, showing the extent and magnitude of their works, and giving statistics of their operations, together with models of machinery, and examples of valves, pipes, meters, and a multitude of other appliances necessary for the carrying on of their business. It is with this portion of the Exhibition that we now propose to deal. In plan the building is an octagon, and each of the companies has an eighth part of the space, the centre being occupied by a handsome fountain. The inside of the main building is entirely devoted to statistics and drawings, while specimens and models are displayed in an outer corridor, where the same principle of division has been observed as in the octagon, the name of each company and its sources of supply being conspicuously posted up in the several sections. The main entrance to the corridor is through an arch constructed of ordinary socket pipes, and the corridor communicates with the main building by four openings, with drinking fountains on each side, in which an excellent effect has been obtained by the use of long vertical glass tubes, through which water is continually permitted to trickle. Each company has one fountain, so that within the compass of a few yards comparison can be made between the eight different qualities of water supplied in the metropolis, though we believe, so far, that the water-drinking public visiting the Exhibition has been unable to detect any difference between the much abused Thames water and the much lauded supply from the chalk. We do not, however, purpose entering into controversial matters such as these, and we pass on to notice the method of distribution, in relation to the constant supply by meter in place of an annual charge, about which so much has been lately heard. The annexed table gives some details of the present supply by the various companies, and from it it will be seen that there is considerable variation in the different districts, the percentage of houses on constant supply being 7·8 in the case of the Southwark and Vauxhall Company, and 83·5 in that of the East London Company.

The constant supply system is of advantage both to the water company and the consumer. To the former chiefly on account of the prevention of waste, and to the latter as it ensures only the precise quantity used being charged for, and permits the entire abolition of the house storage system, which is required with an intermittent supply.

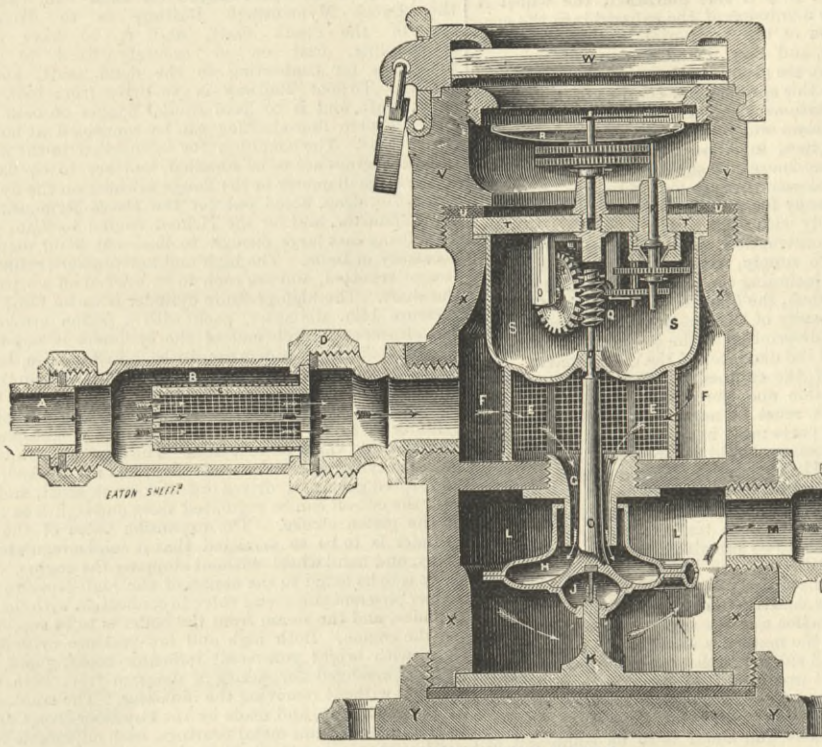


Fig. 1—SIEMENS' WATER METER.

An efficient water-measuring machine is therefore a valuable instrument, and we are not surprised to find that considerable space has been devoted to the exhibition of such apparatus. Meters may roughly be divided into two classes, viz., those for dealing with a flow of water without being subjected to pressure—such, for instance, as is necessary for registering the delivery of water into an open cistern or tank—and those in which the water is passed through and discharged under whatever pressure exists in the main or service pipe. Of the first class we do not propose to say much. There are several instruments of considerable accuracy in use, but their application is limited. Parkinson's meter is one of those best known, and it consists of a light metal drum divided into compartments which are successively filled by the entering water, the drum revolving according to the rate of supply, and so registering the consumption on a suitable index. High-pressure meters may themselves be subdivided into two distinct types, viz., those known as inferential, and those having a positive action, the great desiderata in either being absolute accuracy in registration under variations both in amount of flow and pressure, freedom from liability to get out of order or to alter after being put to work, while it is, of course, of great importance that the power required to work the apparatus should be so small that the water issues at as nearly the same pressure as it enters. Coupled to these, it is obvious that the price should be so low as not to interfere with its general adoption even in the case of small houses. The construction of inferential meters is very simple. They generally consist of a small wheel or drum connected with suitable index gear, which is revolved either by passing the water through it and allowing it to escape through curved channels at the periphery, in a line almost tangential to it, somewhat in the manner of a Barker's mill, or by guiding the water by means of fixed channels and allowing it to impinge against projections on the drum. A number of such meters are in use, but we will probably best serve the purpose of this article if we confine ourselves to describing the instrument originally invented by the late Sir William Siemens, and manufactured by Messrs. Guest and Chrimes, Rotherham, which is exhibited by several of the water companies. Fig. 1 is a section through a ½in. Siemens meter, the flow of water being indicated by arrows. A is the inlet pipe, and C a filter for preventing foreign and injurious substances from entering into the working parts, the filter case being connected by the screw D, so that it can be readily detached and cleansed. E is an inner filter to arrest any solid matter which may have escaped the first filter, either from its being damaged or from some other cause. The water after passing through the filters is conducted down the tube G into the drum H, and is discharged through the outlets on the periphery; small vanes, which are not shown in the engraving, being fixed to the drum in order to give uniformity of measurement. The drum is supported on the bottom spindle K, which has a steel pivot, and is enclosed by the oil cup or chamber J. The upper spindle O works in a German silver bush P, and has the worm Q attached at the top for giving motion to the train of wheels, in order to indicate on a dial the number of cubic feet or gallons of water passed through the meter, the wheels working in the oil chamber S, which also prevents any foreign substances from getting into the teeth. The meter is covered with a cap containing the glass plate W. Since these instruments were first introduced some thirty years ago, a very large number have been applied, in sizes varying from ⅜in. to 12in., the accuracy of measurement being stated to be within 5 per cent. of the actual amount of water passed. Their first cost being low, and bulk small, they are equally well suited for ordinary house purposes, as for measuring the flow in large mains. The 12in. meter is the largest size made, as the makers prefer to use the instruments in duplicate or triplicate, so that one can be

	Daily supply per head in gallons.	Total number of houses supplied.	Number of houses under constant supply.	Percentage of houses under constant supply.
East London	32·4	143,512	119,889	83·5
Kent	26·4	60,679	28,789	47·4
Lambeth	29·6	76,932	28,564	37·1
Southwark and Vauxhall	26·88	101,481	7,958	7·8
Chelsea	37·56	32,797	3,697	11·2
Grand Junction	32·25	48,535	30,287	62·4
West Middlesex	25·55	63,898	15,431	24·1
New River	27·34	140,698	20,305	14·4

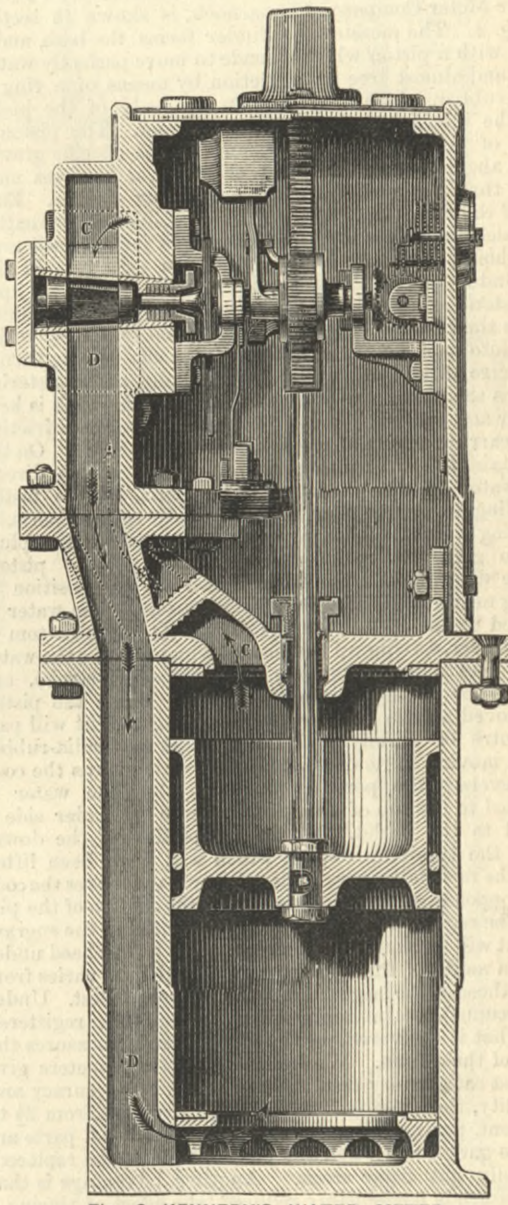
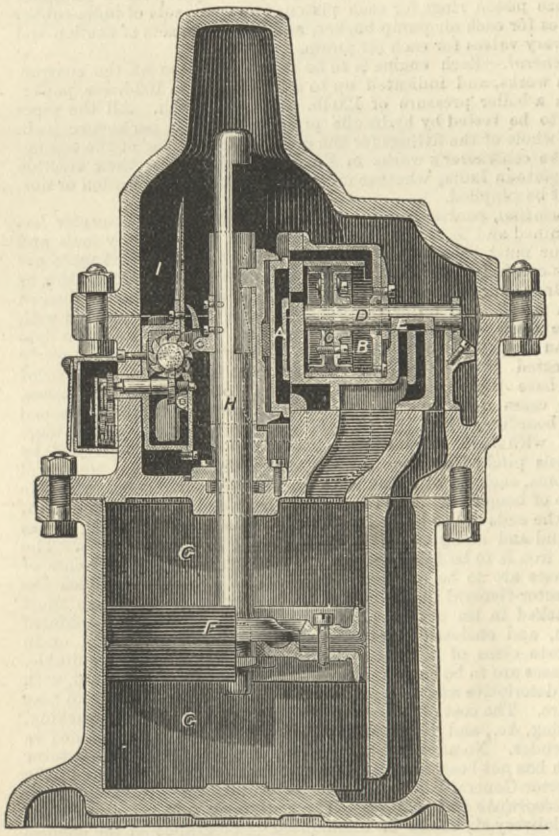


Fig. 2—KENNEDY'S WATER METER.



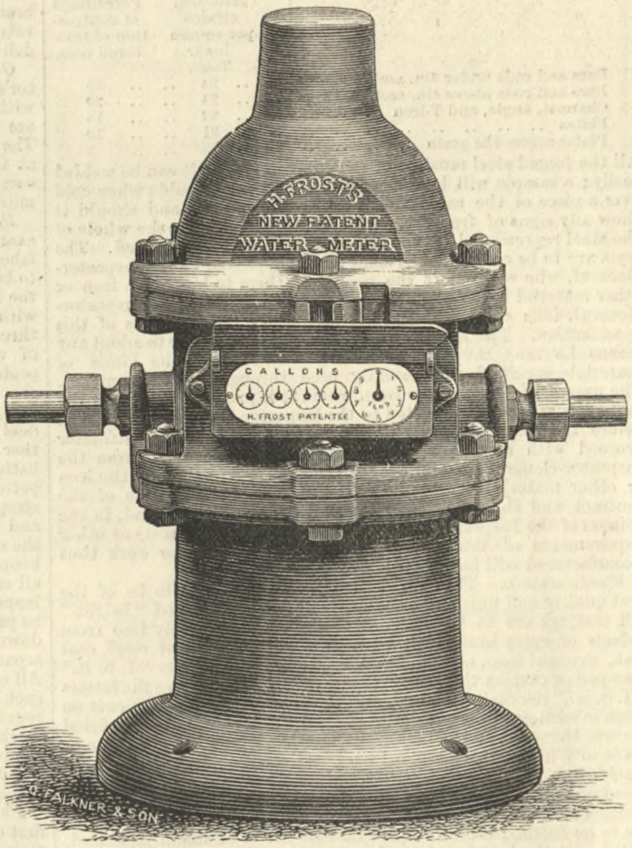


Fig. 3 FROST'S WATER METER. Fig. 4

taken out for examination or repair without interfering with the regular supply.

In positive meters the water is passed through a cylinder in which a piston reciprocates, discharging a constant volume for each inch of stroke, and it is claimed that no matter how small and trifling the flow is, the measurement is made with almost the same accuracy as when large quantities are being passed, so that the detection of the smallest leakage is rendered quite easy. This is not the case with inferential meters, as the flow of water may be so small as not to give sufficient reaction to overcome the resistance of the moving parts, and in this case water may be drawn off without registration. To a certain extent, however, this may be avoided by an arrangement shown by the Kent Company. This consists in placing a loaded valve on the main close to the meter, so that when the flow falls below a certain limit, the valve closes and shuts off the supply from the meter on the main, the flow being diverted temporarily through a bypass, in which is placed a small meter of such capacity as to accurately measure the minimum quantity. When the demand increases, the loaded valve opens automatically, and the large meter comes into action again. This is a plan which might be very advantageously applied to large mains.

Samples of positive meters made about fifty years ago are shown by the East London Company, and from their close resemblance to those of modern construction, it is evident that engineers were on very much the same track then as now.

The positive meter manufactured by Kennedy's Patent Water Meter Company, Kilmarnock, is shown in section in Fig. 2. The measuring cylinder forms the base, and is fitted with a piston which is made to move perfectly water-tight and almost free from friction by means of a ring of india-rubber, which rolls between the body of the piston and the internal surface of the cylinder. The piston is made of vulcanite, as on account of the specific gravity being about the same as that of water, it reverses more easily than if it was of iron, besides being cleaner. Each end of the cylinder is fitted with an india-rubber seating on which the piston forms a water-tight joint if back pressure should force it to either end of the cylinder; in this way undue pressure is prevented from being thrown upon the piston roller. The piston-rod passes through a stuffing-box in the cylinder cover, and is attached to a rack which gears into a pinion fixed on a shaft, the shaft being turned in reverse directions, actuating the index and registering gear, as the piston moves up and down. The rack is kept in gear and guided in a vertical line by an anti-friction roller carried on a stud projecting from a bracket. On the same axial line as the shaft is a taper cock which directs the water to the upper or lower side of the piston according to its position in relation to certain ports, a tumbling weight worked by the rack actuating the plug, and so giving a reciprocating motion to the piston. In the diagram the meter is shown in the position of having nearly completed its upward stroke. The water is directed by the cock down the passage D to the bottom of the cylinder, forcing up the piston, which presses the water which had entered on the previous down-stroke, out through the passage C into the outlet. When the piston has moved a little further, the tumbling weight will pass its centre of gravity and fall against an india-rubber buffer, moving in its descent a lever, which turns the cock and reverses the port openings, so that the water is admitted to the top of the piston, while the under side is opened to the outlet. At the completion of the down-stroke the tumbling weight, which will have been lifted up by the rack, falls over on the other side and moves the cock in the opposite direction, so reversing the motion of the piston. The registering gear is merely indicated in the engraving, but will be readily understood. The lowest head under which a meter of this construction will deliver varies from 4in. in those of the largest size to 3ft. in the smallest. Under any circumstances a larger quantity cannot be registered than what is delivered, as the index merely measures the travel of the piston. We believe that these meters give the most satisfactory results, both as regards accuracy and durability, the average repairs not exceeding from $2\frac{1}{2}$ to 3 per cent. per annum on the original cost. All parts are made to gauge, and when any piece requires to be replaced, it is easily got from stock. Another advantage is that the pressure is not sensibly reduced, the effect of placing a 1in. meter in a 1in. pipe being no more than what would result from adding a length of $3\frac{1}{2}$ yards of piping.

Figs. 3 and 4 show Frost's patent positive water meters, as manufactured by the Manchester Water Meter Company, Manchester. In this apparatus the tumbling weight is dispensed with, the valve which regulates the action of the main piston being worked by a small piston in a supplementary cylinder, the position of which is controlled by a small slide moved by the main piston-rod, the whole device being similar to what is generally adopted for the working of non-rotating steam or hydraulic engines. In the section the piston is shown in the middle of its upward stroke, the small valve A, which is worked directly by the main piston rod, being in its lowest position, so admitting water to the back of the small piston C, which moves the main valve E, so that the lower side of the piston F is opened to the supply, while the upper side is placed in communication with the outlet. When the piston approaches the top of its stroke the valve A is moved by a projection in the piston rod, so as to reverse the pressure on the small piston C, and cause it to travel to the other end of its stroke, carrying with it the main valve E, and so admitting the supply above the main piston and allowing the water to exhaust from the under side. The index gear is worked by a catch attached to the main piston-rod, which is carried up and down against the motion plate I, and brought into contact with a ratchet wheel connected with gearing outside. The cylinder is of iron lined with brass, and the piston is packed with cup leathers. These meters are compact and durable, and work with very little noise. In respect to maintenance, the makers state that the first meter of this construction has been at work over eight years, and is still in constant use and perfect working order, though no cost has been incurred for repairs. All the working parts are of gun-metal.

VERTICAL COMPOUND ENGINES FOR THE INDIAN STATE RAILWAYS.

THE Indian State Railways have asked for tenders for vertical compound engines for the Tirhoot and Dacca-Mymensingh Metre-gauge Railways. We annex a copy of the specification, and we give on page 82 drawings of the engines. In our engravings, Fig. 1, is a vertical sectional elevation, and Fig. 2 a horizontal section through the cylinders. Fig. 3 is a side elevation, the wheel A being a valve to control the admission of the exhaust into the condenser. Figs. 4 are views of the horizontal bracing providing attachments for the guides, and Figs. 5 and 6 plans of the condenser, of which more views are given at the top of the page.

The work required under this specification consists of two vertical compound condensing stationary engines, with all steam, water, and feed pipes, valves for steam and feed-water, air pump suction and delivery valves and pipes, injection cocks, all gearing and piping required in the engine-houses for suction and delivery, with duplicate parts, and all necessary fittings and bolts, &c., for connecting and fixing them ready for work in India. The manufacturers tendering are to supply with their tender a general drawing showing the arrangement, construction, and approximate weight of the engines they propose to supply, with a detailed description, and the general dimensions, including the grade of expansion in both high and low-pressure cylinders, the diameter and length of stroke of the air pump and the capacity of the condenser, the diameter of piston and connecting rods, description of the steam and expansion valves for the cylinders, and the diameter of the crank shaft. The drawings and description of the engines are to be in accordance with this general specification and the drawings exhibited, the figured dimensions of which must be accurately worked to; the arrangement of the internal parts may, however, be altered to suit existing patterns. The air pump should be increased in diameter to suit the size of engine. The drawings exhibited may be seen at the office of the Director-General of Stores, India-office. Before proceeding with the work, general and detail working drawings are to be prepared by the contractor whose tender is accepted, and at his own expense; but they are to be submitted to and approved by the Inspector-General of Railway Stores before the work is commenced. The contractor is to be entirely responsible for the efficiency of the engines, and for their construction in accordance with the terms of this general specification and the approved drawings.

Materials.—The whole of the materials used for this contract are to be of the best quality, and subject to the special approval of the Inspector-General. The cast iron used is to be of such a quality that a bar of the same 1in. broad and 2in. deep, placed on edge on bearings 3ft. apart, shall not break with a less load than 30 cwt. suspended in the centre. The gun-metal is to be composed of seven parts of copper to one of tin, without other admixture. The wrought iron is to be well and cleanly rolled, and free from scales, blisters, laminations, cracked edges, defects, and blemishes of every sort, and the name of the maker must be stamped or rolled on every piece, where practicable. When scrap iron is used it must be cleaned in a properly constructed machine before being used for the manufacture of forgings. The iron must be of such strength and quality that it shall be equal to the undernamed several tensional strains, and shall indicate the several rates of contraction of the original area at the point of fracture that follow, namely:—

	Tensional strains per square inch. Tons.	Percentage of contraction of fractured area.
Bars and rods under 4in. sectional area	24	25
Bars and rods above 4in. sectional area	24	20
Channel, angle, and T-iron	22	15
Plates	21	10
Plates across the grain	18	5

All the forged steel must be of such a quality that it can be welded easily; a sample will be taken from it, and bent double when cold over a piece of the same thickness as the sample, and should it show any signs of fracture, at the bend or elsewhere, the whole of the steel represented by the tested sample will be rejected. The tests are to be conducted by some person approved by the Inspector-General, who will report the results of them to him. No iron or other material is to be used which, in the opinion of the Inspector-General, falls short of the tests and other requirements of this specification. The Inspector-General is to have power to adopt any means he may think fit to satisfy himself that the kinds of materials specified are actually used throughout the contract. The names of the makers from whom it is proposed to obtain the materials are to be submitted to the Inspector-General for approval before the commencement of the work. Should the contractor proceed with any part of the work before receiving from the Inspector-General the approval of the class and quality of the iron or other material proposed to be used for the execution of the contract, and should either of them be subsequently found, in the opinion of the Inspector-General, to fall short of the tests or other requirements of this specification, the whole of the work thus manufactured will be rejected.

Workmanship.—The workmanship throughout is to be of the best quality and finish, and the engines are to be finished "bright." All castings are to be sharp and sound, and perfectly free from defects of every kind. All separate parts, whether of steel, cast iron, wrought iron, or gun-metal, are to have the letters "I. S. R." stamped or cast on them. The large castings are to have the letters "I. S. R.," the maker's name, and the year of manufacture cast on them in some conspicuous position. All the turned, bored, or fitted parts of the work, and all bolt heads, nuts, and screw threads are to be made to Whitworth's standard sizes. All meeting surfaces are to be machined. All nuts of cylinders, valve covers, and glands are to be case-hardened and finished bright. The edges and flanges of the valve casings, cylinder covers, packing glands, stop valve covers, and glands are to be finished bright. The cylinders are to be steam-jacketted, felted with the best hair felt, cleated with well-seasoned teak wood, and cased with sheet steel in a neat and substantial manner. Each cylinder is to be fitted with a bright gun-metal tallow cup, and water relief valves, taps, and pipes, at each end of the cylinder. The pistons are to be of cast iron and fitted with phosphor bronze ring packings, with springs and junk rings to keep them in position. The piston-rods are to be of mild steel, the crossheads of wrought iron, and finished bright. The connecting rods are to be of steel, fitted with marine ends and gun-metal adjustable bushes at each end and finished bright throughout. Suitable bright lubricators and pipes are to be fitted to each connecting rod. The crank shaft is to be finished bright throughout, and fitted with a self-acting bright gun-metal lubricator to each journal. The engines must be provided with the best possible means for lubrication, economy of oil, and cleanliness. The glands should be provided with caps to prevent any leakage from them running down the cylinders, and to receive swabs to lubricate the rods. The bottom of each slide bar must be fitted with cups, into which combs attached to the slides may dip and lubricate the bars. The crank shaft bearings must also be fitted with drip cups. A light iron gallery, with perforated iron plates and bright hand rails, must be attached to the engine standards to enable the engine driver to examine and oil the excentrics, crank shaft bearings, &c. All packing glands and bushes are to be of gun-metal, machined into their places. All valves on the engines or feed pipes are to be of gun-metal, with gun-metal seats, machined into their places and ground up perfectly true. The stop valves on the engines are to have the spindles of steel and the hand wheels turned and finished bright, and those on the main steam pipe are to have the covers, glands, nuts, and hand wheels finished bright. All necessary steam, condensed water, injection, feed, blow off, and other pipes and bends in the engine house are to be supplied. All pipes for the engines are to be flanged, machined on the face, drilled to a template, and fitted with bolts, turned under the head, and faced on both sides of the nut.

Engines.—Each engine is to be self-contained and direct-acting, and is to work at a steam pressure of 120 lb. per square inch, and run at a speed of 100 revolutions per minute. The cylinders are to be placed between two strong cast iron side frames, machined, and fixed to a cast iron base-plate. The base-plate in each case is to form the condenser of the engine, and is to be specially strengthened for the support of the side frames and engine. The crank shaft will be carried in bearings at the top of the side frames, and is to be coupled direct on to the main shaft. The crank shaft is to have a fly-wheel keyed on each end. The engine for the Dacca-Mymensingh Railway is to drive from one end of the crank shaft, and is to have a flange for a coupling, cast on or securely fixed to one of the fly-wheels for connecting to the main shaft, and the engine for the Tirhoot Railway is to drive from both ends of the crank shaft, and is to have similar flanges on both fly-wheels, so that the main line shafting can be connected at both ends of the crank shaft. The couplings for connection to the main line shaft in both engines are to be supplied, and are to be flange couplings of the same diameter in the flange as those on the fly-wheels, with bosses 7in. deep, bored out for the Dacca-Mymensingh engine to $3\frac{3}{4}$in. diameter, and for the Tirhoot engine to $2\frac{1}{2}$in. diameter, the boss being cast large enough to bore out $3\frac{1}{2}$in. diameter if found necessary in India. The high and low-pressure cylinders are to be steam jacketted, and are each to be worked off a separate crank on the shaft. The high-pressure cylinder is to be 8in., and the low-pressure 14in. diameter, each with a piston stroke of 1ft. 6in. The clearance at each end of the cylinders is not to exceed $\frac{3}{8}$in. The ends of the cylinders are to be bored out $\frac{1}{8}$in. larger than the working barrel, so that the piston rings will overrun the barrel $\frac{1}{8}$in. at each end. The steam valves and cylinders are to be as close together as possible, to shorten all the steam passages. Each cylinder is to be fitted with a slide valve of phosphor bronze and an expansion valve of cast iron. The expansion valve of the high-pressure cylinder is to be controlled, but not worked, by a Porter's high-speed governor, driven off the crank shaft, and so arranged that the cut-off can be regulated from one-eighth to three-quarters of the piston stroke. The expansion valve of the low-pressure cylinder is to be so arranged that it can be regulated by a screw, index, and hand wheel, without stopping the engine. A steam stop valve is to be fitted to the casing of the high-pressure cylinder. A copper pipe and gun-metal valve in connection with the low-pressure cylinder, and the steam from the boiler is to be supplied for starting the engine. Both high and low-pressure cylinders are to be fitted with bright gun-metal indicator cocks, pipes, and gearing suitably arranged for taking a diagram from both ends of each cylinder without removing the indicator. The crank shaft is to be of Lowmoor iron, and made by the Lowmoor Iron Company. It is to run in strong gun-metal bearings, each adjustable for wear, and not less than one and a-half times the diameter of the journal in length. The fly-wheel is to be as heavy as possible for the diameter given, and is to be balanced to suit the cranks, and turned on the boss, rim, and face. The air pump barrel, bucket, rod, valve seats, and guards are to be of gun-metal, and the valves of india-rubber. The suction and delivery valves and guards are to be of gun-metal and the valves of india-rubber. A mercury column gun-metal vacuum gauge and pipes are to be fitted to and supplied with each air pump.

Duplicate parts.—The following duplicate parts are to be supplied with each engine:—One complete set of spare brasses for both connecting rods of each engine, two spare sets of phosphor bronze piston rings for each piston, two spare sets of india-rubber valves for each air pump bucket, and two spare sets of suction and delivery valves for each air pump.

General.—Each engine is to be tested in steam at the contractor's works, and indicated up to a load equal to 100-horse power with a boiler pressure of 120 lb. per square inch. All the pipes are to be tested by hydraulic pressure to 240 lb. per square inch. The whole of the fittings for the erection and testing of the engines at the contractor's works in England, and also for their erection complete in India, whether mentioned in this specification or not, must be supplied.

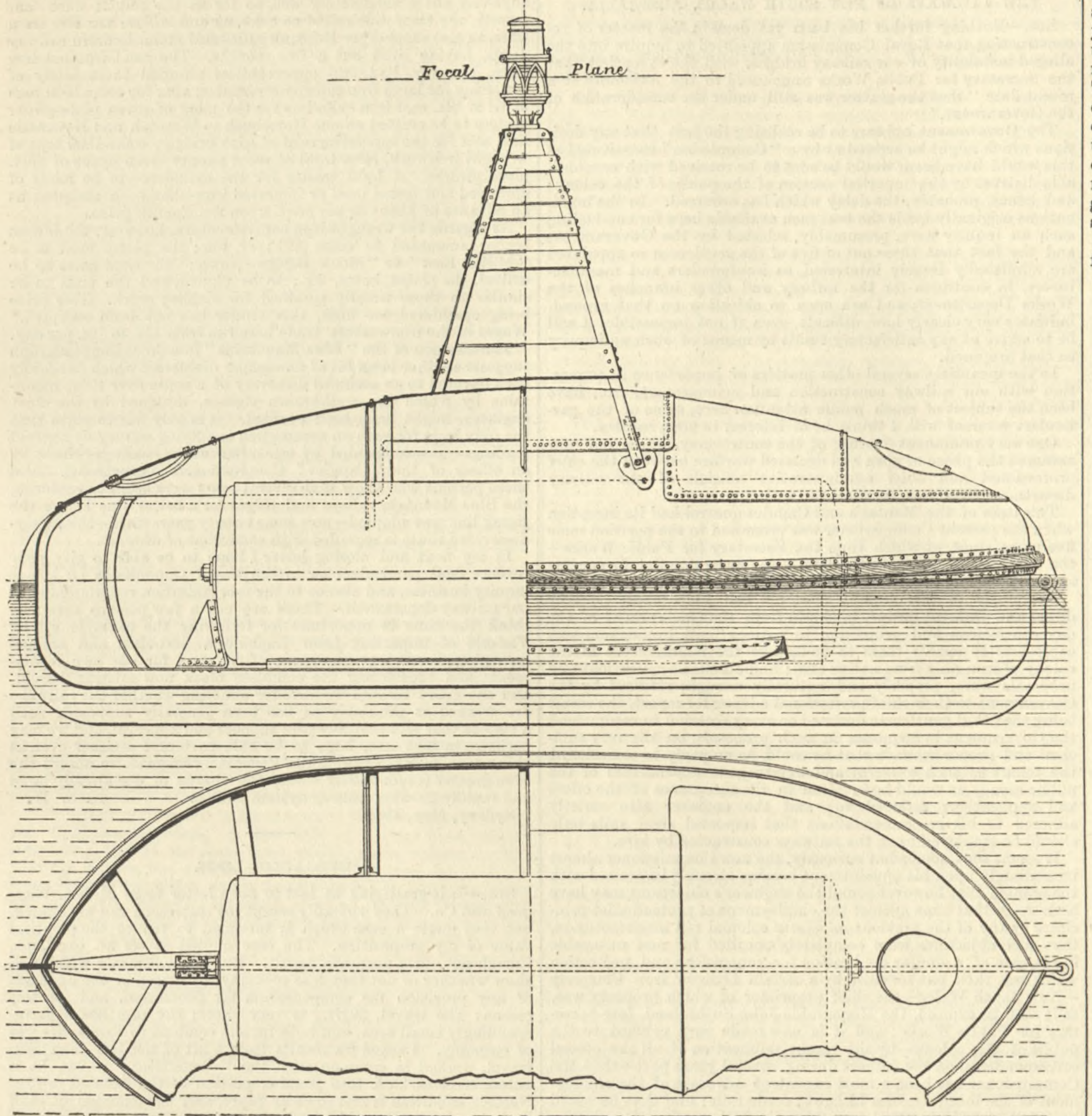
Painting, packing, and marking, &c.—After the inspector has examined and tested the work—for which all necessary tools and labour must be given him—all screwed, fitted, or bright parts are to be carefully coated with white lead, or such other preparation as the Inspector-General shall approve, and all screw holes plugged with wood. All other ironwork is to be carefully painted with three coats of good oil paint, the first red lead and the last of an approved colour, so that the whole may be properly protected from corrosion. Every part of the work, except the base plate and side frames, is to be packed in cases. The cases are to be made of $1\frac{1}{4}$in. thick well seasoned deal boarding, with $1\frac{1}{4}$in. thick elm ends; the whole nailed together with $3\frac{1}{2}$in. wire nails. They are to be strengthened by battens pitched at a proper distance along the sides, tops, and bottoms, each set of which is to be entirely surrounded with one strap of hoop iron. The cases are to have end corner posts of elm, and the ends are to be tied with hoop irons, each stretching across the end and along the sides to meet the first side battens. The hoop iron is to be $1\frac{1}{2}$in. wide, No. 18 b.w.g. thick. The joints of all cases are to be tongued and grooved. All articles which the Inspector-General shall consider to require such protection must be packed in tin or zinc of suitable thickness, properly soldered down, and enclosed in the cases containing the engines, or in separate cases of a similar description, as may be most suitable. All cases are to be clearly cut or branded, not merely painted, with such descriptive and shipping marks as the Inspector-General may require. The cost of labour, testing at contractor's works, packing, marking, &c., and delivery is to be included in the sum named in the tender. No additional sum for extras of any nature whatever which has not been submitted to and approved of in writing by the Inspector-General before the work is commenced will be admitted.

Photographs and tracings.—The contractor is to supply with his first delivery six copies of unmounted photographs of the engines as erected, not exceeding 10in. by 6in. He is also to supply three sets of neatly executed and fully dimensioned hand-made tracings on cloth of the engines and the foundations required for them, showing the general arrangement of the whole, and all the fittings in full detail. Each set of drawings is to consist of a general drawing, giving a plan, elevation, and cross section of the engines, the foundations for the engines, and detail tracings showing all the fittings of the engines, to a scale of not less than half size. These tracings are not to exceed 25in. in width, and are to be delivered rolled up on a wooden roller, and not folded in any way.

AMERICAN EXHIBITION IN EUROPE, LONDON, 1886.—In the year 1886—101 years since John Adams, the first Minister of the United States who came on a friendly mission to Great Britain, presented his credentials to King George III.—an American Exhibition is to be opened in London on the 1st of May. The United States Government, the Governors of the several States and Territories, the great Civic and Commercial Corporations, having expressed approval, a complete representation will be given of the manufactures, employments, arts and productions of the principal nations of the New World. Americans are indefatigable in visiting Europe, and are diligent students of its antiquities. They have been hitherto less zealous to offer to general inspection the treasures of their own vast dominions. The wonders of the Yosemitè Valley, the harbour of San Francisco—the Golden Gate—the prairies and the Yellowstone Park, the Mammoth Caves of Kentucky, Plymouth Rock, the Bartholdi Monument and New York Harbour, will all be illustrated in the coming Exhibition. A separate hall—the artisans' hall—will be devoted to the handicrafts pursued by white, Chinese, Indian, and Negro men and girls.

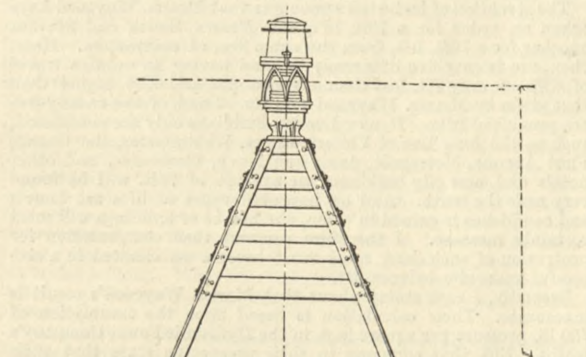
GAS LIGHT BUOY.

FIG. I.



THE accompanying engraving represents a light buoy made by the Pintsch's Patent Lighting Company for the river Humber. The chief dimensions of the buoy are given in the engraving, which also shows that the gasholder is placed within the boat in such a way as to be protected from blows likely to cause any leakage. The buoy has a special form to meet its requirements as a lightship, and the conditions of its employment is the fast tidal current of the river. It was designed by Mr. C. Berthon, of Westminster, and is intended to carry a six months' supply of

FIG. 2.



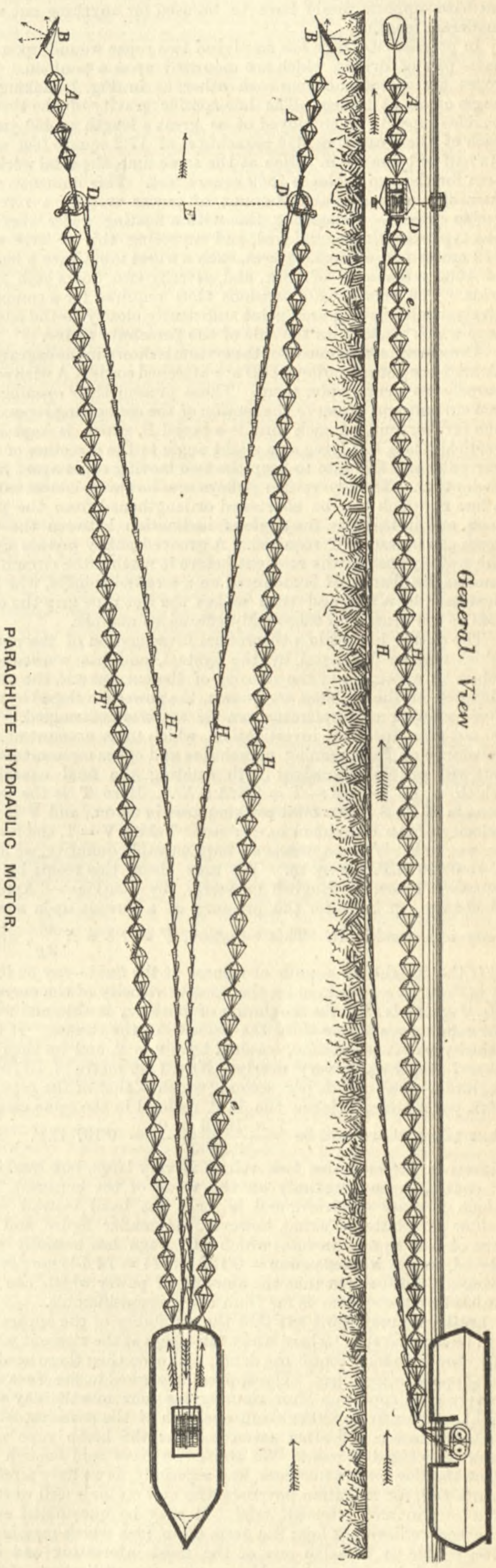
gas, the burner, regulator, and lamp being on the well-known Pintsch system. The hull is formed of $\frac{3}{8}$in. plate, 24ft. 3in. total length, and 9ft. beam at the line of flotation. The laps of the plates are 4in. wide, and rivetted with $\frac{3}{4}$in. rivets, spaced $2\frac{1}{4}$in. apart centre to centre. The keel and stem are both in one piece, as shown, and to this the garboard strake is to be fastened. The bilge pieces are rivetted on to the bilge, and made of 9in. by $4\frac{1}{2}$in. by $\frac{9}{16}$in. T-iron. A wooden fender, 4in. by 4in. wood, is fitted on both sides of hull, running from stem to stern, by 3in. by $3\frac{1}{2}$in. by $\frac{7}{16}$in., L-iron top and bottom, with the sheer as shown. The hull from water line falls in as shown, so as to describe at midships an arc of 4ft. 6in., and a circular deck of $\frac{1}{8}$in. plate is rivetted on the hull. There are two manholes, each 16in. diameter in the clear, placed in end plates of the circular deck as shown, and provided with covers $\frac{3}{8}$in. thick, secured by twenty screws $\frac{3}{4}$in. diameter. The edge of each manhole is stiffened by a welded iron ring. The surface of the mooring link that comes in contact with the shackle and mooring chain is steeled. The gasholder rests upon a plate bent up on each side, and rivetted to the keelson, and is prevented from rolling by four gusset plates, with two short pieces of angle iron rivetted thereto at the ends and coming in contact with the holder, and at the ends by angular plates, and angle iron rivetted on each side and rivetted to the keelson. The superstructure consists of four legs of angle iron $2\frac{1}{2}$in. by $2\frac{1}{2}$in. by $\frac{5}{16}$in., the upper ends of the legs being attached to a square flanged plate for supporting the lighting apparatus. Four wooden battens of pitch pine, 4in. by $1\frac{1}{2}$in., are bolted on to each cant of the angle iron superstructure, with $\frac{7}{8}$in. galvanised iron bolts and nuts.

PARACHUTE HYDRAULIC MOTOR.

THE very singular and simple hydraulic motor which we illustrate herewith is the invention of a Russian engineer, Mr. Jagn. It is scarcely as yet known in Western Europe, where, however, something will probably be heard of it ere long. Its true field would seem to be Egypt, India, or any country where canals or rivers are used for irrigation, and where it is desired to draw water from them at particular spots in the simplest and cheapest manner. At present in nearly all such cases water is raised by hand or steam power; nevertheless, it must be obvious that the current of the canal itself, slow though it may be, is quite sufficient to raise a small portion of the discharge to the very moderate height generally needed to lift it over the banks into the adjoining fields. Why then is it not employed for the purpose? The answer is obvious, when we consider the various hydraulic motors at present in use. Of course, motors worked by water pressure must here be excluded; and we are left with scarcely anything but the undershot wheel, the turbine, and the screw pump. All these require expensive buildings and erections to set them to work, present but a very small fraction of their surface to the water at any one time, and must be very large and costly if they are to draw even a very moderate amount of power from such a source. There is no possibility of adjusting them readily to suit variations in the speed of the current or in the quantity of water required, nor of moving them from place to place should this be convenient.

