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The Canadian Patent Office Record AND MECHANICS' MAGAZINE

Vol I.—No. 2. MAY, 1873. Price in Canada $1.50 per An. United States - $2.00 "

FIG. 1.

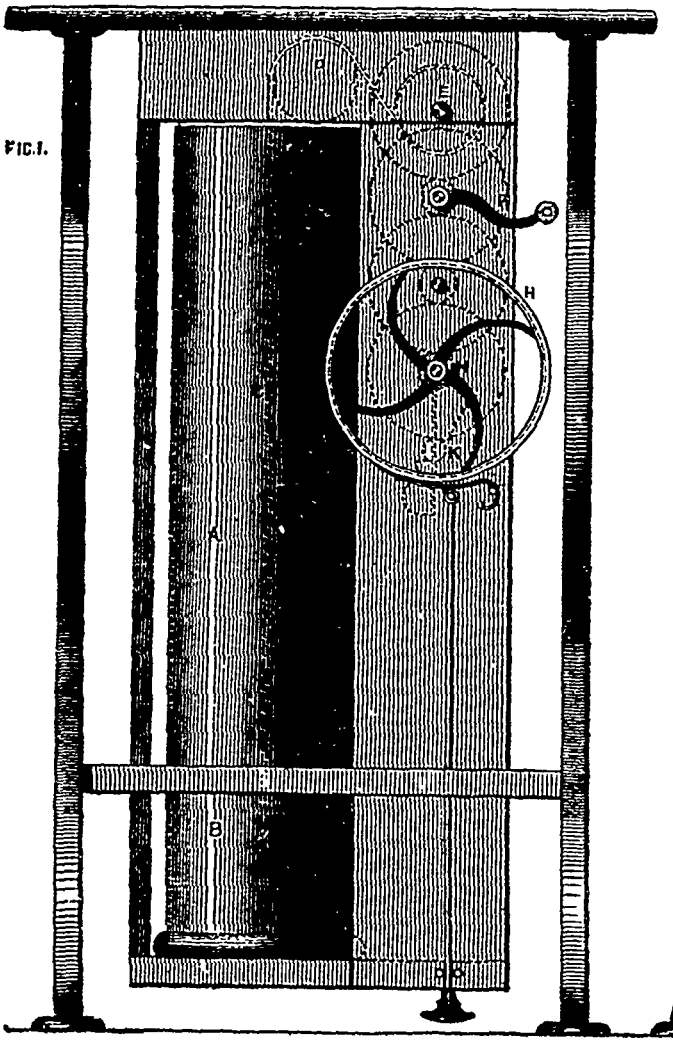
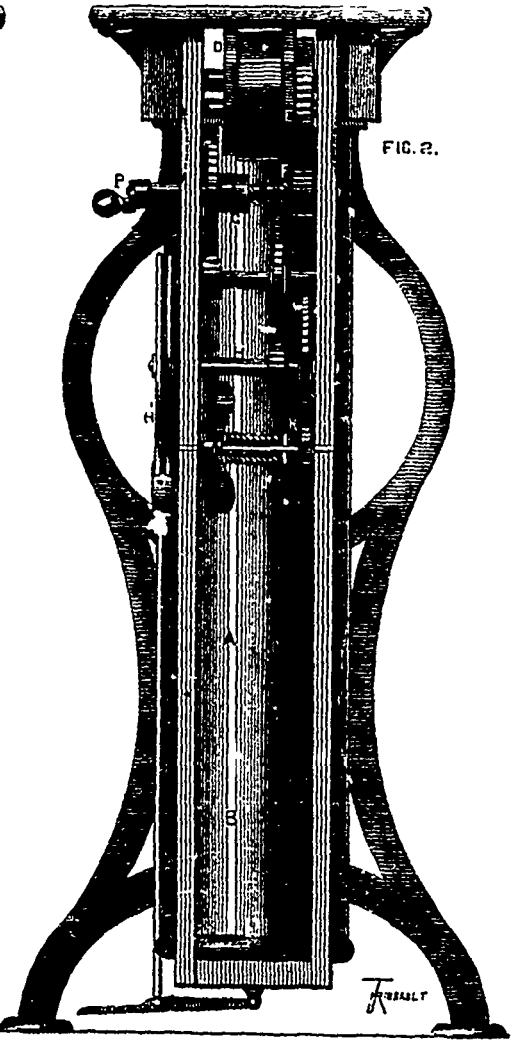


FIG. 2.



APPARATUS FOR DRIVING SEWING · MACHINES.

Designed by Mr. Joseph E. Holmes, Engineer, London.

MOTIVE POWER FOR SMALL MACHINES.—(See page 33.)

The want of a cheap motive power capable of driving sewing and other machines has long been felt, and much ingenuity has been expended in attempting to supply it. The contrivances which have been designed to attain this end may be divided into two classes, the first being composed of motive powers properly so called, and the second consisting of accumulators of power, or contrivances by which a considerable amount of manual force exerted for a short interval is stored up and given out as required in the form of a lesser force exerted for a longer period. Amongst the motive powers of the first class we have had small turbines driven by water supplied from the ordinary mains, "domestic" steam engines, small gas engines, and electro-magnetic engines, some few of these contrivances being well designed, but none of them, so far as we are aware having come into general use.

Machines of the second class have consisted, with but few exceptions, of arrangements of springs brought into a state of compression or tension by gear worked by hand, their recoil being utilized to actuate the machine to be driven. The arrangement which we now illustrate on page 33 and which has been designed by Mr. Joseph Holmes, London, England, belongs to the second class, but it differs from its predecessors in an important respect, namely, that instead of the power being stored up by the tension or compression of steel springs or by raising dead weights, the necessary force is obtained by the pressure of the atmosphere upon the surface of a piston moving in a cylinder, and below which a vacuum has been formed. The advantages of this arrangement are that a practically constant force is obtained acting through any required distance, while, at the same time, the whole machine can be kept comparatively light. Thus, for instance, if we suppose a vacuum of 14 lbs. per square inch (and the arrangement admits of an almost perfect vacuum being obtained) to exist below a piston 9 in. in diameter, the pressure on that piston will amount to 890 lbs., or be nearly equal to a dead weight of 8 cwt, while the weight of the parts required to obtain this result is very moderate. On the other hand, too, the force exerted on the piston, being practically constant throughout its stroke, there is no necessity to resort to fusees or other contrivances to equalise the force exerted, as is the case when steel springs with their variable resistance are employed.

The arrangement adopted by Mr. Holmes will be readily understood by reference to the engravings, fig. 1 being a front, and fig. 2, an end elevation of the motor.

In these figures, A, is a cylinder of suitable diameter and length fitted with a piston, B, which moves freely—but perfectly air-tight—in it. To this piston is attached a band or chain C, which extends through one end of the cylinder over a pulley D, to the drum E; the latter being geared to a shaft F, which can be turned by the wrench or key P, so as to wind up or raise the piston from the bottom to the top of the cylinder. Instead of the chain or band C, a rack may be employed. The shaft F, is connected by a clutch G, or a ratchet and pawl or other suitable contrivance, with toothed or frictional gearing, or with belts and pulleys whereby the motion imparted to the shaft on which the drum E, is fixed, is communicated to other shafts. The gearing or pulleys are so proportioned that any speed communicated to the first wheel or shaft is greatly accelerated in its transmission from it to the last shaft H, of the series, which is connected directly or indirectly with the sewing or other machine to be driven. H^1, is a fly or band wheel, which may have grooves at different diameters to correspond with the pulley attached to the machine to be driven, and by which the speed or power may be regulated to suit the work to be performed.

The piston B, as before stated is fitted to work air-tight in the cylinder A, and the latter is closed air-tight at the bottom or at one end, the top or other end being open. When the piston is raised or drawn towards the top or open end of the cylinder a vacuum will be produced in the cylinder below the piston, and the latter will be pressed down with the full pressure of the atmosphere, and this force is communicated as explained through the aforesaid gearing to the machine to be driven. It will be seen from the engraving that the motor is provided with a simple brake applied to the wheel H_1, this brake being so arranged that it is always in action except when removed by the pressure of the foot on the treadle shown. By simply pressing or releasing this treadle the motor is started or stopped at pleasure, and thus perfect command is obtained over the motion of the machine which is being driven.

Of course, in such an arrangement as that we have described a vital point is to obtain a piston which shall move freely in the cylinder, and which shall yet maintain itself air-tight without skilled attention. Practical experience has proved that such a piston can be constructed.

With a motor of the kind we have described, having a 9 inch cylinder and 2 ft. stroke of piston, a force of about 1800 foot-pounds can be stored up, the piston being raised by 82 turns of the crank handle, and the work of winding up being easily accomplished in one minute. This amount of stored-up work is sufficient to make about 5000 stitches with a sewing machine, or to sew about seven or eight yards, according to the quality of the work. The arrangement in modified forms is also available for a variety of purposes where the exertion of a small power for long periods is required, and we anticipate that numerous applications will be found for it.—*Engineering*.

PEAT-CONDENSING MACHINERY.—(See page 36.)

The total absence of coal in the strata of this and the adjoining province is a source of weakness which has for a long time been patent to the most careless considerer of our progress in manufactures. Our water power is abundant, but we have no coal and our vast forests already begin to fail to supply fuel necessary even for household consumption. We have however vast deposits of a most useful fuel hitherto almost untouched, in the peat-beds of Anticosti and other places. Deposits of this fuel exist to a great extent in Great Britain and Ireland and the present high price of coal there has turned the attention of the public to this hitherto neglected source of heat. Experimental trials of peat-condensing machinery have recently been made there in the presense of influential capitalists and engineers, all of whom expressed their opinion that the success of the project was undeniable. It is quite unnecessary to remind our readers that the question of fuel here, in Quebec and Ontario, is in a very unsatisfactory state. Our forests are beginning to fail, and our deposits of metallic ores are for the most part necessarily neglected. This being the case we may learn a profitable lesson from the misfortune of the present scarcity of coal in England.

We give on page 36 a plan and side elevation of a peat-condensing machine by Messrs. Clayton, Son, and Howlett, recently introduced to public notice. The illustration is from the *Engineer* which remarks upon it as follows: "It is unnecessary for us here to enlarge on the importance which, as our readers know, we have always attached to the utilisation in some form or other of the immense deposits of fuel contained in the peat fields of Great Britain and Ireland, and we will therefore at once proceed to a description of the details of this machinery, which, to our minds, is certainly the nearest approach to a solution of the great question of how peat can be freed from the hygroscopic and fixed water it contains in its natural state, and also reduced in bulk as to be convenient for transport storage, yet brought forward.

In the system which Messrs. Clayton, Son and Howlett propose to pursue, however, the peat, when cut, is first of all filled into what they called "squeezing trucks," in which, during its journey to the works, by the action of a screw or lever, a large proportion of free water is forced out through perforations in the bottom and sides of the said trucks It will be seen from our illustration that, separate from the moveable driving engine, the condensing machine itself consists primarily of hoisting gear, which is connected or disengaged from the motive power by a hand lever, and is used to raise the peat as it arrives from the bogs to the level of the vertical hopper, but which is clearly an arrangement quite extraneous to the vital principle of the manufacture. The mastication or trituration of the peat, after it has been filled into the hopper, is effected by a vertical shaft revolving in the upright chamber, and carrying a series of cutting blades set round the shaft like the thread of a screw, and by the action of which the peat is forced down into the long horizontally-placed cylinder. This also is fitted with a revolving shaft, passing through its centre, on which is a forcing screw and also a set of discs arranged to form a dissecting double screw, and at the end of this cylinder further from the hopper are fitted cutting blades of hard steel. The action of the machine is then this: the peat, forced into the horizontal cylinder by the joint action of the blades and screws, is carried

forward by the twisting movement of the di cs, every revolution driving it against the cutters, whereby ery effective trituration is effected of the fibrous and other un composed portions, and the whole thus reduced to a pulpy, ho ogeneous mass.

At the delivery end of the cylinder t pulped peat is forced out through orifices, of any s ction that may be found suitabl , on to a system of rollers, which carry it forward to trays, where it is cut into lengths, and either carri d or passed along a tramway to the drying sheds, where in about three days it becomes sufficiently dry to permit of its being taken from the portable trays, and stacked in open racks of a somewhat special construction, but th s is merely a question of getting the best ventilation in the smallest space, where the final drying is completed.

The great feature, as it appears to us, in the whole of this manipulation, is the breaking up of the cellular tissues of the peat, which contain what may not inaptly be called the *fixed* moisture; the mere hygroscopic or free water can always be readily got rid of, but fine and close trituration is absolutely necessary to enable th other to be removed, and that this is really realised the remarkable shrinkage which takes place in the blo ks or briquettes in drying is the best and most tangible proof. The condensed peat, when made ready for the market, which, we are assured, does not require more than eight days at the very outside, is of great firmness and solidity, and quite as strong in its resistance to a cutting edge as many of our softer woods As to its inflammable qualities, we can only say that we saw a bright, clear fire burning in one of the office-rooms at Messrs. Clayton's which was made up of the condensed peat, and which was distinctly most admirably adapted to cooking. Until further experiments have been made it is impossible for us to give any data as to what may be the water-evaporating power of this new fuel; but, judging from appearances, we are disposed to believe that it will be found high, whilst as to the reduction of iron in blast furnaces, w are prepared at once to say—and our experience with wood charcoal has not been inconsiderable —that it is admirably adapted for that use. The difficulty in this process has always been to get the peat in a sufficiently solid form to resist the pressure of blast just at the tuyeres, but we believe that Messrs. Clayton, Son and Howlett's patent produces it so condensed that it will be found equal to sustaining the impingement of a pillar of blast of, say, 2lb. to 2½lb, which is amply sufficient. We may also call the attention of the manufacturers of charcoal tinned-plates, whose supplies of wood are necessarily daily decreasing, to this process, which places within their reach a fuel admirably adapted for use in their hollow and sinking-down fires."