The motor of Mr. Jagn is on a totally different principle. Its essential features consist, as shown, of an endless rope made of hemp or aloe fibre, which takes a turn or two round a pair of drums mounted on a barge or pontoon, and then passes down the channel to return over a pulley hung from a floating punt, at such a depth that the whole of the rope is immersed in the water. Along this rope are suspended at equal intervals a number of parachutes made of sail-cloth. The rope passes through the centre of each of these, and to it are attached a series of strings, the other ends of which are connected to the outside edge of the parachute. Thus they act like the spokes of an umbrella to prevent the parachute from opening too far under the pressure of the current. The parachutes must be placed so far apart that the current may act fairly on each, and the sum of the pressures forms the force which draws the rope through the water. The moment, however, that any parachute has passed round the return pulley, the current acts upon it in the opposite direction. It then shuts up like an umbrella, and assumes a volume so small that its resistance on the return journey is insignificant. After passing round the drum at the upper end, it at once opens afresh of its own accord, and once more becomes part of the moving power of the whole system. The parachutes are formed by first cutting out a complete circle of cloth, and then taking from this a sector equal to one-fifth or one-sixth of the total area. Such parachutes are found to keep their form when stretched by the water better than a surface originally spherical, although the latter would be theoretically more correct. The motion of the drum is transmitted by spur gear or otherwise, as may be required, to give the requisite speed.

It will be seen that the advantages of the system are as follows:—First, the facility it offers for obtaining a large working area, which may be increased or diminished at will, according to the requirements of the moment, by lengthening or shortening the rope. Secondly, the ease with which it is erected and set to work. Thirdly, the small part of the river section which it occupies, so as to present no obstacle to navigation. Fourthly, the ease with which it can be mounted on a barge of any kind, and carried wherever it may be needed. Fifthly, it is not stopped, like all other hydraulic motors, by the appearance of ice—it has, in fact, already been worked under ice in the Neva. At the same time, winds and waves have no influence upon it.



PARACHUTE HYDRAULIC MOTOR.

The principle of the apparatus is not altogether new. In 1872 there was tried on the Ohio river an arrangement termed the Brooks motor. It was composed of two drums, placed horizontally and parallel to each other. Round these there passed endless chains at equal spaces apart on the length of the drums, and to these chains were fixed wooden blades or arms of a curved form, and so jointed to the frames that they opened when moving in one direction, and closed down on the chain when moving in the other. In this machine the weight of the chains was a serious obstacle to obtaining any large amount of power. The whole apparatus was mounted on a heavy wooden scaffold, which proved an impediment to the flow of the river. Again, the resistance due to the surface of the returning blades and to their stiffness was found to be far from insignificant.

In the present system Mr. Jagn has found, after many experiments, that the best effect was obtained when the parachutes were spaced apart at twice their diameter, and when the rope made an angle of 8 deg. to 10 deg. with the current. It is found that when open and in motion the parachutes never touch the bottom. This was the case with a rope containing 180 parachutes of 4ft. diameter, and working in a depth of only 6ft. This is easily explained by the fact that the velocity of a current always diminishes as it approaches the bottom. Hence the pressure on the lower part of the parachute will be less than that on the upper part; but the former pressure tends to draw the parachute downwards, whilst the latter tends to raise it to the top of the water. Thus, the latter being the larger, the parachute will always have a tendency to rise. In fact, it is necessary to sink the return pulley sufficiently deep to make sure that the parachutes will not emerge from the surface. For the same reason no intermediate supports are needed over the driving span; if any are needed it is for the return span, on which the parachutes are closed. Of course, if metal were used instead of hemp, the case would be entirely different, and intermediate supports would have to be used for anything but very moderate lengths.

In practice Mr. Jagn has employed two ropes wound upon the same pair of drums, which are mounted upon a pontoon. The ropes are spread out from each other, as in Fig. 1, making an angle of about 10 deg. The low specific gravity of the system enables ropes to be employed of as great a length as 450 yards, each of them carrying 350 parachutes of 17·2 square feet area. As half of these are in action at the same time, the total working area for the two cables is 5860 square feet. This immense area furnishes a considerable amount of power even in a river of feeble current. Comparing this with a floating water wheel of the type sometimes employed, and supposing this to have only 172 square feet of working area, such a wheel must have a length of 46ft., a diameter of 23ft., and seventy-two floats each 2½ft. wide. The enormous dimensions thus required for a comparatively small working area point sufficiently clearly to the advantage which remains on the side of the parachute motor.

The general arrangement of the system is shown in the engraving. Behind the return pulleys D D are attached cords A A with some parachutes strung upon them. These present their openings to the current and preserve the tension of the connecting ropes. At the further end of each cord is a board B, which is kept in a vertical plane, but lying at a slight angle to the direction of the current; and this acts to keep the two moving ropes apart from each other. The two return pulleys are, however, connected by a line E, which can be shortened or lengthened from the pontoon, and in this way the angle of inclination between the two ropes can be varied if required. A grooved pulley presses upon the trailing span at the moment before it reaches the circumference of the drum. It is mounted on a screwed spindle, which is depressed by a nut, and thus makes the wet rope grip the outside of the drum in a thoroughly efficacious manner.

The author has made a theoretical investigation of the power which may be developed by the system, and has worked out tables by which, when the velocity of the current and the other elements of the problem are known, the power developed by any given number of parachutes can be at once determined. We do not reproduce this investigation, which takes account of the resistance of the returning parachutes and other circumstances, but will content ourselves with quoting the final equation, which is as follows:—$T = 0{\cdot}328\ S\ V^3$. Here T is the work done in H.P., S is the total working area in sq. m., and V is the velocity of the current in m. per sec. Taking $V = 1$, and $S = 1$ sq. m., which is by no means an impracticable quantity, we have $T = 0{\cdot}328$ H.P. per sq. m. We may check this result by the equation given, in English measures, by Rankine—"Applied Mechanics," p. 398—for the pressure of a current upon a solid body immersed in it. This equation, $F = 1{\cdot}8\ m\ A\ \frac{v^2}{2g}$, where m is the weight of a unit of volume of the fluid—say 62 lb.—A is the area exposed, and v the relative velocity of the current. Mr. Jagn finds that the maximum of efficiency is obtained when the rope moves at one-third the velocity of the stream. If this velocity be 3ft. per second, we shall have $v = 2$, and we then get $F = 7$ lb. per sq. ft. very nearly. Now 1 sq. metre = 10·76 sq. ft., and a speed of 1ft. per second (which is that of the rope) is 60ft. per minute. Hence the H.P. realised in the same case as that taken above will be $\frac{7 \times 10{\cdot}76 \times 60}{33{,}000} = 0{\cdot}137$ H.P. The difference between the two values is very large, but Rankine, of course, depends entirely on the value of the constant 1·8, which is quite empirical, and is for a flat band instead of a hollow parachute. Taking, however, his smaller figure, and an area of 544 square inches, which Mr. Jagn has actually employed, we get a gross power $= 0{\cdot}137 \times 544 = 74{\cdot}5$-horse power. Hence, it will be seen that the amount of power which can be realised by the system is far from being inconsiderable.

Lastly, we may point out that the durability of the apparatus will be considerable. There is no wear except at the moment when the rope is passing round the drum, and even then there need be no slipping or grinding. The apparatus worked in the Neva was in very good condition after running for four months day and night. After five months about one-fifth of the parachutes had to be replaced, but after seven months the hemp rope still showed no signs of wear. We think we have said enough to show that for certain purposes, and especially, as we have already mentioned, for irrigation purposes, the new motor is well worthy of a careful and extended trial. It may be questioned even whether we have not here the germ of an idea which may hereafter enable us to solve one of the most interesting and important of engineering problems, viz., the utilisation of the great store of power provided for us twice daily in the ebb and flow of the tide.

Naval Engineer Appointments.—The following appointments have been made at the Admiralty:—Philip Marrack, assistant engineer, to the Indus, for service in the Tamar; George R. Taylor, acting assistant engineer, to the Orontes; Edward A. E. Crowley, acting assistant engineer, to the Achilles; William J. C. Brown, chief engineer, to the Assistance; and Matthew R. Miller, chief engineer, to the Wrangler.

Use of Disinfectants in Paris.—Experiments in the disinfecting of rooms have been carried on throughout the past week in a Paris hospital, and many have witnessed the experiments conducted by Drs. Pasteur and Dujardin-Beaumetz. At present two systems are under discussion—the use of the liquid sulphurous anhydride and the simple burning of sulphur. At first the sulphur would not burn, and the acid, though it told on the litmus test papers, did not kill the microbes which M. Pasteur had left in the room. Now, however, by pouring a little alcohol over the sulphur, it has been made to burn very successfully, and by using a larger quantity of the disinfectant, whether in a liquid or a solid state, the microbes were killed. Both the rooms measured 98 cubic metres, and 2 kilos. of sulphur had to be burnt before the living organisms left in the room were destroyed. This is about the same amount which long experience in England has proved to be necessary.

LETTERS TO THE EDITOR.

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

THE RAILWAYS OF NEW SOUTH WALES, AUSTRALIA.

Sir,—Nothing further has been yet done in the matter of reconstructing that Royal Commission appointed to inquire into the alleged instability of our railway bridges, with the exception that the Secretary for Public Works announced to the Assembly at a recent date "that the matter was still under the consideration of the Government."

The Government appears to be realising the fact that any decisions which might be arrived at by a "Commission" constituted as this would have been, would be sure to be received with considerable distrust by the impartial section of the public of the colony; and hence, probably, the delay which has occurred. In the nominations originally made the best men available here for conducting such an inquiry were, presumably, selected by the Government; and the fact that three out of five of the gentlemen so appointed are admittedly largely interested, as ironfounders and manufacturers, in contracts for the railway and other branches of the Works Department, and are open to objection on that ground, indicates very clearly how difficult, even if not impossible, it will be to arrive at any satisfactory result by means of such an inquiry as that proposed.

In the meantime several other matters of importance in connection with our railway construction and management, &c., have been the subject of much public attention here, some of the particulars whereof will, I think, be of interest to your readers.

One very prominent feature of the controversy, which has now assumed the phase of open and declared warfare between the chief professional and chief administrative officials of our railway department, has been the steel rail question.

This item of the Montagu and Capulet quarrel had its inception when the present Commissioner was promoted to the position some five years since, at which time the Secretary for Public Works—the Honourable John Sutherland—was instrumental in causing such appointment to be made.

Previously to this several attempts had been made, both by direct and indirect means, to obtain from the Government of the day concessions and protection to various local ironmakers and capitalists to enable them to undertake the manufacture in the colony of iron rails from native ores; and all such applications and proposals were, properly and naturally enough, referred by the Government to their chief professional adviser for report, the result being that that gentleman declined on every occasion to recommend the Government to acquiesce in such proposals, on the very sufficient and proper grounds that he could be no party to committing the colony to such wasteful and extravagant expenditure of the public money as would be involved in the acceptance of the offers and applications referred to; and the engineer also strictly adhered to his recommendations that imported steel rails only should be employed upon the railways constructed by him.

It seems that, somewhat curiously, the new Commissioner almost immediately upon his appointment became strongly impressed with the opinion that however sound the engineer's objections may have been up to that time against the employment of protectionist principles by any of the previous *soi disant* colonial rail manufacturers, that such objections were completely uncalled for and untenable in the case of a similar application for concessions and protection which was then put forward by a certain Lithgow Iron Company—New South Wales—the chief proprietor of which property was, as it soon transpired, the Honourable John Sutherland, late Secretary for Public Works; and it is now made very evident to the public of this colony—by the recent publication of all the official correspondence on the subject during several years past—that the Commissioner has been a most consistent advocate of the employment of the local, *i.e.*, the Lithgow, made rails; and that he would have felt himself justified in paying the Lithgow Iron Company a considerably higher price for colonial made iron rails than that for which steel rails could be imported from England.

He says, indeed, in one of his reports:—"I would suggest that a specification should be prepared of what is known as the bull-headed rail—70 lb. to the yard—to be made of iron, from the native ores of the colony; that to enable capitalists to make their arrangements, six months' notice should be given, prior to the receipt of tenders, for the manufacture of 100,000 tons of such rails within ten years—the first 5000 tons to be delivered within twelve months of the acceptance of tender and 1000 tons per month thereafter;" and proceeding to strike an average value for English iron rails, delivered at Lithgow, N.S.W., he arrives at the price as being = £10 5s. per ton, and says, "It is probable that as good, if not better, rails could be made in the colony for the same money. In a minute paper in reply to this we find that the engineer-in-chief says:—"I confess I am at a loss to know what advantage the Government could possibly derive from such an arrangement. The price for steel rails in England at the present time—1880—is about £7 per ton, and will probably be considerably less before the expiration of the ten years over which this contract is supposed to extend. As one ton of steel rails is certainly worth at the very least six tons of iron rails, it appears to me that the proposal is simply to subsidise indirectly the iron industries of this colony. If they are to be subsidised, it should, in my opinion, be done by a direct vote of Parliament, and not in the indirect way now suggested, which would cause a very heavy loss to the colony. The following is a fair comparative estimate of the cost of the iron and steel rails:—

"*Iron Rails.*

"Cost of 100,000 tons at .. .. £10 5s. = ...		£1,025,000
" re-rolling, at per ton ..	£3	
" carriage	£2	
" taking up and re-laying	£2	
	£7	
"As this expense would have to be incurred five times, the total cost of re-rolling, &c., would be 100,000 tons × 35 = ...		3,500,000
"The total cost, therefore, of iron rails = ...		£4,525,000

"*Steel Rails.*

"Cost of 100,000 tons at £10 5s. = ...	1,025,000
"Showing that the cost of iron rails, as recommended by the Commissioner, in excess of steel rails would be = ...	£3,500,000"

In the above comparison it will be seen that the life of the steel rails has been taken as being only six times that of the iron rail—a much lower figure than the engineer would have been justified in using; whilst £10 5s. is probably a high average price to take for steel rails over a period of ten years.

The publication of the above and other items of this voluminous and instructive correspondence has been productive of much comment in Parliament and in the public press of the colony, and it has been very generally admitted that the chief engineer's position in the argument is unassailable.

I should, perhaps, mention that at the present time tenders are invited by the Commissioner for 100,000 tons of rails, to be of colonial manufacture and of colonial ore, and delivered during the next ten years. This should enable those persons desirous of establishing the rail-making business here to fully test the practicability and profitableness of the undertaking. As a matter of fact, some excellent veins of brown hematite ore are known to exist in the colony, and one, some 2ft. in thickness, has been opened up at Lithgow, or "Eskbank," Iron Company's ground; but there is nothing worthy the name of an "iron mine" yet opened or worked in the colony, the mine just referred to, situated in the Blue Mountains, being little better than a lot of surface scratchings, no extent of systematic mining having been attempted; and the chief engineer is certainly correct when he states that at present little or nothing is positively known of the extent or value of the native ores, though he is of opinion that a good steel-making ore exists. The only opportunity yet afforded us of judging of the actual quality of "Lithgow" made rails was anything but a satisfactory one, so far as the results were concerned; the tram rails rolled at Eskbank and laid on our city tram lines, as also some other Eskbank rails tried in the Redfern railway yards, having lived but a few months. The local ironfounders have, however, had two opportunities afforded them lately of tendering for large iron railway structures, viz., for some 1600 tons in all of 6ft. cast iron cylinders for the piers of seven plate-girder bridges to be erected on our Homebush to Waratah and Newcastle line, and for the superstructure of such bridges, some 1500 tons of wrought ironwork, for a total of some twenty-seven spans of 66ft. plate girders. A local tender for the cylinders—to be made of approved and tested local or imported iron—has been accepted at an advance of about 8½ per cent. upon the English price.

As regards the wrought iron superstructure, however, the lowest tender amounted to some £21 per ton; the plates used to be "Milton Best" or "Monk Bridge Crown;" the rivet holes to be drilled, the plates, butts, &c., to be planed, and the tests to be similar to those usually specified for English work. This price being considered too high, this tender has not been accepted.* Wages in the ironworkers' trade here run from 11s. to 12s. per day.

The mention of the "Blue Mountains" in a preceding paragraph suggests another brisk bit of newspaper discussion which has lately been devoted to an assumed discovery of a route over those mountains by which the well-known zigzags, designed by the chief engineer, might have been avoided. It is only fair to state that the only basis for such an assumption is a flying survey by aneroid readings—unaccompanied by measurements or bearings—made by an officer of the "Capulet" Commissioners' department. And those persons who know that several years were spent in exploring the Blue Mountain valleys and ridges for a better line before the zigzag line was adopted—now some twenty years since—this newly-discovered route is regarded with somewhat of distrust.

In my next and closing letter I hope to be able to give your readers final particulars as to the Royal Commission on bridge inquiry business, and also as to the reorganisation contemplated of our railway department. There are not a few persons here who think the time is opportune for following the example set by Victoria of importing from England a first-class and trained managing director or chairman of railways for our own department; and considering the complete block now existing therein, and the grave reasons we have for doubting whether our railways are worked as profitably as has been generally supposed, such a step as that will probably gain support and approval, and we may perhaps, in that case, hope to be able to tempt another even as able a man as Mr. Speight, the Victorian chairman, to accept the even greater responsibility which the charge of our already large and rapidly-growing railway system entails. N. S. W.

Sydney, May, 1884.

HYDRAULIC LIFTS.

Sir,—It is gratifying at last to see a letter from Messrs. Waygood and Co. They virtually accept my statement and my figures, but they quote a case which is intended to reduce the practical value of my proposition. The case quoted shows an excellent, though not quite accurate, result. But it is not a case which will show whether or not they lose economy, by reason of the omission of any provision for compensation for protrusion, and for this reason: The travel, 39⅞ft., is very short; the ram has a correspondingly small area, and both factors combine to reduce the loss of economy. I asked for results from a lift of not less than 60ft. travel, worked in common with the "economiser," which, be it noted, receives back into itself a portion of the exhaust water. Neither condition is met in their reply, and the omission of each leads to a misleading element in the result. First, with respect to height, Messrs. Waygood and Co. say my example of 70ft. is higher than the average of London lifts. To this I demur; and the question may readily be set at rest without going far outside the limits of this correspondence. Mr. Ellington's paper read before the Mechanical Institute has been referred to. That paper contained reference to twelve lifts, having an average travel of 62ft.; the maximum was 90ft. In a letter published in *Engineering* of May 23rd, 1884, and signed by Messrs. Stevens and Major, four lifts are quoted; average travel, 60ft.; maximum, 80ft. Mr. Gibson, in his letter appearing in your issue of June 27th, quotes six lifts; average travel, 60ft. Messrs. Smith and Stevens, in their letter published by you on the 18th inst., quote one lift, 73ft. travel.

The *Architect* of last week announces that Messrs. Waygood have taken an order for a 79ft. lift, and Messrs. Smith and Stevens another for a 76ft. lift, from the same firm of contractors. Here, then, are twenty-five lifts ready to hand having an average travel of 63ft., or only 7ft. less than my example, and 23ft. higher than that given by Messrs. Waygood and Co. Some of the twenty-five are provincial lifts. If new London buildings only are considered, such as the long line of Victoria-street, Westminster, the Grand, First Avenue, Metropolé, Army and Navy, Grosvenor, and other hotels and new city buildings, an average of 75ft. will be found very near the truth. And as improved types of lifts are known and confidence is gained in them, the height of buildings will most certainly increase. I therefore contend that compensation for protrusion of such long rams must become an element in a successful hydraulic balance lift.

Secondly, I have stated above that Messrs. Waygood's result is inaccurate. Their calculation is based upon the assumption of 750 lb. pressure per square inch in the Hydraulic Power Company's mains. But that company in their prospectus state that their accumulated pressure is 800 lb. per square inch. Messrs. Waygood and Co. may say that pressure will be reduced before it reaches their lift; but if they will refer to the calculation made and quoted by Mr. Gibson and Messrs. Smith and Stevens, they will see that those correspondents gave the static head—in one case the full head to the tank, and in the other the accumulator pressure. I have seen the pressure gauge go down as much as 20 per cent. of the static pressure, owing to the friction of pipes when the lift and water were put in motion. I believe the static head is the usual, and I consider the only fair, basis for calculation. Had Messrs. Waygood and Co. given a case of a lift worked from one of their own accumulators or "economisers," they could doubtless have also quoted the exact static pressure.

Messrs. Ellington and Woodall do not appear quite to understand my letter. A few figures would, of course, make it clear to any engineer that to take water at a pressure of 700 lb. to 800 lb. per square inch to work a direct-acting ram lift, with a ram strong enough to carry 10 cwt. even 50ft. high, would involve an excess of lifting power, and consequent loss of water. From that point of view, any differential cylinder which would suitably reduce the pressure might be termed an "economiser." But who has erected, or proposed to erect, such an abortion as the lift imagined? The differential or balance cylinder has long since left the crude stage assumed in Messrs. Ellington and Woodall's letter, and in Mr. Ellington's paper alluded to above, that gentleman makes a point of the advantage and action of his arrangement for compensation for protrusion, and my letter was penned in a spirit of perfect agreement with that portion of the paper.

My objection to the misuse of the term "economiser" was on the ground that it was applied to an apparatus which was retrogressive as compared with its predecessors—for instance, that described by Mr. Ellington. Economiser.

July 24th.

[*For continuation of Letters see page* 84.]

* These bridges are now being ordered in England.

RAILWAY MATTERS.

The formal opening of the Arlberg Railway is to take place in presence of the Emperor on the 15th September next, but the goods traffic will begin on the 18th of August.

A meeting of the shareholders of the Scarborough and Whitby Railway Company on Tuesday gave their sanction to a resolution authorising the directors to raise £160,000 by the creation of preference stock, and the further exercise of their borrowing powers to the extent of £53,000.

Traders at Wolverhampton hope that good will ensue from an interview which has just taken place between a deputation from the Birmingham and District Railway and Canal Rates Association and Mr. Lambert, the chief goods manager of the Great Western Railway Company. The deputation was a representative one, and the questions affecting the rates on metallic bedsteads, wire and wire rods, and other goods, were fully discussed.

The locomotives of the German Railroad Union in 1882 consumed, among other fuels, 49,827 tons of peat. The Austro-Hungarian roads in the Union burned considerable wood—209,918 cubic metres, against 974,316 tons of lignite and 655,708 tons of coal. On the German roads 97 per cent. of the fuel used—reckoned by heating capacity—was coal; on Austro-Hungarian roads, only 59⅜ per cent. The total consumed on all the Union roads was equivalent to 4,560,628 tons of coal.

In concluding his report on the collision which occurred on the 1st of June of a passenger train with buffer-stops at Bank Top station, Darlington, on the North-Eastern Railway, Major-General C. S. Hutchinson says:—"Had the engine been provided with air-brake fittings, so that the driver might have had brake control over the whole train—though he ought not to have been permitted to depend upon the continuous brake for ordinary running into terminal stations—he would have had a reserve of brake power to fall back upon when he found too late that his speed was too fast."

The amalgamation of the Great Eastern and Great Northern Railways is again proposed. The union of these two companies was much discussed in 1877, and the negotiations came to a close as the directors could not agree upon the terms of the ultimate fusion. On behalf of the Great Eastern it was proposed that the ultimate fusion should be by the holders of Great Eastern Ordinary Stock receiving for every £100 Great Eastern Ordinary Stock 60 per cent. of Great Northern Ordinary Stock; the Great Northern directors offered 50 per cent.—the directors of the Great Eastern subsequently proposed a reduction of the amount to 55 per cent.—but did not feel justified in making any further abatement, unless the Great Northern would make modifications on their side. The fusion would undoubtedly afford great terminal facilities, and the train arrangements could be made to suit public convenience.

"Picturesque Wales: a Hand-book of Scenery accessible from the Cambrian Railways," is the title of a more than usually interesting, and at the same time useful, guide written by Mr. Godfrey Turner, and published at a very low price by the Cambrian Railway Company, and in London by W. J. Adams and Sons and by Messrs. Simpkin, Marshall, and Co. Mr. Turner seems to have long been much interested in Wales and Welsh scenery, and he has produced a book which is at the same time a guide and a sober gossip about Wales and its history. Some engineering matters of interest, as the Vyrnwy water supply for Liverpool and some of the heavy railway work, are referred to, and the book is well illustrated with engravings of the scenery and with two maps. It relates chiefly to the central and northern part and coast of Wales. It is worthy of a good index, which it has not, but it will be found an interesting companion.

The alterations and extensions of the New-street station, Birmingham, of the London and North-Western Railway Company, which are to make that station double its present size, and leave it the largest in the world, are proceeding rapidly and successfully. Last Sunday an important instalment of the alterations was effected at one portion of the south tunnel. Between half-past three in the morning and six o'clock in the evening 48ft. of the tunnel were demolished by an army of bricklayers and labourers. All the passengers arriving by the Midland and North-Western trains towards the north during the operations were stopped at Curzon-street, some distance outside the station, and through passengers were conveyed in omnibuses to New-street station to continue their journey, and passengers arriving from the north were similarly conveyed to Curzon-street. The arrangements worked admirably.

"A good story comes from an authentic source: Some years ago the floods carried away a bridge on the Michigan Central, and until it could be replaced there was a suspension of traffic. Said the General Superintendent to the blunt hard-working old master bridge builder, "You must put all your men on that bridge; they must work all night, and the bridge must be completed by daylight. The chief engineer shall furnish you with the plan, and you shall go right ahead." Early next morning the General Superintendent, in a very doubtful frame of mind, met the old bridge builder. "Well," said the General, "did the engineer give you a plan for the bridge?" "General," returned the old man slowly, "the bridge is done. I don't know whether the picture is or not." Referring to this the *Railroad Gazette* says:—"This story has been going the rounds of the newspapers recently. It is, however, at least twenty years old, having been first told of Stonewall Jackson and his bridge builder. Some one has picked it up and has turned it into a railroad story, although the adaptation has been rather clumsily done."

The report of axle breakages in 1883 on the roads of the German Railroad Union shows a total of 157, against 181 in the previous year. Of those breaking last year 122 were iron and 35 steel. One of these axles had been running thirty-five years, three more than thirty years, 10 more than twenty-five years, and 35 more than twenty years. The average life of those whose age was known was a little less than fifteen years. Three of the broken axles were under passenger cars, 100 under freight cars, 35 under tenders, and 19 under locomotives. On the average they had run more than 200,000 miles each. The causes of the breakages are given as follows:—Defects in material, 17; defective manufacture, 2; an old crack that could have been detected, 49; an old crack that could not have been detected, 39; collisions, 3; derailment, 1; hot journal, 10; unknown, 36. Besides these breakages, the *Railroad Gazette* says no less than 1480 axles were taken out because of cracks detected in the shops, 1306 of which were under freight cars. The number removed the previous year was 1645. Of these 7 per cent. last year and 11 per cent. in 1882 were steel axles, but no information is given of the whole number of each that were in use.

The active interest taken by the Austrian Government in the construction of railways in Bosnia and the Herzegovina is being further illustrated by the proposal for a line from Mctkovic to Mostar, following the right-bank of the Narenta, and designed to facilitate commerce while also serving useful strategical purposes. Mctkovic is at present a point of junction between the steamboat service on the Narenta and the land transports. After the regulation of the stream it is expected that large vessels can reach this point. There are important coal deposits at Mostar. The total length of the line is 26½ miles, and the difference in altitude between the terminal points about 200ft. The gauge is fixed at 29·92in. so as to correspond with that of the Brood-Serajero line. The permanent way will consist of steel rails 3·54in. in height, and weighing about 34 lb. per running yard, the maximum gradient not exceeding 1 in 300. There is a tunnel about 150 yards long, and various cuttings through rocky ground, &c. The three stations are principally intended for supplying water to the engines, as the country is thinly populated. The line is estimated to cost £170,000. It is in view to prolong the line to Serajevo, and a branch from Mctkovic to Ragusa is also spoken of by the *Deutsche Bauzeitung*.

NOTES AND MEMORANDA.

Professor Herbert Macleod recently exhibited in London a sunshine recorder made by placing a water lens in front of a camera box and lens. Sensitised paper is placed in the bottom of the box so that the focussed ray strikes on it, and as the sun moves traces a curved line or band on the paper. Several of these records were shown.

At a recent meeting of the Paris Academy of Sciences, an account was read of a deposit of saltpetre in the neighbourhood of Cochabamba, Bolivia, by M. Sacc. An analysis of this vast deposit, which is large enough to supply the whole of the world with nitrate of potash, yields the following results:—Nitrate of potash, 60·70; borax, with traces of salt and water, 30·70; organic substances, 8·60; total, 100·00. The author concludes that the saltpetre is the result of the decomposition of an enormous deposit of fossil animal remains.

During the week ending June 21st, in thirty cities of the United States, having an aggregate population of 6,857,300, there were 2724 deaths, which is equivalent to an annual death rate of 20·6 per 1000. During the week ending June 28th, in thirty cities of the United States, having an aggregate population of 6,989,300, there were 3179 deaths, which is equivalent to an annual death rate of 23·6 per 1000. The American *Sanitary Engineer* says the main factor in the increased death rate is the great mortality among children under five years of age, principally from diarrhœa diseases.

The annual rate of mortality last week in twenty-eight great towns of England and Wales averaged 24·9 per 1000 of the aggregate population. The rate in Birkenhead was 13; Birmingham, 20; Blackburn, 23; Bolton, 29; Bradford, 16; Brighton, 11; Bristol, 16; Cardiff, 29; Derby, 21; Halifax, 21; Huddersfield, 15; Hull, 21; Leeds, 28; Leicester, 33; Liverpool, 32; London, 26; Manchester, 27; Newcastle-on-Tyne, 24; Norwich, 24; Nottingham, 27; Oldham, 21; Plymouth, 22; Portsmouth, 13; Preston, 24; Salford, 21; Sheffield, 27; Sunderland, 24; and Wolverhampton, 24. The rate in Edinburgh was 18; Glasgow, 28; and Dublin, 19.

At a recent meeting of the Berlin Physical Society, Professor Lampe spoke on the subject of a hypothesis respecting the formation of the solar system set up by M. Faye in place of Laplace's hypothesis. According to M. Faye's theory, in the original uniform nebular mass, vortices were formed which gave rise to the existence, first, of the middle planets, and then, ultimately, of the outer planets. This hypothesis was advanced as an explanation of the fact that the moons of Uranus and Neptune revolved in a direction opposite to that of the sun, the planets, and the other moons, a fact which was not accounted for by Laplace's theory. Only a brief communication, however, had yet been published of M. Faye's hypothesis, which, too, appeared to betray a number of lacunæ.

M. Lazare Weiller has conducted a series of valuable experiments with the object of ascertaining the relative electric conductivity of metals, submitting the results to the Société Internationale des Electriciens. They are referred to a pure silver wire, 1 millimetre in diameter, and having a resistance of 19·37 ohms per kilometre at 0 deg. C., as a standard. The following are his figures:—Pure silver, standard 100·00; pure copper, 100·00; silicon bronze (telegraph), 98·00; alloy of equal parts silver and copper, 86·65; pure gold, 78·00; pure aluminium, 54·20; silicon bronze (telephone), 35·00; pure zinc, 29·90; phosphor bronze (telephone), 29·00; alloy of equal parts silver and gold, 16·10; Swedish iron, 16·00; pure Banca tin, 15·45; 10 per cent. aluminium bronze, 12·60; Siemens steel, 12·00; pure platinum, 10·60; pure lead, 8·88; pure nickel, 7·89; antimony, 3·88.

M. Edouard Landrin, who had previously shown that when an intimate mixture, in certain proportions, of pure lime and quartz is raised to a white heat, the resulting cement sets slightly on contact with water, but becomes very hard in the presence of carbonic acid, has shown us the results of some new experiments on the hydraulicity of cements that (1) silicates of lime raised to high temperatures set with difficulty, and in any case do not harden in water, according to M. Fremy's experiments; (2) for the calcination of cements to exert a maximum influence on the setting, in connection with water, of the compound obtained, the process must be carried sufficiently far for the lime to act on the silica so as to transform it into hydraulic silica and not into fused silica; and (3) carbonic acid is an indispensable factor in the setting of siliceous cements, inasmuch as it is this substance which ultimately brings about their hardening.

Mr. C. V. Boys recently read a paper before the Physical Society on a phenomenon of electro-magnetic induction. Between the poles of an electro-magnet a small disc of copper is hung by a bifilar suspension. If the magnetic field is uniform, and the disc at an angle to the lines of force, then on making the magnet it is jerked parallel with the lines of force. If it is a changing field, and the disc perpendicular to the lines of force, it is repelled on making the magnet and attracted on breaking by the nearest pole. This phenomenon, which was observed by Faraday, was shown by Mr. Boys to be useful for determining the intensity of a magnetic field by measuring the throw of the disc on magnetising and demagnetising. It might also be employed to measure the resistance of bodies in the form of plates, from their diameter, moment of inertia, and observed throw. Any structural difference of resistance in different directions in the body might be determined by its means. Mr. Boys illustrated his remarks with curves of results obtained by experiment. Lord Rayleigh considered that the effect of self-induction on the results was not likely to be serious.

Mr. R. T. Glazebrook recently read a paper before the Physical Society on the determination in absolute measure of the electrical capacity of a condenser, and on a method of finding by electrical observations the period of a tuning-fork. The paper described experiments conducted according to a method given in "Maxwell," vol. ii. § 776, for measuring the capacity of a condenser. Mr. J. J. Thomson showed—*Philosophical Transactions*, 1883, part iii.—that Maxwell's formula is only approximate, and gave the correct formula, which was used in the author's experiments. In these tuning-forks were used of frequencies approximately 16, 32, 64, and 128 to a second, the frequencies being determined by careful comparison with the clock by Lord Rayleigh's method, and the corresponding values found for the capacity were ·3336 m.f., ·3340 m.f., ·3335 m.f., ·3337 m.f. The mean is ·3337 m.f., and the experiments do not show any variation in the capacity, as the time of changing varies from $\frac{1}{16}$ to $\frac{1}{128}$ of a second. The method also gives a ready and accurate means of determining the pitch of a tuning-fork, for if the capacity of the condenser used is known, the frequency (n) can be determined.

At a meeting of the Physical Society on the 28th ult., Lord Rayleigh made a communication on the practical use of the silver voltameter for the measurement of an electric current. On a former meeting of the society the method was explained by the author, but on the present occasion the apparatus was exhibited. The author considers this the best method of determining the strength of current in absolute measure. One ampère deposits 4 grammes of silver in an hour; therefore, a quarter to half an hour is sufficient to give 1 or 2 grammes, quantities which can be measured with accuracy. Any current from $\frac{1}{10}$ to 4 or 5 ampères can be measured successfully in this way. With very weak currents there is a difficulty in weighing the deposits; with very dense currents the deposit is apt to be irregular. The author deprecates the use of acetate of silver, pure nitrate or pure chlorate of silver giving the best results. The cathode of his apparatus is a platinum bowl, the anode a silver sheet wrapped with clean filter paper sealed over it to keep any loose silver from dropping on the cathode. The anode is immersed in the solution of silver salt; and at the end of several hours—if great accuracy is required—a measurement of the weight of silver deposited is made by weighing the bowl cathode in a chemical balance.

MISCELLANEA.

A new first-class Thornycroft torpedo boat, for the German Government, made the passage to Kiel, the other day, from London in fifty-two hours.

The Sanitary Institute of Great Britain has issued a programme of arrangements for its Autumn Congress, which will be held at Dublin, on September 30th and following days, under the presidentship of Sir Robert Rawlinson, C.B.

The Comptroller of the Bridge-house Estates has announced that on and after Monday, the 11th prox., the carriage way of Blackfriars Bridge will be partially closed for the purpose of being repaved, and that during the execution of the work provision will be made for keeping open three lines of traffic to be regulated by the police.

On the 23rd inst. the Napoli, a fine passenger steamer belonging to the Veloce Company of Genoa, was tried over the Admiralty knot, and attained a mean speed of over 14 knots. The Napoli is a fine steamer of 2000 tons register, with cabins and accommodation for 800 first-class passengers and emigrants. She was originally fitted with horizontal engines, but these did not drive her more than 11 knots. Her owners last year placed her in the hands of the builders of the hull, Messrs. Wigham, Richardson, and Co., and without increasing the consumption of fuel, they have been able to improve the speed by no less than 3 knots per hour.

The producers of petroleum on the western shore of the Caspian Sea have been contemplating seriously the laying a pipe line entirely across Persia to the Persian Gulf. If this were done they say that they would have the Asiatic market to themselves; which is not so certain, however, because there would be no traffic to the Persian Gulf port for vessels taking petroleum to India, China, &c., from it. A pipe line would have to be something more than 700 miles long to reach the coast, and as it would for a long distance pass through a territory of savage Kurds and other nomadic tribes, it is feared that it could not easily be kept in operation.

The preparatory measures for the junction of the sea of Aral with the Caspian Sea have reached a further stage by the return to St. Petersburg of the Russian expedition which has been surveying the route. The Russian Government was so convinced of the important nature of the proposed water-way that General Gluchowsky, the originator of the idea, was sent at a cost of nearly £100,000 with a corps of experts and engineers to make the necessary investigations. The results of this step have not been made public, on the ground of their being under examination by a commission. It is, however, concluded in some quarters that the silence of the official press indicates the non-fulfilment of the original expectations.

The estimated number of letters posted for delivery within New South Wales during the year 1883 was 31,258,300, as against 25,737,300 for 1882; the number of letters posted for delivery in the Australian Colonies and New Zealand was 1,401,900, as compared with 1,202,600 for 1882; and the number of letters posted for foreign despatch was 585,200, as against 498,300 for last year. The total number of letters posted in the colony during 1883 was 33,245,400, as compared with 27,438,200 for last year. The number of newspapers posted in the colony was 18,344,500, as against 16,970,100 for 1882. The total number of parcels, &c., was 1,435,900, as compared with 1,087,400 for 1882. The total number of post cards was 259,400, as against 222,800 for 1882.

From the annual report of the Metropolitan Board of Works for 1883 it appears that the staff of the London Fire Brigade consists of 670 men. The number of firemen employed on the several watches kept up throughout the metropolis is at present 108 by day, and 253 by night, making a total of 361 in every 24 hours; the remaining men are available for general work at fires. The number of calls for fires, or supposed fires, received during the year was 2630. Of these 337 were false alarms, 149 proved to be only chimney alarms, and 2144 were calls for fires, of which 184 resulted in serious damage, and 1960 in slight damage. The fires of 1883, compared with those of 1882, show an increase of 218; and, compared with the average of the last ten years, an increase of 446.

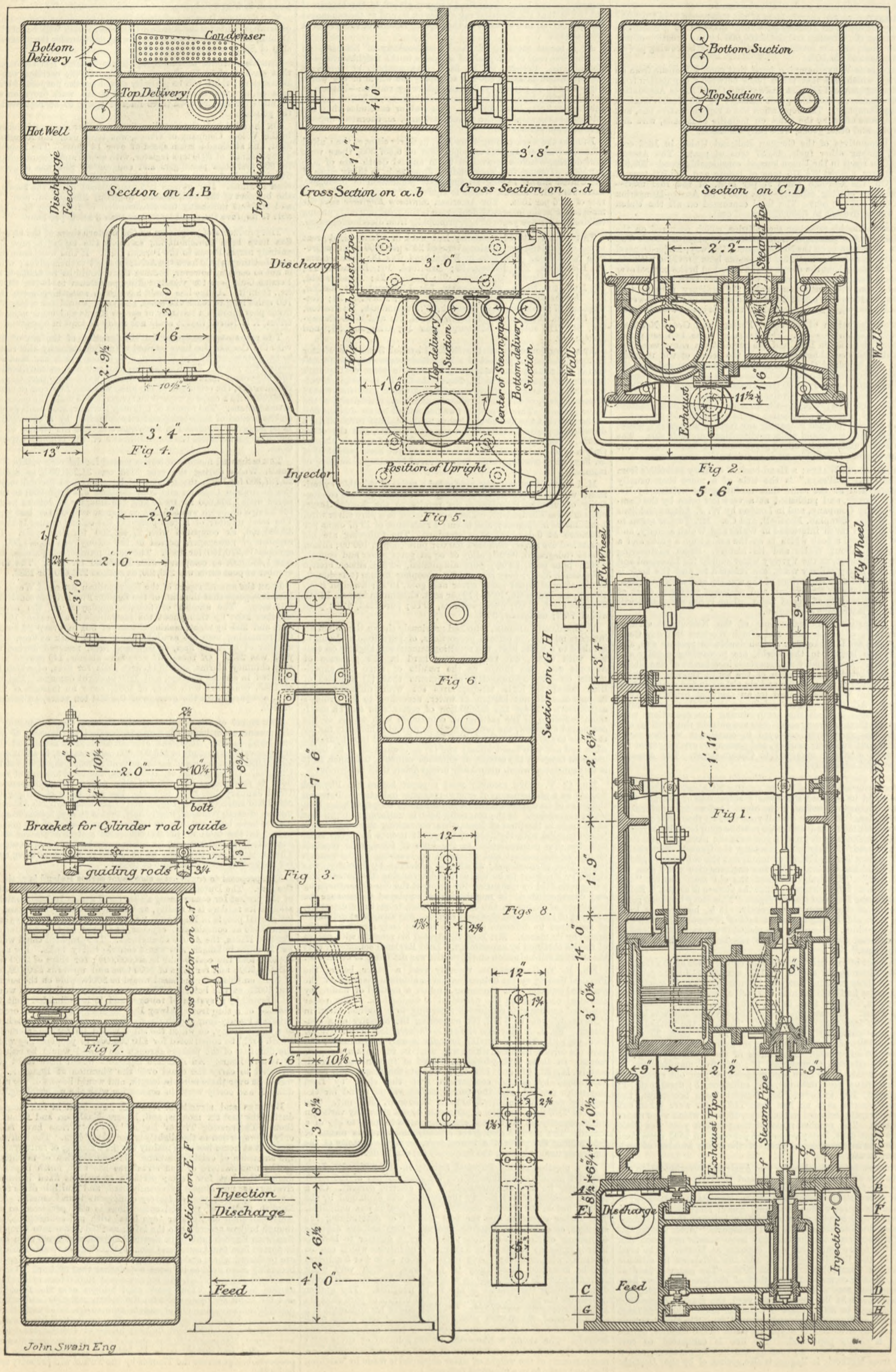
The report of the directors of the Panama Canal Company on the present condition of the works states that the number of men employed in May, 1884, was over 19,000. It is calculated that the excavations amount to 110,000,000 cubic metres, in addition to 10,000,000 cubic metres of earthworks in altering the course of the Chagres. Up to the end of April, 1884, the total amount of work done is represented by 5,243,302 cubic metres of earth removed. Until January 1st, 1884, however, the real work of cutting the canal had scarcely fairly begun, and of the total of 5,243,302 cubic metres of earth removed, nearly half, that is to say, 2,482,768 cubic metres have been removed in the first four months of the present year. In the total of 120,000,000 cubic metres of ground to be excavated, 40,000,000 will be taken away by means of dredgers. The projector says there can be no doubt of the canal being open for navigation before the close of 1888.

The proposal to construct a ship canal across Ireland is again to the fore. The Dublin *Freeman's Journal* has published particulars of the project for constructing a ship canal across Ireland, which it assures its readers is a reality, and has been warmly espoused by influential people in England. "Elaborate plans and surveys have been made at considerable expense, and have been submitted by Captain Eades, the American engineer. The proposed canal would be 127 miles in length, and would contain thirty locks. For ships of 1500 tons the cost would be £8,000,000; for ships of 2500 tons £12,000,000; and for ships of 5000 tons and upwards £20,000,000. If built on this scale the canal would be 200ft. wide on the surface and 100ft. at the bottom. The passage through the canal would be effected by a system of towage, and it is estimated that the passage of a ship from Galway Bay to Kingstown would occupy between twenty-four and thirty-six hours. An alternative scheme of a ship railway, on which the ships would be carried in cradles, which could be constructed for £10,000,000, is proposed, by which the duration of the passage through the island would be reduced to twelve hours. An immense aqueduct would have to be constructed to carry the canal over the Shannon at Banogue. It would be over three miles in length, and would be one of the most difficult and costly works in connection with the undertaking."

Bridges and structional ironwork have been in fair demand during the past six months, and, Messrs. Matheson and Grant in their "Engineering Trades' Report" say:—"Prices have fallen only in proportion to the slightly lower cost of iron. The ironwork required at home has been mainly for the widening of railways and the extension of existing stations. The application of machinery to the manufacture of iron structures has been much improved during the last few years; portable as well as fixed hydraulic rivetters are now almost universally used, and multiple drills form a more important part of factory equipment than formerly. The English system of rivetted connections is still preferred to the American plan of links or 'eye bars' with pin connections, and though bridges according to the latter method come into competition with English bridges in South America, and have even been imported into the Australian Colonies, the English rivetted bridges are preferred where stability and permanence are valued. Steel is becoming more used as its price approaches that of iron. Besides the Forth Bridge, which will require about 10,000 tons of steel per annum for the next four years, steel bridges over the Hooghley and the Indus are being made for the Indian railways, and will do much to render engineers and manufacturers acquainted with its use. In London, the railway bridge over the Thames at Blackfriars is being doubled, the South-Eastern Railway bridge at Charing-cross is to be widened, Hammersmith Suspension Bridge is to be strengthened, and a new iron bridge is to be built at Battersea. The long proposed bridge across the Thames by the Tower will probably soon be built."

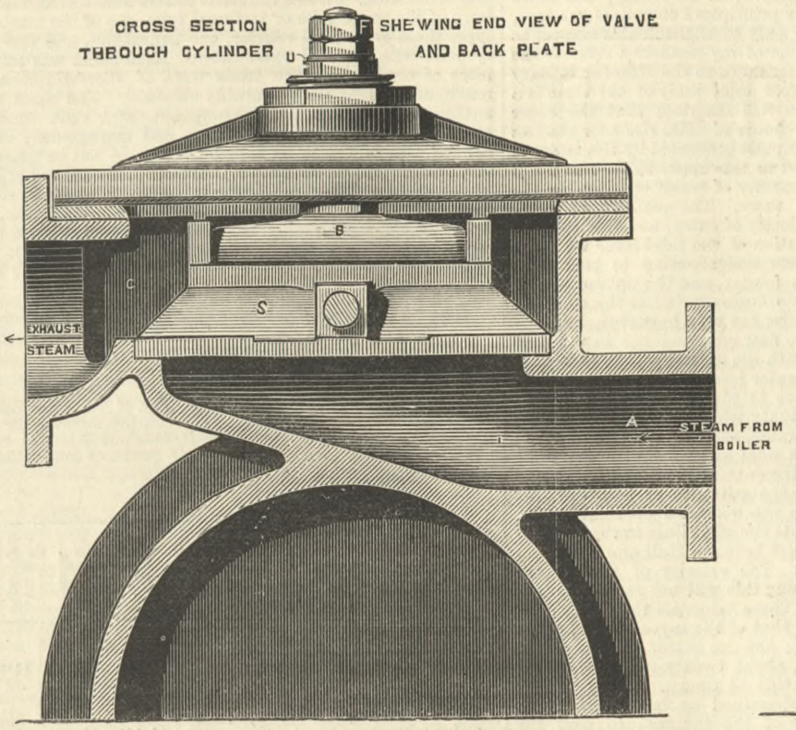
VERTICAL COMPOUND ENGINES, INDIAN STATE RAILWAYS.

(For description see page 78.)

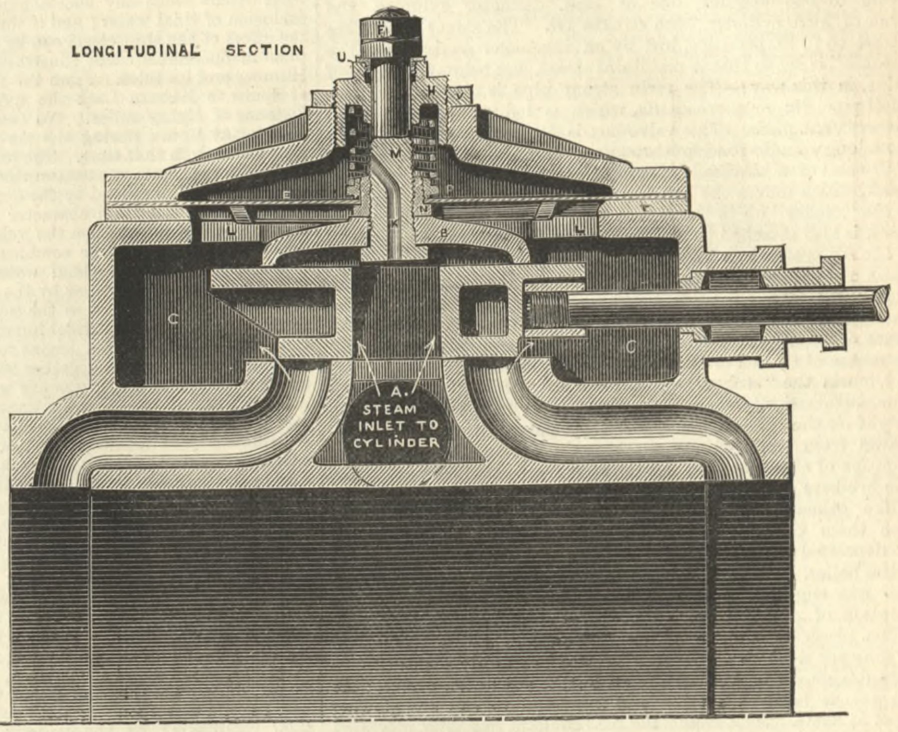


TIPPING'S BALANCED SLIDE VALVES.

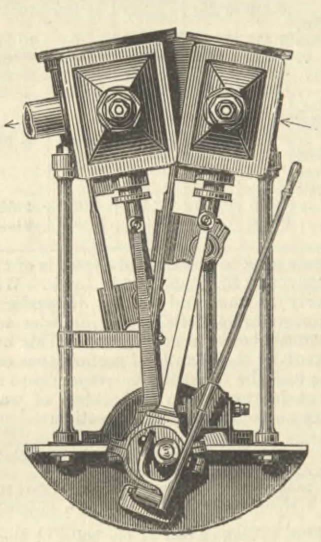
CROSS SECTION THROUGH CYLINDER SHEWING END VIEW OF VALVE AND BACK PLATE



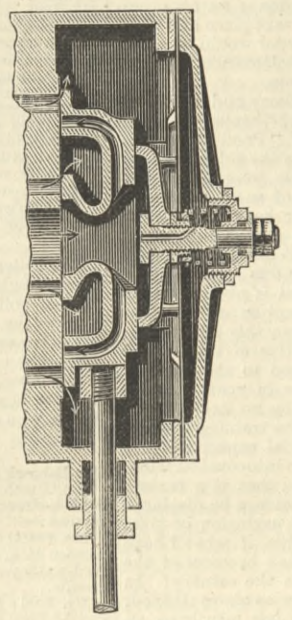
LONGITUDINAL SECTION



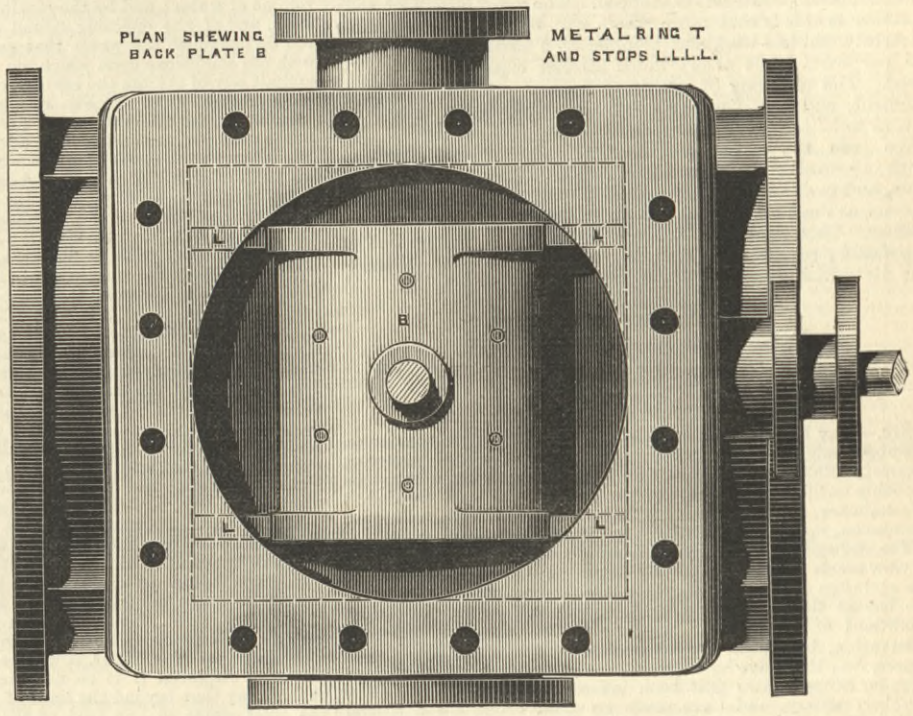
SKETCH OF ENGINES SHEWING FRONT VIEW OF SLIDE JACKET



DOUBLE PORTED VALVE



PLAN SHEWING BACK PLATE B METAL RING T AND STOPS L.L.L.L.



THE accompanying engraving illustrates a balanced slide valve patented by Mr. H. Tipping, of Circus-street, Greenwich. We have already had occasion more than once to speak highly of Mr. Tipping's launch engines, for which this valve has been specially invented. In our illustration it will be seen that the steam is admitted at A inside the slide valve S, and is exhausted through the steam chest C; the valve S is open through, B is a back plate

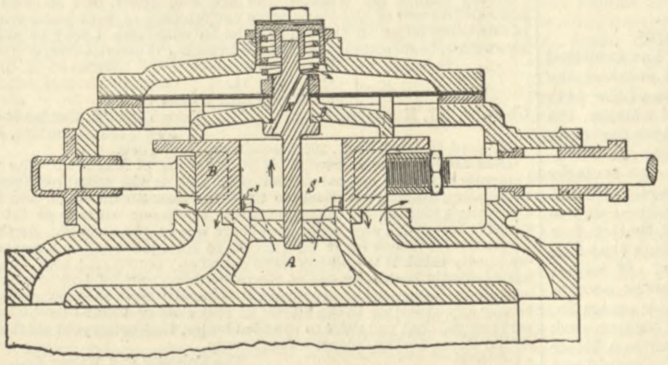
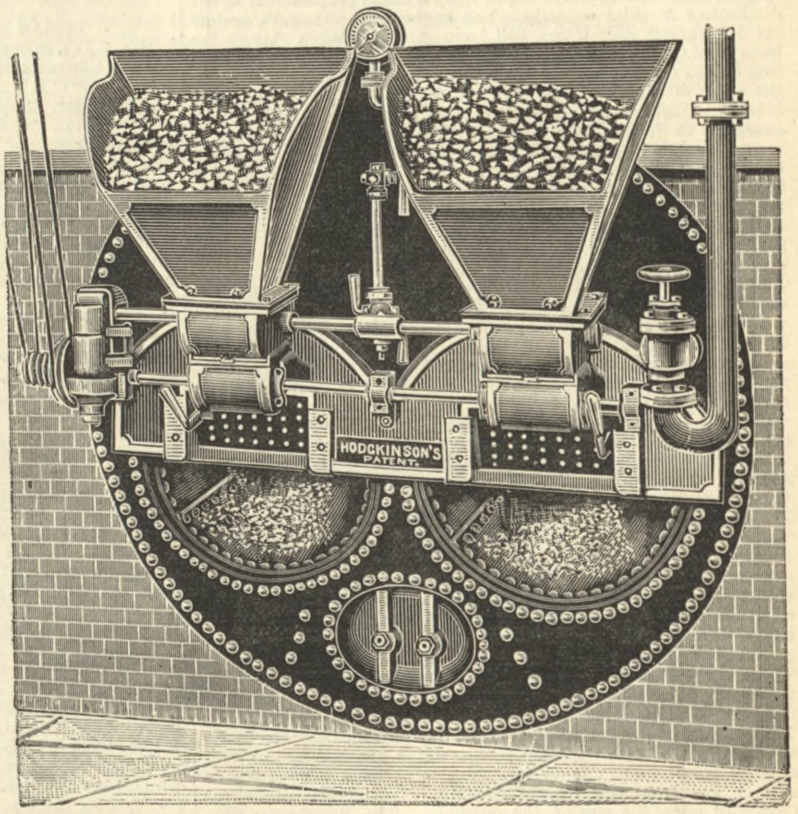


Fig. 5—TIPPING'S BALANCED VALVE.

resting thereon nearly in equilibrium, E is a diaphragm plate, F are nuts, tightening which will relieve the pressure on the valve, G is a spiral spring, the compression of which will add pressure in adjusting the valve. This arrangement affords a light, handy, and simple device, which we understand works very well, and may be constructed either rectangular or circular in shape and to any size, and for either single or double ports. In Fig. 5 the valve stem is not carried through the cover.

HODGKINSON'S PATENT MECHANICAL STOKER

THAT there is a strong prejudice in the minds of steam users against all kinds of mechanical stoking is a well-known fact, and that such a prejudice is well founded is beyond contradiction. Patent after patent has been taken out for many and various systems of superseding hand firing; but the success which any one of them has attained is but small, and in most cases bitter disappointment has followed its adoption. The reasons which account for this state of affairs are of many kinds; but, generally speaking, the failure of a "stoker" has been caused by its complicated mechanism, its liability to break down, and the generally bad and uneven kind of fire which it has maintained. A stoker to be thoroughly satisfactory must be simple in its mechanism, with few parts capable of failing; it must be one which can be worked without extraordinary care and supervision for an unlimited time; it must do the firing at least as well as a man; it must impose no unfair duty on a boiler, nor interfere with the proper examination of boiler fronts and furnaces; and, finally, it must be so constructed and fitted that the furnace can be easily got at for cleaning or hand firing, should that at any time become necessary. Steam users, though prejudiced against stokers as a whole, would no doubt be prepared willingly to adopt one which fulfils all the conditions above stated; and Mr. Hodgkinson, of the Ordsal Machine Works, Salford, claims for his invention that it does meet all the demands likely to be made on it; and, after experimental observation, we are led to conclude that his claims are well based. The general arrangement of the machine which we illustrate is as follows:—A large hopper for the reception of the coal to be fed into the bars stands well up, its top being about level with the top of the boiler, or, if necessary, higher still; at its mouth is a slowly revolving rose, which makes about three revolutions in two minutes, and which keeps the coal agitated, and feeds it uniformly into the lower drum. The interior of this lower drum is fitted with a revolving boss, on the periphery of which two fans or webs are cast, the duty of which is to send the coal on to the bars; these fans or webs are curved convexly to the direction of their revolutions. The exact curve has been arrived at by experiment, and is so made to scatter the coals along the sides as well as the centre of the furnace. A fast running shaft, with a series of graduated pulleys, passes through this boss, which can be driven as occasion demands at any speed from 100 to 500 or 600 per minute, 200 having been found to be the best speed, as at that it spreads the coal well without knocking it into dust. The shafts are driven from the pulleys at the side of the machine; the arrangement of speeds—one very slow, the other very quick—being effected by means of worm wheels on a small vertical shaft at the side. Below the feeding drum a fire door is fitted for the convenience of cleaning fires, examining the furnace, or, if necessary, for allowing of hand stoking. It will be readily understood that the coal is sent into the fire like hail; that a perfectly level fire is maintained, as thick or as thin as is desirable; that in consequence of the "hailing" of the coal the fuel bursts into combustion almost before it touches the fire, and that smoke is as a result to a remarkable extent consumed; furthermore, that as the firing is theoretically good, being



perfectly level and thin, and that coal of a very inferior order may be used, a high degree of economy is assured. The whole machine is hung by means of brackets and T-bolts from the to of the boiler, and so the necessity to drill holes in the front plate is obviated, as well as the evil of having a heavy piece of mechanism with full hoppers of coal hanging from a plate already fully loaded, with the steam pressure on the other side of it. We have seen a couple of machines fitted to and working on a large Lancashire boiler in the works of Messrs. Bamber Bros., Bolton. The boiler is 7ft. in diameter by 30ft. long, and supplies steam to two engines, one of 18in. diameter cylinder, the other of 24in. cylinder, both strokes 4ft. The safety valves are loaded to 75 lb. pressure, but by an ingenious contrivance the "stoker" is set so that it maintains steam just below the blow-off point, in this way:—The main steam pipe is furnished with a small pipe, $\frac{3}{4}$in. or thereabouts, which is led into a valve-box at a convenient place. This valve-box is fitted with a valve, which has a long spindle passing through a stuffing-box, and attached to the end of a balanced bell crank. A wire is fitted to the bell crank, which moves the bell fork for throwing the driving belt of the "stoker" on to the fast or loose pulley, and the same bell crank is also attached to the damper in the chimney. As soon as the set pressure is exceeded, the valve lifts, throws the bell crank over, which puts the driving belt for the stoker on to the loose pulley, and consequently stops the firing, while it, at the same time, puts the damper into the chimney. As soon as the steam drops to the desired pressure, the valve falls again, and by means of its bell crank pulls the damper out of the chimney, and starts the "stoker" again. We saw this operation being done automatically every few minutes; in fact, every time the weight on the engines was altered by the addition to or withdrawal from work of any machine in the factory, or by the stoppage of either engine, this arrangement acted as a governor. The fire-bars of this particular boiler are revolving bars, but, unlike others, they run out instead of in, and so carry with them the unconsumed ashes, refuse, or clinker, which are deposited within a handsome brass-mounted fender in front of the boiler. We were informed by a very intelligent fireman who was engaged in looking after this boiler, that since the adoption of the Hodgkinson stoker the consumption of coal, under precisely similar circumstances, had fallen from over 20 tons per week to under 13. Ignition certainly seemed to be instantaneous, and combustion all but, it not quite, perfect; the fire was as level as a table, and from end to end one glowing sheet of flame. By a touch the feed could be instantly increased or diminished or altogether stopped. The great benefit of such a stoker as this is that more steam can be raised with greater certainty and less work and trouble, at a saving of from 15 to 25 per cent., while a very much inferior class of coal can be used. The changing of speeds of feeding can be done in a moment, and the quantity of coal may be varied from 6 or 8 tons to 35 tons per boiler per week of fifty-four hours. We have seen the stoker working with the ordinary fire-bars, with the revolving bars, and with Hodgkinson's patent rocking bars, and in all cases with satisfaction and this is a point in its favour, as most other machines without a special grate bar are useless. This stoker has been tried at sea, and with highly satisfactory results, it being in successful use on, for instance, the State Line steamer State of Nevada.

LETTERS TO THE EDITOR.

(*Continued from page* 80.)

THE MANCHESTER SHIP CANAL.

Sir,—May I trespass on your space with a few remarks upon the above subject—one which is undoubtedly of wide engineering interest? Should you permit this letter to appear, it will not be probably until after the fate of the scheme has been decided at Westminster, and my object is only to invite discussion, with your permission, upon the particular views that I enumerate.

The strength of the opponent's case from an engineering point of view seems to have lain in the statement that in consequence of the exclusion of tidal water, which it is assumed would take place, the bar at the entrance to the Mersey would suffer. The tidal conditions of the Mersey have not come under my personal observation, but much can be learned by a study of the various papers, &c., that have been written on the subject. I have, however, for several years past been intimately acquainted with the Humber estuary, and have made its tidal conditions a special study. Every estuary is, however, unlike every other estuary, and parallel cases cannot be well drawn; but general principles, if true, are equally applicable to all estuaries.

Now, there is one view of the question of the exclusion of tidal water which seems to have escaped general notice, and which, if true, will go very far towards minimising the fear which the opponents have as to the damage to the bar of the Mersey, which will ensue after the construction of the training walls of the canal. Hydraulic engineers are agreed as to the value of tidal water in maintaining the depth on the bar, and they are agreed also that the diminution in depth upon a bar is proportional to the diminution in tidal capacity. The engineering witnesses against the Manchester Ship Canal Bill have generally taken this as the basis of their arguments; they have then stated that the construction of the training walls must inevitably be followed by silting in the upper estuary, *and that therefore there will be a diminution in tidal capacity, and a consequent damage to the bar*. Now, I take exception to the italicised portion of the conclusion above, and I state that, though there be silting up in the upper part of an estuary, there will not of necessity follow the slightest diminution in tidal capacity, and therefore no harm to the bar. This statement can, I believe, be simply demonstrated on true scientific principles, and I hope the statements I am about to enumerate may be read and discussed in your columns, so that their truth may be established or otherwise.

There are four physical conditions upon which alone the quantity of tidal water in a given estuary depends, viz.:—(1) The tidal force which generates the inflowing current; (2) the upland water that, in endeavouring to pass out, opposes the inflowing tidal current, and becomes a force opposing the tidal force; (3) the capacity of the entrance to the estuary to pass a volume of water; (4) the capacity of the tidal receiver, *i.e.*, of the portion of the estuary that receives tidal water from the sea. With regard to these points:—(1) The Atlantic tidal wave, on approaching the west of Ireland, is split up into two branches, one passing round the south and one round the north. These branches meet again in the Irish Sea, and there cause the tidal rise of some 30ft. at the entrance to the Mersey. As this resultant tidal wave in the Irish Sea causes the water surface to rise, a head of water is developed at the Mersey entrance, and causes the flood tide and inflowing current into the estuary. Whatever is done inside the estuary cannot affect this tidal rise at the entrance. Indeed, were a barrier placed across the entrance, the tidal rise would probably be the same, as it depends entirely upon external influences. Thus the tidal force which generates the inflowing current will be unchanged by artificial works in the estuary. (2) The upland water which opposes the tidal flow, depending upon the extent of the water-shed and rainfall, will be again uninfluenced by works inside the estuary. (3) The quantity of water passing through any entrance channel under the influence of two opposing forces which are constant in their action—except in so far as variations arise from neap tides to springs and from dry to wet weather—is evidently dependent primarily upon the size of the entrance. The Manchester Ship Canal Bill does not contemplate any works at the entrance of the Mersey, and except by indirect action—which I shall immediately discuss—such as the silting up of the bar, no change will be made in the capacity of the entrance to pass a volume of water.

I think now it will be admitted that whatever else may follow from the construction of the training walls of the canal, there will be the same quantity of tidal water endeavouring to pass in; the same quantity of upland waters passing out and opposing the tidal entry; and the same capacity of the tidal conductor—with the possible exception I have stated. (4) I now proceed to show to what extent alone any encroachment upon an estuary can cause exclusion of tidal water; and if the principles I enunciate are true, the effect of the ship canal can be only so slight in this respect as to be inappreciable. For illustration of my remarks I refer to the Humber and its tides. From the entrance to the Humber estuary at Spurn to Naburn Lock the upper tidal limit of the Ouse is a distance of eighty miles. No one will maintain that the water entering at Spurn during the six hours of tidal rise ever reaches Naburn Lock in that time. The impulse generated by the entry of tidal water is, however, transmitted to this upper tidal limit; and this impulse, determined by the quantity of water entering, is the sole cause of the tidal character there. The quantity of water entering is dependent upon the velocity of entry, and this velocity depends in turn upon the combination of the tidal force with the opposing force of the upland waters endeavouring to pass out; this latter force is overcome by the former, and the upland waters are backed up. As soon as the tide begins to fall at the entrance to the estuary, the total tidal impulse has been imparted, and the tidal water from the sea begins to flow out, and has in the next six hours all passed out together with the upland waters that have accumulated since last it was low water level at the entrance.

Now, I submit that if the entrance to the estuary be enlarged, any artificial works within the estuary which cause accretion or reclamation will exclude tidal water only if such works are executed within the limits to which tidal water from the sea flows during the period of rising tide at the entrance to the estuary; and as a consequence, the farther from the entrance or bar that the works are removed the less will be the exclusion of tidal water. Refer now to Fig. 1, which represents the tidal lines in the Humber for a certain tide. The water surface between Hull and Spurn for each hour of rising tide is shown. The velocity of flow at the entrance during the six hours of rising tide will not exceed 2, 4, 5, 5, 4, 2 miles respectively, and with these velocities the path of the first portion of water that enters is that of the curved line, supposing there be no mixture of water; and no water entering can, therefore, pass beyond the point A, about twenty-two miles from Spurn, during the period of rising tide at Spurn. Every estuary has, I say, a corresponding point determined by its capacity as a tidal receptacle; by the capacity of the entrance to pass the volume of water; and by the resultant of the forces of the tidal wave, and of the opposing upland waters. It is evident that if you do not touch the water that comes in, and do not interfere with the conditions upon which its quantity depends, you cannot exclude any of it from the estuary, and the entrance or bar cannot consequently suffer. In Fig. 1 the portion shaded is an area proportional to the tidal inflow. If a reclamation take place at a point B, for example, the exclusion of tidal water proper would be not in proportion to the depth of water where the reclamation is made, but to the depth B C as indicated on the diagram.

Apply now these principles to the Mersey estuary and the Manchester Ship Canal. Fig. 2 is reduced from Mr. Shoolbred's paper on "The Mersey," in vol. 46 of the Minutes of "Proceedings" of the Institution of Civil Engineers, and it shows the tidal lines for successive hours for an equinoctial spring tide from the bar to Garston. Now, assuming the mean velocities of entry for such a tide at the bar to be 2, 4, 6, 6, 4, 2 miles per hour respectively during the successive hours of rising tide, the curved line shows the path of the first entering water and the limit beyond which any works in the estuary would not exclude tidal waters from the sea. The extremity of the training walls of the canal is about twenty-two miles from the bar, and if the above assumption of velocities be correct, observations are required to determine this accurately. The diagram shows how very small a proportion of tidal water would be excluded even if silting up were caused to the level of high-water mark; and if the accretion in course of years did not reach above, say, half-tide level, there would be no exclusion of tidal water at all. And the indirect effect of the training walls in diminishing the depth on the bar, and the tidal capacity of the entrance by accretion of the bar need not be taken into consideration.

The conclusion usually accepted is this, viz., that if a certain amount of space occupied by water in a tidal estuary be displaced by land or deposit, there will be an equivalent exclusion of tidal water. This seems to me an incorrect deduction, if what I have said above be true. But, it will be asked, what becomes of the water so displaced if it be not excluded from the estuary? In reply, I say that beyond the limit of tidal inflow as above defined, the tidal water in any part of the estuary exists merely as an effect of an impulse generated lower down, and that the displacement of the water by solid matter only necessitates an equivalent absorption of the energy of the impulse in some other manner, such as an increased velocity past the spot, or a greater oscillation and elevation of the tide at the place. Instances can be named bearing out these views.

In conclusion, I hope I have placed the matter in a clear light, and that you will allow it to be discussed in your columns.

A. C. Hurtzig.

Alexandra Dock Works, Hull, July 28th.

INDIAN RAILWAY GOVERNMENT CONTRACTS.

Sir,—As a carriage and wagon builder, whose firm has executed several contracts for India, I have read with some interest the letters of "C.E." and "Another C.E." in your issues of the 11th and 25th inst. Setting aside the apparently personal animus, the chief point in "C.E.'s" letter is his assertion that these contracts are the *bête noir* of the market. As this writer directs his attention solely to carriage and wagon work, perhaps a few remarks from one engaged in that branch may not be out of place. "C.E." criticises the design of what he terms a "muck" wagon—I do not think that was the contract name—but what does it matter to a contractor if the design is needlessly expensive, providing that it is properly described in the drawings and specifications? If he has not the appliances or the disposition to execute the work accordingly he should not tender; it is here that the *bête noir* comes in, the builder of ordinary wagons, &c., taking a contract for ironwork for India has had to be taught a lesson, in some instances a bitter one, viz., that the old style of making wooden vehicles would not answer for those made of iron. If the different parts of the former did not come together quite accurately a little coaxing would do it; but with iron strict accuracy is essential, necessitating special and expensive machinery and elaborate templates. The old-fashioned wagon maker sneeringly calls it "watchwork," "locomotive work," and so on; but the "proof of the pudding is in the eating." When we have accepted an India States contract we know precisely what we have to do, and the work having been rigidly inspected during progress, goes abroad and nothing more is heard of it.

Is this so with all engineers? Some give out general drawings and require the contractor to submit detail drawings for approval, some wait till the pattern vehicle is complete before deciding on the details; and then, notwithstanding this, complaints from abroad have reached the contractor.

The specifications issued by Mr. Rendel are sometimes felt to be needlessly oppressive, especially when an occasional inspector acts by the strict letter rather than the spirit of the contract; but it has to be borne in mind that as the work must be put together in India for the first time, accuracy is required, also that one result of good work is cheap maintenance.

In conclusion, I may express an opinion that when our foreign competitors have had a lesson or two in *bête noir*, they will not be able execute the work any cheaper than we in England.

July 28th. Template.

WATER-TUBE BOILERS.

Sir,—The evidence in regard to the relative merits of different types of steam boilers is, of course, largely made up of *ex parte* statements from interested persons, and comparisons of relative performance are apt to be misleading, from the fact that the conditions of trial are seldom identical. A remarkable exception to this state of affairs is, however, to be found in the official report of the series of boiler trials conducted at the United States Centennial Exhibition. Fifteen different boilers were tested, nine of which were of the water-tube or sectional type, one of the marine tubular type, three cylindrical tubular, one Lancashire, and one a vertical cylinder with external water tubes. Each boiler was tested at two rates of combustion; the trials were of short duration, so that maximum results were probably obtained. The same quality of anthracite coal was used throughout, and each exhibitor was allowed to superintend the firing and management of his own boiler. One of the water-tube boilers could not be made tight for trial, so that its record does not appear in the official report. The performance of the other fourteen boilers, arranged in the order of their relative standing in respect to average evaporation, is shown in the accompanying table, the figures being taken from the official report of the trials; and it is believed that the table is worthy of careful examination by those who are interested in the subject of boiler performance:—

Boiler Tests at United States' International Exhibition, 1876.

Boiler.	Lbs. of combustible consumed hourly, per sq. ft. of heating surface.		Lbs. of water evaporated into dry, saturated steam, from and at 212 deg. Fah., per lb. of combustible.			Ratio of evaporation per lb. of combustible in economy tests, to similar evaporation in capacity tests.
	Capacity tests.	Economy tests.	Capacity tests.	Economy tests.	Average of capacity & economy tests.	
Smith, cylindrical tubular, with water tube furnace attachment	0·313	0·234	11·925	11·906	11·916	1·002
Lowe, cylindrical tubular with combustion chamber in front connection, and superheating drum	0·289	0·185	11·163	11·923	11·543	1·062
Firmenich, water tube ..	0·207	0·161	11·064	11·988	11·526	1·084
Galloway, Lancashire, with water tubes in flue.. ..	0·482	0·361	11·216	11·583	11·400	1·033
Root, water tube	0·307	0·214	10·441	12·094	11·268	1·159
Babcock and Wilcox, water tube	0·372	0·236	10·330	11·822	11·076	1·144
Harrison, sectional	0·420	0·288	9·889	10·930	10·410	1·105
Andrews, marine tubular, with superheating tubes	0·410	0·263	9·745	11·039	10·392	1·133
Anderson, water tube ..	0·429	0·286	9·568	10·618	10·093	1·111
Exeter, sectional	0·239	0·159	9·974	10·041	10·008	1·003
Megand, water tube	0·458	0·351	9·145	10·834	9·990	1·185
Pierce, cylindrical tubular, revolving on trunnions over furnace	0·679	0·509	9·865	10·021	9·943	1·016
Rogers and Black, vertical cylinder, suspended over furnace, with external water tubes	0·615	0·410	9·429	9·613	9·521	1·020
Kelly, water tube	0·646	0·426	8·397	10·312	9·355	1·228

The boiler most largely used in the United States is of the cylindrical tubular type, externally fired and set in brick. When this form of boiler is properly designed and well set, its performance is believed by many engineers to be little, if any, inferior to that of any other type of stationary boiler in general use. This opinion is supported to some extent by the records of performance contained in the preceding table; and the following correspondence seems to indicate that there is at least one firm of builders of water-tube boilers who are not very anxious to test the question.

I.

206, Broadway, New York, May 31st, 1884.

The Babcock and Wilcox Co., 30, Cortlandt-street, N.Y.

Gentlemen,—One day, nearly two years ago, your Mr. Pratt met me in Fulton-street, and had a short conversation with me, substantially as follows:—

Mr. Pratt: Can we get you to make a test of our boiler at the Richard Borden Man. Co. in Fall River? It was tested some time ago, but the feed-water was measured with a meter, and we are not satisfied with the results.

Mr. Buel: I will try and find time to do it if you will give me a few days' notice, and probably Mr. Borden will fit up the apparatus that was used when I tested his Corliss boilers for you.

Mr. Pratt: I will ask Mr. Babcock to talk the matter over with you. Do you know that you are making a great mistake with your boilers in Gold-street? You should have taken our boilers. Those water-drums and side-pipes will burn out in a few months. We have tried the water-drum and found it a failure.

Mr. Buel: Do you really think, Mr. Pratt, that you have the most economical boiler in the market?

Mr. Pratt: We know it. We are ready and anxious to prove it, and for money. We are a responsible company, with plenty of money. I mean just what I say, and the company will back me.

Please inform me whether you are still ready and anxious for a comparative test of the evaporative performance of your boiler with that of any other boiler in the market, as in such case I may be able, in a short time, to do something towards bringing it about.—Respectfully,

Richard H. Buel.

II.

The Babcock and Wilcox Co.,

Glasgow, 107, Hope-street. New York, 30, Cortlandt-street.

New York, June 2nd, 1884.

Richard H. Buel, Esq., 206, Broadway, New York.

Dear Sir,—We are in receipt of your favour of May 31st. The writer remembers having a conversation with you at the time you were contemplating making additions to the American Steam, Heat, and Power Company's plants. At that time it was worth our while to go into competitive tests with any boiler that there was in the market. As there is no particular reason for it now, either to get a job or set on a competitor, we hardly think it would pay us to spend any money on a test. Until we are decidedly beaten by one of the numerous group of boilers who come as near infringement as they dare, it is hardly worth the company's while to pay any attention to the efforts of this class of water-tube boilers, for we presume that you refer to the Sted boiler, that being your old favourite at the steam heating plant.—Yours truly,

The Babcock and Wilcox Co.

Nat. W. Pratt, Tr.

III.

206, Broadway, New York, June 4th, 1884.

The Babcock and Wilcox Co, 30, Cortlandt-street, N.Y.

Gentlemen,—My letter of May 31st was prompted by the following circumstance:—

An engineer in this vicinity, who has charge of several boilers, some of which are of the water-tube type, Babcock and Wilcox patent, and others are of the cylindrical tubular type, set in brick, told me, not long ago, that he was satisfied, from some trials made by himself, that the cylindrical tubular boilers evaporated more water per pound of coal than was evaporated by the Babcock and Wilcox boilers.

I thought that it would be interesting to settle this question on its merits by careful trials, and that you might like to take part in the trials and send an expert to represent you. If you are averse to spending money on a test, and really believe that your boiler is more economical than a well-proportioned and well-set cylindrical tubular boiler, I think that the question of expenses could be arranged in this way:—If your boiler should prove to be more economical than the cylindrical tubular boiler, you would not be called upon to pay anything, not even the charges of your own expert; but if the reverse should prove to be the case, you would settle all the bills.

Please let me know what you think of this.—Respectfully,

Richard H. Buel.

Letter No. III. completed the correspondence; for a correspondence, like a quarrel, requires two parties, and the parties of the second part have failed to respond. Richard H. Buel.

New York City, U.S.A., July 15th.

THE PENISTONE DISASTER.

Sir,—Sir Edward Watkin is reported at the half-yearly meeting on the 24th inst., of the South-Eastern Railway Company, to have been asked by a proprietor whether the brake in use on the South-Eastern Railway was the same as that in use on the Manchester, Sheffield, and Lincolnshire Railway, and Sir Edward's reply as given in the three principal railway papers is to the same effect, viz.:—

"The chairman replied that the brake used on the South-Eastern was the vacuum brake, which was the very best brake out. The brake spoken of in competition with it—viz., the Westinghouse brake—was, in his opinion, one of the most complicated and dangerous brakes that could be put into operation. The Westinghouse was worked with an air pump at a pressure of 90lb. to the inch. This was on the engine, so that if the air pump were to explode—and it was not an impossibility—it would lead to the most dreadful disaster. In the accident which had been alluded to the brake did its duty. The brake was on and the carriages held together; and if, through Providence, the engine-driver could have gone another sixty yards the train would have got into the cutting, and there might not have been a single injury."

Sir Edward is a little apt to quote "Providence" in the wrong direction in furtherance of his own particular views, and is equally fond of making violent attacks upon anything or anybody that he may conceive to be antagonistic at any particular time. It is not the first occasion on which he has made similar statements in regard to the Westinghouse brake—see the report of the January meeting of the Metropolitan Railway Company—and his repetition of them at the recent South-Eastern meeting was, no doubt, prompted by the feeling that the vacuum brake had failed most unfortunately when it was wanted to save life in the course of the recent accident at Penistone on the Manchester, Sheffield, and Lincolnshire Railway.

The Westinghouse Brake Company, however unwilling they might otherwise be to interfere at such a time, is now bound in self-defence to reply to the above uncalled for and unjustifiable statements of Sir Edward Watkin, and I have, therefore, to request, on behalf of that company, that you will kindly afford them a limited amount of space for that purpose.

Sir Edward Watkin has here pitted the ordinary non-automatic vacuum brake against the Westinghouse automatic brake as worked on the North-Eastern, Great Eastern, Brighton, Chatham and Dover, North British, Caledonian, Glasgow and South-Western, and other railways in this country. As a proof of the danger of employing the latter, he states that it is worked with an air pump at a pressure of 90 lb. to the square inch, and that if the air pump on the engine were to explode it would lead to the most dreadful disaster. Our answer, Sir, to this allegation is that the Westinghouse air pump is worked by the steam from the boiler itself, which carries a pressure of 140 lb. or 150 lb. per square inch, and supplies the cylinders of the engine; and although there are upwards of 11,000 of these air pumps upon engines in different parts of the world which are fitted with the Westinghouse brake, and of which large numbers have been working for upwards of ten years, not one of them has ever exploded, which is more than can be said for the boilers of the locomotive engines themselves. Moreover, if an air pump were to explode, the damage to be feared from it would be infinitesimal as compared with that of an explosion of the engine boiler.

We can only suppose that Sir Edward Watkin has ventured upon this absurd statement for the reason that he could not find a better argument, and that "any stick is good enough to beat a dog with," and the only conclusion to be derived from it is that, according to Sir Edward's views, the locomotive engine itself is a most dangerous appliance, and should no longer be employed on English railways.