It is stated that this fuel can be prepared in England at a cost of from five to six shillings per ton of the dry briquettes. The cost of production here should be, if anything, less than that, and would moreover give employment to hundreds of our population who now go annually to work in the factories and brick-fields of the States.

MILL'S FUEL ECONOMISER.—(See page 45.)

Mr. R. Mill, of Val Plaisant, Jersey, has lately patented a simple and, as it seems, very effective arrangement of tubes for promoting the circulation of water in steam boilers, while at the same time increasing the heating surface, besides possessing collateral advantages which will be mentioned further on. The accompanying drawings illustrate some modes of carrying this invention into effect. Fig. 1 is a vertical section through an ordinary Cornish boiler; Fig. 4 is a horizontal section through the flue of the same; and Fig. 2 is a front elevation. Two pipe systems are shown over the grate, bent serpentine fashion, or similarly joined by bends, as shown; and each connected with its side of the boiler, viz., at the back, connected to the water space over the crown of the furnace, and in front connected to the water space near the bottom of the flue; A is a circulation cock, and B a blow-off cock; by shutting the former, and opening the latter, the tubes may be cleared of any sediment, though very little deposit takes place because of the scouring action of the rapid circulation. The pipes are supported by brackets, Fig. 3 is a front elevation of a Cornish boiler, fitted with two similar pipe systems, but without circulation cocks. There is besides shown a third system, in the centre of the flue, and which will be described with reference to Fig. 5. Fig. 5 is a vertical longitudinal section of a furnace flue for a Cornish, Lancashire, marine, or other furnace flue boiler. D is the lower limb of a pipe system, and is by the pipe F connected to the water space in the lower part of the boiler, close by the ashpit, or front side of the bridge. Where the pipe passes through the grate the bars are cut short, and supported from their adjoining bars, or in any other suitable manner. E is the upper limb of the system, which is carried to the back of the boiler and terminates in the water space at or near the furnace crown. This arrangement may, for very small furnace flues, be used alone, but for larger flues, in combination with the pipe systems described, with reference to Figs. 1, 2, and 3, and either separa from or connected to them.

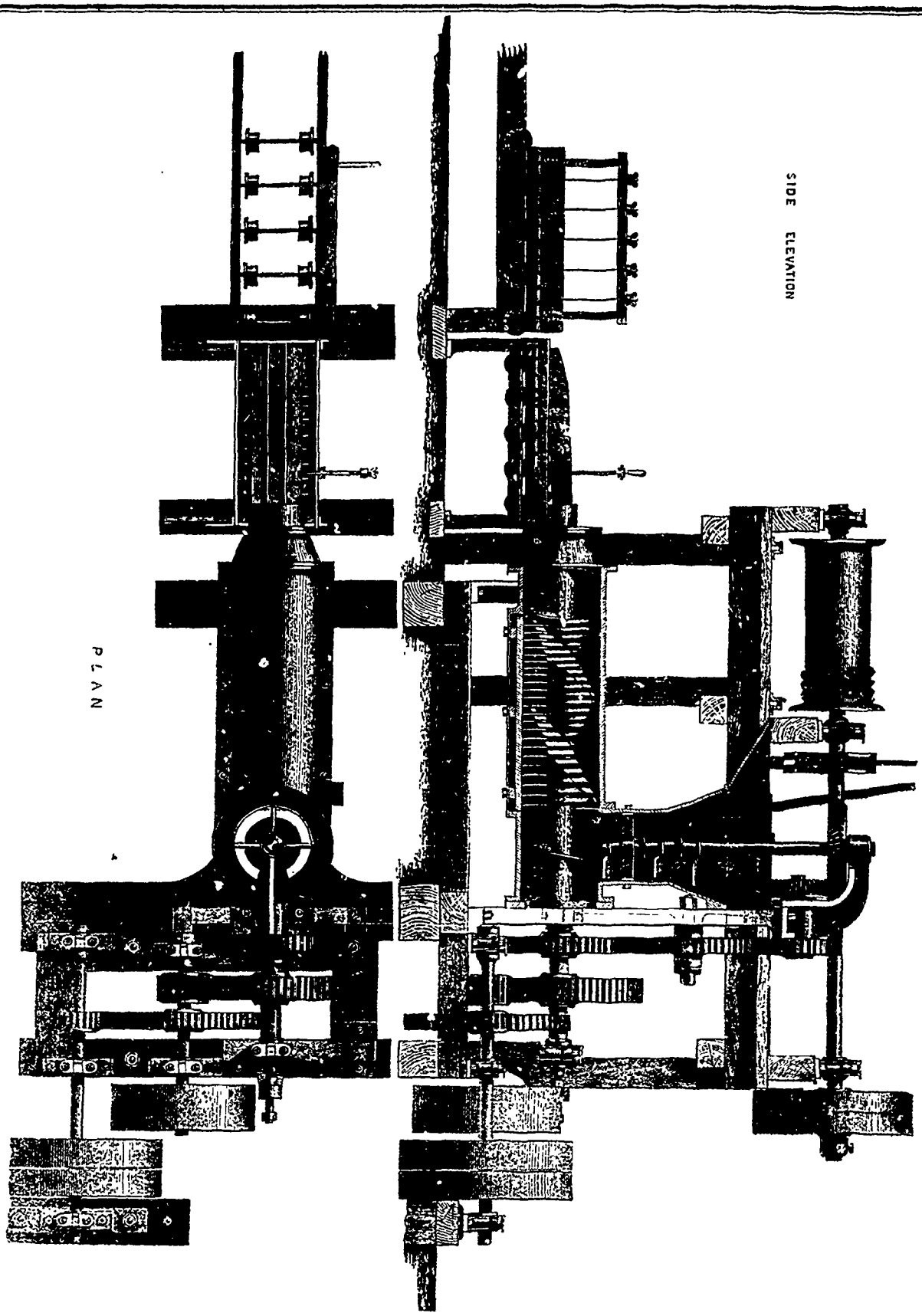
Fig. 6 is a vertical elevation of an egg-ended boiler, fitted with two pipe systems, one on each side, and with their tubes arranged vertically, or slanting one above the other, but so as to leave the middle of the furnace clear. I, K, and L are three tubes, connected together by double bends, or in one piece bent to the shape. The pipe I runs along the whole length of the underside of the boiler, and has its exit in the water space at the back end of the boiler; the pipes K and L are arranged under the pipe I, but only in the furnace part of the flue. L runs to the front of the brickwork setting, and is by the pipe M connected to the water space at the front of the boiler; N is the circulation cock, and O the blow-off cock, as described with reference to Figs. 1, 2, and 3.

As to the advantages resulting from the application of these circulating tubes, some experience, extending over from two to eleven months, has already been gained in respect to land boilers. Firstly, a clear and considerable saving in fuel, because of the additional and effective heating surface, and increased circulation, and secondly, a saving in wear and tear in the furnace crown or in the bottom plates as regards boilers fired underneath, because of the equalisation of the heat given out in the furnace, a great part of it being used to heat and evaporate water drawn from other parts of the boiler, instead of as heretofore, being for the greatest part absorbed by the plates over the furnace, which thus do many times more work than any other part of the boiler. Unequal expansion, with its disadvantages, is also lessened. Thirdly, obtaining a much lower temperature at, and in front of the furnace door, which by the application of this invention, has been effected. Fourthly, a saving in the wear and tear of the brickwork in the furnace of externally-fired boilers, as it remains black instead of being red, or white hot, thereby preventing the possibility and inconvenient stoppages for relining.—*Engineer.*

CULINARY BOILER.—(See page 61.)

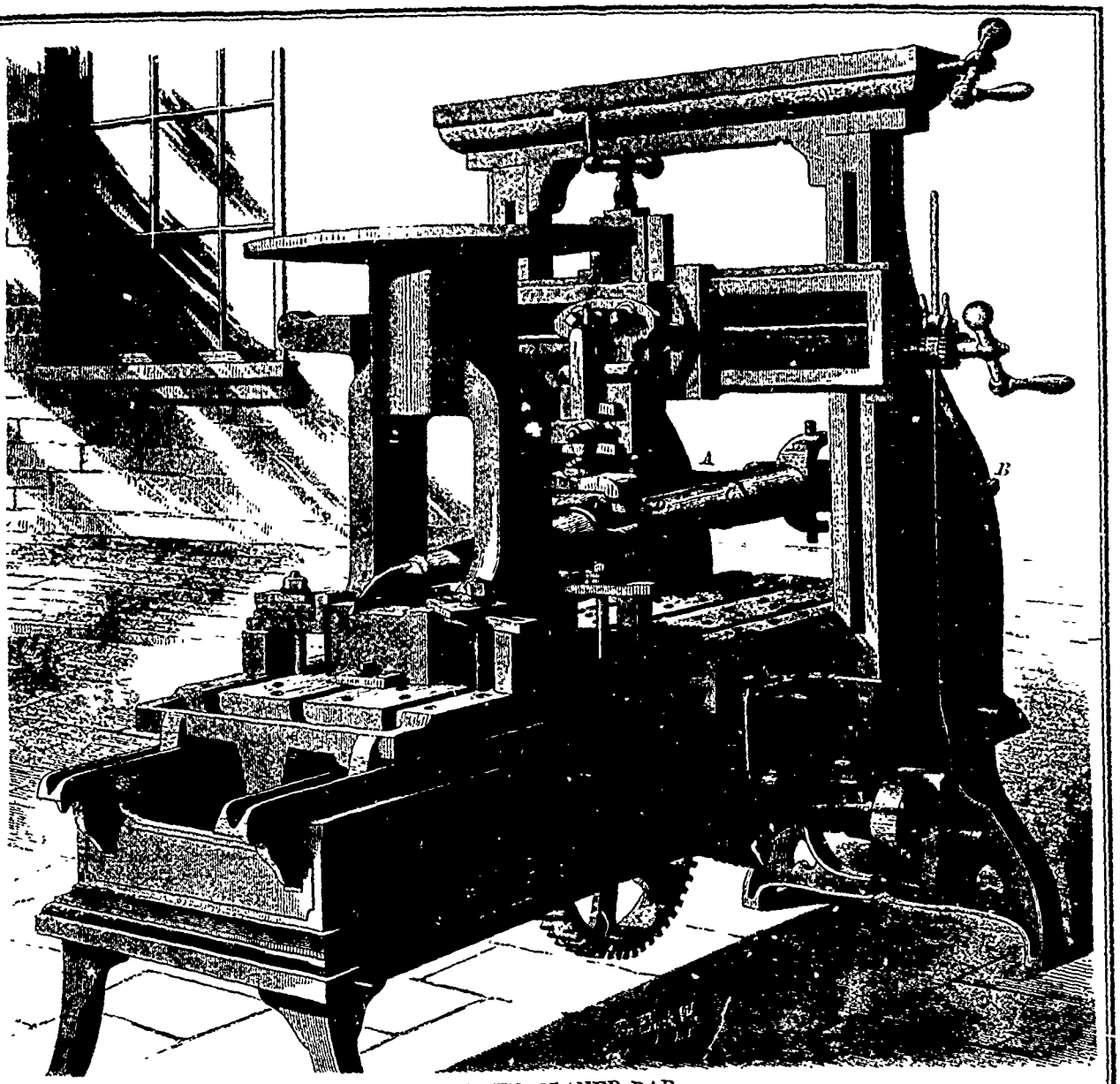
Mr. Israel Kinney, of London, Canada, is the inventor of the novel form of culinary vessel represented in our illustration. The object sought is to provide a means of conducting away vapours arising from the cooking article, so that they will pass into the stove and up the chimney, and thus not be disseminated through the house. This is effected by casting the side wall of the pot with a vertical recess, extending down from the top to the bottom, following the offset made by the pit. The outer edges of the recess, down to the plane of the offset for the pit, are formed with flanges to receive a sheet metal slide, A, which closes the recess and preserves the circular form of the vessel, and at the same time forms a flue. The vapours rising are drawn down through the latter, and thence into the stove. This improvement is applicable to all vessels used in cooking. Patented August 27, 1872.—*Scientific American.*

The total annual production of iron is estimated at about eleven and one-eighth millions of tons for the whole world, in 1869, and must have increased greatly in more recent years. At that time England produced over five millions; the United States of North America, over one and a-half millions, France nearly one and a-quarter millions; Prussia rather more than one million; Belgium not quite half a million, the Austrian Empire a third of a million, Sweden and Norway nearly 400,000; Russia and the Zollverein nearly half a million tons between them, of which four-sevenths came from the former. Spain and Italy made up nearly 100,000 tons, two-fifths from the latter The increase in the production of the United States in the five preceding years was nearly 64 per cent; in Prussia, 36 per cent.; and in England, in six years, 26 per cent.



PEAT CONDENSING MACHINE.

Messrs. Clayton, Son, and Howlett, Engineers, Atlas Works, Harrow Road, London.



SHAW'S PLANER BAR.

We illustrate above a most ingenious invention patented recently in the United States. Our illustration is from the *Scientific American*, which describes the machine as follows:

"In brief, the device is a planer bar; its object, to reach through work on planing machines, and thus serve to perform a large proportion of the labor of slotting and shaping apparatus, at, of course, a materially decreased expense. It consists of a heavy shaft, A, at the rear of the planer, which rides upon centers, B. On this shaft the bar, C, is pivoted; so that by this mode of connection a universal joint is obtained, and the outer end of the bar rendered capable of motion in all directions. Near the centre of the bar is a pivoted box, D, from which a pin projects, which is securely fastened to the tool post and carriage. The bar is therefore subject to the movements of the latter, and is regulated by the ordinary feed motion of the planer. At E the tool end is represented as operating on the inside of a wide casting.

"It is claimed that the ability of the device to reach through work is unlimited, and that it will plane one third the length of the planer; while its action being of an end thrust character, it will cut all that the machine is able to pull without chattering. Our illustration presents so enlarged a view of the invention that any further details here are unnecessary to insure its comprehension"

THE SUPLEE NEEDLE.—(See page 61.)

The Suplee needle is a recent California invention and one which, says the *San Francisco Mining and Scientific Press*, is destined to do away entirely with the old-fashioned sewing machine needles so long in use. It differs from all other sewing machine needles by having an open eye or slit so arranged that it can be threaded instantly by taking the thread in both hands as shown in the accompanying cut, placing it at the eye, and pulling it gently against the needle with a downward motion. This dispenses at once with the slow process of biting off the thread and twisting the end into a point so as to get it through the ordinary eye. The saving of time alone is an item in its favour, without taking into consideration the trouble incident to threading old-fashioned needles. The manufacture of sewing machine needles in the United States has heretofore been confined almost exclusively to North Bridgewater, Mass., but a factory for turning out needles of this patent is now under way in this city, owned by the Suplee Needle Company.

THE PRINCIPAL ENACTMENTS OF THE BILL INTRODUCED BY DR. TUPPER, RESPECTING WEIGHTS AND MEASURES.

It is not so very long since our Canadian coinage, or rather the coins which were current here were of such different descriptions and values as sometimes to puzzle even the most experienced dealers. Now that is all changed, and the next step is to systematize our weights and measures. We had an occasion, not long since, of witnessing the painful efforts of a professional scientific gentleman of this province in his search after legal standards of weights and measures. The search was very arduous, and the results by no means satisfactory. We hail with pleasure an attempt on the part of the Government to remedy this state of affairs. We are indebted to the columns of the *Montreal Herald* for the following summary:

WEIGHTS AND MEASURES.

The "Imperial yard" shall be the standard of length, wherefrom all other measures of length, whether lineal, superficial or solid, shall be derived, and all measures of length shall be certain proportions of the standard yard.

Here follow descriptions of measures of length and superficies derived as above:

The "Imperial pound Avoirdupois" shall be the standard measure of weight from which all other weights and measures having reference to weight shall be derived; and shall be in parts, multiples or proportions of the pound avoirdupois.

Here follow descriptions of weights as derived above, and it is stated that:

One hundred pounds shall be a hundred weight, and two thousand pounds a ton.

One hundred standard pounds shall also be called a "Central."

The Troy ounce shall be equal to four hundred and eighty avoirdupois grains, and shall be the standard measure of weight for gold, silver, platina, and precious stones; and all measures of Troy weight shall be taken in parts, multiples, and certain proportions of the Troy ounce.

Contracts for gold, silver, platina, and precious stones by the Troy ounce, and by any weights, being decimal parts or multiples of such ounce, shall be valid.

The gallon known as the "Imperial gallon," containing ten pounds weight of distilled water, weighed in air at a temperature of 62 degrees Fahrenheit and the barometer standing at thirty inches, shall be the standard measure of capacity for liquids, from which all other measures of capacity in respect of liquids shall be derived.

One fourth of the gallon shall be a quart, and one eighth part a pint.

The "Imperial bushel," containing eight Imperial or standard gallons, shall be the standard measure of commodities sold by dry measure, from which all other measures of capacity in respect of such commodities shall be derived.

But in contracts for any of the articles in this section mentioned, the standard bushel shall mean the weight of a bushel, as hereinafter mentioned, and not a bushel in measure, unless the contrary appears to have been agreed upon by the parties, viz:

Wheat	Sixty pounds.
Indian Corn	Fifty-six pounds.
Rye	Fifty-six pounds.
Peas	Sixty pounds.
Barley	Forty-eight pounds.
Oats	Thirty-two pounds.
Beans	Sixty pounds.
Clover Seed	Sixty pounds.
Timothy Seed	Forty-eight pounds.
Buckwheat	Forty-eight pounds.
Flax Seed	Fifty pounds.
Hemp Seed	Forty-four pounds.
Blue Grass Seed	Fourteen pounds.
Castor Beans	Forty pounds.
Potatoes, Turnips, Carrots, Parsnips, Beets and Onions	Sixty pounds.
Salt	Fifty-six pounds.
Dried Apples	Twenty-two pounds.
Dried Peaches	Thirty-three pounds.
Malt	Thirty-six pounds.

"Provided that for years the Wine gallon of 231 cubic inches, and the Winchester bushel of 2150 42-100ths cubic inches, may be used by special understanding between parties, and during the same period the ratio which such measures shall bear to the standard measures, shall be as follows:—Twelve Wine gallons shall be equal to ten Standard gallons; one Winchester bushel and thirty-one thousandth parts thereof, shall be equal to one Standard bushel. Provided also that the Governor may make such provisions, not inconsistent with this Act, for the verification of the measures authorized in this proviso and their sub-multiples, as may be deemed necessary."

Every steelyard or other weighing machine shall have marked upon some essential part of it, the actual avoirdupois weight of each weight used with it.

The Governor in Council may declare any multiples or submultiples of any of the weights or measures hereinbefore mentioned, to be legal weights or measures, and may order the discontinuation of any standards, and the substitution of others not inconsistent with this Act.

STANDARDS OF WEIGHTS AND MEASURES.

The Minister of Inland Revenue shall cause to be prepared three sets of Primary Standards of length and weight, each set consisting of:—A Standard Yard; A Standard Pound Avoirdupois; A Standard Ounce Troy; and A Standard Gallon.

The Governor may declare the same to be the only Primary Standards for Canada under the name of "The Dominion Standards," from which all other weights and measures shall be computed; and from and after the date of such proclamation, all Primary Standards legalized by the Legislature of Canada, or Nova Scotia, New Brunswick and British Columbia, shall be transferred to the possession of the Department of Inland Revenue.

One set of the Dominion Standard shall be placed in the custody of the Speaker of the Senate, one in the custody of the Speaker of the House of Commons, and one in the custody of the Minister of Inland Revenue, under such precautions against deterioration as determined.

The Minister of Inland Revenue shall also cause to be prepared two sets of Secondary Standards; and the Governor may declare Secondary Standards to be legal Secondary Standards under the name of The Departmental Standards.

The Commissioner of Inland Revenue shall have the custody of the Departmental Standards, and all operations with reference to standards, shall be conducted under his supervision, and the said Commissioner may be paid, in addition to his salary as Commissioner, such further allowance as may be directed.

The Minister of Inland Revenue shall also procure the necessary apparatus for use in connection with the Standards.

As soon as the Standards have been legalized and deposited, the Governor may fix a day, giving not less than six months previous notice, after which all contracts for work to be done, or things to be sold where no special agreement is made to the contrary, shall be deemed to be made according to the standards fixed by this Act.

Provided that in the Province of Quebec the measures of length, superficies and capacity hereinafter mentioned, may be used by special understanding between the parties and shall be understood when such contract relates to any of the purposes for which they are established by the laws of that Province, unless by the express terms of such contract, it appears that the parties intended standard measure; and the proportion which such measures shall bear to the standard measures, shall be as follows:

The French or "Paris foot"—shall be twelve inches and seventy-nine hundreths standard measure. Here follows a description of the arpent and perch according to the above standard.

The "Canada minot" shall contain two thousand three hundred and thirty-nine cubic standard inches; provided that in contracts for any articles mentioned in section five, the word "minot" shall mean the weight of a "bushel," as fixed by the said section and not a Canada minot, unless it appears that the parties must have intended a Canada minot of measure.

After the day fixed by proclamation as above, Her Majesty's revenues shall be payable, in accordance therewith, and such as are now charged by the wine gallon shall be charged by the standard gallon in proportion to the greater capacity of that measure; that is to say, in the proportion of six cents on the Imperial gallon for five cents on the wine gallon.

The Governor appoints Inspectors of Weights and Measures for each Province, whose duties are detailed in the next succeeding sections, of which those which concern the public are as follows:

The Inspector within the District assigned to him shall see that each Deputy Inspector is furnished with the apparatus necessary; shall carefully compare his standards with the official standards and shall certify to the correctness of the same by a suitable mark, as may be directed; shall determine any disputes between any Deputy Inspector and any other person in relation to any duties of inspection performed by such Deputy Inspector, and shall have such other duties and powers as may be assigned to him by order in council.

The Governor may appoint in each district deputy inspectors.

Each Deputy Inspector shall, upon such day and at such place as may be appointed by the Inspector of his District—and of which public notice shall be given—attend with his apparatus, for the purpose of inspecting all weights, measures and weighing machines, and shall inspect and if found correct shall certify all weights and measures, scales and weighing-machines brought to him for inspection.

The Deputy Inspector may, at all reasonable times, enter any place where any commodity is kept for sale, or charged for carriage weight or measure, and there examine all weights, measures, beams, or other weighing machines, and shall do so, without previous notice, and shall attend at any reasonable time and place, for the purpose of inspecting any fixed weighing machine in his division; and he may also certify any weights, measures, or weighing machines at the request of the owner.

The Deputy Inspector shall enter all verifications made by him, and at the time deliver to the person procuring verification, a certificate setting forth the fact.

Within two months after the expiration of one year from the first verification, and of each period of one year after each subsequent verification, every weight, measure, and weighing machine shall be again verified and a new certificate obtained.

Every person, who, after the expiration of the time appointed under this Act, offers for sale or uses, any weight, measure, or weighing machine not duly inspected according to this Act, or which may be found deficient shall, on conviction, incur a penalty of not more than *fifty* or less than *five* dollars for each offence; and every such deficient weight shall be forfeited and broken.

Any person who refuses to produce for inspection, when required, all weights, measures, beams, or weighing machines in his possession, shall, on his conviction, forfeit a sum not exceeding *twenty* dollars for the first, and *forty* dollars for each subsequent offence.

If any person counterfeits any mark used for inspection purposes, or alters any balance, weight or weighing machine marked under this Act, or sells any things by any weight, measure, or weighing machine, marked with any counterfeit mark, he shall, for the first offence incur a penalty of *forty* dollars, and for each subsequent offence, *one hundred* dollars, and suffer two months' imprisonment.

Any person who causes to be made or sold, any unjust measure, or any other weighing machi shall for the first offence incur a penalty not exceeding y dollars; and for each subsequent offence *one hundred* dollars, and suffer two weeks' imprisonment.

If any person obstructs any officer acting in execution of this Act, he shall on conviction, incur a penalty of *one hundred* dollars and the Deputy Inspector, or any person whom he may call to his assistance, may seize the offender and detain him until he can be dealt with according to the law.

All penalties shall be recoverable before any justice for the place in which the offence was committed, if such penalty does not exceed *fifty* dollars; and before any two Justices, or any Magistrate having the power of two Justices, if it exceeds that sum, upon proof by confession, or the oath of one creditable witness, and may be levied by distress.

No contract shall be invalid, on the ground that the weights or measures expressed in such contract, are weights or measures of the Metric System, or on the ground that the decimal subdivisons of legal weights and measures, whether Metric or otherwise, are used in such contracts or dealing.

The tables in a Schedule hereto annexed shall be deemed to set forth the equivalents of the weights and measures therein expressed in the terms of the Metric System; and such table may be lawfully used for computing and expressing in weights and measures of Canada, weights and measures of the Metric System.

The Governor may direct Standards of Metric weights and measures to be procured and legalized, and verified copies of them to be provided.

CANADIAN PLUMBAGO.