In dispute of Sir Edward Watkin's other assertions, we cannot do better than inclose a printed copy of Mr. T. E. Harrison's notes on the working and maintenance of the Westinghouse brake on the North-Eastern Railway. No railway engineer in this country can be considered more competent, more impartial, or more independent than Mr. Harrison, and his testimony on this subject is the most valuable that could be adduced, as it has been compiled by himself, unsolicited, for his own information.

But what is of still greater interest to the general public is the action of the vacuum brake in the Penistone accident, and the results that would have been obtained if the train to which this disaster happened had been fitted with the Westinghouse brake. The facts of the case are briefly these:—The crank axle of the engine failed while the train was running at its usual high speed near the Bullhouse signal-box. The engine of the train ran upwards of 500 yards before it came to a stand, with the tender and the horse-box still attached to it. The other vehicles of the train were more or less damaged or destroyed after running upwards of 200 yards from the point at which, according to the evidence, after the fracture of the crank axle the vacuum brake was applied. This distance of 200 yards was sufficient to bring the train to a stand, as shown not only by experiments specially tried on different lines of railway, but also in the ordinary working of the Westinghouse brake on every line on which it is in daily use for every stoppage of every train which is so fitted. The engine and every vehicle of this particular train might and would either have been brought to a dead stand within these 200 yards, or the speed at the end of the 200 yards would have been so much reduced that none of the carriages would have been damaged, and that no man, woman, or child would have been injured. Major Marindin, the Government inspector, says: "Had the brake been automatic I think there is no doubt that the rear vehicles would have gone over the bank at very much less speed, even if they had not been stopped before going over."

If there is any doubt on this subject, let a train, fitted with the Westinghouse brake, similarly constituted, be run over the same spot, and let it be ascertained within what distance such a train running at the same speed could be stopped. Surely, Sir, the frightful loss of life and injuries which have been sustained by so many passengers would justify this easily made experiment.

One point to which we should not, in conclusion, omit to refer is this, that when a coupling fails between two carriages or elsewhere, or if the brake apparatus is injured in any way, there is no brake power left on a train fitted with the vacuum brake, whereas when a coupling fails on any portion of a train fitted with the Westinghouse brake, or should any part of the apparatus be damaged, the brake blocks are applied with full force to the engine and every wheel throughout the train.

I may add that during three years and nine months there has been an increase in the sales of Westinghouse automatic brakes of 8276 sets of apparatus for engines, and 49,563 for carriages and wagons, there being altogether on the 30th of April last, 11,553 sets for engines and 63,065 for carriages and wagons. These figures should in themselves be sufficient refutation of Sir Edward Watkin's groundless accusations.

ALBERT KAPTEYN, secretary, the Westinghouse Brake Company, Limited.

Canal-road, King's-cross, London, N.

SIR,—The *Standard* of to-day has the following paragraph, which occupies exactly eight and a-half lines:—"The Midland five o'clock express from London to Manchester and Liverpool met last evening with an accident to the engine at Elstree, which delayed the train for an hour and a-half. It appears that while running at full speed the axle of the engine gave way, but the driver at once applied the brake and stopped the train, which was put into a siding till a fresh engine was procured. No inconvenience was experienced beyond the delay." It is needless to state in your paper that the Midland Railway Company has adopted the Westinghouse air brake, and it is equally superfluous to point out that but for this brake not eight and a-half lines but several columns would probably have been required to describe the consequences of the failure of the locomotive axle had the train been fitted with the vacuum non-automatic brake, as in the Penistone disaster on the 16th July on the Manchester, Sheffield, and Lincoln Railway.

STEPHEN H. TERRY.

17, St. Philip's-road, Surbiton.
July 25th.

SIR,—May I be permitted to trespass on your valuable space to suggest that flaws in iron or steel can be detected by submitting the axle to strain and magnetism, exploring with a magnetic needle? All that is needed is the poles of a powerful electro-magnet and a small magnetic needle in a glass tube. A magnetic chart of any angle could be drawn, and any change in homogeneity noted. I hope that some attention may be paid to this practical method of diagnosing hidden defects in iron and steel submitted to such varying stresses, and many distressing delays and accidents thereby prevented.

PHILLIP BRAHAM, F.C.S.

July 29th.

THE WILMSLOW ACCIDENT.

SIR,—On the 7th July a collision occurred at Wilmslow, on the London and North-Western Railway. An express engine was making a trial trip from Longsight and running at a speed of sixty miles an hour under the direction of a foreman fitter. The block system was improperly worked, Webb's steam brake failed to act, a collision followed, and the fitter was killed by jumping off the engine. The driver has been committed for manslaughter, arrested and locked up. The jury were informed by the company's assistant superintendent that sixty miles an hour is an improper rate. If this be true I fear there are many trains very improper. Mr. Whale also stated that if the driver had reversed at sixty miles an hour he could have stopped in 350 yards. Upon this statement the jury formed their verdict; but I desire to point out that at Newark a London and North-Western engine and tender was run at a speed of fifty-six miles an hour, the engine was reversed, back steam applied, the tender hand brake put on, yet I well remember that it ran no less than 433 yards. At Newark everything was in first-rate order, but at Wilmslow a pin fell out of the Webb brake, and the engine being new out of the shops, it was very hard to reverse. Some years ago an engine-driver was imprisoned to save the reputation of the chain brake, now another unfortunate man has been locked up, and discharged from the service, simply because the steam brake failed, and reversing the engine at sixty miles an hour did not do an impossibility and stop in 350 yards.

The recent brake failures and inefficient action at Penistone, Nottingham, Swansea, Wilmslow, Leeds, and Holbeck should certainly direct the attention of railway officials to the danger of brakes which are non-automatic and liable to fail at any moment.

CLEMENT E. STRETTON.

40, Saxe-Coburg-street, Leicester, July 26th.

THE INVERSE ACTION OF THE ELLIPTICAL CHUCK.

SIR,—In reference to Lieutenant-Colonel Campbell's letter upon this subject in last week's ENGINEER, in which he says, "Singular as it may appear, I have never come across any notice of the inverse action of the elliptical chuck, so believe it to be nearly, if not quite, unknown to our lathe makers and turners," I beg to say that this peculiar action has been known to me for many years, and I have at different times explained it to a great many friends. In 1853 I invented an elliptograph, drawings and description of which will be found at page 33 of the "Engineer and Machinists' Drawing Book," published by Blackie and Son in 1855. This instrument has been made and sold by Mr. W. F. Stanley, of London. I soon discovered that by mounting a disc upon the spindle of the ellipto-graph, and holding a pencil against it while it was rotating, an epicycloidal figure was produced, and that by varying the position of the pencil and the excentricity of the ellipto-graph, very beautiful patterns could be traced. I enclose you specimens made in my original ellipto-graph.

JAMES FINNEY.

Bocking, near Braintree, Essex, July 30th.

STRESS DIAGRAMS.

SIR,—I regret that Mr. Graham does not see his way to answer my inquiries, but I trust he will reconsider his decision. A few short articles on the theory of the disintegration of trusses would materially assist students in understanding and working out the examples given in his book, and would form a useful supplement to it.

Perhaps he will be good enough to refer me to some books—recent ones—in which I would find the subject thoroughly discussed.

C. S.

July 29th.

THE LAWS OF VOLUME AND SPECIFIC HEAT.

THE following interesting communication from Mr. Samuel E. Phillips recently appeared in *Nature*. "The facts as to the variation of specific heats of gases will be seen to be of much importance. The former, known as the "law of Avogadro," implies that any given volume at the same temperature and pressure must contain the same number of molecules. It includes the law of Chasles, viz., equal expansibility for equal increments of heat; and the law of Boyle or Marriotte, that the volume of any gas must vary inversely as the pressure. The other is that of Dulong and Pettit; and as the former necessitated equal volumes, so this latter implies constant heats for parallel conditions. But, finding that few elements approximated this law, it was an early device to double, treble, or quadruple the old atomic weights to secure a supposed uniformity; and thus the law found this expression, viz., that the specific heat of any solid element would prove to be a measure of its atomic quantity. This, put in plausible fashion, will be the stock instruction of the superficial books for some time to come; but in the higher circles of chemical life it is being admitted more and more that a great change has come over the spirit of this dream. Departures from the normal 6·4 are no longer attributed to errors of observation, and that constant is replaced by a range of 5·5 to 6·9; while, to keep within this, M. Weber has proved that the doubled carbon equivalent must be tested at a range of temperature exceeding 1000 deg. C. He has found that within the limits of — 50 deg. and 600 deg. its heat value increases sevenfold! Well indeed may he say, "The idea that temperature can be overlooked must no longer be entertained;" also, "That the specific heats are not generally expressed by constant numbers; the physical condition of the elements influence their specific heats as much as their chemical nature."

These be great admissions from one of the highest authority, but they are as nothing compared with the new demands of physical chemistry. Mr. J. T. Sprague, an able and determined new chemist, has been the first in England to challenge attention to the recent researches of M. Berthelot, L. Troost, and others of the very highest chemical authority. In a recent paper he admits that the new results "strike at the root of the most favourite chemical doctrines of the day, doctrines which are the foundation of the modern atomic weight and molecular theory, and consequently of the doctrines of atomicity, and the complicated molecular theories which have been based upon the supposed atomicity and specific bonds of different atoms." The laws of Avogadro and Dulong and Pettit are offshoots of one principle, and one really implies the other. If true, it would follow that the atomic heat must be the same for all substances, or, if otherwise, the same quantity of heat would not produce equal expansions; also that the specific heats must be equal at all temperatures, or equal quantities of heat would act differently at different temperatures, or else it must vary equally for all gases, or they would expand unequally for equal quantities of heat.

Now, it is a misfortune for these laws that none of these conditions subsist over wide areas. As a consequence of the two laws, an air thermometer should measure all temperatures by equal rates of expansion, and a given expansion should correspond to a fixed quantity of heat; such a thermometer should also read equally if filled with any other perfect gas. In other words, these laws can only be true if the relation between the weight and volume of different gases be constant, and if the heat absorbed in producing a given change of volume is equal at all temperatures—that is, if the specific heat is constant. These conditions are practically fulfilled by air, O, N, and H, between 0 deg. and 200 deg. Cent., so that the scale of temperature derived from the change of volume is the same as the scale derived from quantities of heat; but between 200 deg. and 4500 deg. there is a gradual growth of changed conditions which proves fatal to both laws, and there is apparently an absorption of energy which does not appear either in the form of expansion or of sensible heat as temperature. At this high stage the specific heat of some of the simple gases has increased threefold, while some gases have a greater rate of expansion than others. The same thing occurs with other simple gases, but at a much lower temperature, as, even within 0 deg. and 200 deg., where dissociation cannot be entertained, chlorine and other halogens differ considerably from N or H, and at 1600 deg., if an air thermometer indicated 1600 deg. for a given expansion, a chlorine one would register by expansion 2400 deg. for an equal temperature, though with a much greater absorption of heat by the chlorine. This difference is dependent on the fact that at 1600 deg. the comparative density of chlorine has diminished one-third, or, in other words, that its volume, as compared with H, instead of being 1, has become 1·5; or, to put it in another way, that under these conditions, the specific heat of Cl is threefold that of H. Quite apart from these extreme cases, the specific heat is never a constant value; it takes more heat to raise a given weight of substance 1 deg. at one temperature than another. The specific heat increases with temperature, but differently for different substances:—

	0 deg. to 100 deg.	0 deg. to 300 deg.
Iron	=·1098	·1218
Platinum	=·0335	·0343
Mercury	=·0330	·0350

The differences here are both distinct and small, but Be (glucinium) increases twofold within a moderate range, and we have seen that between — 50 deg. and 600 deg. carbon increases its specific heat sevenfold, or, as Mr. Sprague expresses it: "The heat relation of each substance is described by a particular curve; and the small differences observed in some cases are not errors, but actual differences of the several curves, and where there is approach to identity it is accidental, due to the temperature of observation being within a limit at which the curves are near their commencement, and have barely begun to separate." However tempting or fashionable it may be to rush into hypothetic explanations of half-digested truths, yet I have taken some pains to keep within facts, which are in some respects incipient and but little understood. If the causal differences in the production of light and sound had been fairly or patiently entertained, the "luminiferous ether" would never have been invented, which now crosses our path, as an "opaque fact, stopping the progress of further knowledge."

If a little more humility and patience had been evinced in respect of the expanding facts connected with gaseous volumes and specific heats, the old equivalents would never have been doubled, trebled, or quadrupled, to mar the symmetry of a beautiful science. I quite agree with M. Troost, who, in repudiating the hasty references to dissociation, &c., observes: "The only consequences which necessarily flow from the experiments at high temperatures, or at low pressures, are that the coefficient of expansion is variable with the temperature, or that the coefficient of compressibility varies with the pressure." Also with the final conclusion of M. Berthelot: "The only law absolutely and universally applicable to the elements is the invariability of the relations of weight according to which they combine. This notion, and that of the energy brought into play in their reactions, are the sole and only firm foundations of chemical science."

ROYAL AGRICULTURAL SOCIETY'S TRIALS OF SHEAF BINDERS.

IT has now been arranged that the trials of sheaf-binding machinery entered for competition and exhibited in the Shrewsbury showyard shall commence on Wednesday morning, August 6th, upon the farm of Mr. Edmund Hawkins, at Dinthill, about four miles from Shrewsbury, on the Welshpool turnpike road. Originally as many as thirty-one machines were entered, but on account of withdrawals of some, and failure to exhibit others as required by the rules of the Society, the number to be presented for trial has been reduced to twenty-one. With but one exception all of these inventions were taken charge of by the competitors at the close of the Shrewsbury Show, after depositing with the Society the sum of £25 for each machine, as a guarantee for its being produced on the trial field in working order by the time appointed. The entries, as they now stand, are as follows:—

Class 1.—Sheaf-binding reaper, the binding material to be other than wire; first prize, £100; second prize, £50. Eighteen entries, viz.: Messrs. J. and F. Howard, of Bedford, three machines; The Johnstone Harvester Company, of London, one machine; Mr. A. C. Bamlett, of Thirsk, one machine; Messrs. Lankester and Co., of London (agents for the McCormick Harvesting Machine Company, of Chicago, U.S.), three machines; Mr. H. J. H. King, of Newmarket, Stroud, one machine; Messrs. Samuelson and Co., of Banbury, two machines; Mr. George Kearsley, of Ripon, two machines; Mr. Walter A. Wood, of London, two machines; Messrs. Richard Hornsby and Sons, Limited, of Grantham, three machines.

Class 2.—Separate sheaf binder, the binding material to be other than wire. Prize £25, three entries, viz.: The Notts Fork and Implement Company, of Rainskill, Bawtry, one machine; Messrs. Kingsford, Fairless, and Co., of Kingston-on-Thames, two machines.

The competitors have been instructed to have their machines in readiness by Tuesday, August 5th, so that the operations may commence on the following morning in a field of seventeen acres of oats. Subsequently the binders will be tested on growing crops of wheat and barley. The judges are Mr. Thomas Bell, Hedley Hall, Newcastle-on-Tyne; Mr. Mason Cooke, The Lawns, Ely, Cambridge; and Mr. William Scotson, Mossley Hill, Liverpool.

ENGINES OF THE STEAMSHIP AMERICA.

IN our last impression, page 63, we described at some length the National Steamship Company's fine steamer the America. We this week give on page 86 front and side elevations of her engines. These are of the three-cylinder type, the high-pressure cylinder, 63in. diameter, standing between the others, which are each 91in. diameter, the stroke of all the pistons being 5ft. 6in. It will be seen that the cranks are not equally divided round the circle, and in this way more regular turning is secured. Condensing water is supplied by centrifugal pumps, the air and bilge pumps being worked by levers off the low-pressure engines.

THE INSTITUTION OF MECHANICAL ENGINEERS.—The summer meeting of this Institution takes place next week at Cardiff, commencing on Tuesday, and continuing throughout the week. An excellent programme for the week has been arranged, and nothing but fine weather is necessary to complete it.

ENGINES OF THE ATLANTIC STEAMSHIP AMERICA.

MESSRS. JAMES AND GEORGE THOMSON, ENGINEERS AND SHIPBUILDERS, CLYDE BANK, GLASGOW.

(*For description see page* 85.)

Fig 1.

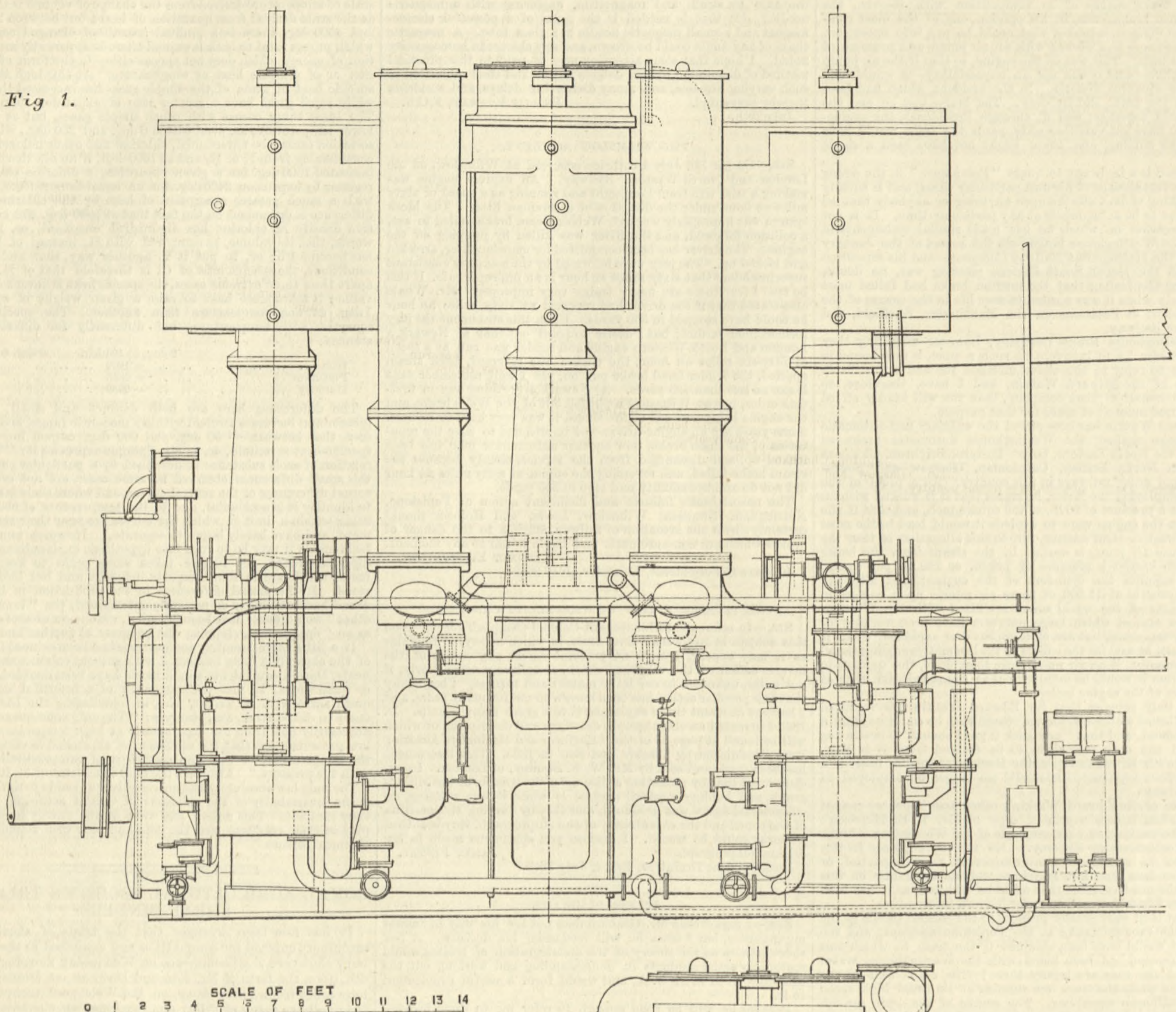
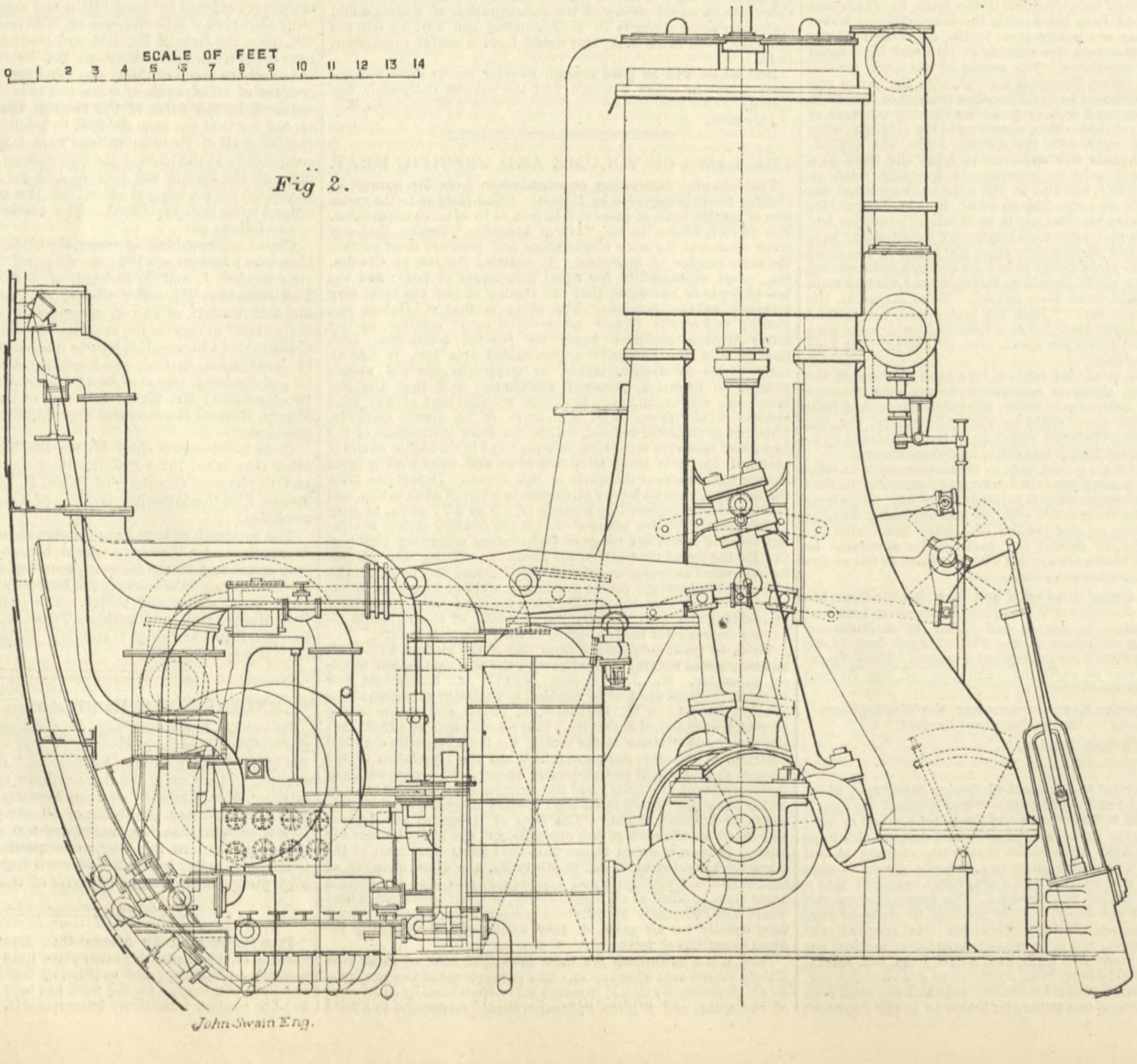


Fig 2.



John Swain Eng.

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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* 1d. *postage stamp, in order that answers received by us may be forwarded to their destination. No notice will be taken of communications which do not comply with these instructions.*

*** *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.*

J. R.—*Yes; but you must not call it a patented invention.*

J. K. S.—*There is no cause for alarm. It is highly improbable that a Bill of the kind will ever become law.*

T. S. B. (Carmarthen).—*We have failed to find anything new in your letter, which only travels over a well-worn road, therefore we do not publish it.*

PROGRESS.—*There is nothing new in your proposal to lead sewer gases by ventilators into house and other chimneys. The objections to the ventilation, or the attempt to dispose of the foul air in this way, are numerous.*

G. P. (Mary-street, Birmingham).—*You can work as you propose and save some coal—nothing like one-half. Your engine will run very irregularly, in all probability, more power being given out in the high than in the low-pressure cylinders. If you leave your engines as they are, and pin a piece on each end of each slide valve so as to increase the lap, shifting the eccentric a little round in the shaft at the same time, you will work more expansively whether the drivers like it or not, and will save more coal than you can by compounding in the way you suggest.*

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THE ENGINEER.

AUGUST 1, 1884.

THE TOWER BRIDGE.

IT is with some satisfaction that we draw the attention of our readers to the present condition of this scheme, and to the probability of a long-needed public improvement being carried into effect in the manner we have, in the face of much opposition, been recommending for the last ten years. It is no longer necessary to urge the need for a Thames crossing below London Bridge. This part of the case has been long acknowledged by all concerned; but it is interesting to note how a project so long considered and so bitterly opposed is at last likely to be accomplished. Perhaps there has never been a more palpable instance of the difficulties encountered in this country in carrying out public works, however important they may be, when they touch the vested interests of private persons, however few, who have the control of official channels through which to make themselves heard and felt. The traffic on London Bridge is admirably managed by the police, and were it only to increase the available passage way over the river itself, the Tower Bridge scheme might have been held back a little longer; but the eastern part of the City and all the approaches to London Bridge have become so congested by the converging traffic that the remedy can no longer be delayed. From an engineer's point of view, there has never been any question that a low-level bridge near the Tower can alone supply the accommodation needed. The hindrance which a bridge so placed would present to the passage of masted vessels is an inconvenience that can be measured, and is one quite insignificant when compared with the advantages gained. It is mainly to the ingenuity with which this hindrance to vessels has been exaggerated, and the facts perverted, that the low-level bridge has not long ago been sanctioned. A small group of property owners in and about Thames-street and Billingsgate has endeavoured to show, and has apparently convinced till lately, a majority of the Common Council that the City would suffer an inconceivable loss if the Continental steamers, fruit vessels, and fishing smacks were compelled to land their cargoes below the Tower; and so-called representatives of the working classes have been put forward to assert that if the trade be thus moved down the river, thousands of men will be thrown out of employment. So powerful has been the City to oppose the interests of greater London, that the Metropolitan Board of Works, through its engineer—Sir Joseph Bazalgette—has not ventured to propose a low-level bridge, but has spent much public money in propounding impossible alternatives. Thus, in 1878 Parliament was asked to authorise a high-level bridge with a roadway 35ft. above that of London Bridge—a scheme which, as we pointed out at the time, would, on a moderate computation of the traffic, involve an unnecessary lifting work daily of 700,000 foot-tons. The absurd gradients and approaches, and the opposition of the City to any kind of bridge, caused the rejection of the scheme, and the matter was dropped for a time. So powerful did the Billingsgate interest prove, that the Metropolitan Board, constituted, as it is, with no direct constituents to support it, did not venture to move till again urged by public opinion, and then it proposed a tunnel, with gradients and approaches just as bad as those of the high-level bridge, and with the additional inconvenience of a subterranean passage. It was evident from the first that this project could never be sanctioned, but counsel and engineers were again employed, and it became clear that only by the costly process of setting up every kind of plausible scheme and showing their absurdity could the real solution afforded by a low-level bridge be, by a process of exhaustion, at last reached. Sir F. Bramwell and other engineers lent their names and reputation to schemes for hydraulic lifts, by which the traffic of a vast city was to be lifted by elevators like luggage in an hotel. Other engineers endeavoured to prove that a duplex bridge within which large steamers in a rapid tideway were to be moved and navigated was the proper remedy. These and other schemes were gravely put before a Parliamentary Committee to be as quickly thrown over. London having no self-government, has been obliged to pay as much for these investigations as would almost have constructed a simple bridge. The beginning of the end seems, however, to have come at last; the Committee of this session has not only recommended a low level bridge with mechanical openings, but that the City and not the Metropolitan Board shall construct it; and despite the continual opposition of the interested members, who again proposed a tunnel, the Common Council, stimulated by the eastern parishes, and with the Municipal Reform Bill looming in advance, voted on Monday last, by a majority of 83 to 58, that immediate steps should be taken towards designing of the bridge. It is to have openings for the passage of masted vessels, but as these openings will almost certainly never be used, when, after the first few years the sea-going ships take their proper place below the Tower, it is to be hoped that the piers and other parts of the structure will be so contrived as to allow of alteration to a sightly non-opening bridge. On this and some other points, such as the combination of the road bridge with a high-level railway bridge, we may have something to say on a future occasion. Meanwhile we hope no time will be lost, and that the Corporation, moribund though it may be, will prove equal to the occasion, and give us a structure worthy of the metropolis. London expects it will no longer allow the interests of a fruit dealer or a fishmonger to weigh against the wants of millions of people, and that the creditably active members of the Corporation will no longer act in concert, or allow themselves to be classed with these or their actions which have done so much to bring that old institution into scorn.

TELEGRAPHIC COMMUNICATION WITH OUR COLONIES.

ON many occasions in the past it has been observable that it is not until some great crisis occurs that those of our colonies which are in communication by cable with the mother country fully recognise the value of that communication, or that those which as yet remain without its pale appreciate strongly their need of it. Thus, it was not until the disturbed condition of South Africa during late years brought prominently forward the disability under which that colony laboured, that steps were taken to remove it. It was more the necessities of war that caused the Home Government fully to appreciate the value of electric communication than any remonstrances of the colonists; and in that fact we recognise once more some truth in the old saying that "War is the great civiliser." A crisis—this time, fortunately, not of a warlike character—is now directing attention to the demands of the population of Mauritius to be in their turn embraced within the great circle of speaking nations. The stoppage of the Oriental Bank is one of those disasters which almost periodically disturb the commercial balance; and if its ill effects have been but comparatively slightly felt in these islands, it is certain that much distress has resulted from the failure throughout many of our Eastern possessions. In most of these the closing of the doors of the various branches of the bank was, owing to the telegraph, simultaneous with that action in London. Thus, transactions in which that institution was engaged terminated as regards nearly all our colonies in what we may term an equilibrium. But this was not so with the bank's establishment and its customers in Mauritius. There, in ignorance of what was proceeding at home, for more than a fortnight sums of money were paid into what was really then a bankrupt concern; and we hear of instances of much distress arising from the unfortunate circumstance among the creditors of the bank; while, on the other hand, the local managers were continuing to make advances which largely affected the assets of the bank, and which would probably, had it not been for the wise authorisation of our Courts of Law to lend further money for the continuance of cultivation of the crops on which such advances were made, have been wholly lost. The news of the suspension eventually reached the sugar island by a messenger sent by steamer from Durban, to which place it had of course been telegraphed, but his arrival was naturally too late to prevent the transactions referred to above.

We have sketched out one of the many instances in which from time to time the advantages to our colonies of telegraphic communication with the mother country become more strikingly apparent. Residents in them are so used to the daily bulletins of world-wide news, that they almost cease to consider how they come to them, and fail to recognise what their position would be should the means whereby they receive them be cut off at a moment of crisis such as we have above quoted. We have, therefore, taken the case of the Mauritius as a text for the consideration of the subject of the duty of the colonists towards those who provide for their telegraphic communication with the rest of the world. It happens, unfortunately, that the expense of laying cables to some of our outlying colonies is altogether out of proportion to the paying traffic which their limited *mercantile* populations will insure. We emphasize the word "mercantile" because, of course, it is as a rule only to the messages sent by the mercantile classes that a cable company can look for its income. But there is not a single member of the population who is not more or less interested in the preservation of its ocean telegraph; and it is, therefore, only just that in inverse proportion to the amount of private business a colony is able to afford, its Government should subsidise the undertaking in the welfare of the people generally. Undoubtedly one of the most important of our oceanic telegraph lines is that which enables us to communicate with our West Indian Colonies, while it is equally undoubted that in no case has any line we are aware of either been constructed or maintained under greater difficulties than the main cable, and its numerous branches to the scattered islands which form the West Indian group. The growth of sharp coral in the shallow waters which fringe these islands is most destructive to the cables; and although we are far from saying that no mistakes have been committed in laying them, it is certain that the repairs and renewals under the conditions named must always prove to be a fruitful source of expense.

The experience of the West Indian and Panama Telegraph Company gained during many years has proved this expense to be so great that the subsidies granted by the several colonies did not augment the receipts from the limited mercantile contributions sufficiently to make the investment a paying concern. These subsidies had been granted under a condition that the company should gratuitously supply certain bulletins of news of public interest, and when the question of increased subsidy was first mooted, it was alleged against granting such a concession that these bulletins were exceedingly meagre and defective. Against such a failure of contract, however, there must exist, or could be imposed, many means of guarding. It certainly can afford no argument of sufficient weight to justify incurring a risk of suspension of telegraphic communication altogether. The lines must be made to pay, or they must be abandoned by any company which can only carry on its operations at a direct financial loss. The negotiations as to the increased subsidy, under which such a loss may in future be avoided and a decent profit secured, have been proceeding between the company and the several Governments of the West Indian Colonies for several years past; but it is only very recently that all of them, with one exception, have given in their adherence to the new scale. That exception, we hear with surprise, is the highly fertile and prosperous island of Barbadoes, and we fail to understand upon what grounds it can pose in opposition. Its Governor, Sir William Robinson, K.C.M.G., is recognised as one of the most capable and energetic of the staff of colonial governors, who has done much in his administration of Barbadoes to advance its social and financial interests. Possessing the influence he undoubtedly does among the people he governs, it is the more extraordinary that Barbadoes alone of all the West Indian Colonies should show a failure to appreciate the boon conferred upon it by telegraphic communication. We are not writing as advocates for any particular company, but simply to give reasons why a liberal policy as to telegraphic communication must be a wise one. Even half a loaf is better than no bread; as the Barbadians would realise should a crisis affect them as it has done Mauritius.

THE PROSPECTS OF YOUNG ENGINEERS.

MR. AUDAIN a few weeks since began a correspondence in our pages which it is impossible to read without interest. Young men, more or less entitled to call themselves engineers, not only complain that they have fallen on evil days, but suggest means by which others may escape similar disasters. There is on certain points universal agreement among our correspondents. Concerning other questions opinions differ; but all have something to say worth hearing. We do not propose to summarise this correspondence, and express definite opinions concerning the points in dispute; but we think that something may be gained if we put the whole question of the future and present prospects of young engineers in a somewhat different light from that which has been employed by those who have up to the present dealt with the subject in our pages.

The substance of the complaint made by our correspondents is, that after receiving a more or less expensive special education, they are unable to earn their livelihood. They cannot get employment at all in some cases, and in others the work they do is very badly paid for. They contend that those whose pupils they were have been guilty of distinct breaches of faith. They denounce the pupilage system; but they have not been quite successful in devising a substitute. Now the whole matter really lies in a nutshell, and a little attention being paid to the broad principles involved, there can be no difficulty in arriving at definite notions as to the reason why so many find engineering a failure as a means of even earning bread and cheese. The world buys the services of those whom it wants and who are able to serve it; and the price is settled, like that of all commodities, by the quality and quantity of the thing bought. At the present moment, and for some time past, the supply of young men who have just served their apprenticeship is in excess of the demand. It would be mere waste of time to explain minutely why; but it is principally due to the circumstance that young men have become engineers without asking themselves whether it was likely they would be wanted. This is not peculiar to engineering. It has been stated, we believe on good authority, that there are now 3000 barristers who cannot by any possibility ever get work enough to pay them 10s. a week. Not long since an advertisement appeared in our pages for a draughtsman; something a little better than usual was offered in the shape of salary to secure a good man. The result was that the advertisers received 620 applications, but they did not find what they wanted among them. If such facts were generally known, we fancy parents would think twice before they made engineers of their sons. Apart altogether from the multiplicity of young men seeking employment, we have to consider what it is these young men can give in return for so many sovereigns per month. This is, unfortunately, the point to which those most interested pay least attention, and it is well that we should dwell on it even at such length that we shall have to reserve the consideration of other questions for another opportunity.

To begin with, a broad distinction must be drawn between the statical—commonly called the civil—engineer and the dynamical—commonly known as the mechanical—engineer. The former has to spend large sums of money with very little regard for the consequences. He is expected to work cheaply in the sense that he gets good value for his money, but the first consideration is that the work shall be done. The result is that a man who can take levels, make a small survey, plot a section, or run out a simple trigonometrical calculation, may be of considerable use in a civil engineer's office; always provided that he is quick, and scrupulously accurate. An inaccurate man will be very dear at any price. It follows that young civil engineers just out of their time would find little or no difficulty in getting employment if only civil engineering work was being done. As it happens, however, that in Great Britain at all events, we are not making in any quantity roads, or railways, or docks, or canals, or bridges, while there are a least fifty applicants for any possible berth, it follows that the case of the young civil engineer is nearly hopeless, and this notwithstanding that he really has professional knowledge of a useful kind, as far as it goes, to sell. The pupilage system is not a failure with him. He learns what is worth money. If he does not get employment it is not because he is ignorant, but simply because the amount of work to be done is limited in quantity, while the supply of labour is overwhelming. Nothing can improve the prospects of the young civil engineer but a large augmentation in the amount of work to be carried out, or a great reduction in the supply of engineers—such as might be brought about, perhaps, if young men carefully eschewed the business for about fifteen or twenty years.

If we turn now to the mechanical engineer we find matters on an entirely different footing. The mechanical engineer is a manufacturer. He may make lace machines, or power looms, or steam engines, or turbines; but there is no difference between him and the cotton spinner, or the weaver, or the pottery maker. We know that it is the custom to put the mechanical engineer on a much higher footing than the lace maker, let us say. He is regarded as more scientific, more professional, so to speak. Perhaps so. It is not worth while to go into this matter. The broad fact remains that he makes things which he sells, while the civil engineer does not. Now the manufacturer knows that the making of the thing sold is only part of the business of his life. He must make and sell at a profit; and no amount of engineering skill—using the words in their abstract sense—will enable him to do this. He must know how to buy everything he wants in the cheapest and sell in the dearest market, and he must understand how to cut down the cost of production to the lowest possible limit. This is not peculiar to engineering. Such things cannot be learned from books; they are not taught at science classes; and the ordinary pupil never learns them at all. The mechanical engineer who employs young men estimates their worth by what they can do, and he knows that, as a rule, they can do very little. Let us consider for a moment what a man who has served his time in the shops of a good firm, passed through the drawing-office, and studied science, can give in exchange for a salary. He is an indifferent fitter, worth, say, £1 a week; he can run a planer or a shaping machine if the work is fixed for him, as well as a boy of sixteen who has been brought up to run planers and nothing else. He can do a little at the lathe, but is not to be trusted with really accurate jobs. He is a fair draughtsman, in the sense that he can put lines neatly on paper, and can use a box of colours with some judgment. He knows a good deal about the theory of the steam engine. He can calculate volumes of air from weights, pressures, and temperatures. He can tell one end of an indicator diagram from another. He has more than a smattering of algebra and the first six books of Euclid are at his fingers' end. He is a fair arithmetician, and possibly knows something of electricity, magnetism, and chemistry. This is about the sum and substance of his attainments. How far are they likely to be saleable; how much are they likely to fetch in the market? The list of what he does *not* know would be much more extended. We shall not attempt to reproduce it. It will suffice to point out one item. He cannot, for the life of him, tell what anything he makes or sees made costs or ought to cost. He is totally unable to make even an approach to an estimate. Take him into the yard in which he has worked, show him a fly-wheel, and ask him what it weighs, how much pig iron was needed to make it, what the coke that melted it measured, how long it took to turn and bore it, and it will be found that he knows none of these things. Put him in the drawing office, give him an old engine then in the yard to re-build, and see how he will set about it. How much of the old work will he bring in? How many new patterns will he want? Test him in any possible way connected with manufacturing for a profit, apart from abstract scientific engineering, and he will be found utterly ignorant, and being ignorant he is practically useless to the engineer outside a very narrow groove, and yet he expects to find plenty of employment at a good salary. There are pupils who are exceptions to this, and our experience goes to show that such men never want employment for any length of time. They may not be paid all they are worth, but they do not pronounce their lives a mistake. So long as they have health and strength they get work. Such are the men who get into valuable partnerships, or ultimately assume high positions. But, as we have said, they are exceptions to the general rule.

It will be found, and we say it with regret, that one reason why so many men are failures as engineers, is that they do not take saleable goods to market; and this opens up a very large question indeed. The question is one of education, the consideration of which we must reserve. We must, however, before taking leave of the subject for the moment, say that enthusiasts are running the risk just now of teaching young men intended to be engineers a great deal that has no direct money value whatever. Unfortunately far too exalted an idea has been formed of the worth of so-called science to the steam engine maker, let us say. All the science in the world would not keep him out of the bankruptcy court unless he can sell engines for more than they cost him to make. We are not deprecating the teaching of science; we only insist that, in practical mechanical engineering, science does not of necessity mean money. We often hear German and French engineers extolled for the results of their scientific training. What are the locomotives or marine engines which have resulted from it like? The Americans have been the least scientific engineers in the world; yet they have modified engine-building practice all over the world. Germany and France have been unable to compete with us without buying engines from us to copy. Science may prevent a man from making enormous mistakes: it cannot tell him how to produce even moderate commercial successes. Standing alone, it is entirely helpless in commercial mechanical engineering—combined with sound practice it is useful. How and why some pupils learn the commercial part of the business, while others do not; and why some men have better chances of success than others, are points which we shall deal with at a future time. We have said quite enough now, we think, to open the eyes of some of our correspondents, to startle others, and to put a few, perhaps, in direct antagonism with us. We have said nothing, however, which any employer of labour, any practical mechanical engineer, will refuse to allow. Unfortunately one of the first things the pupil discovers when out of his time, is that, according to the world in which he seeks employment, he has really learned to do nothing which is worth substantial remuneration; and all the while employers are at their wits' end to get really good and valuable men.