Since the failure of the celebrated Borrowdale mines in Cumberland, England, most of the present supply of plumbago has been drawn from the East Indies. Small quantities are also produced in Scotland and in Cornwall, England, and in Norway. The present supply is however considerably short of the demand, a great quantity being used in the manufacture of crucibles. This being the case it is a source of great interest to Canadians to find that some extensive deposits of this mineral have been discovered near Buckingham on the River du Lièvre, a tributary of the Ottawa. These mines are said to be very favourably situated, both as regards the working of the ore and its transport. A recent number of *Engineering* states that an examination of these mines made by Mr. George Henwood has disclosed the fact that there are fourteen well-defined lodes, in which plumbago of unusual purity occurs in large quantities. Several of the lodes intersect each other and the mineral in some of them varies in thickness from 6 to 10 feet. Besides this there is a quarry of disseminated ore, over a quarter of a mile in length, and 70 ft. in height, producing a very good percentage of plumbago. Some fine specimens of the mineral taken from the lodes by Mr. Henwood were lately to be seen at the School of Mines, but are now at the offices of Mr Harvey, in St. Clement's House, where we recently inspected them. They are exceedingly rich in appearance, and are remarkable for their crystalline formation and purity. They display all the varieties of the ore, some being columnar and reticulated, and others laminated. One specimen measures 2 ft in length, 16 in. in depth, and about 5 in. in thickness. Assays of this ore, made by Messrs. Johnson and Sons, show it to contain 97 per cent. of plumbago, the minimum annual yield of which the lodes are capable, being estimated by Mr. Henwood at 5000 tons, whilst twice that quantity, it is stated, can be obtained annually from the workings in the quarry. The produce of these mines is said to be preferred before the best Ceylon ores, and to command a higher price in the local markets. From the appearance of the samples and the extent of the deposit in which they occur, we may infer that this discovery will, in its results, exercise an important influence upon the market.

NAIRN'S ROAD LOCOMOTIVE.

We illustrate on page 44, from *Engineering*, one of Nairn's patent road locomotives, constructed by Messrs. J. and T. Dale, of Kirkcaldy, giving a perspective view of this engine, showing it as arranged for driving machinery, the road wheels being thrown out of gear. The crankshaft—which is under the boiler—is extended for the purpose of putting on the belt pulley, and is supported by a malleable cast-iron bracket attached to the framing of the engine. In order to prevent the crankshaft extending beyond the frame, the eye of the pulley is cast upon one side, and the pulley is fixed upon the shaft by means of two steel pinching screws. A belt from the eye of pulley drives a horizontal spring governor for regulating the speed of engine, the spindle of this governor being supported upon two light malleable iron brackets bolted on the top of tank. The governor works a butterfly valve in the steam pipe in the usual way. No parts of engine after coming in from hauling loads upon the road or field require to be disconnected or altered for the purpose of driving stationary machinery, the pulleys and the governor simply require to be fixed in their places, which can easily be done in a few minutes. Messrs. Dale are now making these engines as high as 20 horse power, we believe the largest engines with elastic tires ever constructed.

SACCHARINE MATTER IN MUSHROOMS.—A. Muntz says that mushrooms yield a sirup, readily crystallizable, which presents all the properties of the sugar obtained from the manna of the East.

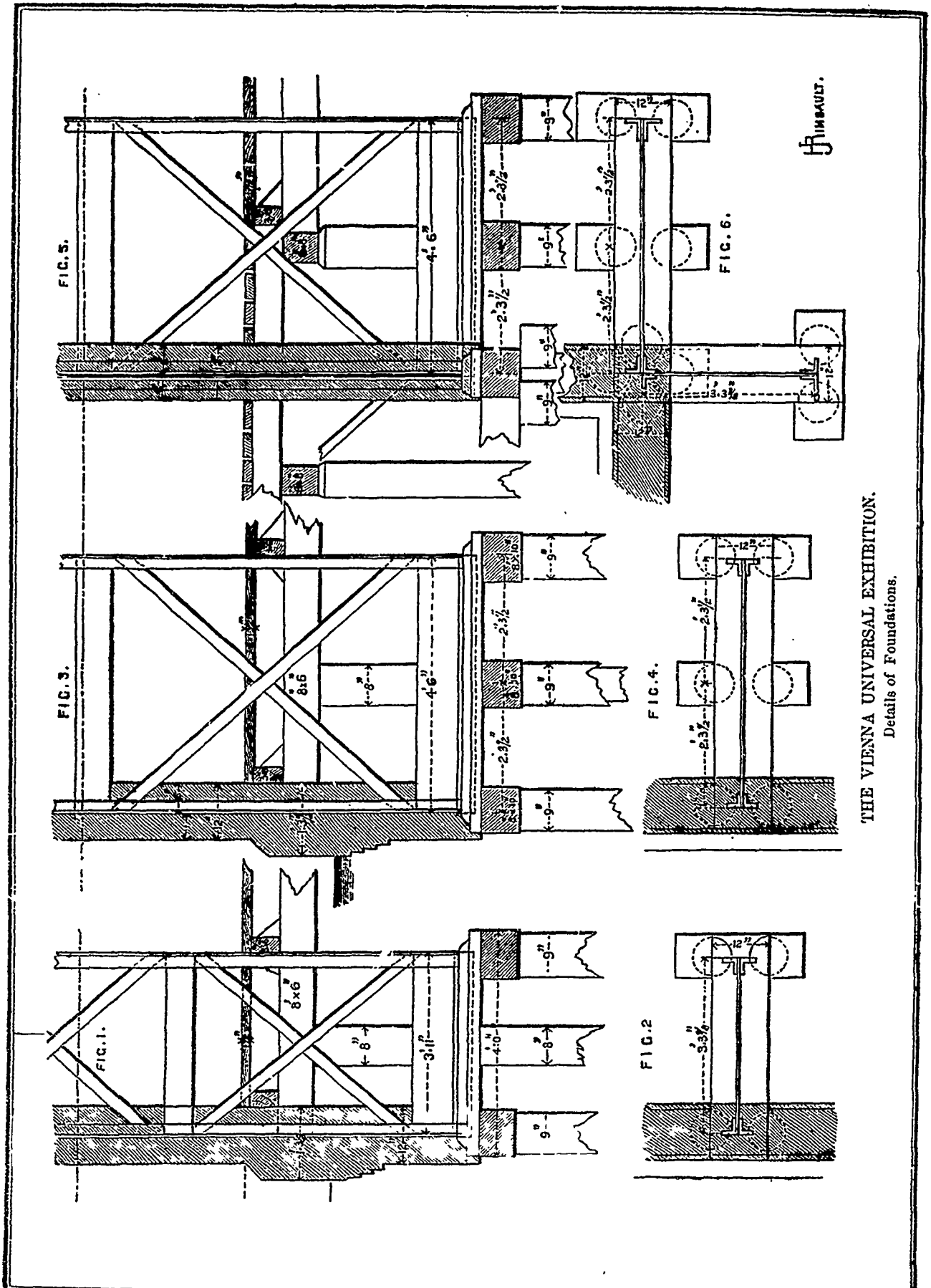
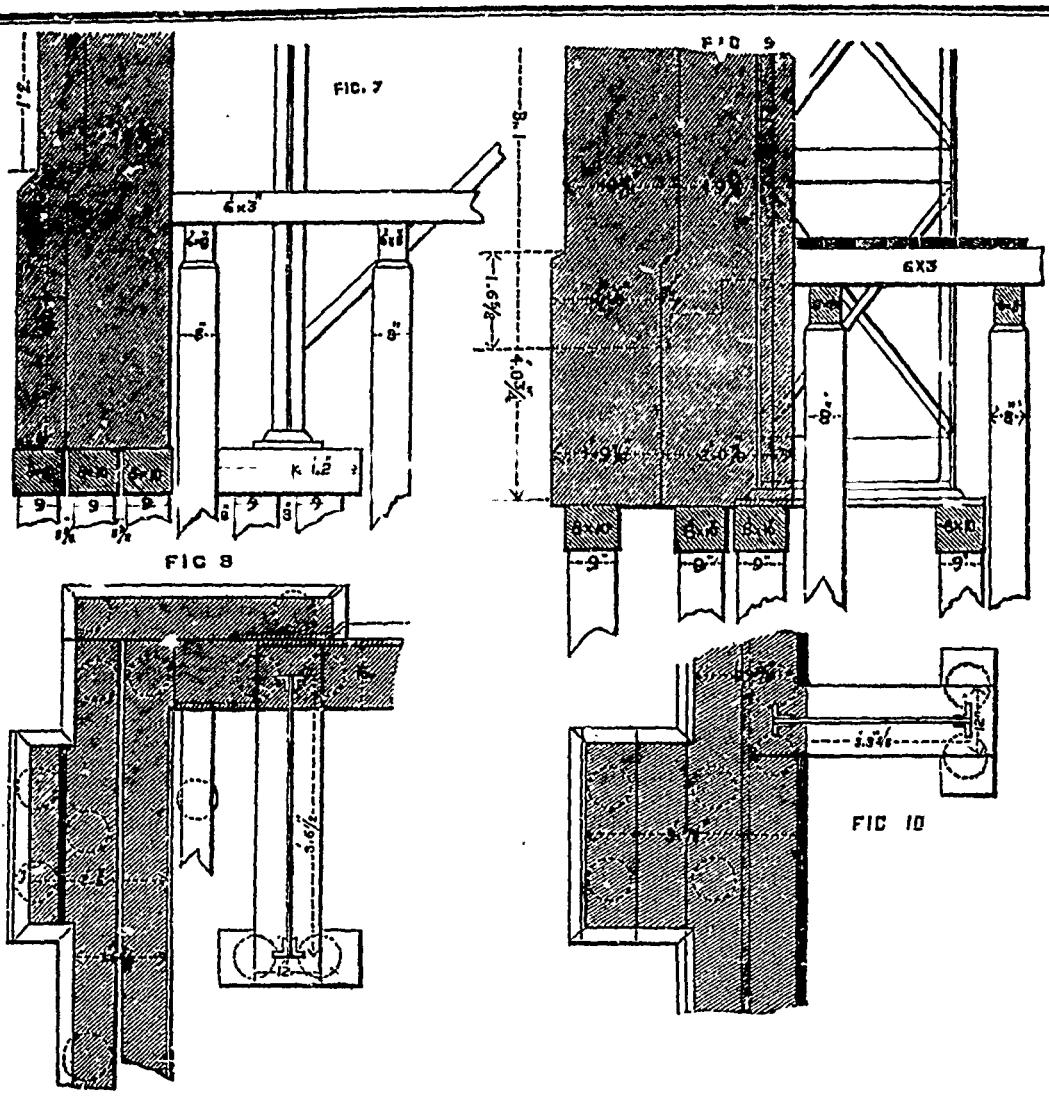


FIG. 1.
FIG. 2
FIG. 3.
FIG. 4.
FIG. 5.
FIG. 6.
THE VIENNA UNIVERSAL EXHIBITION.
Details of Foundations.



THE VIENNA EXHIBITION OF 1873.—(See page 64.)

In our last issue we gave an illustration of the interior of the Industry Palace of the Vienna Universal Exhibition and stated that, in this number, we would give some accounts of the details of construction. The Prater or Park on which the building is being erected lies close to the river Danube, and consists mainly of alternate layers of loose sand and gravel. Water is reached by penetrating on an average 10 feet below the level of the ground. In consequence of this and of the very uneven surface of the ground it was determined that wherever possible the Industry Palace should be built on piles. Those parts, however, which were to be permanent it was determined to build on solid concrete footings. It was originally intended that the superstructure should consist of wooden columns, supporting arched roof principals, which were also to have been made of wood. The columns were to have been connected together by timber frames, in order to give them lateral stability, while the walls were intended to have been formed by filling in the panels of this framework with bricks in the Swiss cottage style. This becoming known to the Austrian contractors caused such a rise in the price of wood that it was resolved to abandon the construction in wood for the nave and transepts and resort to a somewhat similar one in light wrought iron work.

The superstructure, as at present constructed, consists of wrought-iron lattice columns of the lightest possible construction standing on cast-iron foundation plates, which are borne on piles. These columns support the roof principals, which are parabolic arches, also formed of lattice work, and are connected one to another by wooden purlins which rest in angle-iron sockets rivetted to the top flange of the arch. Over the purlins is nailed down a light wooden boarding, the whole being covered in and rendered water tight by a plating of zinc. It will thus be seen that the entire weight of the roof is carried by the columns, the walls having nothing to do but to serve as a panelling. The columns of the nave and transepts differ only in dimensions, the arrangement of their parts being exactly the same. The girders which carry the roof are simply lattice-work arches. Between each pair of columns is situated one of the windows which serve to light the building. The windows are so constructed that their frames form part of the wood work between the columns.

The ring aisle surrounding the Rotunda and the transverse buildings forming the façades were built in a different manner.

The ring aisle being intended for a permanent building was constructed of solid brick piers connected together by arches, the whole being arranged in the Roman Renaissance style of architecture. The spaces between the piers is occupied by colossal windows which serve to illuminate not only the aisle but also the Rotunda itself.

The roof principals are formed of semi-arch girders, which are simply those of the nave cut in two, with this difference, however, that whereas the nave arches are of lattice-work, those of the ring aisle are formed of solid plate. One end of each of these semi-arches rests on the brickwork pier, while the other is fastened to the iron columns of the Rotunda. The junction with the piers is horizontal, and that with the columns is ver-

tical, thus the entire thrust outwards is balanced by the stiffness of the columns, while the piers have only to support part of the weight of the roof acting vertically downwards. There are two of these semi-arches fastened to each of the columns of the Rotunda, and they are all connected together by purlins and covered by boarding and zinc in precisely the same manner as are the trusses of the nave and transepts.

It was found that the Industry Palace, large as it is, could not furnish nearly enough covered space to meet the demands which were put upon it. Instead of weeding the collections of the different countries of the more inferior objects announced for exhibition, it was unfortunately determined to cover in as many of the garden courts as were necessary, in order to make up the space wanted, and accordingly all the courts in the rear, and some even of those in the front of the building were sacrificed. No course that could possibly have been adopted could have been more injurious to the real interests of the Exhibition. Not only is the original plan completely marred thereby, but also the lighting of the building will be greatly interfered with; and as the courts thus closed do not share in the general plan for the ventilation, the heat in them will probably be very trying. The covering sheds, such as they are, are made of timber and brickwork, but not being remarkable in any way, except as eyesores, they do not merit further description here.

All the important structural details of the Industry Palace have now been described, but it remains still to give an account of the internal decorations. The decoration of the Vienna Exhibition was a problem of the greatest difficulty to all concerned in it. So accustomed are the Viennese to a gorgeous style of decoration in all their public buildings, from their palaces and museums down to the commonest cafés and bier halle, that it was felt by the architects, that a quite plain building, or one even so simply got up as the Crystal Palace at Sydenham, would not meet with popular approbation. On the other hand, to go in for the style of richly painted walls and ceilings, common enough in the town, would not only have cost an immense sum of money, but could also never have been finished in time. They were fortunately helped out of this dilemma by the timely invention of an Italian, M. Bossi, of Milan, who discovered how to print patterns on common canvas in such a manner that at a little distance the effect thus produced could not be distinguished from real painting.

Herr von Gugitz, who is associated with Messrs. Hasenauer and Korompay, as one of the chief architects of the Exhibition, heard of this invention while staying at Milan, and at once conceived the idea of applying it to the decoration of the Industry Palace. All through last summer thousands of square yards of this material were being prepared at the establishment of M. Bossi, near Vienna, and were ready to be hung in their proper places as soon as the walls were ready to receive them. The material when finished costs from 7d. to 1s. per yard, according to the colour and has this great advantage over paper-hangings, that it has no tendency to bag when applied to damp walls, and consequently can be used as soon as the structure is finished, without waiting for it to dry. Thus the difficulty of time and money was overcome, and the best method of applying the new invention to the existing state of things was all that remained for consideration.

It was necessary to fix upon a style of decoration which should do away with the commonplace railway station appearance caused by the perpetually recurring lattice-work columns and arches. The original intention was to cloak that flange of the iron columns which was not buried in the brickwork of the walls with an ornamental column of light woodwork, which should seem to support a cornice from which the arches of the roof would appear to spring, but an unforeseen accident occurred which rendered a slight but very expensive modification of the above plan necessary. It will be remembered that the columns are all supported on piles, which are independent of those piles which form the foundations of the walls. One flange of the columns, however, is not independent of the walls, but is, on the contrary, bricked into it for the sake of obtaining that lateral stiffness in which it is itself deficient, and is consequently liable to be affected by any movement of the walls caused by a sinking of the foundations, a shrinking of the brickwork or otherwise. Some such movement is precisely what occurred. Probably the piles which supported the walls of the transepts sunk under the weight of the brickwork, carrying with the latter the encastré flanges of the columns, while the free flanges, being carried by independent piles, were prevented from sinking equally with the other, and were in consequence bent into S curves, the bending taking place in a plane parallel to the wall. A great many instances of this occurred directly after the walls were built, and as it was thought quite likely that in process of time the whole of the walls might sink a little, it was deemed necessary to provide against such a contingency by so strengthening the free flange, that it would be enabled to resist any buckling strain to which it would be subjected. This end was accomplished by bolting stout trees 12 in. and 13 in. in diameter to the outer sides of the flanges in question. The trees were first turned quite round to the required diameter, so that they might be employed also as ornamental columns. Then a strip bounded by about one-quarter of the circumference was sawn off in order that the flat side thus obtained might butt directly against the flange. This strip was then sawn in two, and one-half laid in the corner of each of the angle irons which form the flange. The whole was lastly bound together by wrought-iron straps, and bolts passing through both trees and angle irons. Thus it happens that the chief feature of the decoration of this building is not a mere encumbrance or make-believe, but is a real integral portion of the structure itself, and thus fulfils the most essential requirements of the modern theory of ornament. The decorative character of the columns is completed by furnishing them with light wooden pedestals and mouldings, and plaster-of-paris capitals, all painted to resemble bronze, while the smooth portion of the tree is covered with tightly-strained crimson canvas adorned with spiral lines in gold. The columns carry a handsome cornice made of wood, and painted of a creamy grey colour picked out with gold. From this cornice the roof girders seem to spring. The latter are left perfectly plain and are painted olive green, the boarding of the roof behind them being whitewashed in order to obtain a light effect. Between the columns the walls are decorated in the following manner: The lower portion, as it is destined to be partially covered by the cases containing objects of exhibition, is simply painted in panels of a light neutral green, which harmonises remarkably well with the crimson of the columns; while above the piers between, and the portions of the wall around the windows, are covered with canvas in its natural colour, but printed with arabesque patterns in dark blue and orange. It is utterly impossible for any spectator standing on the floor to distinguish this printed canvas from the most carefully executed painting. It will thus be seen that the decorations are confined to the walls of the building, the roof being left perfectly plain.

HUNTER'S COMBINATION RAIL.

We find in the Chicago *Railway Review*, the leading railway journal of the West, a very favorable notice of the combination railroad rail, invented by Mr. W. S. Hunter, of Stanstead, Que. One of the great difficulties to be overcome in the construction of railways is the providing a permanent way possessing sufficient elasticity to do away with the vibratory jar by which the molecular structure of the entire iron employed in road-bed, engines and rolling stock is so injured. And although many and good changes have been made, it is admitted by all railway men that the present system is open to vast improvements. Experiments made with various appliances to rolling stock, according to the *Railway Review*, show a diminution of wear and breakage of from 10 to 35 per cent., according as the vibration had been done away with. Experience teaches that the prime cause of this vibration is rigidity in the rail employed, and the jar occasioned by loose and unreliable joints. The great desideratum is a rail perfectly continuous, yet regulated for contraction and expansion, and possessing the much desired elasticity with capability of augmenting strength to any degree, thus insuring durability of road and stock, a saving of expense in maintenance of road-bed, besides increase of comfort and safety to travellers. Mr. Hunter's rail is formed by a combination of iron, or steel and wood. The steel and iron portion is held throughout on wood, and kept in position by means of bolts passing through the *web*, the wooden rail, and the chairs, which secure the latter to the ties; the web fitting the groove of the wooden portion, and the jaws rolled on the head of the iron rail securing its lateral position perfectly. The chairs or fastenings may be spiked or bolted to the ties as desirable. The rail is rolled in the shape of an old fashioned (or English) letter T with the "foot" taken off. The *web* is calculated to give the rail the proper vertical

rigidity, it being almost impossible to curve or bend it upwards, upon the same principal that it is exceedingly difficult to bend even a very light board edgewise,—i. e., in a direction parallel to its plane. The bolt-holes through the web are slotted so as to allow for contraction and expansion. The face of the rail from its peculiar form, for the same reasons which enable it to resist a vertical strain, preserves adequate strength against any lateral strains to which it may be subjected. This rail, in the opinion of prominent civil engineers, combines all the advantages of any yet used. One of the most important advantages is its perfect continuity, the iron and wood breaking joints alternately. Another highly important feature is its immunity from fracture by frost, which is now the cause of so many frightful disasters; for even if the rail should break there would be strength enough in the stringer to maintain a passing train of cars in place. The proprietors of the patent, we learn, intend to organise a joint stock company for the manufacture and supply of this rail to railway companies. Any information respecting it may be obtained from Mr. E. H. Goff, Secretary of the "Hunter Combination Railroad Rail Co., 245 St. James street, in this city.—*Gazette.*

SCIENTIFIC NEWS.

[*We should be glad to receive scientific news, suitable to this part of our paper, from any of our correspondents.*]

M. Jacobi has lately communicated to the St. Petersburg Academy a note on "The galvanic reduction of iron through the action of a strong electro-magnetic solenoid."

Guarana appears to be almost a specific for sick-headache. The *British Medical Journal* is collecting reports from those of its readers who may have used it, and these have hitherto been of a very favourable character. It is easily administered as a powder in coffee, &c. On the Continent it is also used with success in the treatment of diarrhœa.

With reference to ozone, we may mention the publication of "Ozone and Antozone; When, Where, Why, How is Ozone Observed in the Atmosphere?" by Cornelius B. Fox, M.D., M.R.C.P., which professes to be an exhaustive treatise on a subject which the author has studied for several years.

Ozonised water is a beverage likely to be much in quired after. It appears that ozone is soluble in water, in the proportion of one part by weight in 100,000 of water, and a firm of chemists in Berlin are engaged in the manufacture of ozonised water for medicinal use.

Dr. Louvel has been awarded a prize of 400 dollars, by the French Academy of Sciences, for designing an apparatus for keeping grain in a vacuum, or rather within a vessel in which the air is so rarefied as to kill any granivorous insect.

A New Battery.—M. H. Cauderay, of Lausanne, describes the construction of a small, portable, and economical galvanic battery, which, he says, will be particularly useful for purposes of military telegraphy. Its fundamental part will certainly be peculiarly accessible to military men, for the cells, which serve at the same time as the positive electromotors, consist of the used copper cases of rifle cartridges. These are scraped clean, and arranged in holes made in a small board. They are then charged with a layer of about half an inch of pounded and moistened sulphate of copper, and filled up nearly to the top with sawdust soaked in pure water. The negative electromotor is a small cylinder of zinc, about an eighth of an inch thick, which is passed down into the sawdust through a hole in a varnished cork, closing the aperture of the cell. A small notch must be made in one side of the cork, to allow of the escape of gas. Of course the copper cell and the zinc cylinder must have wires attached to them, for the purpose of attaching them to the opposite poles of the neighbouring cells. A battery of twenty such cells, exhibited by M. Cauderay to the Society of Sciences at Lausanne, sufficed to work a portable military telegraph against a resistance of 4000 Siemens units. The knowledge of so cheap a form of battery will be welcome to many who like to amuse themselves with experiments in galvanism.

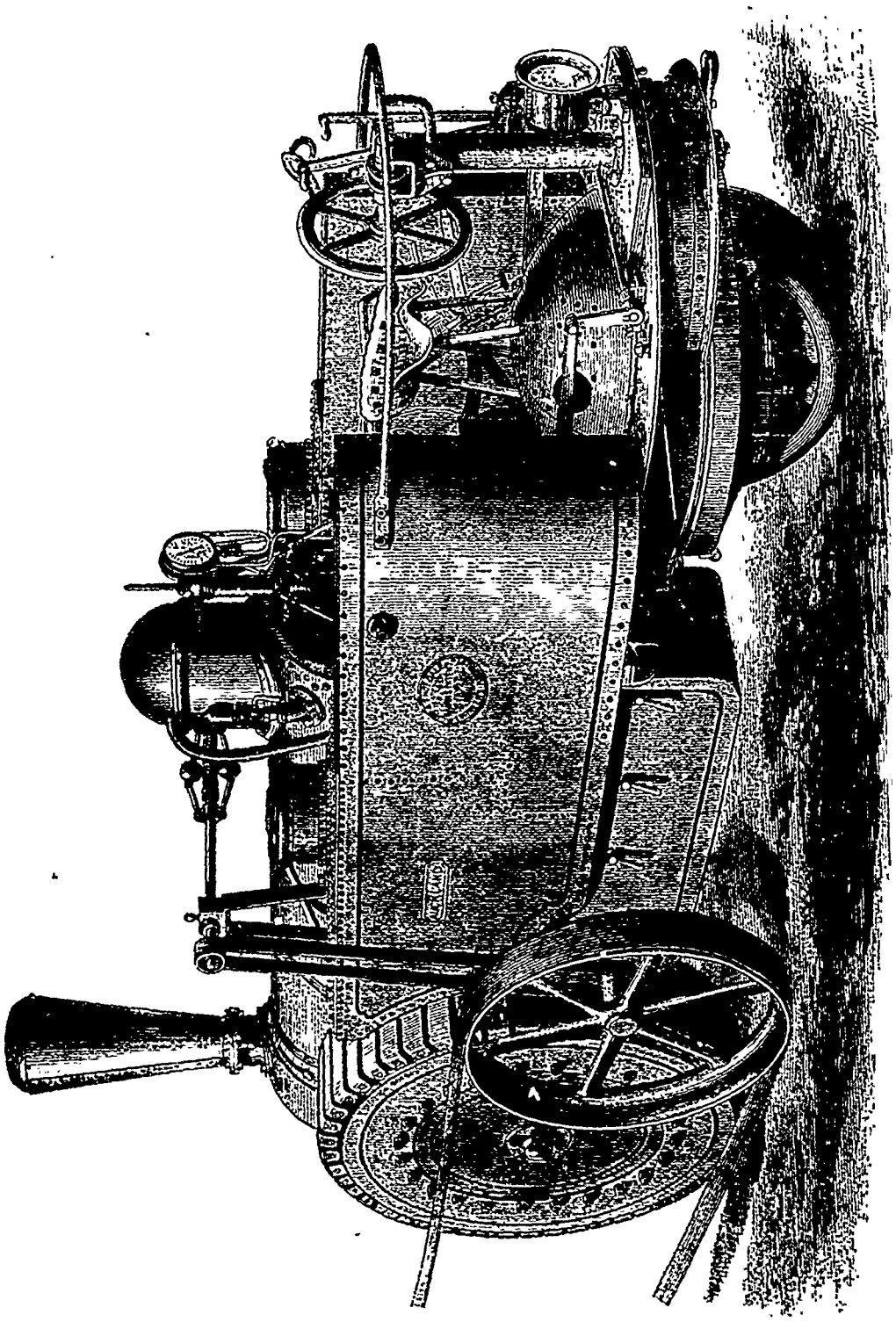
A new osmometer, which appears to offer certain advantages in the study of osmosis, and especially with reference to the difference of pressure on the two sides of the membrane, is described by M. Carlet in *Comptes-Rendus.*

An instrument has been invented in Germany for testing colour blindness. It consists of a rotating apparatus, which moves a disc whose centre is a circle, one half black and the other white; outside of this is a ring half red and half green, then another ring of violet and red, then the outside ring of violet and green. When rapidly rotated the centre appears to be coloured grey, then is black and white mixed. To a green blind person the middle line will appear grey, that being the result to him of a mixture of violet and red. The outer ring will appear grey to the red blind patient, and the inner, grey to the violet blind. By the use of this instrument, a large number of patients may be simultaneously examined for one or more kinds of colour blindness.