OUR SALT MINES.

Since we last referred to the salt trade, the official statement of the produce of the mines and works for the past year has been published. It shows that of rock salt we produced 233,170 tons last year; of white salt, 1,989,384 tons; and of salt contained in brine used in ammonia process of soda manufacture, 110,400 tons; the total, less a small quantity of white salt made from rock salt, being 2,325,720 tons. The district of Durham is the latest of the producing parts, and naturally attention is directed to it. It appears that last year there were produced in South Durham 19,640 tons of white salt at the works of Messrs. Bell Brothers, the estimated value of the salt at the works being £9820. Other attempts are being made to add to the production of salt in South Durham. Messrs. Allhusen and Co., of Newcastle-on-Tyne, have just contracted for the putting down of a bore-hole north of that of Messrs. Bell Brothers, and nearer to Seaton Carew. And it is stated that the same deposits of salt are to be tapped on the Yorkshire side of the river by Messrs. Bolckow, Vaughan, and Co., and that it is possible that by the end of the present year the salt production of the Durham district may be largely increased. Hitherto the salt production has mainly been in the Cheshire district, and on that part of our island; if it should be proved workable on the east coast we must expect to see a new lease of life given to the chemical trade in that district, which now does not seem very promising in its prospect. But if it could obtain its salt locally at anything like the price that it is estimated for in the official returns, the saving of one third, or nearly that, of the cost would change the condition of the struggle that is going on in the chemical trade, and would enable the north-east coast to make soda by the cheaper ammonia process. Hence the result of the attempts to extend the area within which the salt deposits are tapped is of great importance.

PNEUMATIC TRAIN PROPULSION.

The propulsion of trains by means of compressed air is again being brought before the public by Mr. Rammell, whose name is known in connection with a proposed West of London underground line. A working model of the new arrangement shows that it is applicable to existing railways. It consists of a tube fixed along the top of the sleepers between the rails, the tube being slotted and the train provided with a piston on a jointed rod, by which provision for the movements of the vehicles is made. It is urged that for working metropolitan railways, with stations at short distances, the air pressure would have usually to be maintained on but short distances. The difficulties connected with the use of compressed air in long lengths of pipe would not, it is believed, be met with; and the inventor believes he has overcome the difficulty which was experienced with the long slot in the atmospheric railway tube. On the atmospheric railway, however, the difficulty arose through the want of flexibility of the system and with the crossings.

LITERATURE.

Report of the United States Gun Foundry Board on their Visit to Europe.

Many of our readers have doubtless had this report in their hands for some time. For the sake of those who have not this advantage we notice it briefly.

The Act of Congress in March, 1883, organised a Board termed the Gun Foundry Board, with a view to arriving at the most satisfactory method of providing the nation with ordnance for the future. Since the American war, the armaments had naturally been allowed to drop in arrear—we say naturally, for the States hold a position which enables them to neglect these matters without incurring the danger that would attend a similar course if followed by any Continental nation in contact with restless and powerfully armed neighbours; or England, with her tempting trade and property dangling all over the world in the eyes and almost in the grasp of those who have no great reason to love her. There must, however eventually come a time, even for the United States, when money can no longer be saved in this way, and when the interests of her people must suffer if her armaments are not pushed on sufficiently to be up to date, even if it be decided that they may be comparatively modest in extent. This time to many appeared to have long since arrived—hence the formation of the Gun Foundry Board.

The Board formed consisted of the following officers:—Admiral Simpson, president; Capt. E. O. Matthews, Colonel T. G. Baylor, Colonel H. L. Abbot, Major S. Elder, and Lieut. W. H. Jaques. They were directed to report specially on three points: (1) Which American arsenal or navy yard is best for a Government foundry; (2) What other method, if any, should be adopted for the manufacture of ordnance; (3) The cost for the necessary means to make the heaviest guns. The Board considered that the second point involved the consideration of the following alternatives:—(1) The supply of plant to private firms to enable them to make for Government. (2) The giving of contracts sufficiently large to enable steel makers to work them out without direct aid. (3) That the Government should establish a gun factory, not a foundry, and obtain material from private firms. A visit to Europe was clearly necessary to obtain data to enable a judgment to be arrived at. Consequently England, France, and Russia were visited, but nothing was done in Germany. Krupp offered to carry out a programme of practice at Meppen, at considerable cost, but he declined to show them manufacturing operations at Essen. The Board did not consider that artillery practice came within the scope of their work, and therefore declined Krupp's offer. While disappointed in what must certainly have been one of their principal objects, they were met with remarkable cordiality by Sir Joseph Whitworth, who showed them apparently more than any one has hitherto been permitted to see of his system of steel casting and forging. This was highly appreciated; indeed the account of this constitutes the chief manufacturing feature in the report.

In their general summary, the Board remark that England and Russia made mistakes in their relations with private firms, each of them having committed themselves to an agreement which involved the payment of very high prices for articles delivered, or as an alternative, a heavy expense to terminate the obligation. Germany, the Board considered, is committed to Krupp and dependent on him to an extent that is intolerable. France, on the other hand, suffered terribly at the time of her war with Germany from having nothing but Government factories which had dropped behind from the absence of competition and public scrutiny. The present condition of France is considered the sound and right one; that is, the employment of Government factories, supplemented by private contract work, the latter being sufficiently extensive to develope powerful private establishments without the Government being committed to them. It might have been added that England is now in the same position. In another respect France is held up as an example, namely, in having separate arsenals for her army and navy. We may remark by the way that our English authorities regard this as a terrible blunder, and point to the confusion and loss of efficiency at present caused in France by totally different designs being adopted in the army and navy, as well as other fruits of service jealousies. Be this as it may, the American Board recommend separate arsenals for the States, one at Watervliet Arsenal, West Troy, New York, for the army, and Washington Yard, Columbia district, for the navy. In both of these guns are to be made, but made from castings and materials obtained from private firms.

The system of ordnance to be adopted hardly falls within the scope of the report directly, but it cannot fail to be shadowed pretty plainly on their recommendations. The construction of guns to be made of parts obtained from private foundries, means, of course, that the guns will be built up of steel cylinders, and the Board's admiration of the hydraulic press and its work indicates pretty plainly that Whitworth will come largely into requisition probably for steel tubes at first, and afterwards for machinery for American foundries, which will work in all the better, because his patents will shortly expire. The Board state that the English gun is now practically the "Vavasseur design—a gun composed of a steel tube, with a steel jacket—breech-piece—supplemented by superimposed layers of steel hoops." They obviously contemplate the adoption of a gun of somewhat this class; indeed, if their minds were made up to make guns in America, it appears to us that something of this kind must be the result. Even in America cast iron has been pretty well played out, and steel tubes of reasonable thickness are so much more easily dealt with by the divided work of factories and foundries, that possibly Krupp showed his sagacity in keeping clear of the Board as distinctly as Sir J. Whitworth did by throwing himself into their arms, at the same time this form of sagacity is a new feature in Whitworth's policy. The Elswick Company appears to have been very frank and liberal in showing the Board its works; but as it deals in guns, not in steel tubes for others to make into guns, the visit to its works was not likely to come to much. Some of the steel works in France excited the admiration of the Board, but in the matter of casting they unquestionably look to Whitworth. Their words are: "As to the assorting of ores, and the treatment of metal in the furnaces, there is no intention to draw distinctions; but as to the treatment of the metal after casting, there can be no doubt of the superiority of the system adopted by Sir Joseph Whitworth over that of all other manufacturers in the world." As to further English features in detail, the wire gun is noticed, but no decided opinion is expressed on it. The Gun Factory form of chamber, 3½ calibres long, seems to be regarded as the safest at present. The De Bange and Elswick gas checks are mentioned without the expression of any distinct preference. In France the gun factories of Bourges, Ruelle, and the steel works of St. Chamont, Le Creusot, and Terre Noire are noticed at some length. The 100-ton hammer at Creusot naturally receives special attention, though it is thought that a hydraulic press is a better alternative. As a whole, this report is a most interesting and valuable paper.

INTERNATIONAL CONVENTION FOR THE PROTECTION OF INDUSTRIAL PROPERTY.

The following is a Convention for the protection of International Industrial Property, signed at Paris March 20th, 1883:—

His Majesty the King of the Belgians, his Majesty the Emperor of Brazil, his Majesty the King of Spain, the President of the French Republic, the President of the Republic of Guatemala, his Majesty the King of Italy, his Majesty the King of the Netherlands, his Majesty the King of Portugal and the Algarves, the President of the Republic of Salvador, his Majesty the King of Servia, and the Federal Council of the Swiss Conferation,

Being equally animated with the desire to secure, by mutual agreement, complete and effectual protection for the industry and commerce of their respective subjects and citizens, and to provide a guarantee for the rights of inventors, and for the loyalty of commercial transactions, have resolved to conclude a Convention to that effect, and have named as their Plenipotentiaries, that is to say:—

His Majesty the King of the Belgians: the Baron Beyens, Grand Officer of his Majesty's Royal Order of Leopold, Grand Officer of the Legion of Honour, his Majesty's Envoy Extraordinary and Minister Plenipotentiary at Paris, &c.;

His Majesty the Emperor of Brazil: M. Jules Constant, Count de Villeneuve, member of his Majesty's Council, his Majesty's Envoy Extraordinary and Minister Plenipotentiary at the Court of his Majesty the King of the Belgians, Commander of the Order of Christ, Officer of his Majesty's Order of the Rose, Chevalier of the Legion of Honour, &c.;

His Majesty the King of Spain: His Excellency the Duke de Fernan-Nunez, de Montellano et del Arco, Count de Cervellon, Marquis de Almonacir, Grandee of Spain First Class, Chevalier of the Distinguished Order of the Golden Fleece, Grand Cross of the Order of Charles III., Chevalier de Calatrava, Grand Cross of the Legion of Honour, Senator of the Kingdom, his Majesty's Ambassador Extraordinary and Plenipotentiary at Paris, &c.;

The President of the French Republic: M. Paul Challemel-Lacour, Senator, Minister for Foreign Affairs; M. Hérisson, Deputy, Minister of Commerce; M. Charles Jagerschmidt, Minister Plenipotentiary of the First Class, Officer of the National Order of the Legion of Honour, &c.;

The President of the Republic of Guatemala: M. Crisanto-Medina, Officer of the Legion of Honour, his Envoy Extraordinary and Minister Plenipotentiary at Paris, &c.;

His Majesty the King of Italy: M. Constantin Ressman, Commander of his Majesty's Orders of Saints Maurice and Lazarus, and of the Crown of Italy, Commander of the Legion of Honour, Councillor of the Italian Embassy at Paris, &c.;

His Majesty the King of the Netherlands: the Baron de Zuylen de Nyevelt, Commander of his Majesty's Order of the Netherlands Lion, Grand Cross of his Majesty's Grand Ducal Order of the Oaken Crown, and of the Golden Lion of Nassau, Grand Officer of the Legion of Honour, his Majesty's Envoy Extraordinary and Minister Plenipotentiary at Paris, &c.;

His Majesty the King of Portugal and the Algarves: M. Jose da Silva Mendes Leal, Councillor of State, Peer of the Realm, Minister and Honorary Secretary of State, Grand Cross of the Order of St. James, Chevalier of the Order of the Tower and Sword of Portugal, Grand Officer of the Legion of Honour, his Majesty's Envoy Extraordinary and Minister Plenipotentiary at Paris, &c.; M. Fernand de Azevedo, Officer of the Legion of Honour, First Secretary of the Portuguese Legation at Paris, &c.;

The President of the Republic of Salvador: M. Torres-Caicedo, corresponding member of the French Institute, Grand Officer of the Legion of Honour, his Envoy Extraordinary and Minister Plenipotentiary at Paris, &c.;

His Majesty the King of Servia: M. Sima M. Marinovitch, Chargé d'Affaires of Servia *ad interim*, Chevalier of the Royal Order of Takova, &c.;

And the Federal Council of the Swiss Confederation: M. Charles Edouard Lardy, Envoy Extraordinary and Minister Plenipotentiary at Paris, &c.; M. J. Weibel, Engineer at Geneva, President of the Swiss Section of the Permanent Commission for the Protection of Industrial Property;

Who, having communicated to each other their respective full powers, found in good and due form, have agreed upon the following Articles:—

Article I.—The Governments of Belgium, Brazil, Spain, France, Guatemala, Italy, Holland, Portugal, Salvador, Servia, and Switzerland constitute themselves into a Union for the protection of Industrial Property.

Article II.—The subjects or citizens of each of the contracting States shall, in all the other States of the Union, as regards patents, industrial designs or models, trade marks and trade names, enjoy the advantages that their respective laws now grant, or shall hereafter grant, to their own subjects or citizens. Consequently, they shall have the same protection as the latter, and the same legal remedy against any infringement of their rights, provided they observe the formalities and conditions imposed on subjects or citizens by the internal legislation of each State.

Article III.—Subjects or citizens of States not forming part of the Union, who are domiciled or have industrial or commercial establishments in the territory of any of the States of the Union, shall be assimilated to the subjects or citizens of the contracting States.

Article IV.—Any person who has duly applied for a patent, industrial design or model, or trade-mark in one of the contracting States, shall enjoy, as regards registration in the other States, and reserving the rights of third parties, a right of priority during the periods hereinafter stated. Consequently, subsequent registration in any of the other States of the Union before expiry of these periods shall not be invalidated through any acts accomplished in the interval, either, for instance, by another registration, by publication of the invention, or by the working of it by a third party, by the sale of copies of the design or model, or by use of the trade-mark. The above-mentioned terms of priority shall be six months for patents, and three months for industrial designs and models and trade-marks. A month longer is allowed for countries beyond sea.

Article V.—The introduction by the patentee into the country where the patent has been granted of objects manufactured in any of the States of the Union shall not entail forfeiture. Nevertheless, the patentee shall remain bound to work his patent in conformity with the laws of the country into which he introduces the patented objects.

Article VI.—Every trade-mark duly registered in the country of origin shall be admitted for registration, and protected in the form originally registered in all the other countries of the Union. That country shall be deemed the country of origin where the applicant has his chief seat of business. If this chief seat of business is not situated in one of the countries of the Union, the country to which the applicant belongs shall be deemed the country of origin. Registration may be refused if the object for which it is solicited is considered contrary to morality or public order.

Article VII.—The nature of the goods on which the trade-mark is to be used can, in no case, be an obstacle to the registration of the trade-mark.

Article VIII.—A trade name shall be protected in all the countries of the Union, without necessity of registration, whether it form part or not of a trade-mark.

Article IX.—All goods illegally bearing a trade-mark or trade name may be seized on importation into those States of the Union where this mark or name has a right to legal protection. The seizure shall be effected at the request of either the proper Public Department or of the interested party, pursuant to the internal legislation of each country.

Article X.—The provisions of the preceding Article shall apply to all goods falsely bearing the name of any locality as indication of the place of origin, when such indication is associated with a trade name of a fictitious character or assumed with a fraudulent intention. Any manufacturer of, or trader in, such goods, established in the locality falsely designated as the place of origin, shall be deemed an interested party.

Article XI.—The high contracting parties agree to grant temporary protection to patentable inventions, to industrial designs or models, and trade-marks, for articles exhibited at official or officially recognised International Exhibitions.

Article XII.—Each of the high contracting parties agrees to establish a special Government Department for industrial property, and a central office for communication to the public of patents, industrial designs or models, and trade-marks.

Article XIII.—An international office shall be organised under the name of "Bureau International de l'Union pour la Protection de la Propriété Industrielle" (International Office of the Union for the Protection of Industrial Property). This office, the expense of which shall be defrayed by the Governments of the contracting States, shall be placed under the high authority of the Central Administration of the Swiss Confederation, and shall work under its supervision. Its functions shall be determined by agreement between the States of the Union.

Article XIV.—The present Convention shall be submitted to periodical revisions, with a view to introducing improvements calculated to perfect the system of the Union. To this end Conferences shall be successively held in one of the contracting States by delegates of the said States. The next meeting shall take place in 1885 at Rome.

Article XV.—It is agreed that the high contracting parties respectively reserve to themselves the right to make separately, as between themselves, special arrangements for the protection of industrial property, in so far as such arrangements do not contravene the provisions of the present Convention.

Article XVI.—States which have not taken part in the present Convention shall be permitted to adhere to it at their request. Such adhesion shall be notified officially through the diplomatic channel to the Government of the Swiss Confederation, and by the latter to all the others. It shall imply complete accession to all the clauses, and admission to all the advantages stipulated by the present Convention.

Article XVII.—The execution of the reciprocal engagements contained in the present Convention is subordinated, in so far as necessary, to the observance of the formalities and rules established by the constitutional laws of those of the high contracting parties who are bound to procure the application of the same, which they engage to do with as little delay as possible.

Article XVIII.—The present Convention shall come into operation one month after the exchange of ratifications, and shall remain in force for an unlimited time, till the expiry of one year from the date of its denunciation. This denunciation shall be addressed to the Government commissioned to receive adhesions. It shall only affect the denouncing State. The Convention remaining in operation as regards the other contracting parties.

Article XIX.—The present Convention shall be ratified, and the ratifications exchanged in Paris, within one year at the latest.

In witness whereof the respective Plenipotentiaries have signed the same, and have affixed thereto their seals.

Done at Paris the 20th March, 1883.

(Signed)

(L.S.) Beyens.
(L.S.) Villeneuve.
(L.S.) Duc De Fernan-Nunez.
(L.S.) P. Challemel-Lacour.
(L.S.) Ch. Herisson.
(L.S.) Ch. Jagerschmidt.
(L.S.) Crisanto-Medina.
(L.S.) Ressman.
(L.S.) Baron De Zuylen de Nyevelt.
(L.S.) Jose Da Silva Mendes Leal.
(L.S.) F. D'Azevedo.
(L.S.) J.-M. Torres-Caicedo.
(L.S.) Sima M. Marinovitch.
(L.S.) Lardy.
(L.S.) J. Weibel.

Final Protocol.

On proceeding to the signature of the Convention concluded this day between the Governments of Belgium, Brazil, Spain, France, Guatemala, Italy, the Netherlands, Portugal, Salvador, Servia, and Switzerland, for the protection of industrial property, the undersigned plenipotentiaries have agreed as follows:—

(1) The words "industrial property" are to be understood in their broadest sense; they are not to apply simply to industrial products properly so called, but also to agricultural products—wines, corn, fruits, cattle, &c.—and to mineral products employed in commerce—mineral waters, &c.

(2) Under the word "patents" are comprised the various kinds of industrial patents recognised by the legislation of each of the contracting States, such as importation patents, improvement patents, &c.

(3) The last paragraph of Article II. does not affect the legislation of each of the contracting States as regards the procedure to be followed before the tribunals, and the competence of those tribunals.

(4) Paragraph 1 of Article VI. is to be understood as meaning that no trade mark shall be excluded from protection in any State of the Union, from the fact alone that it does not satisfy, in regard to the signs composing it, the conditions of the legislation of that State; provided that on this point it comply with the legislation of the country of origin, and that it had been properly registered in said country of origin. With this exception, which relates only to the form of the mark, and under reserve of the provisions of the other Articles of the Convention, the internal legislation of each State remains in force. To avoid misconstruction, it is agreed that the use of public armorial bearings and decorations may be considered as being contrary to public order in the sense of the last paragraph of Article VI.

(5) The organisation of the special department for industrial property mentioned in Article XII., shall comprise, so far as possible, the publication in each State of a periodical official paper.

(6) The common expenses of the International Office, instituted by virtue of Article XIII., are in no case to exceed for a single year a total sum representing an average of 2000f. for each contracting State. To determine the part which each State should contribute to this total of expenses, the contracting States, and those which may afterwards join the Union, shall be divided into six classes, each contributing in the proportion of a certain number of units, namely:—1st class, 25 units; 2nd class, 20 units; 3rd class, 15 units; 4th class, 10 units; 5th class, 5 units; 6th class, 3 units. These coefficients will be multiplied by the number of States in each class, and the sum of the result thus obtained will supply the number of units by which the total expense has to be divided. The quotient will give the amount of the unit of expense. The contracting States are classed as follows, with regard to the division of expense:—1st class, France, Italy; 2nd class, Spain; 3rd class, Belgium, Brazil, Portugal, Switzerland; 4th class, Holland; 5th class, Servia; 6th class, Guatemala, Salvador. The Swiss Government will superintend the expenses of the International Office, advance the necessary funds, and render an annual account, which will be communicated to all the other Administrations. The International Office will centralise information of every kind relating to the protection of industrial property, and will bring it together in the form of a general statistical statement, which will be distributed to all the Administrations. It will interest itself in all matters of common utility to the Union, and will edit, with the help of the documents supplied to it by the various Administrations, a periodical paper in the French language dealing with questions regarding the object of the Union. The numbers of this paper, as well as all the documents published by the International Office, will be circulated among the Administrations of the States of the Union in the proportion of the number of contributing units as mentioned above. Such further copies as may be desired either by said Administrations, or by societies or private persons, will be paid for separately. The International Office shall at all times hold itself at the service of members of the Union, in order to supply them with any special information they may need on questions relating to the international system of industrial property. The Administration of the country in which the next conference is to be held will make preparation for the transactions of that conference, with the assistance of the International Office. The Director of the International Office will be present at the meetings of the conferences, and will take part in the discussions, but without the privilege of voting. He will furnish an annual report upon his administration of the office, which shall be communicated to all members of the Union. The official language of the International Office will be French.

(7) The present final protocol, which shall be ratified together with the Convention concluded this day shall be considered as forming an integral part of, and shall have the same force, validity, and duration as the said Convention. In witness whereof the undersigned plenipotentiaries have drawn up the present protocol.

(Signed) Beyens.
Villeneuve.
Duc de Fernan-Nunez.
P. Challemel-Lacour.
Ch. Hérisson.
Ch. Jagerschmidt.
Crisanto-Medina.
Ressman.
Baron de Zuylen de Nyevelt.
Jose Da Silva Mendes Leal.
F. D'Azevedo.
J.-M. Torres-Caicedo.
Sima M. Marinovitch.
Lardy.
J. Weibel.

CURIOSITIES OF SCREW-CUTTING.

The exact tests in measurements which are now made from precise standards of dimensions in machinists' work reveal some rather humiliating facts to those who have heretofore claimed to build tools of precision. Standards of diameters and lengths have been acknowledged as difficult to attain to in ordinary work; but it was supposed that screws, particularly the leading screws of lathes, could not vary much in pitch of thread from an established standard. But with tests made by lined hardened steel bars, aided by the microscope, it is proved that the best of screws, as ordinarily produced, are defective. So great have been ascertained to be these defects that a half nut, only 3in. long, correctly cut by the aid of the microscope, would ride the thread of an ordinary lathe leading screw of the same supposed and intended pitch. In one instance a leading screw, 36in. long, with a pitch of six threads to the inch, was tested, inch by inch, the readings being by five-thousandths of an inch, and every inch showed a falling off from the true pitch, the minus in the aggregate being 0·027 of an inch in the 36in.

Another screw of the same pitch—six threads to the inch—was tested inch by inch on a scale of seventy-thousandths of an inch with the following result:—Each one of the four columns represents 18in., and each figure represents the fraction of one seventy-thousandth of an inch variation from the true pitch. It is curious to observe the jumps in the variation in some places. Thus, in the third column there is a jump from minus 42 to plus 369. And this screw was cut by the manufacturers of machine tools that indisputably have no superiors in accuracy.

Lathe leading screw, 72in. long, pitch six threads to the inch. Grade of test, one seventy-thousandth of an inch.

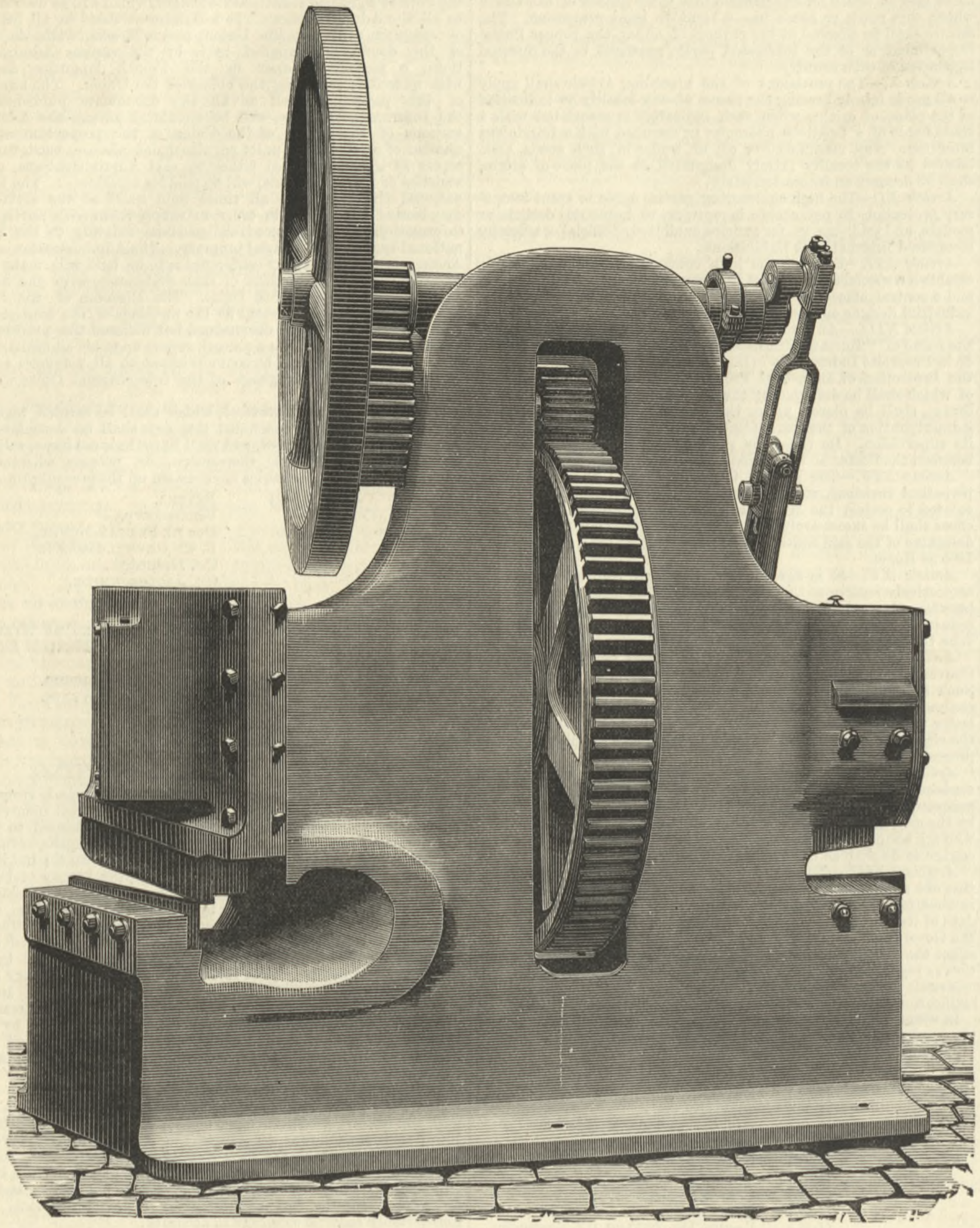
− 28	0	− 29	− 4
− 19	− 16	− 7	− 14
− 26	− 12	+ 10	− 12
− 16	+ 19	+ 23	− 14
− 33	− 8	− 6	0
− 15	− 8	− 12	− 32
− 12	− 14	− 17	0
− 15	− 17	− 21	0
− 24	− 22	− 34	0
− 33	− 9	− 40	0
− 18	− 3	− 31	− 11
− 17	− 25	− 43	− 17
+ 8	− 19	− 46	− 20
− 13	− 18	− 37	− 53
− 8	− 28	− 42	− 32
− 8	− 18	+369	− 33
− 5	− 11	+ 25	− 37
− 27	− 58	− 14	− 58
−309	−267	+ 48	−315

Total variation − $\frac{843}{70,000}$

Some thoughtless person may say that the exactions of a microscopical standard to this degree are finical and useless. But let one consider that these variations from the true standard not only repeat themselves, but are cumulative. In the case of the screw first mentioned, there was a minus of the grade or pitch of the thread of 0·027in. in only 36in. Should this leading lathe screw be used to produce other lathe screws it would require only six reproductions to lose an entire thread, even if the rate of loss was only that of the original screw. But, ascertaining and demonstrating these imperfections is of little account unless they can be prevented. This can be done, and leading lathe screws, screws for elevating planer crossheads, and for other exact purposes can be made so as to be absolutely "tools of precision."

Conference on Water Supply.—On July 24th and 25th a conference on water supply was held by the Society of Arts at the International Health Exhibition, Sir Frederick Abel, C.B., F.R.S., &c., presiding. The chairman opened the proceedings with an appropriate address, in the course of which he drew attention to the desirability of a Royal Commission being appointed to investigate and report upon all questions connected with the supply of potable water in the United Kingdom, a suggestion, which, we understand, was made to the Government some years ago by H.R.H. the Prince of Wales, as president of the Society of Arts. He further pointed out the extreme difference of opinion which exists as to the suitability of various waters for drinking purposes, some persons maintaining that river water, once polluted by sewage, can never again be fit for use from a hygienic point of view, while some, on the other hand, hold that in a flow of a few miles the organic matter is oxidised and the water rendered perfectly wholesome. Probably, Sir Frederick Abel said, the truth lies between the two. The address was followed by the reading of papers. These, together with the discussions, will be published in the *Journal* of the Society of Arts, to which we must refer our readers for further information. The subjects treated were:—(1) Sources of supply. (2) Quality of water; filtration and softening. (3) Methods of distribution; modes of giving pressure; house fittings; discovery and prevention of waste.

FAST AND SLOW SPEED PLATE, SCRAP, AND BAR SHEARS.

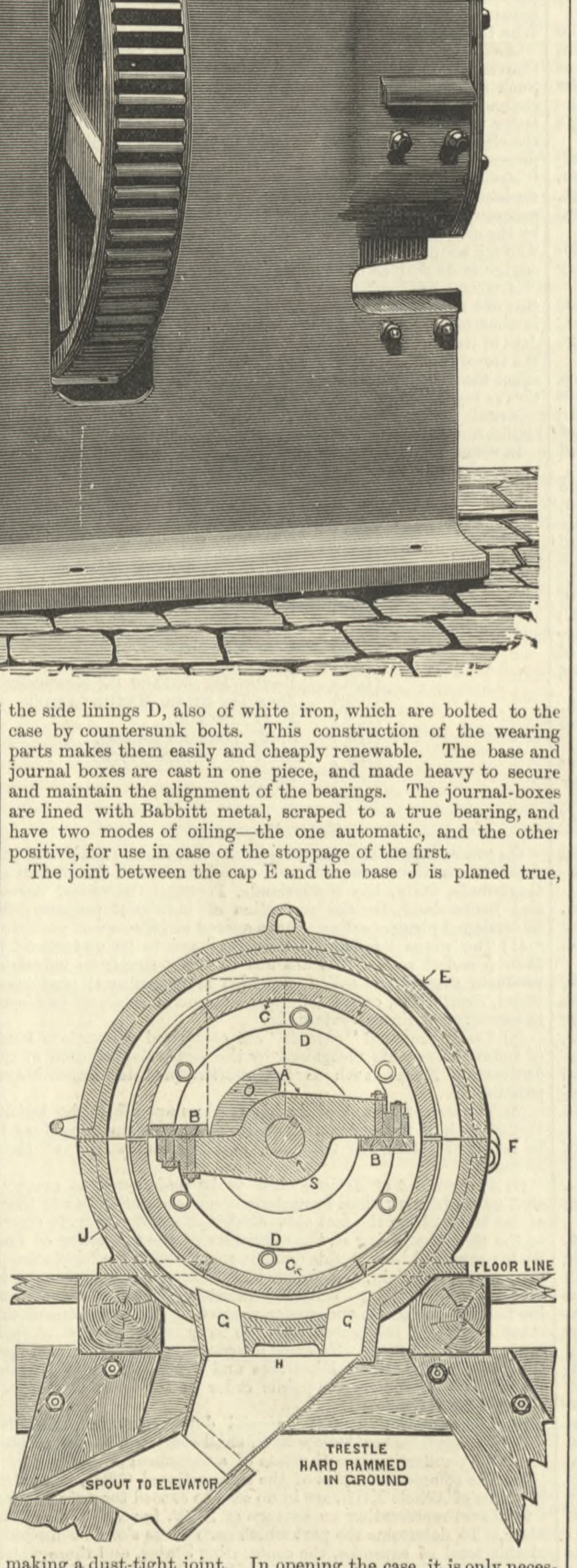


THE accompanying illustration is taken from a photograph of a new double-ended shearing machine, which has been constructed by Messrs. Wm. Collier and Co., of Salford, Manchester, from the designs of Mr. E. Fletcher, the head of the firm. The special object of the new arrangement introduced is to adapt the machine for cutting up thin plates or scrap quickly at one end, whilst the machine is operating with a slower cut on heavier work at the other. This has been effected by means of a very simple arrangement, which enables the machine to make two cuts at one end whilst one stroke is making one at the other, and it is a new feature which certainly commends itself as a very useful improvement. The machine consists of a massive cast iron frame of the ordinary type for vertical excentric machines, bored and fitted with a steel shaft having an ordinary excentric at one end and a double-throw steel cam at the other, to give two strokes for one revolution. This is obtained by having the double cam so arranged that one part presses down the slide and the other part lifts it up, and by this arrangement the machine is enabled to make two strokes of the slide at one end whilst one stroke is being made at the other. This is an arrangement which could, of course, be applied equally well to horizontal or other types of machines where two or more slides are used, and could be driven either by engine or strap power. The machine of which we give an illustration is used at one end for cutting up light sheets or scraps, whilst the other is employed for bars and heavier work, and the arrangement for doubling the stroke at one end enables the machine to adapt itself to both classes of work without the loss of time which must necessarily take place when the action of both sets of shears has to be regulated by the slow cuts of the heavy work. This, in fact, has long been a recognised drawback in the double-ended type of machine, the motion for the heavy being too slow for the lighter class of work. By introducing the cam action, which gives a double stroke to one end of the machine, it is enabled to cut up twice as much light scrap as the ordinary machine, whilst the slow motion being retained at the other end, sufficient time is allowed for handling any heavy work that is being dealt with.

WALKER'S PULVERISER.

THE pulveriser here illustrated is made by Messrs. Walker Brothers and Co., of Philadelphia. It is driven by two pulleys 8in. diameter for a 6in. belt. The shaft or spindle S is of cast steel, and is gradually increased in diameter from the journals to the centre, the object being to secure the greatest stiffness with the least friction in the journals. The arm A, which is tightly fitted and keyed on the shaft S, is of forged iron, turned and planed true all over, making both ends precisely alike in shape and size, thus securing a perfect running balance. The beaters B B, on which nearly all the wear comes, are made of hardened cast steel, and are bolted to the arm with countersunk bolts. When one end is worn, they are turned end for end and worn again. The perforated linings or segments C are cast in white iron, and drop into place without fitting, being held in by the side linings D, also of white iron, which are bolted to the case by countersunk bolts. This construction of the wearing parts makes them easily and cheaply renewable. The base and journal boxes are cast in one piece, and made heavy to secure and maintain the alignment of the bearings. The journal-boxes are lined with Babbitt metal, scraped to a true bearing, and have two modes of oiling—the one automatic, and the other positive, for use in case of the stoppage of the first.

The joint between the cap E and the base J is planed true,

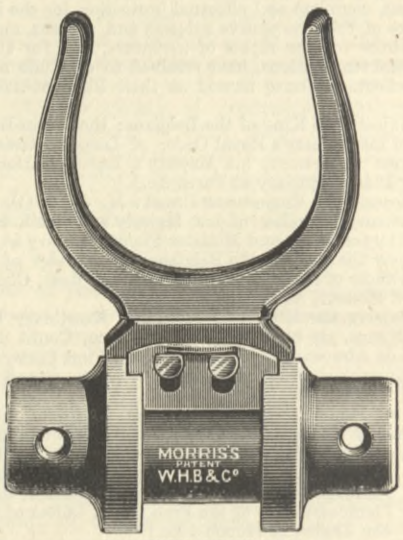


making a dust-tight joint. In opening the case, it is only necessary to slack four nuts and push the bolts to one side in the holes, which are slotted, when the cap may be easily raised, being hinged at F and counterweighted. The ore is fed into the spout, shown by dotted lines near the middle of one side of the cap, and enters the case through the opening O, and falls to the bottom of the case, where it is struck by the rapidly moving beaters, and is, by reason of its own inertia, broken into powder. Any fragments that may escape the first blow strike against the linings, only to fall and be again struck by the beaters. As fast as pulverised, the ore is carried by the current of air, generated by the motion of the arm, through the fine holes in the segments, and thence, by an annular space at the back of them, to the discharges G G and the spout H, which is continued to an elevator, storage-bin, or what may best suit circumstances.

We (the *Engineering and Mining Journal*) are informed that on limestone it will pulverise 15 tons a day of ten hours, at an expense for wear of not over 15 cents a ton, this being an average for several months. On average quartz, it is claimed that it will do 12½ tons a day, at a cost of from 20 cents to 30 cents a ton, making the ore 60-mesh fine. It is stated that in pushing it, it may be made to exceed this rate, over two tons having been frequently pulverised in an hour in special test-runs. Its use is not confined to ores, but it may be advantageously used on phosphates, bones, hoof and horn, fire-brick, manganese, corundum, alum, saltpetre, charcoal, and all substances requiring fine pulverisation. It is not quite clear that there is any novelty in this machine.

MORRIS'S FIXED ROWLOCK.

THE accompanying engravings represent a form of rowlock invented by Captain C. W. Morris, whose experience in boatwork and boat requirements has been acknowledged in the shape of awards by the jurors of the Norwich 1881, Edinburgh 1882. The object is to obtain the advantages of the swivelling and



MORRIS'S ROWLOCK.

falling rowlock, and at the same time to have them always fixed in position, so as to be ready for immediate use.

In the engravings Fig. A shows the rowlock fitted to gunwale

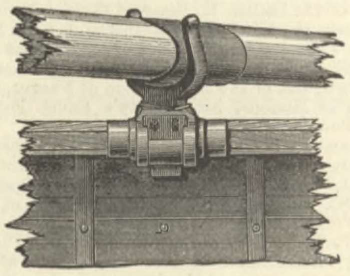


FIG. A.

and with the oar shipped ready for rowing: Fig. B showing it folded down and leaving the gunwale quite clear from any obstruction. Fig. C shows the arrangement of the crutch pin

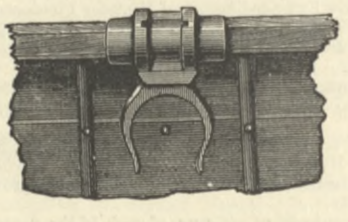


FIG. B, ROWLOCK UNSHIPPED.

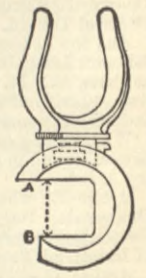


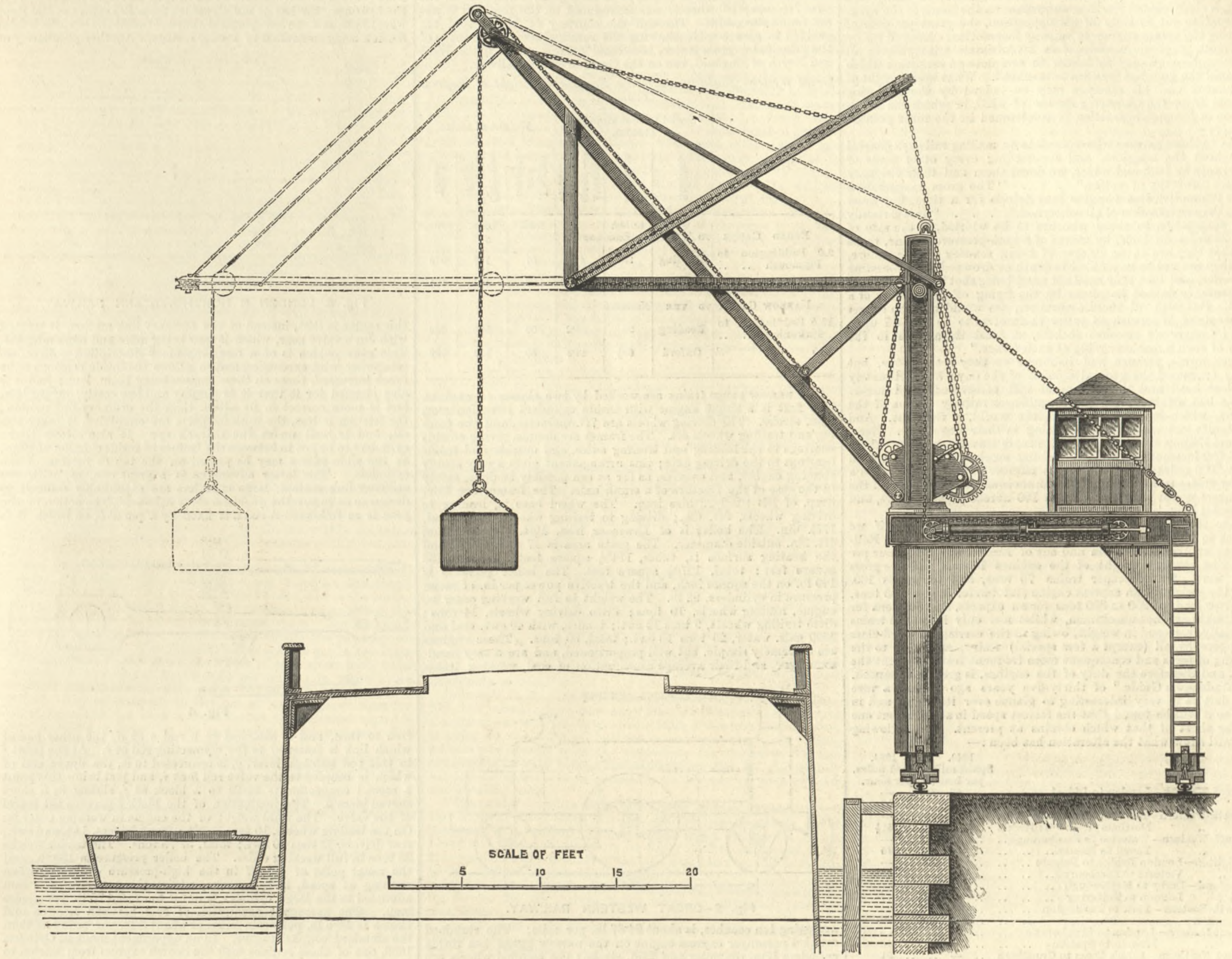
FIG. C.

and the jaw for fitting on to the gunwale, from which it will be seen that it strengthens the gunwale instead of weakening it, as is the case with the ordinary forms of rowlocks. Messrs. W. H. Bailey and Co., of Salford, Manchester, are now the makers of these rowlocks.

SOUTH KENSINGTON MUSEUM.—Visitors during the week ending July 26th, 1884:—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., Museum, 10,514; mercantile marine, Indian section, and other collections, 3836. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. to 6 p.m., Museum, 2010; mercantile marine, Indian section, and other collections, 262. Total, 16,622. Average of corresponding week in former years 18,664. Total from the opening of the Museum, 21,219,090.

ENGINEERING PROSPECTS.—The prospects for engineers in the immediate future are not very bright. At home, professional engineers are not, as a class, well employed, and the new schemes in view are not very numerous. The principal English trunk lines have extensions in progress or view, which will be managed by their own engineers. Large new dock works are likely to commence at Cardiff; the heavier dock works of the Tilbury Docks are nearly finished; the approaching completion of the Mersey Tunnel will probably render necessary new railway connections in Liverpool and Birkenhead; the last link of the Inner Circle Railway in London is to be finished next month; the Irish railways are to be connected by a joint line across Dublin; and the Manchester Ship Canal is likely to be authorised by Parliament, although its ultimate success is doubtful. The present Bank of England rate of discount of 2 per cent. shows a want of confidence among investors that hinders greatly the projection of railway and other enterprises on which the engineering trades depend. It is increasingly evident that professional and manufacturing engineers must look to work abroad, and the field is ever widening, notwithstanding the prohibitory tariffs of many countries. It is a marked characteristic of this, the leading English industry, that public works create a never-ceasing need for more. The extension of railways in India and the Colonies is opening out new districts for development, and while agriculture is the first to benefit by facilities of transport, mining operations, subsidiary railways, harbour works, steamship lines, and local manufactories promise an endless source of employment to the engineering trades of this country.—*Matheson and Grant's Engineering Trades' Report.*

HYDRAULIC OVERSIDE CRANE.



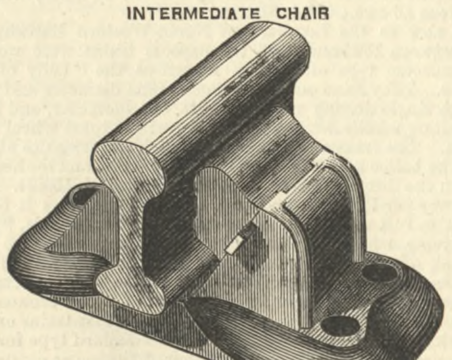
THE cranes we illustrate are designed by Messrs. W. L. Williams, of 2, Westminster-chambers, and Henry Adams, of 60, Queen Victoria-street, London, to discharge goods over the side of ships into lighters lying alongside by means of extending jibs, the arrangement being such that when required to unload on to the quay the cranes can be worked in the ordinary manner. A triangular frame is rivetted to the jib, and from this an arm constructed of two channel bars extends horizontally. Between these channel bars runs a trolley, having a sheave to engage the lifting chain of the crane. This trolley is run out and home by a pair of hydraulic cylinders placed in any convenient position on the framing of the crane. After the load has been lifted clear of the hatches, it is run out horizontally till it is clear of the ship, when it is lowered into the lighter. The operation takes about the same time as that of turning round over the quay, so that the same tonnage can be done per hour. When the crane is required to work in the ordinary way and discharge on to the quay, the channel bars are folded back as shown in dotted lines, so as not to foul the rigging, &c.

A crane constructed on this principle has been at work on the Atlas No. 2 floating wharf of Messrs. W. Cory and Sons, the well-known coal factors, for nearly a year, and the result has been so satisfactory that three more cranes on the same principle are now being constructed for them. By its use a very important saving in the breakage of the coal has been effected, a matter of the utmost importance with some classes of coal. There is also much less labour involved, and the lighters get away with much greater expedition, sailing barges being loaded as easily as the ordinary barges. The weighing gear attached to the crane is in no way interfered with, and before and after a ship has discharged the extending jib is folded back and the crane swung round in the ordinary way to put the tubs on and off the ship. The arrangement, which is the subject of a patent, is of course applicable to quay cranes for discharging general goods, either upon the quay or into lighters alongside, and in ports where there is much transshipment into smaller craft, this direct and expeditious method of handling goods will effect a large saving both in time and labour. We have not described the hydraulic machinery by which the crane is actuated, but this is sufficiently obvious.

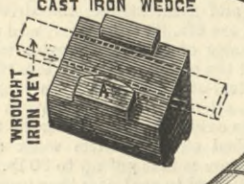
LEADBEATER'S PATENT RAILWAY CHAIR.

THE object of this chair is to dispense with the wooden wedges, and to hold the rail more firmly. It is also brought out as a joint chair, with the object of dispensing with fish-plates and bolts. The inventor claims for it that it can be used with any section of rail, and being about the same weight, costs little more than the ordinary chair. Referring to the illustration, it will be seen that a wrought iron wedge or cotter is driven into the grooves cast for it in the chair and cast iron wedge, which has a projection A curved on the upper edge; by this means the key is driven tightly in, the cast iron wedge is drawn down, thus wedging it between the rail and chair, and so making a rigid fastening. The same plan is adopted with the joint chair, which has two studs cast on the chair to fit the present bolt holes at the end of the rails. It is necessary to have these studs and holes to prevent the chair leaving the joints. The wrought iron cotters when driven tightly in are bent down at the thin end, and so kept in place. A well-known railway engineer is of opinion, after trial, that this chair will do away with the possibility of the wedge or keys coming out, as

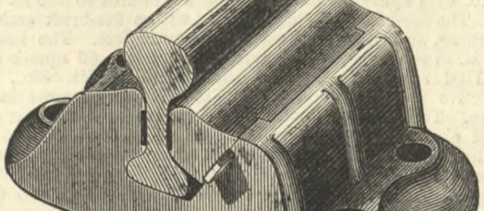
INTERMEDIATE CHAIR



CAST IRON WEDGE



JOINT CHAIR



was reported to be the case in the Downton railway accident, where the rails spread and let the train off the line. About forty of the intermediate chairs have been in use on a steep gradient on the Great Northern Railway at Holbeck Junction for the last nine or ten months, and have answered very well, and a trial quarter-mile complete is just about to be laid on the Great Northern to try the system fully.

WATER-TUBE STEAM BOILERS AT THE LUCY FURNACES, PITTSBURGH., PA.

By Mr. WILLIAM KENT, M.E., New York.*

I DESIRE to place on record in our "Transactions" a recent innovation in blast furnace practice, namely, the introduction at the Lucy Furnaces, at Pittsburgh, of four water-tube steam boilers of the Babcock and Wilcox pattern, aggregating 832-horse power, builders' rating, or 9568 square feet of heating surface, utilising the waste gases of the furnaces as fuel. The boilers are set in two batteries, each of 416-horse power, and each battery occupying a ground space of 22ft. 7in. by 20ft. 4in.

The boilers are the regular design of the Babcock and Wilcox Company, but the setting is a novel one, designed by the superintendent of the furnaces, Mr. Julian Kennedy, member of the Institute. The boilers are raised about 5ft. above what would be their ordinary position if fired with coal, to allow of the introduction under each of a tall combustion chamber about 7ft. 6in. square by 10ft. high. This chamber is divided into two portions, a front and rear, by a perforated wall, and by a number of tiles, set on edge, reaching from the top of this wall to the front wall of the boiler. The gas is conveyed to the boiler through an underground flue, 5ft. by 3ft., and is introduced into the combustion chamber under each of the four boilers through a Witherow and Gordon gas burner. The gas striking the hot perforated wall and the tiles overhead, and passing through them, and the proper amount of air being admitted, part through the burner and part through small flues in the front wall of the boiler, by which it is heated before admission, thorough combustion is insured. A small fire of coal is kept burning on the grate as a precaution to secure relighting of the gas in case of the possible interruption of its supply. The heating surface of the boiler is divided into two portions, front and rear, by a transverse division wall. The heated gases of combustion pass up through the front portion of the heating surface, and down through the rear, and enter a flue leading to the chimney. Four side cleaning doors are attached to each boiler, through which the dust deposited from the gases is easily cleaned from the tubes by means of a steam jet.

The boilers have now been in use two months, with great satisfaction to all concerned. Without mentioning the general advantages of water-tube boilers, which are now well known, I may mention that they are especially adapted to replace the cylinder and two flue boilers ordinarily used at blast furnaces, on account of their occupying less than one-third of the ground space, and being actually cheaper in first cost for an equal amount of heating surface.

MR. RICHARD GARRETT.—It is with regret that we have to announce the death, suddenly after some three months illness, of Mr. Richard Garrett, of the Leiston Works, Saxmundham, in which he was partner with Mr. Frank Garrett. Mr. Richard Garrett was especially proud of his early connection with portable steam engine and thrashing machine construction, in which he was a pioneer. Latterly he had paid most attention to farming and stock, and was known as a champion of the Suffolk Cart-horse. He was elected an Associate of the Institution of Civil Engineers in 1854, and became a member in 1877.

* Read at the Chicago meeting of the American Institute of Mining Engineers, May 27th, 1884.

MODERN LOCOMOTIVE PRACTICE.*

By H. Michell Whitley, Assoc. M.I.C.E., F.G.S.

A little more than half a century ago, but yet at a period not so far distant as to be beyond the remembrance of many still living, a clear-headed North-countryman, on the banks of the Tyne, was working out in spite of all opposition, the great problem of adapting the steam engine to railway locomotion. Buoyed up by an almost prophetic confidence in his ultimate triumph over all obstacles, he continued to labour to complete an invention which promised the grandest benefits to mankind. What was thought of Stephenson and his schemes may be judged by the following extracts from the *Quarterly Review* of 1825, in which the introduction of locomotive traction is condemned in the most pointed manner:—

"As to those persons who speculate on making railways general throughout the kingdom, and superseding every other mode of conveyance by land and water, we deem them and their visionary schemes unworthy of notice." . . . "The gross exaggeration of the locomotive steam engine may delude for a time, but must end in the mortification of all concerned." . . . "It is certainly some consolation to those who are to be whirled, at the rate of 18 or 20 miles an hour, by means of a high-pressure engine, to be told that they are in no danger of being sea-sick while on shore, that they are not to be scalded to death or drowned by the bursting of a boiler, and that they need not mind being shot by the shattered fragments, or dashed in pieces by the flying off or breaking of a wheel. But with all these assurances, we would as soon expect the people of Woolwich to suffer themselves to be fired off upon one of Congreve's ricochet rockets, as trust themselves to the mercy of such a machine going at such a rate."

These words, strange and ludicrous as they seem to us, but tersely expressed the general opinion of the day; but fortunately the clear head and the undaunted will persevered, until success was at last attained, and the magnificent railway system of the present, which has revolutionised the world, is the issue. And the results are almost overwhelming in their magnitude. Here, in Great Britain alone, 654,000,000 people travel annually. There are 14,000 locomotives, and the rolling stock would form a train nearly 2000 miles long; whilst the number of miles travelled in a year by trains is more than 10,000 times round the world; and the passengers would form a procession 100 abreast, a yard apart, and 3700 miles long.

These stupendous results have been attained gradually; if we go back to 1848, we find that on the London and Birmingham Railway the number of trains in and out of Euston was forty-four per day. The average weight of the engines 18 tons, and the gross loads were, for passenger trains 76 tons, and for goods 160. Now, the weight of an express engine and tender is about 65 tons, and gross loads of 250 to 300 tons for an express, and 500 tons for a coal train are not uncommon, whilst not only have the trains materially increased in weight, owing to the carriage of third-class passengers by all (except a few special) trains, and also to the lowering of fares and consequent more frequent travelling, but the speed, and therefore the duty of the engines, is greatly enhanced. A "Bradshaw's Guide" of thirty-five years ago is now a rare book, but it is very interesting to glance over its pages, and in doing so it will be found that the fastest speed in all cases but one falls far short of that which obtains at present. The following table will show what the alteration has been:—

	1849. Speed miles per hour.	1884. Speed miles. per hour.
Great Western—London to Didcot	56	—
,, ,, to Swindon	—	53
North-Western—Euston to Wolverton	37	—
,, Northampton to Willesden ..	—	51½
South-Western—Waterloo to Farnborough	39	—
,, Yeovil to Exeter	—	46
Brighton—London Bridge to Reigate	36	—
,, Victoria to Eastbourne	—	45
Midland—Derby to Masborough	43	—
,, London to Kettering	—	47
North-Eastern—York to Darlington	38	—
Do. do.	—	50
Great Eastern—London to Broxbourne	29	—
,, Lincoln to Spalding	—	49
Great Northern—King's Cross to Grantham ..	—	51
Cheshire Lines—Manchester to Liverpool	—	51

With this problem then before them, increased weight, increased speed, and increased duty, the locomotive superintendents of our various railways have designed numerous types of engines, of which the author proposes to give a brief account, confining himself entirely to English practice, as foreign practice in addition would open too wide a field for a single paper.

Commencing then with passenger engines for fast traffic, and taking first in order the Great Western Railway, we find that it holds a unique position, as its fast broad gauge trains are worked by the same type of engine as that designed by Sir Daniel Gooch in 1848, although, of course, the bulk of the stock has been rebuilt, almost on the same lines, and rendered substantially new engines. They are single engines of 7ft. gauge with inside cylinders 18in. diameter, and 24in. stroke; the driving-wheels are 8ft. in diameter, and there are two pair of leading wheels, and one of trailing, all of 4ft. 6in. diameter. The total wheel base is 18ft. 6in., the boiler is 4ft. 6in. diameter, and 11ft. 3in. long. The grate area is 21 square feet, and the heating surface is, in the fire-box, 153 square feet; tubes, 1800 square feet; total, 1953 square feet. The weight in full working order is, on the four leading wheels, 15 ton 18 cwt.; driving wheels, 16 tons; trailing wheels, 9 tons 10 cwt.; total, 41 tons 8 cwt. The tender, which is low-sided and very graceful in appearance, weighs 15 tons 10 cwt., and will hold 2700 gallons of water.

The boiler pressure is 140lb. on the square inch, and the tractive power per pound of steam pressure in the cylinders is 81 lb. These engines take the fast trains to the West of England—the Flying Dutchman averages 170 tons gross load, and runs at a mean timetable speed of 53 miles per hour, which allowing for starting, stopping, and slowing down to 25 miles per hour through Didcot, gives a speed of nearly 60 miles an hour.

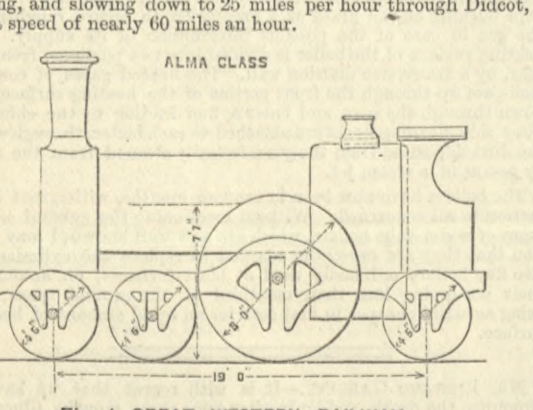


Fig. 1—GREAT WESTERN RAILWAY.

The average consumption of coal per mile, of thirteen of these engines, with the express trains between London and Bristol, during the half-year averaged 24·67 lb. per mile, the lowest being 23·22 lb., and the highest 26·17 lb., the average load being about eight coaches, or 243 tons. We have already seen that in 1849 the Great Western express ran at a higher rate than at present, being an exception to the general rule; and the fastest journey on record was performed at this time by one of these engines, when on May 14th, 1848, the Great Britain took this Bristol express, consisting of four coaches and a van, to Didcot, fifty-three miles, in forty-seven minutes, or at the average speed of sixty-eight miles an hour. The maximum running speed was seventy-five miles an hour, and the indicated horse-power 1000. A class of engines corresponding to this type in their general dimensions, but with 7ft. coupled wheels, was introduced on the line, but it was not found successful. Through the courtesy of Mr. Dean I am enabled to give a table showing the running speeds and loads of the principal express trains, broad and narrow gauge, to the West and North of England, run on the Great Western Railway.

Great Western Railway.—Average Speed and Weight of Express Trains.

Train.	Speed to first stopping station. Station.	Distance.	Average speed—r miles pe hour.	Weight of train. Engine and tender.	Carriages and vans, empty.	Total.
		miles.		tons.	tons.	tons.
Broad Gauge	to West	of Eng-	land:			
9.0 Paddington to Plymouth	Reading	36	47	67	149	216
11.45 do.	Swindon	77¼	53	67	104	171
Narrow Gauge	to the	North:				
10.0 Paddington to Birkenhead	Reading	36	39·2	60	190	250
4.45 do.	Oxford	63½	48·8	60	129	189

The narrow gauge trains are worked by two classes of engines. The first is a single engine with inside cylinders 18in. diameter, 24in. stroke. The driving wheels are 7ft. diameter, and the leading and trailing wheels 4ft. The frames are double, giving outside bearings to the leading and trailing axles, and outside and inside bearings to the driving axle; this arrangement gives a very steady running engine, and ensures, as far as can possibly be done, safety in the case of the fracture of a crank axle. The frames are 15in. deep, of BB Staffordshire iron. The wheel base is, leading to driving wheels, 8ft. 6in.; driving to trailing wheels, 9ft.; total, 17ft. 6in. The boiler is of Lowmoor iron, 10ft. 6in. long and 4ft. 2in. outside diameter. The grate area is 17 square feet, and the heating surface is, tubes, 1145½ square feet; fire-box, 133 square feet; total, 1278½ square feet. The boiler pressure is 140 lb. on the square inch, and the tractive power per lb. of mean pressure in cylinders, 92 lb. The weight in full working order is, engine, leading wheels, 10 tons; ditto driving wheels, 14 tons; ditto trailing wheels, 9 tons 10 cwt.; tender, with 40 cwt. coal and 2600 gals. water, 26 tons 10 cwt.; total, 60 tons. These engines are extremely simple, but well proportioned, and are a very handsome type, and their average consumption of coal, working trains

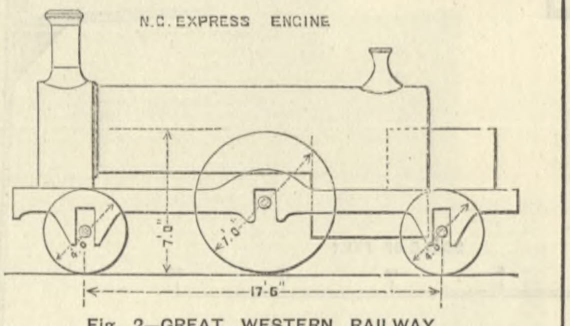


Fig. 2—GREAT WESTERN RAILWAY.

averaging ten coaches, is about 24·87 lb. per mile. The standard coupled passenger express engine on the narrow gauge has inside cylinders 17in. diameter and 24in. stroke; the coupled wheels are 6ft. 6in. diameter, and the leading wheels 4ft.; the wheel base is 16ft. 9in. The frames are double, giving outside bearings to the leading axle, and inside bearings to the coupled wheels. The boiler is 11ft. long by 4ft. 2in. diameter; the grate area is 16·25 square feet; and the heating surface is, tubes, 1216·5 square feet; fire-box, 97·0 square feet; total, 1313·5 square feet. The boiler pressure is 140 lb., and the tractive power per lb. of steam pressure in the cylinders, 88 lb. The weight in full working order is on the leading wheels, 10 tons 5 cwt.; driving wheels, 11 tons; trailing wheels, 9 tons 15 cwt.; total, 31 tons.

Turning now to the London and North-Western Railway, we find that between 1862 and 1865 the express trains were worked with a handsome type of engines, known as the "Lady of the Lake" class. They have outside cylinders 16in. diameter and 24in. stroke, with single driving wheels of 7ft. 6in. diameter, and leading and trailing wheels 3ft. 6in. diameter, with a total wheel base of 15ft. 5in. The frames are single, with inside bearings to all the wheels. The boiler is 11ft. long and 4ft. diameter, and the heating surface is in the tubes, 1013ft.; fire-box, 85ft.; total, 1098ft. The tractive power per lb. of steam pressure in the cylinders is 68 lb. The weight in full working order is on the leading wheels, 9 tons 8 cwt.; driving wheels, 11 tons 10 cwt.; trailing wheels, 6 tons 2 cwt.; total, 27 tons. The tender weighs 17½ tons in working order. These engines burn about 27 lb. of coal per mile with trains of the gross weight of 117 tons, which is not at all an economical duty. About 1872, the weight of the heavier express trains on the North-Western had so increased, that a new standard type for this service was designed, and is now the standard passenger engine; it has inside cylinders 17in. diameter and 24in. stroke; the driving and trailing wheels are coupled, and are 6ft. 6in. diameter, and the leading wheels 3ft. 6in. The frames of steel are single, with inside bearings to all the wheels, and the boiler, of steel, is 9ft. 10in. long and 4ft. 2in. diameter. The steel used has a tensile strength of 32 to 34 tons per square inch, all the rivets are put in by hydraulic pressure, and the magnetic oxide on the surface of the plates where they overlap is washed off by a little weak sal-ammoniac and water. In testing, steam is first got up to 30 lb. on the square inch, the boiler is then allowed to cool, it is then proved to 200 lb. with hydraulic pressure, and afterwards to 160 lb. with steam. The fire-box is of copper, fitted with a fire-brick arch for coal burning, and the grate area is 15 square feet. The heating surface is, in the tubes, 1013 square feet; fire-box, 89 square feet; total, 1102 square feet. The wheel base is 15ft. 8in., and the tractive power 88 lb. for each lb. of steam pressure in the cylinders. These engines, working the fast passenger trains at a speed of about 45 miles per hour, burn about 35 lb. of coal per mile, when taking trains weighing about 230 tons gross. A variation from this type has been adopted on the Northern and Welsh sections, known as the "Precursor" class. These engines have 5ft. 6in. coupled wheels, and weigh 31 tons 8 cwt. in working order, but in other respects are very similar to the standard engines just described; with the Scotch express, averaging in total weight 187 tons, between Crewe and Carlisle, over heavy gradients, they burn 33 lb. of coal per mile. These engines, although much more powerful than the standard type, are not nearly so handsome an appearance, the drivers seeming much too small for the boiler under which they are placed. But by far the boldest innovation on existing practice is the new class of compound locomotives now being introduced by Mr. Webb. It is a six-wheel engine, with leading wheels 4ft. diameter, and two pairs of drivers, 6ft. 6in. diameter. The trailing drivers are driven by a pair of outside cylinders, 13in. diameter and 24in. stroke; and the leading drivers by a single low-pressure cylinder—which takes the exhaust steam from the high-pressure cylinders—of 26in. diameter and 24in. stroke, placed under the centre of the smoke-box. The boiler is the same as that in the standard type of engine, but the wheel base is 17ft. 7in., and in order to allow it to traverse curves easily, the front axle is fitted with a radial axle-box, which is in one casting from journal to journal, and fitted at each end with brass steps for the bearings; the box is radial, struck from the centre of the rigid wheel base, and the hornplates are curved to suit the box, the lateral motion being controlled by strong springs. Another peculiarity of

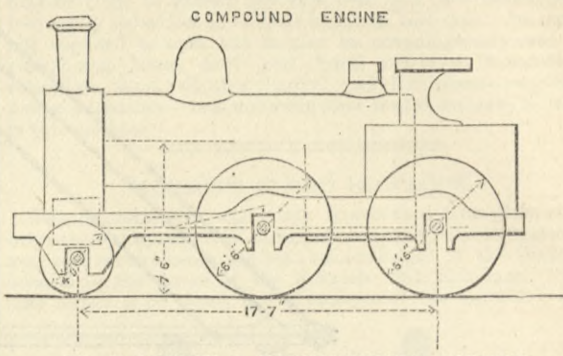


Fig. 8—LONDON & NORTH-WESTERN RAILWAY.

this engine is that, instead of the ordinary link motion, it is fitted with Joy's valve gear, which is now being more and more adopted. This gear—which is of a most ingenious description—dispenses altogether with excentrics, and so allows the inside bearings to be much increased, those on these engines being 13½in. long; and it is also claimed for it that it is simpler and less costly, weighs less, and is more correct in its action than the ordinary link motion; the friction is less, the working parts are simplified, it takes less oil, and is well under the driver's eye. It also allows larger cylinders to be got in between the frames of inside cylinder engines, as the slide valves may be placed on the top or bottom of the cylinders. This latter advantage is a great one, as, with the ordinary link motion, large cylinders are exceedingly difficult to design so as to get the requisite clear exhaust. The action of the gear is as follows:—A rod *a* is fixed by a pin at *b*, on which it is

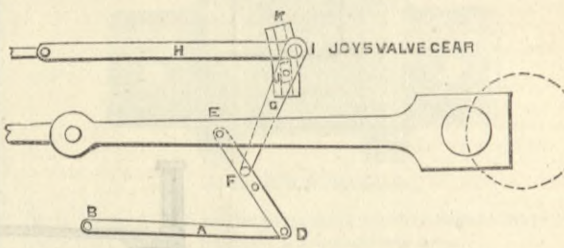


Fig. 4

free to turn, and is attached to a rod *c* at *d*, the other end of which link is fastened to the connecting-rod at *e*. At the point *f* in this rod another lever, *g*, is connected to it, the upper end of which is coupled to the valve rod *h* at *i*, and just below this point a second connection is made to a block at *j*, sliding in a short curved piece *k*. The inclination of the block *k* governs the travel of the valve. The total weight of the engine in working order is: On the leading wheels, 10 tons 8 cwt.; front drivers, 14 tons 4 cwt.; rear drivers, 13 tons 10 cwt.; total, 37·75 tons. The tender weighs 25 tons in full working order. The boiler pressure is 150 lb., and the usual point of cut-off in the high-pressure cylinders, when running at speed, is half-stroke, whilst the pressure of steam admitted to the large cylinder is never to exceed 75 lb. per square inch. The average consumption of coal between London and Crewe is 26·6 lb. per train mile, or about 8 lb. per mile less than the standard coupled engine. In an experiment made in October, 1883, one of these engines took the Scotch express from Euston to Carlisle at an average speed, between stations, of 44 miles an hour, the engine, tender, and train weighing 230 tons, with a consumption of 29½ lb. of coal per mile, and an evaporation of 8·5 lb. of water per pound of fuel.

Mr. Webb's object in designing this engine was to secure in the first place a greater economy of fuel, and secondly, to do away with coupling rods, whilst at the same time obtaining greater adhesion, with the freedom of a single engine. The cost is much more than an ordinary locomotive, but the saving in fuel is said to be 20 per cent. over the other engines of the North-Western Railway. These engines run very sweetly, and are said to steam freely, although with only half the usual number of blasts; but from the small size of the high-pressure cylinders, they are liable to slip when starting heavy trains, as the low-pressure cylinders are not then effective, whilst the consumption of coal does not seem to show the saving that would have been expected, when compared with ordinary engines doing similar duty on other lines—for instance, the Great Northern single engine takes trains of the same weight with the same consumption of coal and at a somewhat higher speed. But it must, of course, be borne in mind in making such a comparison, that the fuel used may not be of the same quality.

(*To be continued.*)

* Paper read before the Civil and Mechanical Engineers' Society 2 Apr 1884

Advertisements on Railway Bridges.—A correspondent calls attention to utter disregard to all sense of æsthetic propriety displayed by railway companies in London, whose bridges across streets, ugly enough in themselves, are disfigured by ugly and miscellaneous advertisements. Bills now in Parliament for bridge extensions should not be passed without a clause to stop this disfigurement of streets. It is a disgrace to the railway companies, and powers should be obtained to stop it.

An Extraordinary Circumstance.—They do very curious things on American railways. A dispatch from Poughkeepsie, N.Y., July 6, says:—"The Summit steamboat express of the Ulster and Delaware Road, which left the Grand Hotel station at 3.40 p.m., stopped at Phœnicia, and took on board three car loads of New York business men and others. The train was composed of an engine, baggage car, Pullman car, two West Shore cars, and three ordinary coaches. There were about 300 passengers on board. After leaving Mount Pleasant, going down grade, twenty-five miles an hour, the engineer saw, on rounding a curve, a mass of rocks partially covering the track. He applied the air brakes, pulled the reverse lever and opened the throttle wide, stopping the train in less than its length, but not before the rocks had stripped off all the steps from the left side of the train, and *broken every cast iron journal box away from every truck from the engine to the rear of the train.* Not a truck was dislodged, nor did any of the passengers know of their perilous position until after the train stopped, when they assisted the labouring men in removing the obstruction. The train reached Kingston one hour behind. On the way thither, after the accident, the passengers gave a vote of thanks to the engineer for his bravery and coolness." We direct particular attention to the words we have italicised. We have known trains run long distances, with hot axle-boxes, or with cracked axle-boxes—that is to say, one box or, at most, two or three on an entire train—but now we have a case where a whole train has been able to proceed without any axle-box at all on one side, and after all is only an hour late. We recall the hero of poetry who, when his legs were cut off, fought upon his stumps. There is an analogy between him and the train, which would be more complete if even the stumps of axle-boxes had been left for the journals to run in. We confess we do not believe the Poughkeepsie despatch.

AMERICAN NOTES.

(*From our own Correspondent.*)

NEW YORK, July 19th.

THE American iron trade is suffering from inactivity, which will probably be unbroken for the remainder of the year. Our iron-masters have become so accustomed to an enormous demand, with orders for from three to six months ahead, that they complain of dull times, and all manner of evils, when requirements are presented only about as material is wanted. We have at present 275 blast furnaces in operation, a less number than at any former period for four years at least. Foundry iron is selling at from 19 dols. to 21 dols., and forge iron from 15.50 dols. to 18 dols. English Bessemer is quoted at 19 dols. 20 per cent.; spiegeleisen at 28 dols. and 80 per cent.; ferro-manganese at 78 dols. Scotch pig is dull and unchanged. There is very little demand for any kind of foreign material, and no inducements are sufficient to induce consumers to place orders at present. The dulness in steel rails continues; prices have declined to 29 dols., according to unauthenticated rumour, and small sales are taking place at 30 dols. to 31 dols. The market is well supplied with old rails, for which consumers are offering 18 dols. to 18.50 dols., and holders asking 19 dols. to 20 dols. Crop ends are worth 19.50 dols. to 20.50 dols. ex-ship for foreign, and 19.50 dols. at mill for American. Very few sales are reported. The demand for nails has fallen off, and prices are weak at 2.15 dols. at Pittsburgh, and 2.25 dols. to 2.40 dols. at Philadelphia. About 1000 tons of plate iron have been ordered within a week, and there are inquiries in hand for 800 to 1000 tons of structural iron, which will be placed in a few days. The bar mills are selling iron at 1.75 to 2c. per lb., according to quality.

The anthracite coal companies have mined a little over 13,000,000 tons of coal so far this year, and expect to mine about 18,000,000 tons more before the close of the year. The bituminous companies expect to add enough to this to make the Pennsylvanian output for the year 50,000,000 tons, or over one-half the total production of the United States. A number of other valuable coalfields have been opened, but the falling off in manufacturing demand will necessitate a long delay in their development. Large purchases of coal lands have been made in West Virginia, and railroads are now being built through that State. Between 200 and 300 miles of coal road have been built in Indiana and Illinois to develope the coal territory there, in order to reach Chicago, St. Louis, and the river markets. A prominent Englishman who has visited this region states his belief that Illinois will be the centre of manufacturing activity in the United States within ten years from the present time.

The natural gas excitement is increasing in Western Pennsylvania. Upwards of fifty wells are being bored at Pittsburgh. Within a year, more than ten wells have been bored in the eastern part of Pittsburgh, and it seems that the great danger now is that too many will be bored within a limited space. But the supply seems to be inexhaustible. Wells bored twenty-five years ago are still flowing freely. The introduction of natural gas in the Edgar Thomson Steel Works saves the labour of seventy-six men, which amounts to a saving of 30,000 dols. per annum in wages alone. Another manufacturing firm saves 15,000 dols. per annum in labour. The experiments in the use of natural gas in blast furnaces have not yet been successful, but our engineers expect to soon be able to arrange for its application to this purpose. This fuel is free from sulphur and phosphorus.

The National Window Glass Manufacturers' Association held a convention in this city on the 17th inst. The Flint Glass Workers held their convention in Pittsburgh last week.

About 3000 miners in the Hocking Valley, Ohio, are being displaced by foreign labourers, and trouble of a serious nature is threatened, so that the police and the militia are on hand. The general assembly of the Knights of Labour of America meets in Philadelphia in September, and delegates will be present from several European countries.

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

(*From our own Correspondent.*)

THE reports of the traders brought to 'Change yesterday in Wolverhampton, and to-day—Thursday—in Birmingham, were unsatisfactory. The demand is becoming slower instead of mending, and increased difficulty is found in keeping the works running with anything like regularity or activity. The only relieving feature is the circumstance that South Staffordshire does not stand alone, but the district is only sharing the depression which exists in all the other iron and steel making centres of the kingdom, and indeed almost of the world.

Merchant orders for shipping are small and few, and home consumers will only buy from hand-to-mouth. With such a limited consuming market it is scarcely to be wondered that competition is becoming increasingly severe. Of this there was this—Thursday—afternoon much complaining. But there seems to be no way out of the difficulty until a considerable improvement in the demand manifests itself. All round prices are reduced to the lowest possible point.

Happily, numerous makers are found to resist middlemen's attempts to buy at wretched figures. Respectable hoop firms have this week returned orders offered them at £6 per ton at works, and some sheet and bar makers have this week taken an equally independent course. Either needy men ultimately get the orders in such cases or they go to other districts. Hoop makers ask £6 5s. to £6 10s.; common bars are £5 15s. to £6, and good medium bars £6 10s.

Crown bars of the Monmoor make, of ½in. to 3in. round and square, or to 6in. flat, were quoted to-day £7 5s. per ton at works for ordinary quality, £8 5s. for best, and £9 5s. for best best. Best rivet iron of the usual sizes the firm quoted £9, and double best £10. Angles to 8 united inches were:—Ordinary, £7 15s.; best, £8 15s.; and double best, £9 15s. Tees were:—£8 5s. for ordinary; £9 5s. for best; and £10 5s. for double best. Monmoor hoops of 4in. to 2⅜in., 2¼in. to 1⅝in., and 1½in. to 1in., of respectively 16, 17, and 19 w.g., were £7 10s.; hoops of ⅞in. and 20 w.g., £8 5s.; and ¾in., 20 w.g., £9. Consumers who would be satisfied with the Wright qualities of the makers were able to purchase at 10s. per ton below these figures.

Tank sheets are priced by the Pelsall Iron Company at £7 10s. up to 18 b.g.; charcoal sheets to 20 b.g., £14 10s.; charcoal rods, £13 5s.; steel hoops and strips, 1in. by 18 b.g. and upwards, £8 10s.; Eureka sheets, not thinner than 20 b.g., £9 10s.

John Bagnall and Sons quote sheets to 20 w.g., £9; 24 w.g., £10 10s.; 27 w.g., £12; ordinary boiler plates to 5 cwt., £9; best, £10; double best, £11; and treble best, £12. For hoops from 14 to 19 w.g. they asked £8; for angles, fullered shoe bars, and plating bars, £8; and for rivet iron, £9 to £10, according to quality. Their turning and horseshoe bars were £7 10s. The firm's ordinary smithy bars are as here: 1in. to 6in. flat, £7 10s.; 6½in., 7in., 8in., and 9in., flat, £8. Round and square, 7/16in. to 3in., £7 10s.; 3⅛in., 3¼in., 3⅜in., and 3½in., £8; 3⅝in., 3¾in., 3⅞in., and 4in., £8; 4⅛in. and 4¼in., £8 10s.; 4⅜in. and 4½in., £9; 4⅝in. and 4¾in., £9 10s.; 4⅞in. and 5in., £10. Round only: 5⅛in. and 5¼in., £10 10s.; 5⅜in. and 5½in., £11; 5⅝in. and 5¾in., £11 10s.; 5⅞in. and 6in., £12; 6¼in. and 6½in., £13; 6¾in. and 7in., £14; 7⅛in. and 7¼in., £15.

The Staffordshire and Steel and Ingot Company has now got its plate mill into regular work. It is of a capacity to produce 500 tons a week. The company is making three qualities—best best plates, guaranteed equal to Lowmoor or Bowling; best boiler plates, which they claim to be superior to any other Staffordshire plates; and bridge and girder plates, which, though tough iron and of high tensile strength, will compete with Middlesbrough plates in price.

A fine specimen of hoop iron has just been rolled, as an exhibition experiment, by Messrs. Geo. Adams and Sons, of the Mars Works, Wolverhampton. It is a hoop of ⅝in., 385ft. long. The same firm have also rolled a hoop of 1in. iron, 300ft. long. In their sheet department, Messrs. Adams are making fine sheets of "string gauges" suitable for deep stamping purposes; and in their bar mills they are producing iron of a quality good enough for bright axle-making.

Orders for pig iron do not improve, and deliveries under old contracts are very small. One reason of the restricted deliveries of hematites is found in the circumstance that best sheet makers and other consumers, instead of now melting so much pig as before in the puddling furnaces, are rolling their finished products out of steel blooms and billets. Some such steel makers have deliveries of hematites still to accept which were contracted for two years ago. Prices of hematites are quoted 56s. to 55s. per ton delivered. Native cold blast all-mine pigs are 77s. 6d., and hot blast 57s. 6d. to 55s. Other prices are without change.

The South Staffordshire and East Worcestershire Millmen's Association are showing their ignorance of the state of the iron trade at the present moment in a remarkable manner. They have just met and condemned the policy of the masters in asking for a reduction in ironworkers' wages, "believing that the cry of Northern competition is the old cry of wolf! wolf! when there is no wolf." There is not much hope that the men will quietly submit to a reduction, and the employers will therefore have to pursue their usual course of appealing to the arbitrator of the Iron Trade Wages Board The Board is called together for Tuesday next, when the masters will prefer their claim and propose that arbitration shall be resorted to.

A somewhat less confident tone is assumed since my last by the colliers now on strike. The collapse of the strike in Lancashire has had something to do with this, whilst the promise of help made at the Conference of Miners' Delegates in Manchester is scarcely likely to result in much practical assistance. At a few pits work is being resumed at the drop. The masters seem determined not to give way.

The engineers and ironfounders, as a rule, keep only poorly employed, the work on the books being in small lots. The manufacture of metal works' machinery, for which this district is well reputed, is being carried on quietly. Among the goods being manufactured are chilled rolls for the rolling of brass, copper, German silver, and other such sheets, particularly well ground and polished, made by Messrs. Thomas Perry and Son, of the Highfields Works, Bilston.

The firm has made a guillotine shearing machine for cutting iron sheets up to about ⅛in. thickness, with blades 5ft. 2in. long, capable of shearing up the centre sheets 4ft. wide, and cross-cutting a width of 4ft. 6in. Combined with it is a smaller shear for cutting the scraps into suitable lengths for working up again. The machine is driven by a neatly-arranged steam engine fixed to one of the standards, the cylinder being 7in. diameter and 9in. stroke. As a rule, however, there is not just now much of this better class machinery on order.