A convenient method for rendering ordinary drawing paper transparent for the purpose of making tracings, and of removing its transparency so as to restore its former appearance when the drawing is compl. d, has been invented by C. Puscher. It consists in dissolving a given quantity of castor-oil, in one, two, or three volumes of absolute alcohol, according to the thickness of the paper, and applying it by means of a sponge. The alcohol evaporates in a few minutes and the tracing paper is dry and ready for immediate use. The drawing or tracing can be made either with lead pencil or india-ink, and the oil removed from the paper by immersing it in absolute alcohol, thus restoring its original opacity. The alcohol, employed in removing the oil is, of course, preserved for diluting the oil used in preparing the next sheet.

Professor C. A. Young in a lecture to the American Institute, has given the following ingenious illustrations of the sun's distance. At present we consider the distance of the son from the earth to be 92,000,000 of miles, with a margin of error of about 500,000 miles. It would take a railroad train 263 years to move from the sun to the earth; so that if the Pilgrim Fathers had started from the sun at the time they started from England, by a train whose only stopping place would be Mercury and Venus, they would not have arrived yet. It would take a cannon ball, going at full speed, about nine years to make the journey. Light takes eight minutes. Sound, if it could be carried over the celestial spaces, would be fourteen years on the way. You know, continued the lecturer, that if you touch a part of the body, one does not feel it instantly. If you touch the hand of any one with a pin, it will be an appreciable part of a second before he will feel it and draw his hand back. Now if I had an arm long enough to reach to the sun, and should put my fingers into the solar flame and burn them there, it would be one hundred years before I should find it out, and another hundred years before I could remove my hand.

M. de Luynes has communicated to the Academy of Sciences of Paris an account of the results of an investigation that he has made upon the breaking of those curious glass objects known in this country as "Prince Rupert's drops," and in France, it appears, as "Dutch tears." They are long drops of unannealed glass, drawn out into a thin stalk at one end, and if even the extremity of this thin part is broken away whilst the thick part is held in the hand, the whole mass instantly breaks up into a thousand pieces, producing a stinging sensation in the hand holding it, which is rather astonishing to those unacquainted with the peculiarity of the drops. By enclosing the drops in plaster of Paris, M. de Luynes, succeeded in breaking them without allowing any of the fragments to change their position. He then found that each particle is a little cone, with its apex always turned towards the point where the force causing the rupture had been applied. The little cones are partly enclosed one within the other, and are remarkably regular in their arrangement, and a similar regularity of rupture is observed in glass rods which break spontaneously in consequence of their not being sufficiently annealed. The rupture may be accompanied by an elevation of temperature of about 70 deg. Fahrenheit, and often by a flash of light. Small things frequently furnish a clue to the explanation of great phenomena, and M. Elie de Beaumont thinks that something analogous to what takes place in the little Rupert's drops is constantly going on in the interior of our earth.



NAIRN'S ROAD LOCOMOTIVE.
Constructed by Messrs. J. and T. Dale, Engineers, Kirkcaldy.

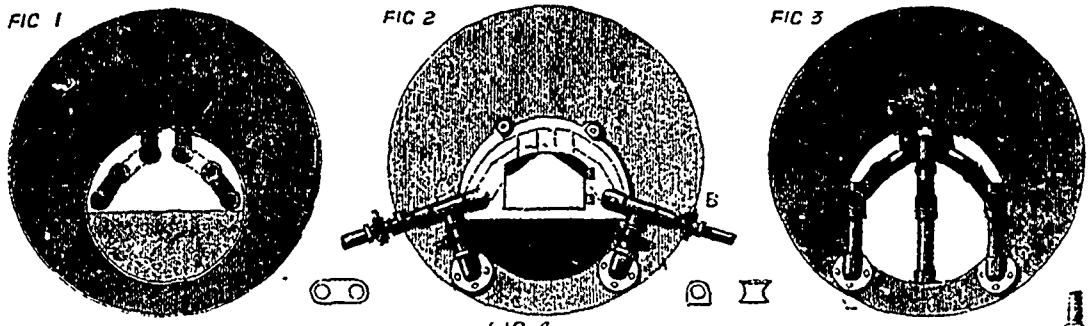


FIG 4.

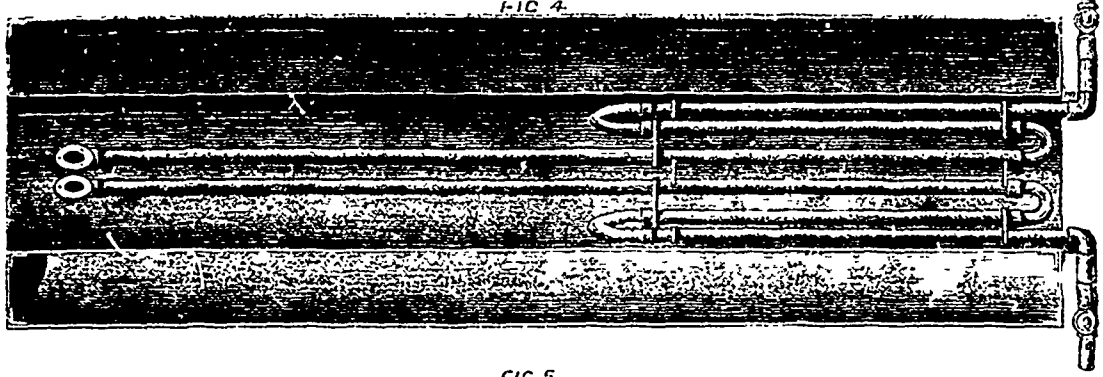
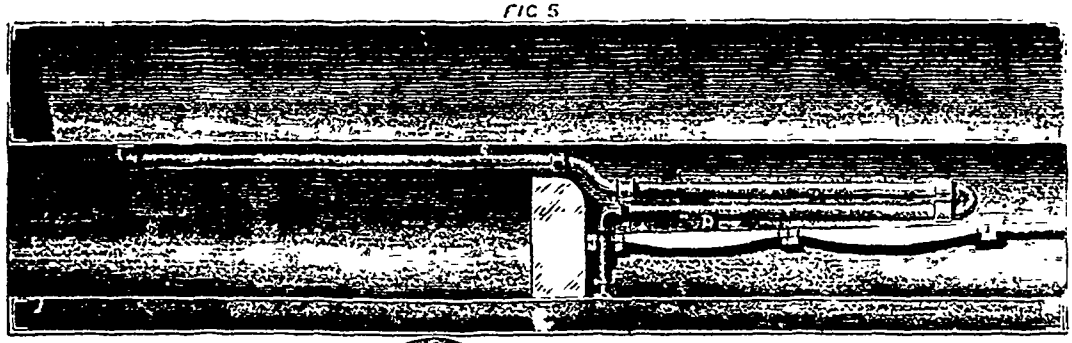
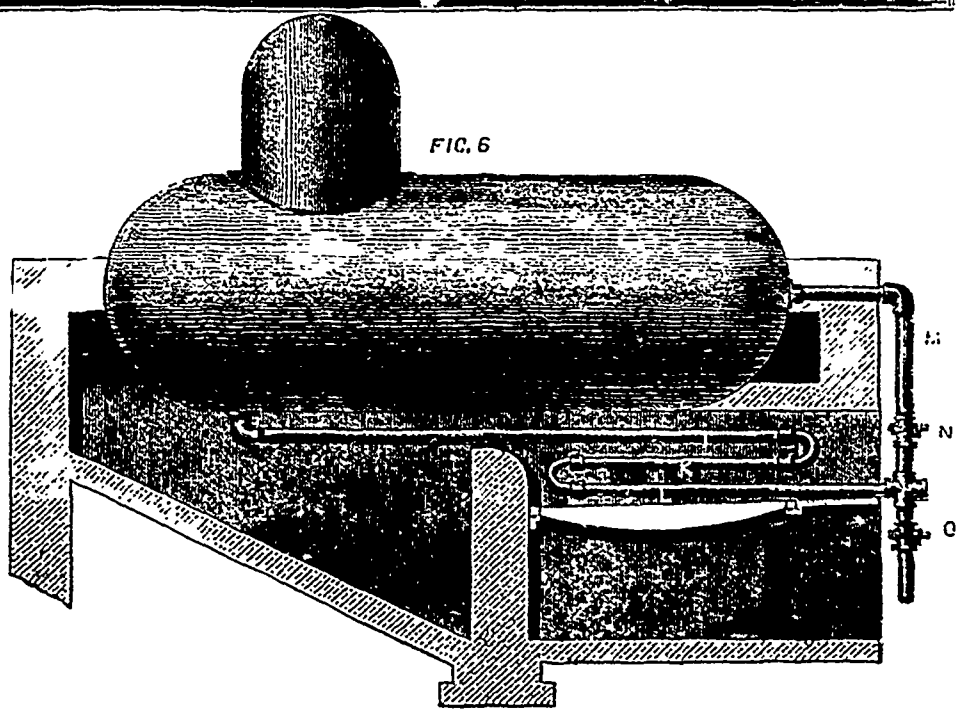


FIG 5





MILL'S PATENT FUEL ECONOMISER.

MECHANICS' MAGAZINE.

MONTREAL, MAY, 1873.

NOTICE.

By reason of the delay which occurred in the issue of the first number of this publication, and the consequent lateness in the present issue, we have dated this second number May instead of April. But subscribers will not suffer thereby, and will receive their full complement of 12 full numbers.

We have on our table a copy of a report by Chas. Legge, Esq., C. E., on a proposed railway bridge over the River St. Lawrence. The bridge is to form part of a railroad to connect the Ottawa Valley with the New England States, forming a short cut for the traffic between those places, and likely to be useful in helping to carry the inter-oceanic freight of the Canadian Pacific Railway A charter for this purpose was granted by the Dominion Parliament last session.

The provisions of the Charter are extremely liberal, giving the right to the adoption of a low level bridge, with swing sections over the navigable channels, a right previously refused to other companies.

The point selected for crossing the St. Lawrence is at the foot of Lake St. Francis, a sheet of water 21 miles in length by 4 miles in width. The outlet of this lake is blocked up with a number of islands, some of considerable extent. The banks of the river and of the islands being but from five to ten feet above water level; and the navigable channels being close to each shore, the project of a high level bridge to permit the passage under it of passenger steamboats, &c., would not be feasible, on account of the vast extent of embankment that would be required at either shore and on the islands. It was less difficult to accomplish this matter in the case of the Victoria Bridge, where the banks being of considerable height, the rail level was carried to the centre channel on a rising grade from each bank, and thus 60 ft. clear headway was easily obtained. At Coteau, where it is proposed to build this bridge, the banks are low and the two channels occur but a few hundred feet from either shore. A high level crossing is thus rendered impracticable except at a cost too great to be contemplated.

There seems, however, to be no great objection to the construction of a low level bridge, with swing sections to permit the passage of vessels. The bridge will be visible for half an hour from approaching steamboats, and as the channel is only used in the day time, the bridge can hardly be a source of danger. There will be two swing sections of 80 feet each, with wing cribs for greater security, placed above the openings and splaying from them in a funnel-like manner.

The estimated cost of the bridge is from $850,000 to $1,000,000 according to construction.

The railway of which the bridge is to form part, is proposed to be constructed from Ottawa City to some point on the Ogdensburgh railway—probably a little east of Centreville Station. This would give a length of road of about 112 miles, independent of the bridge. The cost of building this is estimated at $25,000 per mile, which with the cost of the bridge gives a total estimated cost of $3,800,000.

The road when constructed would be a grand outlet for the sawn lumber of the Ottawa, and would have numerous other sources of revenue, which are carefully enumerated in the report, but which we have not room to state here. There is no doubt but that such a line would be of great service to the Ottawa and St. Lawrence valleys, and would also play an important part in the Canadian extension of the Northern Pacific Railway.