Ironwork, in the shape of fencing, hurdles, large gates, and the like, has recently been sent away from the Walsall district to the Continent—notably Holland—and a little of the same class of work is going to the colonies, but the home demand is poor. Some makers who depend upon the aristocracy for custom in this line are looking forward to the Parliamentary recess for the slightly improved demand always noticeable on account of country seats and shooting boxes.

"Herreshoff" boilers have lately been ordered in this district, and have afforded scope for the skill of local workmen in the necessary tube coiling. One specimen made by Messrs. F. H. Lloyd and Co, of Wednesbury, is a very creditable piece of work. It is composed of a number of tubes of diameters varying from 2in. to 4in., welded together in one length.

In steel wheels, pinions, and wheel gearing, makers find a growing favour for the helical tooth which so effectually prevents back lash.

The directors of the Birmingham Railway Carriage and Wagon Company have declared an interim dividend at the rate of 5 per cent. on the ordinary capital. This and similar concerns continue busy.

The operations of the Union Rolling Stock Company for the past half year have been satisfactory and profitable. The directors recommend an interim dividend on the ordinary shares at the rate of 10 per cent. per annum, and a bonus at the rate of 2 per cent. per annum. £1000 is added to reserve, which thus amounts to £18,750.

The Wolverhampton Chamber of Commerce are pushing forward with vigour the arrangements for the visit to the town on September 30th and October 1st, 2nd, and 3rd, of the Associated Chambers of Commerce. It is expected that excursions will be made to, among other places of interest, the works of the Staffordshire Steel and Ingot Iron Company at Bilston.

An important business feature of the Social Science Congress which is to meet in Birmingham from September 17th to 24th will be the proceedings of the Economy and Trade Department, since the papers are to have especial reference to the South Staffordshire district. Thus, "The Iron Trade of South Staffordshire" is to be contributed by Mr. R. Smith-Casson; "Railway Freights," by Mr. Alfred Hickman; and "Local Trade Unions," by Mr. B. Church. Mr. Richard Tangye and Mr. Alderman White are also likely to contribute special papers on the relative social position of the working classes at the present time and twenty-five years ago.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—There appears to be a steadily growing belief in the iron trade of this district that something very near the bottom has been reached, so far as prices are concerned; but buyers also entertain an equally strong conviction that there is no immediate prospect of any upward movement in values, and generally only a very dull heavy trade, at extremely low prices, is being looked forward to for some time to come. The blowing out of a number of furnaces in the district certainly leaves no room for doubt that many of the pig iron makers have got to the limit of the concessions they are prepared to make to secure business; but buyers apparently are not influenced by this fact to give out orders beyond their hand-to-mouth requirements, and where there is any disposition to enter into speculative transactions, it is only at prices which the leading makers decline to accept. In the finished iron trade makers are also showing a strong determination to resist the downward movement that is being forced on them, but gradually the minimum prices taken in the market become the basis upon which business has to be done. There is necessarily a weakness in the fact that the orders that are to be got even at the lowest prices are not sufficient to keep works fully employed, and this produces keen competition. The average prices now taken for any business of weight are 2s. 6d. per ton under the nominal quoted rates, but buyers point to the fact that there is still a margin of 2s. 6d. per ton over the lowest prices touched a few years back, and it remains to be seen whether they will succeed in again bringing down prices to this point.

There was again only a very dull market at Manchester on Tuesday, and any business done was at extremely low prices. The inquiry reported for pig iron was of the most limited description. For local brands makers were holding to 42s. to 42s. 6d. less 2½ as their minimum for forge and foundry qualities delivered equal to Manchester. For the present, deliveries against contracts are taking away pretty fairly the output of the local furnaces, but there is little or no new business coming forward except at under makers' quoted rates, and they are not disposed to give way. In district brands prices are extremely low, both Lincolnshire and Derbyshire iron being obtainable at under the figures quoted for local brands, and where business is done the average selling prices appear to be 41s. 6d. to 42s. less 2½ delivered here.

In hematites there appear to be practically little or nothing doing. For good foundry brands delivered here 55s., less 2½ per cent., is about an average quoted price, but there are sellers who would take less if there were anything like good orders to be got.

In the manufactured iron trade moderate orders are reported as being got on the basis of £5 12s. 6d. for good qualities of bars delivered into this district, and hoops could be bought at from £6 to £6 2s. 6d. per ton.

The wire trade in the Warrington district has of late shown an improvement. The recent reduction in wages has put makers in a better position to compete with the German houses for the export trade, and some of the firms have their books now pretty well supplied with orders.

Brassfounders generally report trade as only moderate at low prices.

The condition of the engineering trades remains much the same as I have reported of late. There is no improvement, and the general complaint is that there is a decided slackening-off in the weight of new work coming forward. Machinists maintain the improvement which I reported in this branch of trade a month or two back, and there are considerable orders in hand for plant and machinery for the fitting-up of new mills in Scotland. Tool makers are kept tolerably well employed, but except for special work, orders are running out faster than new ones are coming in. The same may be said with regard to locomotive builders, the only order of importance given out in the district for some time past being one recently for fifteen locomotives for India.

There are indications of reviving industrial activity in one important district of Manchester that for several years past, with its closed works and empty houses, has presented an appearance of desolation and decay. Recently the Albion Works at Miles Platting, which had previously been closed for a considerable period, were re-started by Mr. West, the late chief engineer of the Manchester Corporation Gasworks; and now preparations are being made for re-opening two other large works which have been stopped for several years. The Manchester Steel Works are are being restarted by a company that has been formed for carrying out a new process of steel manufacture, and the Railway Steel and Plant Works have been taken by a large engineering firm near Halifax, who have in contemplation the removal of their plant to Miles Platting. Should the re-starting of these two large works be successfully carried out, it will give an impetus to industrial employment in the Miles Platting district that has been wanting for a long time past.

An extraordinary blunder has occurred in connection with the levels of the new bridge crossing the river to the main entrance of the large station just erected by the London and North-Western Company on the Salford side. When the roadway came to be connected with the street, it was found that the level of the bridge was several feet above that of the street. The paving has, in consequence, been postponed until this absurd blunder has been rectified.

A summary of the report of the annual meeting of the Iron Trades Employers' Association, held at Halifax on Thursday, under the presidency of Mr. H. Shield, was given in last week's ENGINEER. The other business transacted at the meeting was mainly of a formal character, and it is only necessary to add that the following gentlemen were appointed the General Committee of Management for the ensuing year:—Barrow-in-Furness, Mr. C. J. Copeland; Barnsley, Mr. J. Farrar; Bradford, Mr. J. Cole; Bristol, Mr. J. L. Stothert; Halifax, Mr. John Crossley; Huddersfield, Mr. G. W. Tomlinson; Hull, Messrs. C. D. Holmes and A. E. Seaton; Keighley, Mr. R. L. Hattersley; Leeds, Messrs. J. Craven, D. Greig, and J. H. Kitson; Leicester, Mr. E. Death; Liverpool and Birkenhead, Messrs. A. Jack, J. Laird, and H. Shield; London, Messrs. J. Donaldson, J. Field, and G. Waller; Manchester, Messrs. B. A. Dobson, R. Peacock, and J. Robinson; Newcastle-on-Tyne, Messrs. W. Boyd, J. Price, and Percy Westmacott; Nottingham, Mr. J. Cropper; Sunderland, Messrs. Geo. Clark, jun., J. Dickinson, and J. H. Irwin; Wakefield, Mr. George Rhodes.

In the coal trade business continues extremely dull, with supplies largely in excess of requirements and prices very low. All classes of round coal are bad to sell, slack shows a tendency to get rather scarce, owing to the small quantity of round coal now being screened, but burgy continues plentiful. At the pit mouth prices remain at about 8s. 6d. to 9s. for best coal, 6s. 6d. to 7s. for seconds, 5s. to 6s. for common coal, 4s. 9d. to 5s. for burgy, 4s. up to 4s. 6d. in some cases for best slack, and 3s. 6d. to 3s. 9d. for ordinary qualities.

For shipment there has been a moderately good trade doing, and in some cases rather better prices have been got, fairly large sales having been made at about 7s. 6d. per ton for Lancashire steam coal delivered at the high-level, Liverpool, or the Garston Docks.

The wages strike in the West Lancashire coal-field is now completely at an end. I have all along pointed out that there was no probability that it would assume anything like serious proportions, and after a feeble attempt to carry on the strike in detail by boycotting one or two of the large firms, the men have had to admit that they have no means for carrying on the struggle even on this limited scale, and it has been resolved to return to work at the reduced rate of wages. The strike has served to show how little the market would have been affected by a continued stoppage of the collieries, and it is scarcely probable that work will be resumed on more than half-time.

Barrow.—The hematite pig iron market of this district, I have to report, lacks activity. Taking everything into consideration, and noting all things affecting the trade at the present moment, this can only be expected. Makers have pushed forward the orders which have been booked for delivery, and others not coming to hand, works are almost at a standstill. Up to the present the output has been well maintained, but the deliveries being low, stocks have rather increased. I believe the very low level of prices now ruling, and the prospect of furnaces being put out, are tending to check the operations of speculators. Prices this week may be put down at 46s. per ton net for ordinary mixed parcels of Bessemer iron, f.o.b.; foundry, 45s. net in trucks; and forge, 44s. 9d. per ton. The steel trade of the district is unchanged, and present prospects of a revival are not very bright. Orders from all quarters are restricted. Steel rails, ordinary double-headed sections, are quoted 95s. per ton; flange sections, 97s. 6d. Iron ore quiet, and large banks are held at mines; sales are made at 8s. 6d. to 9s. 6d. per ton net at mines. Shipbuilding inactive. Coal and coke easier. Shipping dull, as freights are low and difficult to obtain.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

THE strike in the iron trade comes at a very unfortunate time, and if it extends from Staffordshire and Worcestershire to this district can have only one effect—to deepen the prevailing depression, and to inflict much suffering on the ironworkers themselves. At this moment quotations are even weaker than they were at the corresponding period of last year, Nos. 1, 2, and 3 Bessemer pig are now at 53s. 6d., delivered in Sheffield, subject to the usual discount; Derbyshire foundry iron, 42s.; forge qualities, 40s. to 41s.; Lincolnshire, 40s. to 41s.; bars, merchant qualities, £6 to £6 5s.; sheets, £7 10s. to £7 15s.; Bessemer blooms and slabs, £5 to £5 5s., according to carbon. There is no improvement whatever to report in the demand either from home or abroad.

Mr. F. N. Wardell, her Majesty's Inspector of Mines for thi district, reports that during 1883 the aggregate number of pers ons employed in and about the whole of the mines of the United Kingdom of Great Britain and Ireland amounted to 565,168 p sons. The total number of fatal accidents was 989, and the number of deaths occasioned thereby 1140, an increase as compared with 1882 of 30 and 78 respectively. In 1883 there was one fatal accident amongst every 571 persons employed, and one death by accident amongst every 495 persons employed. The average for the ten years, 1874 to 1883, is one fatal accident for every 594 persons employed, and one death by accident amongst every 453 persons employed. The proportion of fatal accidents in 1883 to the number of persons employed is higher, and the death-rate lower, than the average of the last ten years. Of the total number employed, 514,933 were under the Coal Mines' Regulation Act, and 50,235 under the Metalliferous Mines' Regulation Acts. In the former there was one fatal accident for every 575 persons, and in the latter one fatal accident to every 738 employed.

Our Yorkshire miners have been demonstrating at Barnsley this week, partly on behalf of trades unionism and partly on behalf of the Franchise Bill. Mr. John Frith, one of the secretaries of the Yorkshire Miners' Association, proposed a resolution calling upon all miners to join the association at once, "believing that without a powerful association no great or lasting good can be accomplished in matters relating to trade, wages, and settlements of disputes generally." Mr. Frith states that after the amalgamation of the West and South Yorkshire Association the first quarter's income amounted to £1542, and from that time to the last quarter of December, 1882, it gradually increased to £2803; at the end of the December quarter, 1883, the amount had risen to £3244. Between £4000 and £5000 had been placed in the bank, and bad debt paid to the extent of £2438. There was not a large item for strikes, and the principal part of it was incurred at the back end of last year or early in the present year—no doubt in the abortive agitation to compel the employers to concede the 15 per cent. advance.

The adjudicators for the prize of £500 offered by Mr. Ellis Lever for a new safety lamp have reported that they examined 108 lamps, four of which were electric lamps and 104 oil lamps, a few being designed to burn mineral oils. Not one of the electric lamps fulfilled, or approached fulfilment, of the conditions of the award; and there was not one lamp in the entire lot that perfectly fulfilled the whole of the conditions. The result is that no award has been made.

Messrs. John Crowley and Co., of Meadow Hall Ironworks, Sheffield, have been awarded the silver medal at Pershore show for their new ensilage cutting machine. This, I understand, is the only medal granted up to this date for this class of machinery. The machine is specially constructed to cut and elevate green material for ensilage, and is fitted with several of the latest improvements patented by Mr. Samuel Edwards. These improvements are more particularly intended to protect the man feeding the machine from accident, and to prevent choking.

Messrs. Brown, Bayley, and Dixon had their final meeting of shareholders on the 29th ult., when the liquidators—Mr. J. H. Barber, Sheffield, and Mr. Wm. B. Peat, Middlesbrough—submitted their account, showing the manner in which the winding-up of the affairs of the company had been conducted and the property of the company disposed of. The company was registered in 1873 as Brown, Bayley, and Dixon, Limited, Sheffield Steel and Ironworks, and after several years of fairly prosperous trading, suffered severely during the lean years which followed the "boom" of 1873-4. The loss on ordinary shares has been £279,900; on preference shares or debentures, £13,540; while the creditors, who accepted 6s. 8d. in the pound, lost £192,570; total loss, £486,010. The company, whose business has been acquired by a new proprietary largely inclusive of the old, is now on a reduced scale, doing a much better trade.

In coal Messrs. Newton, Chambers, and Co., Thorncliffe, are now quoting as follows:—Mortomley best Silkstone, 13s.; Mortomley thin seam, 12s. 1d.; Mortomley best nuts, 9s. 7d.; Mortomley brights, 10s.; all at canal wharf, Sheffield. These rates will remain unaltered during August.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

No change of importance has taken place in the Cleveland pig iron trade since last report. It still remains in an almost stagnant condition. Consumers are holding back their orders in the expectation of being able to place them at lower prices shortly. The present outlook seems favourable to buyers, as shipments are below the average, and there is every probability that stocks will be found to have increased at the end of the month. What few transactions took place at the market held at Middlesbrough on Tuesday last were sales by merchants, who continue to offer small lots of No. 3 g.m.b. at 36s. 9d., and grey forge iron at 35s. per ton. This cannot, however, be said to be the market price for large quantities. Makers are for the most part supplied with orders which will last through August, and they are consequently firm in their quotations. They will not accept less than 37s. for No. 3, and 35s. 6d. for forge iron. Buyers offer 36s. per ton for warrants, but sellers ask 36s. 9d., and no business is done.

Messrs. Connal and Co.'s stock of pig iron at Middlesbrough has declined 150 tons during the week.

The quantity of pig iron shipped from the Tees during the first twenty-eight days of July amounted to 66,649 tons, as against 73,011 tons in June and 77,390 tons in July, 1883, corresponding period being taken.

In the manufactured iron and steel trades there is little fresh to report. The Witton Park mills and forges are still idle. The Bowesfield Ironworks at Stockton, which have worked regularly since February last, are stopped this week for want of specifications. Four hundred men are idle in consequence, but it is expected that they will be again employed next week.

Messrs. Bolckow, Vaughan and Co.'s steelworks at Eston are also standing, and are not likely to be restarted until fresh orders for rails are received. Two of the rolling mills at the Stockton Malleable Ironworks, after being inoperative for several weeks, are now again in operation.

Quotations for finished iron remain steady. Ship plates are offered at £5 to £5 2s. 6d. per ton on trucks at makers' works; angles at £4 15s. to £4 17s. 6d.; and common bars at £5 2s. 6d. to £5 5s. All cash 10th less 2½ per cent.

Messrs. B. Samuelson and Co., of the Newport Ironworks, who have now only six of their eight blast furnaces in use, are about to blow out another. One of the remaining ones will be set to work upon basic iron, in addition to another already so employed. Owing to this diminution of output, Messrs. Samuelson and Co. have given notice to leave to the whole of the hands employed at their Slapewath Mines, near Guisborough.

The accountant of the North of England Board of Arbitration has issued a bi-monthly report made up to June 30th. It shows that the average net selling price of plates, bars, angles, and iron rails for the two months ending June 30th was £5 5s. 5·36d. per ton. This is a reduction of 3s. 6d. per ton since the end of April, and 12s. 6d. per ton since the beginning of the year. During the whole of 1883 the reduction was 10s. 7d. per ton. Only once in the history of the finished iron trade has the average net selling price been lower than at present, namely, for the quarter ending August, 1879, when it was £5 3s. 3d. per ton. The production also has fallen off considerably. The output for the two months ending June 30th was 68,829 tons, as against 75,044 tons for the two months ending April, and 90,616 tons for January and February.

The directors of the Consett Iron Company have decided to recommend a dividend of 11s. 6d. per share, and the Board of the Consett Spanish Ore Company will divide 5s. per share.

The half-yearly meeting of the North of England Board of Arbitration was held at Darlington on Monday last. A report from the standing committee was read, showing that the number of firms connected with the Board was the same as in January, namely, sixteen. The number of operative members is now 6040, being 2607 less than at that time.

Mr. A. J. Dorman, of the firm of Dorman, Long, and Co., has been, and still is, seriously ill of typhoid fever. Great sympathy is felt throughout the district with him and his relatives. His high abilities are universally acknowledged, and there are few who would be more missed.

The South Gare breakwater at the mouth of the Tees is now almost complete, and a lighthouse has been erected in the centre of the circular head forming the end. Many years have elapsed since the work was commenced, and many a time has the work of weeks been carried away by a single storm. Now, however, the danger of such casualties is past. The North Gare breakwater is also making fair progress.

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

The iron market was quiet at the opening this week, but improved afterwards, the quotations of warrants exhibiting a slight advance. Business has now been resumed after the holidays, and larger supplies of raw iron will consequently be required, but the improved tone in the iron market is not so much a result of any extra inquiry for consumption, as of the desire on the part of brokers to place themselves in a good position at the end of the month. The pig iron shipments in the past week have been rather unsatisfactory, amounting to 10,315 tons, as compared with 8706 in the preceding week, and 14,058 in the corresponding week of 1883. To the United States the quantity dispatched is much larger, but not up to the mark. Italy and France are likewise taking a little more pig iron, but the shipments to Russia have practically ceased for the time. There are 94 furnaces in blast, against 96 last week, one having been put out at Shotts and the other at the Langloan Ironworks. The stock of pigs in Messrs. Connal and Co.'s Glasgow stores has been reduced by 430 tons in the course of the last seven days. Hematite pig iron is in poor request, and the prices are somewhat easier.

Business was done in the Glasgow warrant market on Friday at 41s. 3½d. cash, and 41s. 5½d. one month. On Monday transactions occurred at 41s. 5d., and on Tuesday 41s. 5½d. cash, and 41s. 7½d. one month were quoted. Business was done on Wednesday at 41s. 6d. to 41s. 5½d. cash, and to-day—Thursday—at 41s. 5d. to 41s. 7d. cash.

The values of makers' iron are as follows:—Gartsherrie, f.o.b. at Glasgow, per ton, No. 1, 51s. 9d.; No. 3, 49s. 9d.; Coltness, 57s. 6d. and 51s. 3d.; Langloan, 53s. 6d. and 51s. 3d.; Summerlee, 50s. 6d. and 47s.; Calder, 52s. and 46s. 9d.; Carnbroe, 50s. and 46s. 6d.; Clyde, 48s. and 45s.; Monkland, 43s. 6d. and 40s. 6d.; Quarter, 42s. 6d. and 40s. 3d.; Govan, at Broomielaw, 42s. 6d. and 40s. 6d.; Shotts, at Leith, 51s. 6d. and 51s.; Carron, at Grangemouth, 48s. (specially selected, 54s.), and 47s. 6d.; Kinneil, at Bo'ness, 44s. and 43s.; Glengarnock, at Ardrossan, 50s. and 43s.; Eglinton, 44s. 6d. and 41s.; Dalmellington, 46s. 9d. and 42s. 6d.

Both the malleable iron and steel trades continue much depressed, and there does not as yet appear any reason to believe that business will show any early improvement. The engineering and machinery trades have necessarily been quiet, having barely recovered even their recent measure of employment since the holidays, and the shipments of manufactured articles from Glasgow in the past week embraced £12,000 worth of machinery, £2600 sewing machines, £3500 steel goods, and £34,880 general iron manufactures.

The coal trade in the past week has been quieter than usual, both in the inland and the shipping departments. While upwards of 10,000 tons were shipped at Ayr, the quantities despatched at other ports were comparatively small. The quotations are nominally without alteration.

A conference of miners' delegates was held at Hamilton on Monday, when the chairman—Mr. Story, of Larkhall—had occasion to express regret that there was not a better attendance. His observations respecting the prospects of trade were exceedingly hopeful, although evidently dictated by insufficient information as to the exact position of affairs. The Hamilton miners, it was stated at the meeting, are still working the big darg, and the cause of restriction is evidently not espoused over the mining districts with that heartiness that the leaders of the men could desire.

The shareholders of the Arizona Copper Company met in Edinburgh a few days ago to confirm a series of resolutions, the object of which is to wind up the original company voluntarily, and form a new company under the same name. The Board estimated that, even with the present low price of copper, there would be a profit on the operations of the company.

A strong effort is being made to put the affairs of the Midlothian Oil Company in such a position that it may be possible to carry on the business to advantage.

The death is announced of Mr. Thomas Ellis, the proprietor of the North British Ironworks, Coatbridge. He had been in feeble health for a considerable time.

WALES & ADJOINING COUNTIES.

(*From our own Correspondent.*)

The adjudicators for the prize of £500 for the best safety lamp, given by Mr. Lever, have concluded their examination and tests of 108 lamps, and have decided not one of them fulfilled all the conditions. One of the best, and specially singled out, is the invention of Mr. Morgan, of Pontypridd. The conditions appear to be rather severe.

I am glad to report regular work and peaceful action amongst the principal sections of the colliers. The only exceptions have been a dispute at one of the Pontypridd collieries, consequent upon a change of management, and some little outbreak in the Tynewydd and Garreg, Ogmore Valley. These are expected to be amicably settled.

It is a good sign that the colliers have no local grievances of any account when they are found, as at present, meeting to vote that the House of Lords should be done away with. This is harmless compared with a wages or labour question.

The Swansea coal-trimmers are getting up an agitation for a change in the method of payment. They plead that they should be placed on the same footing as trimmers at Cardiff. The arrangement at Swansea is controlled by stevedores, and not by dock authorities, and payment by the day instead of by the ton. A strike is threatened, but the vigorous action of the coalowners has so far prevented it. These threaten to send men down to the docks if any delay is occasioned in the shipment of coal.

The coal shipments of the last week from all the Welsh ports amounted to 210,000 tons; iron shipments showed a little more life, and amounted to close upon 6000 tons. One hopeful sign is to be gleaned from the brisk way in which the mills are kept going, notwithstanding a paucity of orders. Ironmasters know that rails must be had, and Wales can compete with any in excellence of make and lowness of price.

I see that the managers of Dowlais and Cyfarthfa works gave strong evidence this week against the Barry Dock Bill, which they thought would only benefit the promoters. Mr. Wales's evidence was also damaging. It was to the effect that the future of the Rhondda will extend possibly a dozen years again, and then the great coal harvest will have been gathered. The best men I know, thoroughly conversant with the coalfield and unbiassed, give twenty years as the outside limit for prosperous times in the Rhondda; and Mr. Fisher, of the Taff Vale, the father, so to state, of the best paying line in the kingdom, gives its future as under fifty years. But opinions, *pro* and *con.*, can have no weight now, seeing that the question will be decided one way or the other this week; but for the promoters' own sakes, as well as in common justice to the Marquis of Bute, I hope the Bill will be relegated to the limbo of unsuccessful Bills.

Best coals are in steady demand, and I note increasing call for small steam, with even a tendency to better figures. Patent fuel, too, is in good demand at 10s. 3d. per ton. Swansea is particularly favoured by this branch, and all the works are busy. A project is on foot at Swansea to acquire the Landore Copper Works for a smelting business by a limited company. The name will be the South Wales Smelting Company; capital, £40,000, in 100 shares. The promoters are well-known merchants of Swansea.

Tin-plates maintain their position, and most of the principal works have good books. A fine cargo of 700 tons left Newport this week. In the Forest of Dean the Lydbrook Works are again in action, and prospects are good. The iron trade of the Forest is sluggish, and there are greater accumulations of pigs than there are despatches of manufactured iron. As for coal, the trade is fairly maintained, and prices rule somewhat regularly. Best block realises from 8s. 6d. to 9s. per ton.

The American Association for the Advancement of Science.—The thirty-third session of this Association will commence at Philadelphia on the 3rd of September and close on the 10th. The section D, for mechanical science, was organised at the Cincinnati meeting, 1881, and sessions were held in 1882 at Montreal, in 1883 at Minneapolis, and will be called at the Philadelphia meeting of 1884. The officers for the next meeting are: Vice-president, Robert H. Thurston, president of the section; Professor J. Burkitt Webb, secretary. The British Association will meet in Montreal immediately before the date of assembling of the American Association, and arrangements will be made to bring its members to Philadelphia on September 3rd. A great additional attraction will be found in the Electrical Exhibition to be held in Philadelphia from September 2nd to Obtober 10th. The preparations for this are progressing rapidly, and the fact that it is to be held under the auspices of the Franklin Institute is sufficient to insure its success. If it is desired to place articles, models, or apparatus on exhibition, a list and a statement of the space required should be sent to the secretary, Mr. J. Burkitt Webb, Cornell University, Ithaca, N.Y.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

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

Applications for Letters Patent.

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

22nd July, 1884.

10,420. Two Wheel Velocipede for Two Persons, J. E. Dixon, Nottingham.
10,421. Mattresses for Lying, &c., upon, J. T. Lockey and A. Kendal, Manchester.
10,422. Brewing, J. Gale, Sunderland, and R. Liddle, Monkwearmouth.
10,423. Warp Beam Motions of Looms, J. Entwistle, Darwen.
10,424. Process of Refining Sugar, A. de Maroussem, Brussels.
10,425. Hydraulic Engine which Revolves on its own Axis, E. and J. H. Walker, and T. Brunt, Rotherham.
10,426. Gravy Guard for Well Dishes, J. A. de Macedo, Headingley.
10,427. Liquid Hop Auxiliary, F. W. E. Shrivell, London.
10,428. Appliances for Hatching Chickens, H. Walker, Brockley.
10,429. Folding Shop Window Stand, W. Messent, Moseley.
10,430. Atmospheric Gas Burner, N. G. Richards, Dewsbury.
10,431. Making Cement, G. F. Busbridge and J. H. Turvey, East Malling.
10,432. Steam Pumps, &c., J. D. Noble, Bristol.
10,433. Hydrostatic Automatic Valve, T. S. Truss, Chiswick.
10,434. Domestic Fireplaces, G. H. and A. Brown, London.
10,435. Attaching Handles to Brushes, &c., G. H. and A. Brown, London,
10,436. Tamping Moulds for Castings, M. R. Moore, Indianapolis, U.S.
10,437. Mixing Fluid Carbonic Acid with Beer, L. A. Groth.—(*E. Nuhmann, Germany.*)
10,438. Preparing Textile Fibres, L. A. Groth.—(*H. Giesler, Germany.*)
10,439. Chemically Treating Wool, L. A. Groth.—(*H. Giesler, Germany.*)
10,440. Preserving Hops, L. A Groth.—(*J. A. Gfall, Germany.*)
10,441. Fastening for Earrings, L. A. Groth.—(*M. Spitzer, Austria.*)
10,442. Disinfecting Closets, &c., B. Haigh, London.
10,443. Drawing Wire, S. Cornforth, Birmingham.
10,444. Railway Couplings, C. A. Drake, London.
10,445. Mills for Preventing Dust Explosions while Grinding Grain, H. J. Worssam, Shoreditch.
10,446. Wardrobes, S. Anidjah, Shoreditch.
10,447. Shield for Foresight of Fire-arms, W. Sandbrook, Ebbw Vale.
10,448. Obtaining Ammonia, &c., from Gases, R. Main and W. Galbraith, Glengarnock.
10,449. Bicycles, H. J. Haddan.—(*E. H. Foss, Campello, U.S.*)
10,450. Ink-boxes, A. Eltzbacher, Germany.
10,451. Copying Presses, A. Eltzbacher, Germany.
10,452. Turning, &c., Machinery, C. Thompson, Cavan.
10,453. Gravity Railways, E. T. Gregory and A. Kissam, London.
10,454. Ball-valve, H. Trott, London.
10,455. Perambulators, G. E. Webster, Nottingham.
10,456. Gilling Wool, W. T. Garnett, Bradford.
10,457. Anti-fouling Composition, J. Pickering, London, and H. Saale, Chiswick.
10,458. Pumps, H. E. Newton.—(*C. C. Worthington, Irvington, U.S.*)
10,459. Softening and Purifying Water, &c., H. Porter, Honor Oak, and J. Porter, London.
10,460. Trap for Water-closets, &c., E. Newton, Hitchin.
10,461. Electrical Measuring Instruments, F. V. Andersen, Greenwich, and A. D. Stevenson, London.
10,462. Electro-magnets, F. V. Andersen, Greenwich.
10,463. Electrical Sounding Apparatus, G. Davis, London.
10,464. Pill Rounding and Finishing Machine, G. W. Niblett, London.
10,465. Pencil or Crayon Pointer, M. M. Brophy, London.
10,466. Applying Capsules to Bottles, H. H. Lake.—(*Wirth and Co., Frankfort-on-the-Maine.*)
10,467. Self-adjusting Spanner, H. Sainsbury, London.

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10,468. Bedsteads, &c., J. Eveson and H. Normanse Birmingham.
10,469. Lifting the Drum Out of a Washing Machine F. Orme, Nottingham.
10,470. Opening Internal Stoppered Bottles, R. Rayner, Ashton-under-Lyne.
10,471. Ventilators, R. Chattwood, Tottington.
10,472. Hat Linings, S. Marshall, Denton.
10,473. Horseshoes, G. J. Harcourt, Bristol.
10,474. Ring Magnet, T. J. Handford.—(*R. H. Mather, Windsor, U.S.*)
10,475. Injectors, J. Gresham, Salford.
10,476. Lamps, J. Lucas, Birmingham.
10,477. Moulding Seamless Wrought Metal Knobs, &c., J. Maxfield, Sheffield.
10,478. Automatic Fans, L. A. White, Chorlton-on Medlock.
10,479. Perambulator Wheels, H. W. Twiggs, Bristol.
10,480. Window Blinds, C. O. Sörlie, Norway.
10,481. Velocipedes, W. Jeans, Hampshire.
10,482. Purifying Coal Gas, J. Hanson, Bingley.
10,483. Caloric Engines, H. Guthrie, Longsight.
10,484. Attaching Wheels to Vehicles, C. Colton, London.
10,485. Loose Pulley, J. A. Crowther, Huddersfield.
10,486. Electrical Switches, F. Wynne, London, and G. C. Sillar, Bexley.
10,487. Sockets for Incandesence Electric Lamps, R. P. Sellon and G. C. Sillar, London.
10,488. Drill Chucks, J. Hewitt.—(*J. T. Foster, New Jersey, U.S.*)
10,489. Heads of Screws or Bolts, A. Stopes, Colchester.
10,490. Plaster, R. Stone, London.
10,491. Printing Textile Fabrics, H. Denk, Vienna.
10,492. Determining the Feed of Steam Boilers, C. D. Abel.—(*Comte de Dion, G. T. Bouton, and C. Trépardoux, Paris.*)
10,493. Self-motive Power Driving Machine, R. Westall, East Dulwich.
10,494. Manure Distributing Machines, E. Capitaine.—(*A. Brocksch, Dramburg.*)
10,495. Treating the Lupinus Plant to Adapt it for Use as Food for Cattle, E. Capitaine.—(*R. Habermann, Berlin.*)
10,496. Connecting Winches or Reels to Fishing-rods, C. Laight, Redditch.
10,497. Pressing, &c., Rolls of Tobacco, D. Cavanagh, Edinburgh.
10,498. Mechanical Toy with Climbing Figures, E. de Pass.—(*G. Hébert, Paris.*)
10,499. Spring Air Guns, H. M. Quackenbush New York, U.S.

10,500. Facilitating the Inhalation of Medicated Vapour, C. B. Harness, London.
10,501. Saw Sets, C. Croissant, New York, U.S.
10,502. Mechanical Scene for Theatrical Purposes, E. Jarratt, Glasgow.
10,503. Water and Earth-closets, W. P. Buchan, Glasgow.
10,504. Corkscrews, E. P. Alexander.—(*W. R. Clough, Brooklyn, U.S.*)
10,505. Telephony, J. G. Lorrain, London.
10,506. Handles for Agricultural Implements, W. A. Rollins.—(*W. M. Serviss, Marion, U.S.*)
10,507. Soppers for Bottles, &c., J. H. B. Denison, Kingston-upon-Hull.
10,508. Solitaires, A. Black, Glasgow.
10,509. Stoppers for Bottles, W. R. Lake.—(*G. F. Couty, Paris.*)
10,510. Producing Brilliant Surfaces on Articles of Gold, &c., H. H. Lake.—(*Messrs. Wirth and Co., Frankfort-on-the-Main.*)
10,511. Electro-magnetic Musical Instruments, R. K. Boyle, Liverpool.
10,512. Knitting Machines, W. Cotton, Loughborough.
10,513. Water Meters, W. Cotton, Loughborough.
10,514. Transmitting Motion to Speed Indicators, J. M. Napier, London.
10,515. Appliances for the Support of Varicose Veins, &c., E. Diver, Kenley.
10,516. Feeding Calves, &c., W. Osborn, London.

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10,517. Filters, F. G. Eaton, Stockport.
10,518. Carding Engines, J. M. Hetherington, Manchester.
10,519. Spinning Mules, J. M. Hetherington, Manchester.
10,520. Boxes for Holding Salmon, &c., J. B. Carter, jun., Portsmouth.
19,521. Railway, &c., Curve Lubricator, J. Chew, and G. Parkington, Blackburn.
10,522. Fastening Leggings, &c., B. E. L. Culpin, Stevenage.
10,523. Medical Compound, E. W. R. Schröster, Hamburg.
10,524. Supplementary Safety Valve for Steam Boilers, J. and R. Pendlebury, Preston.
10,525. Type-distributing Apparatus, A. Fraser, Edinburgh.
10,526. Portable Railway Trucks, R. Caldwell, Dublin.
10,527. Securing in their Places the Condenser Tubes of Steam Engines, W. Richards and J. Chamberlain, Bristol.
10,528. Drying and Heating Apparatus, J. A. R. Main and J. Dick, Glasgow.
10,529. Flower-pots, H. D. Child, Twickenham.
10,530. Safety Fusees for Electric Circuits, Sir W. Thomson and J. T. Bottomley, Glasgow.
10,531. Feeding-bottles, F. J. Harrison, London.
10,532. Portable Brickwork, W. S. Rogers, London.
10,533. Bicycle and Tricycle Heads, T. Smith, Birmingham.
10,534. Producing Enamelled Surfaces, &c., B. Baugh, Birmingham.
10,535. Speed or Power Gear applicable to Velocipedes, R. Allen and W. J. Wakefield, London.
10,536. Depolarising Electric Batteries, A. C. Henderson.—(*E. Bazin, Paris.*)
10,537. Fastening Pads to Cart Saddles, T. W. Hill, London.
10,538. Automatic Recorder, R. Barlow, London.
10,539. Cigar, &c., Holders, R. Barlow, London.
10,540. Suspending Curtains over Doors, &c., J. E. Tilling, London.
10,541. Coal-boxes, E. Bullivant, Wolverhampton.
10,542. Feeding-bottles, T. Pearse, London.
10,543. Ornamenting Fabrics, E. P. Alexander.—(*P. V. Renard, France.*)
10,544. Brackets for Supporting Ship Lamps, C. E. Croft, Birmingham.
10,545. Fustian Cutting, G. Roger, Warrington.
10,546. Miners' Lamps, R. Falconer, Dalkeith.
10,547. Pavement, A. G. Brookes.—(*G. F. Zeigler, New York, U.S.*)
10,548. Cauterising Apparatus, J. H. Johnson.—(*C. A. Paquelin and L. de Place, Paris.*)
10,549. Ploughs, C. J. Vircondelet, France.
10,550. Stopper for Bottles, &c., C. Ham, Exeter.
10,551. Furnace Bars, F. B. Chadwick, Cardiff.
10,552. Shearing Ropes, P. M. van Swyndregt, near Rotterdam.
10,553. Lubricators, W. Bormann, Germany.
10,554. Current Wheels, F. Carre.—(*H. Carre, Canada.*)
10,555. Strengthening the Eyes, H. H. Lake.—(*Messrs. Wirth and Co., Frankfort-on-the-Main.*)
10,556. Brougham Saddle-tree made of Metal, T. W. Hill, Hendon.
10,557. Window-sashes, W. Hayward and W. Eckstein, London.
10,558. Obtaining Pictures on Enamel Fixed by Fire, S. J. D'Ostrorog, London.
10,559. Cutting Blanks for Hexagonal Nuts, O. Imray.—(*F. A. Hasenclever, Germany.*)
10,560. Gas Lamps, F. Siemens, London.
10,561. Wheels for Bicycles, &c., C. Robin, Paris.

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10,562. Starting Tram-cars, A. J. Moore, Portsmouth.
10,563. Bolsters, Caps, &c., A. Pilley and B. Ball, Sheffield.
10,564. Spring Door Locks, E. W. Brown, Lower Edmonton.
10,565. Carding Engines, T. B. Kay, Manchester.
10,566. Gunpowder Cartridges, D. F. Downing, Woolwich.
10,567. Circular Drop Shutter for Taking Photographs, F. W. Mousell, Dublin.
10,568. Swinging Movements, W. Bendall, Birmingham.
10,569. Raising and Lowering Busts, J. E. Sheldon, Handsworth.
10,570. Combination Tools, I. Oakley and W. H. Oakley, London.
10,571. Measuring Twisted Fibres, A. Hitchon, Accrington.
10,572. Hoeing Implements, C. Prout, Lower Filham, Ivy Bridge.
10,573. Barring Engines, W. Hargreaves and W. Inglis, Bolton.
10,574. Malleable Iron and Steel, C. Thompson, Sunderland.
10,575. Facilitating the Shipping of Boats' Rudders, H. Emanuel, Surbiton.
10,576. Lanterns or Lamps, H. Cullabine, Sheffield.
10,577. Looms for Weaving, D. Leggett, Pendleton, and W. Ackroyd, Bradford.
10,578. Mules for Spinning, W. Hurst and W. Hamer, Bolton.
10,579. Heating and Circulating Water, F. Hocking, Liverpool.
10,580. Heating the Rooms of Buildings, F. Hocking, Liverpool.
10,581. Transmission of Power, P. A. Humbert, San Francisco, U.S.
10,582. Movable Seat for Baths, J. Price, London.
10,583. Outside Buffers, C. G. Owen, London.
10,584. Washing and Preparing Corks, W. G. Cotching, Taunton.
10,585. Sacking, &c., St. J. V. Day.—(*P. S. Swan, Calcutta.*)
10,586. Drying Racks, R. A. Baxter.—(*Lawrence and Baxter, New York.*)
10,587. Working Window Curtains, J. E. Tilling, London.
10,588. Brushes, W. D. Thornton, Bradford.
10,589. Receptacles for Soaps, &c., G. Martin, Bradford.
10,590. Let-off Apparatus for Warp Beams of Looms, J. Walton, Croston.
10,591. Bottling Machines, R. S. Lloyd and H. W. Dowell, London.
10,592. Applying Electricity to the Human Frame, J. Glew, London.
10,593. Electric Battery, J. Glew, London.
10,594. Shooting Cases, J. Vale-Lane, London.
10,595. Grinding Plates for Mills, J. and W. J. Woods, London.
10,596. Tongs for Regulating Teeth of Saw Blades, H. A. Hansen, Christiania.
10,597. Waterproof Cloaks, Capes, &c., J. H. Perry, London.
10,598. Spanners, E. H. Boutcher, Bedfont, W. F. Westwood and J. H. Boutcher, London.
10,599. Aerated Beverage, A. Andrews, London.
10,600. Waterproof Fabrics, S. Pitt.—(*Company for Manufacturing Waterproof Fabrics, St. Petersburg.*)
10,601. Shaping Soap into Bars, C. Wright, London.
10,602. Wheels, T. E. Knightley, London.
10,603. Fountain Pens, C. W. Robinson, London.
10,604. Economising Steam, K. R. Smith, Tunbridge Wells.
10,605. Spring Rollers, G. D. Peters, London.
10,606. Perambulators, &c., E. Lea, Stratford-on-Avon.
10,607. Shirts, C. F. Rowe, London.
10,608. Nut Locks, W. R. Lake.—(*Abras Frères, Sclessin-lez-Liège, Belgium.*)
10,609. Buckles, W. Lake.—(*J. Thornton, New York.*)
10,610. Boots and Shoes, W. H. Stevens, Leicester.
10,611. Paring the Curls of Hat Brims, E. Bould, London.
10,612. Hat Shaping Machines, E. Bould, London.
10,613. Hammer Rails for Pianofortes, C. Erhardt.—(*C. Gehrling, fils, Paris.*)

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10,614. Driving Gear for Washing, Mangling, &c., Machines, B. Hindle and J. S. Harvey, Clayton-le-Moors.
10,615. Vertical Steam Boilers, H. Kesterton, Birmingham.
10,616. Engines, N. Chandler, Hednesford.
10,617. Wheels, W. Edwards, near Birmingham.
10,618. Cleaning Rifle Barrels, &c., W. Lightwood, Birmingham.
10,619. Traction Engines, T. James, Gloucester.
10,620. Steeling Iron without Welding or Blistering, T. Froggatt, Cheltenham.
10,621. Brick Walls, R. J. Worrall, Liverpool.
10,622. Bricks, C. G. Tebutt, Bluntisham.
10,623. Paper Folding Machines, R. Cundall, Thornton.—*14th June*, 1884.
10,624. Painting Signals, H. Wilmer, Woodford, and T. Bolas, Chiswick.
10,625. Applying Heat to Steam Boilers, G. H. Taylor, Liverpool.
10,626. Furnaces, H. C. Paterson, Glasgow.
10,627. Furnaces, H. C. Paterson, Glasgow.
10,628. Targets, W. Tranter, Aston, and C. Dixon, Witton.
10,629. Buoys, R. Tindall, Fraserburgh.
10,630. Spring Buttons, C. A. Day.—(*D. H. Brandon, Paris, and I. F. Saunders, Michigan.*)
10,631. Vessels, H. Dinn, Gravesend, and G. B. Richards, London.
10,632. Envelopes, H. Henly, London.
10,633. Steam Boilers, H. C. Paterson, Glasgow.
10,634. Smoke Consuming Apparatus, D. Morris, Carnoustie.
10,635. Combined Brooch and Flower Holder, O. L. Woollard, London.
10,636. Cartridges, G. B. Richardson. —(*M. H. Mackesy, Punjab, India.*)
10,637. Tubes with External Discs, J. C. Mewburn. —(*J. and C. de Surmont, France.*)
10,638. Metal Fencing, W. Bayliss, Wolverhampton.
10,639. Pumping Engines, J. Evans and P. R. Björling, Wolverhampton.
10,640. Looms for Weaving Matting, A. M. Clark.—*A. Hurbuch and L. Bieringer, Germany.*)
10,641. Steering Gear for Velocipedes, F. Weck, Lilleshall.
10,642. Double-valve Flushing Box and Water-waste Preventer, J. C. Cowell, Higher Tranmere.
10,643. Separating Solid and Liquid Fœcal Matters, H. W. Lee.—(*T. Roberts, New Zealand.*)
10,644. Materials for Surgical Splints, S. Gamgee, Birmingham.
10,645. Millstone Dress, A. J. Boult.—(*V. Bernard, France.*)
10,646. Boiler Furnaces, C. A. Knight and G. W. Thode, Glasgow.
10,647. Valve Gear, W. R. Cummins, Essex.
10,648. Material for Deodorising Purposes, J. C. Stephenson, Portsmouth.
10,649. Machines for Warping in Sections, &c., P. J. Livsey, Manchester.
10,650. Compressing Ensilage into Silos, D. Richley, Bradford.

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10,651. Granulated Crystalline Carbonate of Soda, J. Mactear, Glasgow.
10,652. Breech-loading Small-arms, C. G. Bonehill, Birmingham.
10,653. Cultivating Land, J. Burfield, Hailsham.
10,654. End Frames for Wringing Machines, J. S. Harvey and B. Hindle, Clayton-le-Moors.
10,655. Shooting Galleries, T. Robottom, Nuneaton.
10,656. Imparting Tension to Driving Bands, H. B. Barlow.—(*E. C. A. Masson, Vincennes.*)
10,657. Vehicles, C. H. M. Wharton, Manchester.
10,658. Obtaining Motive Power from Air Heated by Electricity, W. B. Thomson, Wick.
10,659. Fastener for Boots and Shoes, &c., J. Pond, Norwich.
10,660. Cutting Velvets, M. Baerlein, Salford.
10,661. Brackets for Electric Lights, J. Lawrie, Sheffield.
10,662. Raising and Closing Windows, &c., C. Groombridge, Edmonton.
10,663. Bottle and Stopper, H. Agar, London.
10,664. Water-closets, T. Purdie, jun., Glasgow.
10,665. Pulleys, J. W. Heaps, Keighley.
10,666. Issuing Tickets to Passengers on Tramways, H. T. Davis, North Brixton.
10,667. Glazing, W. Clark, Reading.
10,668. Suspending the Pipes of Well Pumps, &c., J. Brennand, Salford.
10,669. Spring Fasteners, A. Combault, London.
10,670. Umbrella Fasteners, A. Combault, London.
10,671. Saucepans, &c., W. A. Dixon, London.
10,672. Measuring Knife and Paper Cutter, F. Hogg, Kingston-on-Thames.
10,673. Pen-wiping Pen-holder, F. Hogg, Kingston-on-Thames.
10,674. Regulating Combustion in Hot-water Stoves, &c., C. P. Kinnell and G. Rothnie, London.
10,675. Carburation of Gas in Carriage Lamps, E. G. Brewer.—(*J. E. Dery, Brussels.*)
10,676. Producing and Maintaining Motive Power, C. J. Eyre, London.
10,677. Collar Studs, P. H. A. Thümmler, London.
10,678. Covering for Floors, S. Johnson and R. Freeman, London.
10,679. Moulds for Glass Bottles, &c., A. Alexander, London, and R. Park, Sunderland.
10,680. Gelatine Plates for Photography, &c., A. J. Boult.—(*G. Eastman and W. H. Walker, New York.*)
10,681. Pulley Head or Attachment, J. W. Porritt, London.
10,682. Buttons, A. J. Boult.—(*R. Derooster, Belgium.*)
19,683. Metal Cartridge Cases, &c., C. D. Abel.—(*W. Lorenz, Carlsruhe.*)
10,684. Supplying Fuel Automatically to Furnaces, A. Goldthorp, Wakefield.

ABSTRACTS OF SPECIFICATIONS.

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

4524. Gloves, *J. Williams, Sheffield.—21st September,* 1883.—(*Provisional protection not allowed.*) 2d.
Consists in forming a purse or receptacle in the palm of the hand.

4582. Boxes and Parcel Wrappers or Bags, *F. Temple-Allen, London.—26th September,* 1883.—(*Provisional protection not allowed.*) 2d.
Relates to construction of boxes, &c., for the transmission of articles by parcels post.

4832. Steam Heating Apparatus, *T. Morgan, London. —10th October,* 1883.—(*A communication from H. Martini, Chemnitz.*)—(*Provisional protection not allowed.*) 4d.
Relates to apparatus which regulate automatically the pressure of the steam, or simultaneously also, the entrance underneath the grate of the steam boiler.

4860. Burglar Alarms, *H. J. Haddan, London.—12th October,* 1883.—(*A communication from L. Loicq, Bruxelles.*)—(*Provisional protection not allowed.*) 2d.
Relates to the construction of mechanism for discharging a cartridge, and also for striking a gong.

5360. Steel Ingots, &c., *C. A. Day, London.—13th November,* 1883.—(*A communication from G. W. Billings, Cleveland, U.S.*) 8d.
Consists in moulding or casting ingots rapidly, and rapidly compressing the metal within the mould immediately after pouring; whereby an operator is enabled to produce ingots of greater density and better quality than heretofore manufactured, and free of piping or blow-holes.

5392. Machines for Making Cigarettes, *R. W. Page, Hammersmith.—15th November,* 1883. 10d.
Rows of tobacco of any desired length and prepared by hand are transferred transversely at equal distances apart to a longitudinal band, by which the tobacco is conveyed to the mechanism for converting it into cigarettes. For this purpose shelves or supports with grooves are employed. A hopper receives the tobacco from the travelling band and deposits it in a rolling band, which, in combination with a reciprocating bar and frame, and a weight suspended from the band, rolls and compresses the tobacco. A strip of paper is pasted on one edge and fed transversely to the direction in which the tobacco is delivered, the strip of paper actuating the pasting roller.

5527. Ventilators and Chimney Cowls' *J. H. Reynolds, New York.—26th November,* 1883.—(*A communication from A. J. Robinson, Boston, U.S.*)
This relates to the cap or head of ventilators or cowls, and consists in making the upper plate of dome-shape with a flange round its lower edge. The lower plate is also dome-shaped, but is inverted, and secured to the upper plate so as to leave an opening. A pipe is inserted centrally in the lower plate, and extends to near the lower side of the opening. A shield surrounds the opening between the plates to prevent inward currents.

5607. Seamless Upper Leather for Boots and Shoes, *T. T. Marshall, Ontario.—3rd December,* 1883. 6d.
This relates to apparatus for crimping leather, and the mode of cutting the leather when crimped. The crimping machine consists of a special construction of screw press and moulding blocks.

5613. Velocipedes, *W. L. Wise, London.—3rd December,* 1883.—(*A communication from F. J. A. F. von Palstring, Koswig, Saxony.*) 8d.
The velocipede is propelled by the rider by an action of his limbs, which resembles that of walking.

5629. Pulling or Opening Rags, Waste, &c., *G. and J. E. Tolson, Dewsbury.—4th December,* 1883. 8d.
The object is to pull or open rags or other fibrous materials, so that the length of staple composing the fibre is not broken, and this is accomplished by combining an ordinary rag machine with a carding machine, or with that class of machine called a "Garnet machine."

5645. Steering Apparatus, *J. H. Kilbourn, London, and G. Fossick, Stockton-on-Tees.—4th December,* 1883. 6d.
The object is to provide appliances suitable for cushioning the blows from the action of the waves, and strains, by overcoming the excessive and objectionable rigidity. For this purpose two or more springs are employed in close proximity to the rudder head, and so arranged that the whole power used to move the rudder is transmitted through these springs, which also serve to counteract or absorb the shocks received by the rudder.

5662. Producing Motive Power, *S. J. Williamson, Liverpool.—6th December,* 1883.—(*Provisional protection not allowed.*) 2d.
Small wheels are caused to work upon larger wheels by means of weight or pressure.

5696. Pleating Machines, *P. Hayman and H. S. Benjamin, London.—10th December,* 1883.—*A communication from H. Rose, Berlin.*)—(*Provisional protection not allowed.*) 2d.
Consists of a special combination with longitudinally fluted and transversely grooved rollers of metal rods. Guide rollers are provided, and suitable means for heating the rollers and for regulating the pressure.

5703. Hose or Flexible Pipes, *O. Blödner and H. Vierscrodt, Gotha.*)—*11th December,* 1883. 4d.
Relates to the weaving or plaiting of the pipe, and to the coating or covering the same with india-rubber.

5712. Manufacture of Soda and Chlorine Compounds from Sodium Chloride, *E. Carey and F. Hunter, Widnes.—11th December,* 1883. 6d.
The inventors claim the manufacture of soda (meaning thereby bicarbonate and carbonate of soda) from sodium chloride by converting it into sodium sulphate, and treating the sulphate when in solution with ammonia and carbonic acid.

5713. Roundabouts, &c., *J. C. Fell, London.—11th December,* 1883.—(*A communication from Comte de Vaussay, Paris.*) 6d.
This consists in mounting horses, chairs, or carriages upon different concentric rings, which can be caused to revolve at different velocities.

5716. Pumps, *F. J. Preston, J. T. Prestige, and R. J. Preston, London.—12th December,* 1883. 6d.
The main object is to facilitate access to the pump valves for clearing and repair.

5718. Working and Interlocking Railway Signals by Electricity, *S. C. C. Currie and J. A. Timmis, London.—12th December,* 1883. 6d.
The switches and levers are so arranged as to interlock one with the other, the interlocking being effected electrically. The signals and points can be under the combined control of two signalmen at distant points, and also under the automatic control of a passing train.

5724. Distillation of Coal, Shale, &c., *P. Couper, Edinburgh, and M. Rae, Linlithgow.—13th December,* 1883. 8d.
Below the retort employed is a chamber of larger capacity than the retort, so that when desired to recharge the retort by withdrawing ash from the lower chamber, the exhausted charge can enter therein. One or more jets of steam are admitted to the lower part of the chamber and draw in air to secure combustion and distillation, and the retort is heated partly by surrounding flues and partly by heat from the lower chamber. Distillation is effected by combustion in the lower chamber of the organic matters in the substance, and the products of distillation are withdrawn from the upper part of the retort.

5727. Measuring Water, &c., *W. H. Tooth, London. —13th December,* 1883. 6d.
Consists in the employment of a float sliding upon a connecting or guide rod, in combination with and serving to operate an inlet and outlet valve of suitable construction and an index.

5740. Carding Engines, *W. Richardson, Oldham.—14th December,* 1883. 6d.
This relates to improvements in feeding apparatus for carding engines known as "Rodmer's Feed," in which a feed roller operates in conjunction with a curved plate, and it consists in forming the front of such plate with grooves, so that the material delivered to the taker-in roller will be carried along such grooves.

5744. Apparatus employed in the Manufacture of Flour, *T. N. Robinson, Rochdale.—15th December,* 1883. 6d.
Three rollers are disposed in a horizontal or nearly horizontal plane, the grain being fed in between the first and second and second and third rollers, and motion of rotation is given in reverse directions to the outer rollers, the centre roller being stationary or nearly so.

5751. Crushing, Grinding, and Amalgamating Mineral, Animal, and Vegetable Substances, *W. P. Thompson, London.—15th December,* 1883. 6d.
Relates partly to means of preventing the pulp or pulverised substances from getting to the bearings.

5752. Water Filters, *W. L. Barstow, Pontefract.—13th December,* 1883. 6d.
The filter consists of a vessel containing a combination of carbon and porous stone, or earthenware, terracotta, or similar material.

5759. Carding Machines, *W. Gawthorp, J. Reddihough, and S. Wade, Bradford.—14th December,* 1883. 6d.
The invention consists in passing around the rollers and doffers, strips of card clothing side by side of the required number and breadth to suit the width of the card cylinder.

5760. Winding Apparatus for Mines, *C. Pieper, Berlin.—17th December,* 1883.—(*A communication from A. Lindenberg, Dortmund.*) 6d.
The object is to so combine the counterbalance rope with the cages or the winding drums that its weight is not thrown upon the winding rope.

5763. Packing of Frilling, Fringes, &c., *Mac Cullum, Manchester.—17th December,* 1883. 6d.
This relates to forming a reel to receive frilling, &c., and providing a drawer to slide therein.

5768. Spinning and Doubling Cotton, &c., *T. Coulthard, Preston.—17th December,* 1883. 6d.
Consists, First, in constructing a sheet metal ring holder designed to dispense with the employment of the holding-down screws for fastening the ring holder to the surface of the ring rail in that class of frames in which the spindle is self-contained and adjustable; Secondly, in combining with a traveller clearer an arrangement for preventing ballooning.

5772. Construction of the Ceilings and Floors of Buildings for Facilitating Exit therefrom in Case of Fire, *D. R. Clyner, Reading.—18th December,* 1883. 6d.
This relates to the use of flexible ladders which can be folded up into a recess in the ceiling when not required, but which when lowered give access through a hole in the floor above to the floor beneath.

5777. Circuits for Electrical Apparatus, *H. J. Allison, London.—18th December,* 1883.—(*A communication from C. E. Allen, Adams, Massachusetts, U.S.*) 6d.
Relates to so arranging an automatic central office and signal boxes that any subscriber may place himself in independent telephonic communication with any other subscriber without the aid of any one in the central office, and without ringing the bell of any other subscriber than the one with whom he wishes to communicate.

5779. Automatic Holders for Knives, Pens, &c., *J. H. Johnson, London.—18th December,* 1883.—(*A communication from H. Barolzheimer, New York.*) 6d.
Relates to a holder in which the case or handle and mechanism for clamping or holding the articles contained in the said handle are combined with a retracting spring, which maintains the said mechanism normally in a position in which it grasps the article and pressure cap by which the said mechanism can be moved against the stress of the retracting spring for the purpose of releasing the article.

5792. Printing Machines, *W. R. Lake, London.—18th December,* 1883.—(*A communication from T. Nowell, Boston, U.S.*) 6d.
Consists principally in the combination, in a printing press, of a type bed and a platen, both mounted upon, and adapted to be vibrated about the same shaft mounted in fixed bearings; a cam arranged to act upon, and impart an intermittent motion to the said platen, a pair of cranks mounted upon, and operated by the shaft of the said cam and a pair of draw-bars connecting the said cranks and the type bed.

5796. Producing Fluid Currents Available for Ventilation, &c., *A. Lorrain-Richmond.—18th December,* 1883. 6d.
Relates to an apparatus for producing fluid currents, consisting of a sail or flexible sheet, one end of which is held stationary in position, while the other end is caused to revolve by its connection to a revolving crank pin.

5800. Fabrics for Covering Umbrellas, *S. C. Lister, Mannington Mills.—18th December,* 1883.—(*Void.*) 2d.
The fabric is woven with the weft of a Tasar silk, and the warp is woven of net silk or of other fine strong warp, and such fabric is rendered waterproof.

5810. Crayon Holders, *P. Lawrence, London.—19th December,* 1883. 6d.
Consists in means whereby the lead or other marking material is advanced step by step from the holder by longitudinal pressure. It further consists in means to hold the marking material, whereby it is prevented from dropping out more than a predetermined distance.

5816. Ships' Windlasses, &c., *W. Clarke, Gateshead-on-Tyne.—20th December,* 1883. 6d.
Consists principally in the arrangement for giving increased holding power between the driving wheels and the lifters when hauling in cable, the said arrangement consisting of grooves and projections on the sides of the said driving wheels and lifters with gripping surfaces of wood, india-rubber, leather, asbestos, or equivalent material, all arranged and applied, and capable of being brought forcibly together.

5818. Machinery for Making "Mansel" and other Wheels with Wooden Centres, *T. N. Robinson and J. P. Fielden, Rochdale—20th December,* 1883.—(*Void.*) 2d.
Relates to the general construction of the machine.

5819. Card Grinding Machines, &c., *G. Hoyle, Rochdale.—20th December,* 1883. 6d.
The objects are, First, to improve the frame so that it will hold the card roller firmly and steadily, and to enable the card roller to be readily moved to and from the emery roller, and at the same time to keep the two rollers exactly parallel to one another, and also to lock the frame when the parts are properly adjusted for working in such manner that all back-lash or shaking is avoided; and Secondly, to improve the construction of emery rollers so as to render them light and strong and more durable than those of the ordinary construction.

5821. Working of Marble and other Stone, &c., *G. M. Morgan, London.—20th December,* 1883. 6d.
This relates to apparatus for carving out mouldings in marble and stone mechanically, and it consists in causing the work to travel on a table under a tool rest, in which suitable tools are fixed.

5828. Storing Vessels, *H. J. Haddan, London.—21st December,* 1883.—(*A communication from L. Fritz, Memphis, U. S.*)—(*Provisional protection not allowed.*) 2d.
This relates to a sectional jacket applied to vessels, so that it can be removed, and also to a pump for withdrawing the contents of such vessels, and which can be made to enter within the vessel when not in use.

5831. Boat Cover Raft, *A. H. Bremner, Thurso, N.B.—21st December,* 1883.—*(Not proceeded with.)* 2d.
The cover is of waterproof canvas, supported round the sides, in the centre, and across by compartments or divisions of cork. On the upper side are two small oars, and mast and sail, and round the sides is a net, which can be hauled up to form bulwarks. The cover is lowered with the boat between it and the vessel, and prevents the boat striking the side of the vessel.

5838. Spinning and Twisting Fibrous Materials, *W. Tatham, Rochdale.—22nd December,* 1883. 6d.
This relates to spinning and twisting machines in which the flyer is in independent bearings, and is either driven directly or by the drag of the thread when the spindle is rotated, and in one arrangement the flyer revolves on a tubular axis within a bearing, and with a tubular warp on its axis enclosing the lubricant.

5846. Grinding, Crushing, or Reducing to Powder Ores, Quartz, &c., *T. W. B. Mumford and R. Moodie, London.—22nd December,* 1883. 6d.
Consists in an apparatus for crushing or reducing ores, quartz, or the like to powder by means of rolls, in the combination of rolls with a chamber or receptacle beneath, and with an elevator conducting the materials to a receptacle above, in which are different sized riddles or sieves (preferably jogging or vibrating) with compartments or receptacles below and shoots so arranged that the mattes after being acted upon by the grinding rolls are elevated to the said riddles or sieves, and sorted thereby, and redistributed for regrinding and for discharge.

5850. Treatment of Sewage, *F. Herbert, London.—24th December,* 1883. 4d.
This relates to principally the use of electricity as a means of dealing with and deodorising all kinds of sewage, and the utilisation of the gaseous products resulting from such treatment for lighting or other purposes. Special apparatus is described.

5854. Shuttles, *W. Brooks and T. Tweedale, Crawshawbooth, Lancashire.—24th December,* 1883.—*(Void.)* 2d.
A slot is formed in the head of the shuttle peg, and through it passes the pivot pin. A top spring plate secures the peg when hooked on to the pivot pin. The inner surface of the top spring of the peg is strengthened and its elasticity increased by making it concave or of groove section.

5855. Impregnation of Wood, &c., with Preservative Substances, *C. D. Abel, London.—24th December,* 1883.—*(A communication from J. A. Koch, Texas, U.S., and W. Herre, Berlin.)* 4d.
Relates to the general chemical treatment of wood, &c.

5857. Flue Tubes for Steam Boilers and Apparatus for Manufacturing the Same, *J. J. Tinker, Manchester.—24th December,* 1883.—*(Not proceeded with.)* 2d.
The main object is to give increased strength to the flue tubes.

5868. Manufacture of Chlorine, *W. Weldon, Burstow.—27th December,* 1883. 4d.
Consists, First, in obtaining solid manganese chloride in small crystals or masses by subjecting to evaporation solution of manganese chloride and agitating the solution mechanically during the latter part of the operation of evaporating it. Secondly, heating in contact with air solid manganese chloride obtained in small masses in order so to obtain free chlorine and an oxide of manganese or mixture of oxides of manganese, capable of liberating more chlorine from aqueous hydrochloric acid.

5872. Combing Machines, *W. R. Moss and W. H. Brown, Bolton.—27th December,* 1883.—*(Not proceeded with.)* 2d.
According to this invention the fly, fluff, or waste is first conducted to the points of the combs, and is then cleared off by a doffer or clearer cylinder.

5878. Preparation of Safety Paper for Protection against Erasure, &c., *J. Jameson, Newcastle-upon-Tyne.—27th December,* 1883. 4d.
This consists in applying a soluble film in the form of a design to paper, and then printing partly on the film and partly on the paper, so that if moistened to remove any part of the obliteration mark, part of the printing will be removed.

5879. Treating Leather used in the Manufacture of Driving Belts, *J. Paterson, Glasgow.—27th December,* 1883.—*(Not proceeded with.)* 2d.
The object is to render leather more durable and to overcome its tendency to stretch under a strain, and it consists in treating it with a mixture of wood resin and gumthus (otherwise known as frankincense) melted together and added to linseed oil, and an india-rubber solution diluted with petroleum, benzoline, or bi-sulphide of carbon.

5882. Pocket Appliances for Preventing Watch Robberies from the Person, *J. Badcock, London.—28th December,* 1883.—*(Not proceeded with.)* 2d.
Cords are secured inside the pocket and have a sliding ferrule, which can be moved along so as to form a loop between them through which the watch is passed.

5891. Manufacture of German or Dried Yeast, &c., *J. Fordred, Tottenham.—28th December,* 1883. 4d.
This relates, First, to the employment of hard water; Secondly, to the employment of a grist in which rye grain preponderates; Thirdly, in employing a wort of high gravity to produce a strong and healthy crop of yeast cells; Fourthly, the use of the strongest yeast seed obtainable to produce the future crop of yeast cells: Fifthly, the use of filter presses for the separation and purification of the yeast; and Sixthly, the manufacture of vinegar from the resulting wash.

5896. Production of Photographic Negatives for Photo-lithography, Photo-zincography, &c., *A. Borland, Wilmslow.—28th December,* 1883.—*(Not proceeded with.)* 2d.
A screen of wire or hair gauze is placed in front of the sensitive plate inside the camera, so that the negative produced on the plate will consist of lines and dots, and can be used in photo-lithographic and photo-zincographic and similar processes.

5898. Projectiles, *A. A. Cochrane, Westminster.—28th December,* 1883.—*(Not proceeded with.)* 2d.
This relates partly to the construction of projectiles filled with explosives in two parts, such projectiles being either made buoyant or not, and connected or not together by a rope or buoyant tube, and fired from different projectors.

5902. Production of Patterns upon Velvets, &c., *D. Scott, Manchester.—28th December,* 1883. 4d.
Relates to means for embossing or stamping patterns upon plain velvets or other cut or looped pile fabrics, the object being not only to imboss or stamp the pattern or design required, but to shorten or remove certain portions of the pile from the fabric, so that the pattern when produced shall be much more permanent than if the pile were pressed or damped down in the usual manner.

5904. Production of Patterns upon Velvets, &c., *A. Scott, Manchester.—28th December,* 1883. 4d.
The portion of the pile of the velvet which is to form the pattern is pressed down by blocks or engraved rollers, and the part left standing up is removed by a revolving roller covered with emery or other substance, after which the pattern portion is raised again by steaming, washing, or brushing.

5905. Detonating Alarm for Doors, Windows, &c., *E. Edwards, London.—28th December,* 1883.—*(A communication from H. Gibout, Paris.)—(Not proceeded with.)* 2d.
The apparatus is arranged beside the lock or stopper of a door or window, which, if opened when the apparatus is set, causes a hammer to strike a cartridge, and, by exploding the same, give an alarm.

5914. Manufacture of Metallic Alloys or Compounds, *G. A. Dick, London.—29th December,* 1883. 4d.
The inventor claims, First, the manufacture of alloys or compounds of copper, zinc, iron, and phosphorus or manganese, or both, by dissolving phosphoret of iron or ferro-manganese or spiegeleisen in molten zinc, and adding the composition so formed to molten copper; Secondly, the employment in the manufacture of copper alloys of the compound formed by bringing molten zinc into contact with ferro-manganese or phosphoret of iron or spiegeleisen.

5923. Gas Engines, *C. M. Sombart, Germany.—29th December,* 1883. 1s.
This relates, First, to gas engines with two working cylinders and one gas pump, one or both cylinders being capable of being put into action; and Secondly, to engines with one working cylinder and one pump. When two cylinders are employed an explosion takes place at each half revolution; but when only one is employed the explosion occurs at each revolution only. When only one explosion occurs the charge of gas in the pump is caused to pass not to the cylinder, but to the gas conduits, or to the front part of the gas pump, or the part behind the piston. A valve regulated by a governor controls the passage of the charge. A special igniting device and also a self-acting lubricating device are described.

5927. Manufacture of Incandescent Electric Lamps, &c., *S. Z. de Ferranti, London.—29th December,* 1883.—*(Not proceeded with.)* 2d.
Relates to improvements in the lamp and in the air pump for exhausting the same.

5931. Portable Ladder Apparatus to Serve as a Fire Escape, *W. R. Lake, London.—29th December,* 1883.—*(A communication from E. Canziani, Milan.) (Not proceeded with.)* 2d.
This relates to a carriage carrying a ladder made up of sections, which are capable of being raised and lowered by means of cords or chains wound on a drum actuated by suitable cranks.

5932. Bicycle and other Wheels, *E. Sarjeant, Birmingham.—29th December,* 1883.—*(Not proceeded with.)* 2d.
This relates to making the hub of such wheels in two parts, which together securely hold the spokes in position, and also in regulating the tension of the spokes by adjusting the two parts forming the hub.

5936. Compound for Coating Electrical Cables, &c., *R. Punshon and W. Nicholson, London.—29th December,* 1883.—*(Not proceeded with.)* 2d.
Consists of cellulose, gelatine, oak varnish, ozokerit, and, when necessary, india-rubber.

5937. Manufacture of Block Ice, *W. W. Nightingale, Southport.—31st December,* 1883.—*(Not proceeded with.)* 2d.
The water is supplied to an elevated reservoir closed by a cover, but having a tubular outlet extending to a considerable elevation for carrying off air liberated from the water by agitators in the reservoir. The water then flows to the moulds or boxes in which ice is to be formed, and from which the air has been exhausted.

5941. Metallic Packing for Piston Rod, Stuffing-boxes, &c., *S. Perkins, Manchester.—31st December,* 1883.—*(Not proceeded with.)* 2d.
This relates to the use of an inner and outer series of metal rings of triangular section so arranged that when the gland of the stuffing-box is screwed up it forces the rings against each other, and thereby the inner rings against the rod and the outer rings against the side of the stuffing-box.

5948. Galvanic Batteries, &c., *O. E. Rawson, F. L. Rawson, and A. R. Upward, London.—31st December,* 1883.—*(Not proceeded with.)* 2d.
Relates to a combination of elements and exciting fluids, and to certain modifications of construction and operative devices.

5950. Apparatus for the Generation of Steam, &c., *J. W. Gill, Birmingham.—31st December,* 1883. 4d.
A spray of water is injected by a spray producer into a coil of pipes heated by a gas fire.

5951. Gas Motor Engines, *H. Campbell, Leeds.—31st December,* 1883.—*(Not proceeded with.)* 2d.
Two cylinders are placed side by side, one being the motor cylinder and the other the pump cylinder, the former of usual construction, with exhaust ports at its outer end, and the latter cast with deep circumferential ribs. The cylinders are placed in a casing forming a jacket, which is divided transversely, and through one part of which water circulates, while the exhaust ports open to the other.

5954. Treatment of Mineral Oils in Combination with other Matters, and Producing therefrom Soap, Candles, &c., *W. Green, Thanet.—31st December,* 1883. 4d.
This relates to the treatment of petroleum, shale oil, or other mineral oil, and the solid or semi-solid matters, as scales, paraffine, wax, grease, or fat, obtained therefrom, with an oil of lye, with a blast of air, with castor oil or other vegetable or animal oil or fat, with a resinous or gummy matter, with heat sufficient to fuse the said ingredients with a solution of potash and caustic soda, or an alcoholic solution thereof, or with borax, or with common salt, or any other matter whereby a curdy solid soap can be salted out from a fused mineral oil soap.

5957. Machinery for Forging and Shaping Nails, &c., *B. P. Walker, Moseley, and C. B. Kelley, Birmingham.—31st December,* 1883.—*(Not proceeded with.)* 4d.
This relates chiefly to means whereby the head or ends of the nails are automatically perfected by the machinery. It also comprises mechanism for actuating the hammers and for feeding in the rods between the hammers.

5958. Obtaining from Alkali Waste either Free Sulphur, or Free Sulphur and Sulphurous Acid, or Free Sulphur and Sulphuretted Hydrogen, *C. F. Claus, London.—31st December,* 1883. 4d.
The sulphur is obtained from alkali waste by liberating it as sulphuretted hydrogen by treating the waste in the presence of water with carbonic acid gas, air being then added to the sulphuretted hydrogen, and the mixture passed through a bed of solid material kept at a suitable temperature, so as to effect the combustion of the hydrogen and setting the sulphur free.

5959. Obtaining Sulphur from Sulphuretted Hydrogen, *C. F. Claus, London.—31st December,* 1883. 4d.
Air is added to the sulphuretted hydrogen, and the mixture passed through a bed of solid material kept at a suitable temperature, whereby the sulphur of the sulphuretted hydrogen is set free.

5960. Treatment of Mixtures of Sulphuretted Hydrogen and other Gases to Obtain the Sulphur of their Sulphuretted Hydrogen as Sulphurous Acid, *C. F. Claus, London.—31st December,* 1883. 4d.
This consists in effecting the combustion into sulphurous acid gas and vapour of water of the sulphuretted hydrogen in a mixture of sulphuretted hydrogen and other gases, by adding to the mixture a quantity of air to burn both the hydrogen and the sulphur of the sulphuretted hydrogen, and then passing it through a bed of solid material kept at a suitable temperature.

5965. Bleaching Leather and Tanned Hides, *G. W. von Nawrocki, Berlin.—31st December,* 1883.—*(A communication from G. Levinstein, Germany.)—(Not proceeded with.)* 2d.
The leather is impregnated with a soluble chemical compound, such as muriate or sulphate of zinc, which, with alkalies or other chemical substances produces a precipitate which is insoluble in water, and the leather impregnated as described is then passed through a solution of the alkali or chemical substance.

5961. Wheeled Vehicles, *H. F. Lloyd, Liverpool.—31st December,* 1883.—*(Provisional protection not allowed.)* 2d.
This relates to the arrangement of seats, hoods, springs, brakes, and back rests of vehicles.

5963. Teaching Soldiers and others the Use of Rifles, &c., *W. Heath, London.—31st December,* 1883.—*(Not proceeded with.)* 2d.
This relates to the use of an annular block at the base of the cartridge to be used in shooting in galleries, the target being of metal, with cardboard in front, and capable of being raised or lowered, so that by properly sighting the gun and aiming at a fixed point, the adjustment of the target will enable practice to be carried on representing firing at different ranges.

5969. Bleaching of Petroleum, &c., *R. Baynes, J. Fearenside, jun., and W. P. Thompson, Liverpool.—31st December,* 1883.—*(Not proceeded with.)* 2d.
The disagreeable odour of mineral oils is destroyed by blowing through them ordinary wet steam, and powdered charcoal is then mixed with the crude oil and the oil distilled off leaving the colouring matters behind.

5970. Compression of Crops for Ensilage, *P. McIntyre, Trewydyr.—31st December,* 1883.—*(Not proceeded with.)* 2d.
This relates to the use of tanks filled with water or sand for the purpose of compressing crops for ensilage.

5973. Telegraph Wires, &c., *J. S. Lewis, Birkenhead.—31st December,* 1883.—*(Not proceeded with.)* 2d.
This relates to a method of terminating overhead wires, to an insulator and mode of fastening the iron bolt therein, and to a coupling for overhead wires.

5974. Artificial Bone, &c., *C. B. Warner, London.—31st December,* 1883.—*(A communication from L. Mestaniz, New York.)* 6d.
This relates principally to the manufacture of an agglutinative material from skimmed milk, capable of being coloured and pressed into various shapes.

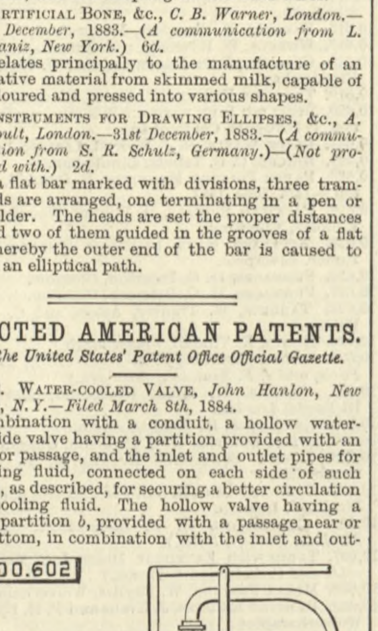
5985. Instruments for Drawing Ellipses, &c., *A. J. Boult, London.—31st December,* 1883.—*(A communication from S. R. Schulz, Germany.)—(Not proceeded with.)* 2d.
Upon a flat bar marked with divisions, three trammel heads are arranged, one terminating in a pen or pencil holder. The heads are set the proper distances apart and two of them guided in the grooves of a flat plate, whereby the outer end of the bar is caused to travel in an elliptical path.

SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

300,602. Water-cooled Valve, *John Hanlon, New York, N.Y.—Filed March 8th,* 1884.
In combination with a conduit, a hollow water-cooled slide valve having a partition provided with an opening or passage, and the inlet and outlet pipes for the cooling fluid, connected on each side of such partition, as described, for securing a better circulation of the cooling fluid. The hollow valve having a pendent partition *b*, provided with a passage near or at its bottom, in combination with the inlet and out-

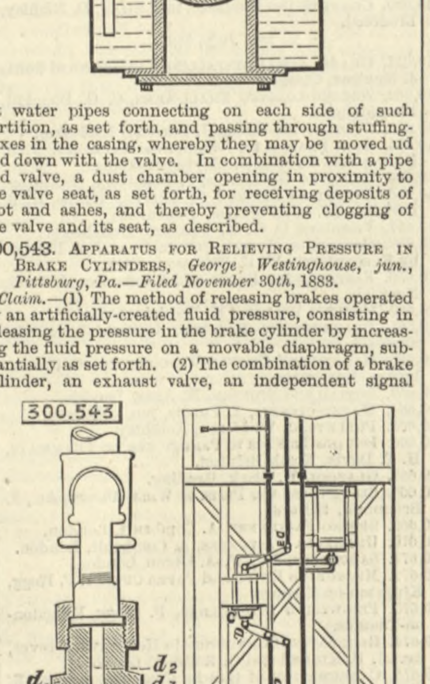
300.602



let water pipes connecting on each side of such partition, as set forth, and passing through stuffing-boxes in the casing, whereby they may be moved ud and down with the valve. In combination with a pipe and valve, a dust chamber opening in proximity to the valve seat, as set forth, for receiving deposits of soot and ashes, and thereby preventing clogging of the valve and its seat, as described.

300,543. Apparatus for Relieving Pressure in Brake Cylinders, *George Westinghouse, jun., Pittsburg, Pa.—Filed November 30th,* 1883.
Claim.—(1) The method of releasing brakes operated by an artificially-created fluid pressure, consisting in releasing the pressure in the brake cylinder by increasing the fluid pressure on a movable diaphragm, substantially as set forth. (2) The combination of a brake cylinder, an exhaust valve, an independent signal

300.543



pipe, the main reservoir, and a cock for admitting the full pressure of the main reservoir into the signal pipe, substantially as set forth. (3) In a fluid-pressure brake mechanism having a brake pipe for operating the brakes by the use of any desired pressure, and a signal pipe normally charged with a less pressure, both connected with the brake cylinder, and, in combination therewith, a pressure-relieving mechanism arranged in the line of communication from the signal pipe to the brake cylinder, and a cock arranged in the pipe which connects the main reservoir with the signalling pipe, substantially as set forth. (4) A fluid pressure brake and signalling apparatus having, in combination, a brake pipe and an independent signalling pipe, a connection from one to the other through a common reservoir, and means for keeping the signalling pipe continually charged with fluid pressure, but at a less pressure than that normally contained in the brake pipe, substantially as set forth. (5) In combination with a brake cylinder C, and a pipe a^3, for the supply and discharge of fluid-pressure in the normal operation of the brakes, an independent exhaust valve a movable diaphragm for operating said valve, a spring to hold said valve to its seat as against normal pressure, and a fluid-pressure-supply pipe and cock for applying an excess of fluid-pressure to unseat said valve, substantially as set forth. (6) In an exhaust valve, the combination of the parts d and d^1, the part d having the passages d^2 and recess d^3, the part d^1 having the passages d^{10}, d^{11}, d^6, d^7, and d^8, and recess d^3 the diaphragm d^5, the presser-stem e, the valve c, provided with guides, and the spring c^1, substantially as set forth.

300,653. Metallic Packing for Piston and Valve Rods, *Charles T. Sleeper, Chicago, Ill.—Filed February 29th,* 1884.
Claim.—In a metallic packing, the combination with a casing or box and sectional metallic packing rings located therein, of followers engaging the rings

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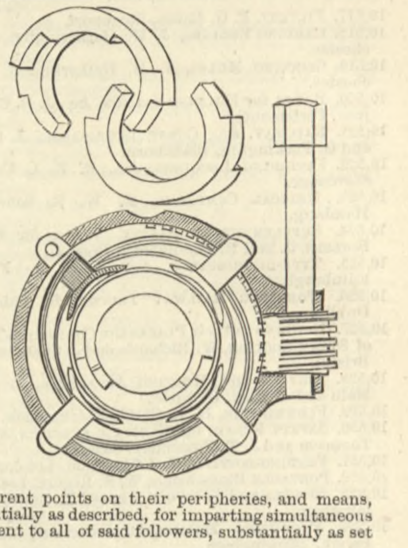
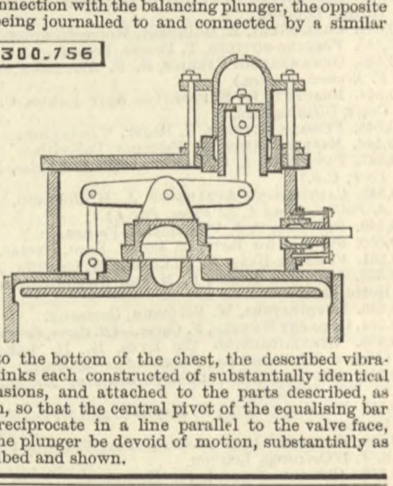


at different points on their peripheries, and means, substantially as described, for imparting simultaneous movement to all of said followers, substantially as set forth.

300,756. Balanced Slide Valve, *James Bewsher, Kansas City, Mo.—Filed February 18th,* 1884.
Claim.—The combination, with a steam engine slide valve, and its inclosing steam chest provided with a vertical packing chamber and plunger near one end, an equalising bar pivotted midway of its length to the back of the valve, and having a vertically vibrating link journalled, as shown, to one extremity for connection with the balancing plunger, the opposite end being journalled to and connected by a similar

300.756



link to the bottom of the chest, the described vibrating links each constructed of substantially identical dimensions, and attached to the parts described, as shown, so that the central pivot of the equalising bar may reciprocate in a line parallel to the valve face, and the plunger be devoid of motion, substantially as described and shown.

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