We call attention to the letter from Mr. Edward W. Furrell under the head of "Correspondence." The fearful loss of life by recent disasters to ocean vessels has made it clearly apparent that something should, at any rate, be tried to increase the power of saving life under such circumstances. Small boats have almost invariably proved inadequate. Something analogous to Mr Furrell's idea exists, we believe in the Royal Navy. There are several plans by which a raft may be rapidly constructed from certain spars, etc. These plans being known and a regular system existing, it would not take long, on a well manned war vessel, to rig up a raft. Still this even is very far behind the plan in question and would be of little avail on a crowded passenger ship. Certainly something should be done in this direction. Mr. Furrell's plan, so far as we can judge of it from the short description in his letter, is in the right direction. The false deck need not be much in the way, and in case of danger especially near shore, as in the recent Atlantic disaster, would prove far more serviceable than small boats.

REVIEWS.

HOW TO MAKE MONEY BY PATENTS; or *Hints and Suggestions to Inventors and Patentees.* By Charles Barlow. (London: E. Marlborough & Co.)

This is a very useful little work by an English patent agent of great experience. The subject of inventions in themselves is gone into at considerable length, especially as to the ascertaining of what are really inventions and what not, and also as to what inventions are likely to prove remunerative or otherwise. Patent law, like most other law, is shown to be easily misunderstood by those in whose interests it has been framed, and the fair conclusion is drawn that inventors generally do well to entrust their business of this kind to reliable agents who make the study of these laws their business and who are liable to damages if their client suffer injury through remissness

on their part. On the subject of making money out of patents there is much good practical advice with reference to disposing of the patent when obtained, to publishing and advertising it, etc., etc. The following extract shows the practical turn of the work:

"There may be said to be four ways of commonly dealing with a patent. The first mode is for the patentee himself to put the invention into practical operation; the second plan is to grant licenses for its use; the third is to dispose of the whole right; and the fourth is to divide the right into shares, and dispose of part of them; but the powers and privileges of the grant permit of a variety of dealings, including mortgages. Unquestionably, the preferable mode is for the patentee himself, if possible, to initiate the practical introduction of the invention into the market. If he possesses the requisite capital and knowledge of the trade, he can introduce it more advantageously to public notice than any other person, because he can best combat the difficulties which are likely to spring up, and soften down the asperities which generally are excited by the appearance of a new competitor for public favour. Fortunate is the patentee who is able to manufacture his patented articles without extraneous assistance,—who can appeal to the public at large, who, in the long run, adopt whatever is practically useful. Not a few novices in patents fall into the error of demanding exorbitant prices for their merchandise; they assert that there would be little advantage in a patent did it not enable the owner to gain high profits. Certainly a higher profit than is usually made in trade is due to the patentee who is taxed for his privilege, and who has to incur heavy expenses in experiments, models, and trials. But sound policy will dictate moderation and the patentee will find it to his real interest to cultivate an extensive trade at fair and reasonable prices. The effect of placing too high a price upon articles is to prevent trial of them, and it should be the object of the patentee to promote by all means in his power a speedy demand."

There are few, even of old inventors, to whom this little work will not prove of service and we recommend it, with confidence, to the consideration of those who have, or think they have, occasion to apply for the protection of the laws respecting patents.

CORRESPONDENCE.

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

PATENT LAW.

To the Editor of the MECHANICS' MAGAZINE,

SIR,—Having in your last issue promised to review in this number the 11th section of the Patent Act of 1872 and some of the other objectionable clauses, I will at once proceed to do so.

The 11th section reads as follows:—

"11. Every inventor, before a patent can be obtained, shall make oath, or, when entitled by law to make an affirmation instead of an oath, shall make an affirmation, that he verily believes that he is, or, in the case of the inventor being deceased, the applicant shall make oath or affirm that the person whose assignee or representative he is, was the inventor of the invention for which the patent is solicited, and that the several allegations in the petition contained are respectively true and correct. Such oath or affirmation may be made before any Justice of the Peace in Canada; but if the inventor or the applicant is not at the time in Canada the oath or affirmation may be made before any Minister plenipotentiary, *chargé d'affaires*, consul, vice-consul or consular agent holding commission under the Government of the United Kingdom, or any Judge of the country in which the applicant happens at the time to be."

This section of the law must be read in conjunction with one of the recent additions to the Rules and Regulations of the Patent Office issued on the 14th day of January last, numbered 3 and headed "Affidavit," which is to this effect:

3. AFFIDAVIT.—In all cases of applications for Patent, where the affidavits are made out of Canada, and before a Judge, the Seal of the Court, presided over by such Judge, must be affixed to such affidavit."

Taking these together (when we consider the requirements in the case of any oath taken out of Canada) there perhaps never was a more reckless and ill-considered piece of legislation promulgated in any civilized country during the present century.

Let us view the effects of the Section and Rule above referred to in England, where there are no Ministers plenipotentiary, *chargés d'affaires*, consuls, vice-consuls, or consular agents, and where therefore, the only persons who can legally administer the oath are Judges.

It would be sufficiently difficult even in the City of London to get a Judge in Chambers to administer the oath, but under this section inventors residing in the provinces would be compelled, first to solve the question of where they could find a Judge sitting in Chambers, and then to take a journey thither. Now calling on an English Judge is not like calling a boot-black, who is ready to attend you at any moment, the judge has certain hours, during which alone he can be seen, and at that time he may very likely be so much engaged that he will not leave the business before him that day. The inventor may thus be compelled to call for two or three days before he can get an opportunity to take his affidavit and obtain the Judge's signature.

I will do the officials of the Department of Justice the credit to say that when these facts (apparently entirely unknown to them before,) were brought to their notice, it was stated that the attestation of a County Court Judge to an affidavit would be received. (I presume that they imagined that the County Courts in England were similar in constitution to those of Canada.)

Even with this permission one would think that the difficulties entailed on the inventor were enough to satisfy the Department of Justice, but such a supposition would be entirely wrong; the edict has been issued that the Judge must attach the Seal of the Court, thus to begin with completely annulling their former concession, as County Court Judges have no seal.

Besides this, as the Judges of the Courts of Queen's Bench and Common Pleas only administer affidavits in Chambers they cannot use the seal of any court and the consequence therefore is that in the whole of the United Kingdom of Great Britain and Ireland there are only three persons who can, properly and strictly speaking, administer the oath and attest it in the prescribed form.

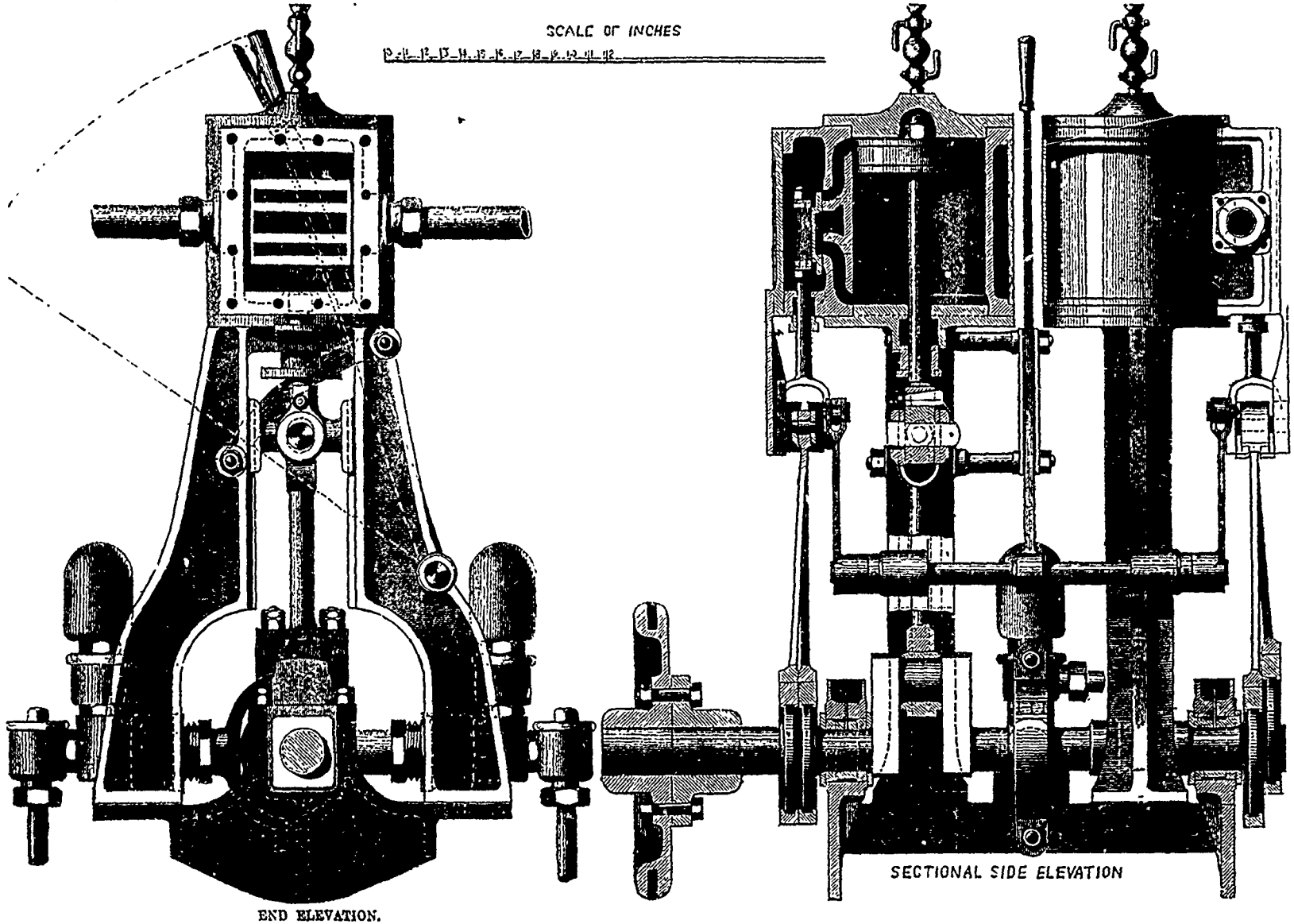
These are three magistrates who, by virtue of their office, are also Judges and have a seal that they can attach. They are as follows:

The Lord Mayor of London, the Lord Provost of Edinburgh, and the Lord Mayor of Dublin, and to one of these three all inventors throughout the Kingdom must travel. Imagine the difficulty of making a joint application for three persons who live in different parts of England!

The affidavit thus taken must be signed by people who, as a rule are not acquainted with the niceties of the forms of the Canadian Patent Office, and be attested by a person who feels that he is conferring a favour in so doing, and that the affair is entirely out of his province; the consequence is that some trifling discrepancy occurs, and so full of red tape is our Department of Justice that, (so to speak) if an *s* is not dotted, or a *t* left uncrossed the oath is rejected and a new one demanded; it thus often happens that three oaths have to be taken before one correctly prepared according to the ideas of our Department of Justice can be obtained.

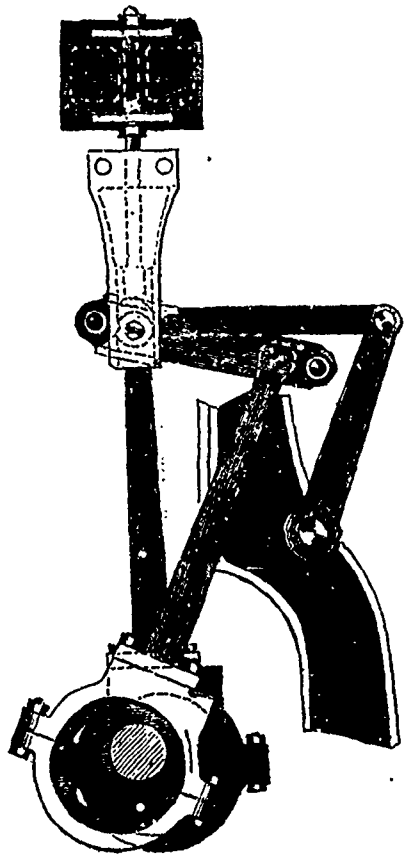
So much is this difficulty felt that many of the leading patent agents in England and the United States, and all inventors who have applied for Canadian Patents are beginning to come to the conclusion that while our Government is supposed to have opened the doors of its Patent Office to them, they are virtually shut out by ridiculous requirements and red tape restrictions.

I do not, however, myself think that the action of the Department of Justice was wilfully directed to that end, but am

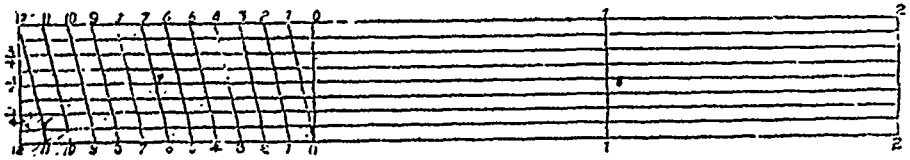


ENGINES OF THE STEAM LAUNCHES "BUJAK DERE" AND "GENERAL ADMIRAL."

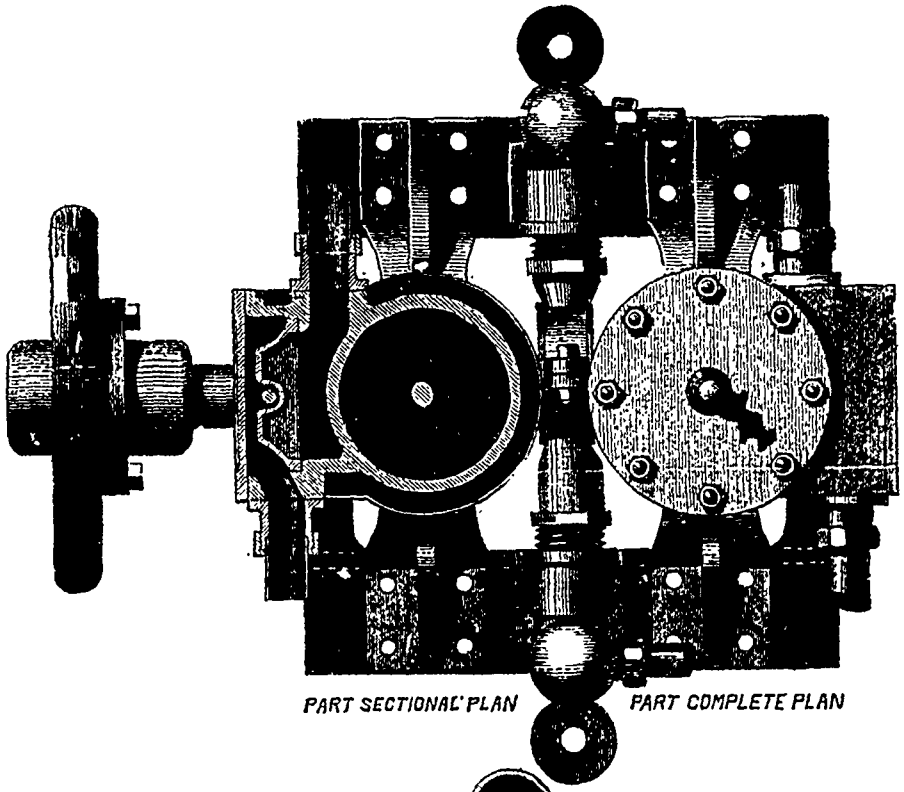
Messrs. W. Crichton and Co., Engineers, Abo, Finland.



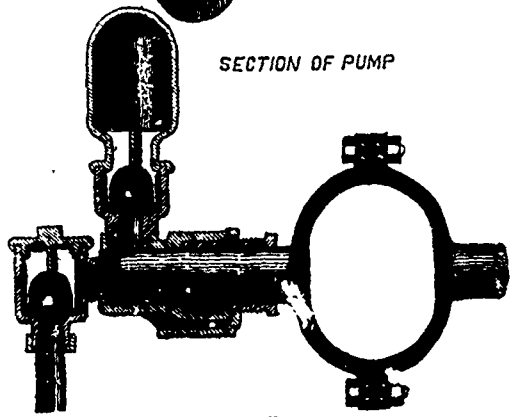
ELEVATION OF ECCENTRIC



SCALE OF FEET



PART SECTIONAL PLAN PART COMPLETE PLAN



SECTION OF PUMP

ENGINES OF THE STEAM LAUNCHES "BUJAK DERE" AND "GENERAL ADMIRAL."

Messrs. W. Crichton and Co., Engineers, Abo, Finland.

inclined to take a more charitable view of the subject, and ascribe these ill effects of their proceedings simply to rash legislation on their part on a subject of which they were utterly ignorant.

In the United States, England, France, Russia, and many other countries an oath taken before a notary public, duly authorized and practising as such, will suffice. Some of these countries have ten times the number of inhabitants that Canada possesses, and a patent in either of them is often worth one hundred dollars for each dollar that the Canada Patent may produce.

The Government of Canada, by the regulations we have referred to, therefore places itself in the position of a dwarf, who, when he goes out must have a huge stick, which, in his opinion enhances his importance, but in reality only makes his insignificance more apparent.

I will now proceed to the 12th Section which reads as follows:

"12. The petitioner for a patent shall for all the purposes of this Act elect his domicile at some known and specified place in Canada and mention the same in his petition for a patent."

I have often been asked by foreign patent solicitors and inventors what use this clause is, or what is the intention in making the inventor state that he elects a domicile in Canada.

I have myself also asked the same question of Government Officials and Members of Parliament, and have never yet found any one who could give me a satisfactory answer. I can only suppose that this forms part of the "dwarf" arrangement above referred to.

The 13th Section is in this shape:

"13. The applicant shall, in his petition for a patent, insert the title or name of the invention, and shall, with the petition, send in a specification, in duplicate."

This is all well enough, but the practice of our Patent Office requires a name to be given as well as the title. This is demanded by no other country and my concluding remarks on the 12th Section equally applies to this.

It is needless to comment on the 14th Section of the Act, as I am informed on the best authority that the practice of preparing the application in duplicate will be abandoned about May next, and a form of procedure adopted resembling as far as possible that of the United States Patent Office.

Nothing further of note occurs until we come to the 18th Section which follows:

"18. Every patent and instrument for the extension of time as aforesaid shall, before it is signed by the Commissioner or any other member of the Privy Council and before the seal hereinbefore mentioned is affixed to it, be examined by the Minister of Justice, who, if he finds it conformable to law, shall certify accordingly, and such patent or instrument may then be signed and the seal affixed thereto, and being duly registered, shall avail to the grantee thereof."

It is very desirable that the Patent Office should be self-contained and competent to perform all work within its own province, and it should therefore be supplied with proper legal advisers attached to the office, to consult on all points arising from the proceedings in Patent cases. *These proceedings should be strictly in equity and not in common law.*

By proceeding at common law the business of the office is impeded by technical objections and useless quibbles, and in proof of this I may cite the recent decision of the Department of Justice that the oath must be attached to the specification with a pin, tape, wire, or some other fastening, and that if this be omitted and the papers be simply sent in one enclosure, the affidavit will be returned and a new one demanded as if the pin or tape had any legal bearing on the case.

I have already referred in my remarks on the 11th Section to the requirement by the last additions to the Rules and Regulations of the Seal of the Court, and will now bring before the notice of your readers another new requirement referring to the specifications.

"2. SPECIFICATIONS.—The Duplicate Specifications, in every application, must each be identified by the justice or judge, who takes the affidavit of the inventor, as 'the Specification referred to in the inventor's affidavit annexed.' Such identification to be, by certificate, written at end of, and in each, such Specification. Thus:—

'This is the Specification referred to in the affidavit of , hereto annexed.
Sworn before me this day of , A. D. 18 .'

JUDGE, or J. P."

Now as there are two specifications and but one oath the certificate at the end of one of them must be absolutely false, and this false statement is, according to the Rules and Regulations and the law, required to be certified by the Judge or J. P. who attests the oath.

I need hardly say that, should he do so, he would deserve to be ignominiously deprived of his commission.

To get over the difficulty it may be ingeniously arranged to attach the two specifications together and the oath to both of them; but, when they arrive at the Patent Office they must be separated, as one specification is to remain there, and the other to be attached to the patent and sent to the inventor. If therefore one of the certificates is not a lie at the time it is written it must of necessity become one afterwards.

A department that can thus lay down, for strict observance, rules and regulations which on their face are self-contradictory and absurd, can hardly be called fit to guide and direct another department the practice of which should be entirely governed by the rules of equity.

This communication has already, Mr. Editor, extended to a greater length than I had intended, and I fear that I have trespassed on your valuable space. With your permission I will resume the subject in your next issue.

I am, Sir,
Your obd't. servant,

C. G. C. SIMPSON.

SAVING LIFE AT SEA.

To the Editor of the MECHANICS' MAGAZINE.

SIR—The late lamentable disaster and sacrifice of human life off the coast of Nova Scotia, must render it painfully evident to the public and particularly to those acquainted with the sea, that the present system of saving life from shipwrecks by means of the boats usually carried for that purpose, is almost useless, and I quite coincide with the opinions expressed in a recent article of the *Scientific American*, as to the desirability of engineers and inventors endeavouring to discover some effectual and reliable life-preserver at sea, which shall be capable of rapid manipulation and render sea voyages less fraught with such fearful danger and anxiety to ship passengers as the recent examples of the "Northfleet" and "Atlantic" are justly calculated to inspire.

I have been a passenger on the ocean several times during my life and can readily understand the awful difficulties that have to be contended with in rescuing human beings from shipboard in the face of fire, rock or tempest. In such cases which generally occur at night, all is darkness and confusion, and, with the exception of a few whose minds accustomed by training to the sea, comprehend the situation at once and do their duty nobly, all lose their presence of mind and in their frantic efforts to escape, only hasten their destruction. In such cases also, time is so short, that the attempts made to lower the boats carried by the ship are generally futile. Some of the boats are perhaps found leaky and stove in by previous storms, others never reach the sea, owing to derangement of their lowering tackle, while the remainder are generally swamped by heavy seas after leaving the wreck.

I beg, therefore, to offer to your notice a plan for dealing with this subject, which may or may not be the desideratum sought. If the idea should meet with the approbation of the nautical world, who are alone capable of judging as to its character, I shall be happy to furnish full particulars of my proposed plan. If condemned, I shall still have the satisfaction of having endeavoured to aid in the cause of humanity.

My plan is as follows:—I propose to place on the uppermost after-deck of a ship a false deck in the form of a raft, say 100 feet long from the stern by 45 feet wide (according to the length and beam of the ship) and of suitable thickness, constructed with alternate layers of planking and cork thoroughly secured together, and capable of supporting from 500 to 600 persons without inconvenience. This false deck

or raft to have sides or bulwarks of thin plate iron in the form of air-tight tubes (which might be used for the stowage of provisions, and for other purposes) and the ends to be closed with strong wire-rope netting. Other suitable gear also to be provided for the safety of passengers.

When not required for use, the raft would simply rest on and form a raised portion of the ship's deck, but in case of accident, I propose to launch it by simple, powerful, rapid, and sufficient gearing from the stern of the ship into the sea.

The following are some of the most important features of my proposed raft:

1. From the nature of the materials used in its construction, as well as from its form and size, the raft would be unsinkable, and could be made of any floating power.

2. In case of fire, the raft could be instantly launched from the stern of the ship, and the passengers and crew betake themselves to it.

3. In the case of the ship foundering the raft would of itself float free from the wreck, with its living freight.

It is not my intention in this letter to describe *how* I propose to secure the raft, when not in use to the deck, on which it is to be placed, nor to meet the many objections which may be justly raised to its adoption, such as the disposition of the wheel-house, mizen-mast, sky-light, and other impeding gear. These objections, serious as they may appear at first sight, are mere matters of detail which can be easily overcome and which I am prepared to meet. In case of its adoption, alterations would necessarily have to be made in the disposition of the stern-gear of a ship. But the importance of the subject is such, that no expense should be spared, and these alterations once made, my proposed raft would form the safest, simplest, and most efficient life-preserver ever invented.

I beg to enclose my card, and to solicit the assistance of the scientific world in developing my invention.

I am yours truly,

EDWARD W. FURRELL, C. E.
60 King Street,

Toronto, April 22.

We publish on pages 40 and 41 illustrations of the pile foundations employed in the construction of the nave and transepts of the Industry Palace, which will further explain the arrangements adopted. In the annexed engravings figs. 1, and 2, show the foundations of one of the columns or standards of the transepts; figs. 3, and 4, are similar views of the foundations of the columns of the nave; figs. 5, and 6, show the foundations employed at the intersections of the nave and transepts; figs. 7, and 8, show the foundations at the front corners of the transepts; while figs. 9, and 10, represent the foundations of the corner pavilions.

IMPROVED FORMS OF ROCK DRILL POINTS.

(See page 61.)

There are few branches of mining which are not more indebted to modern science than Rock Drilling. The holes in the rock in mining and quarrying are beaten by blows of the hand in the same manner that the builders of the Pyramids wrought three or four or more thousand years ago. Whether they used the same form of drill point that we do, is uncertain, but it is probable that they did. We probably have better steel than they, but that is the only point whereby we surpass them. After the holes are drilled, we have in gunpowder and other explosives a means of rapidly tearing rock, which they did not possess.

In our cuts on page 61, we have not shown the diamond drill point which is a section of a cylinder with diamonds set on its face, so that revolving the cylinder grinds out the hole. Or the diamonds are set in, in the end of a pipe, and when the pipe is revolved under heavy pressure, the diamonds wear away the rock and make a hole with a core in the center.

The use of diamonds is very limited and the supply small when compared to steel, and if all the rock work that is done by steel in one year were done by diamonds, all the known diamonds both carbons and brilliants would be required. The few required to supply rock drills have caused an advance in the price in the last three years of several hundred per cent., even the fabulous yield of the Arizona diamond fields failing to keep down the price.

In our engraving No. 1 represents what is called the diamond or lozenge-shaped point. It is the almost universal form used in drilling metals and is largely employed in rock-drilling. Its sharp point is particularly useful in starting a hole in any given point; and in soft rock it is as efficient as one with a rounder form. No. 2 shows a form that is better adapted to harder rock, but No. 3 is the form most commonly prepared for the hardest rock, such as granite, mica slate, containing a large amount of silex, some varieties of trap and amygdaloid, etc.

Figures 7 and 8 (the same figures though different views of the same drill) represent the cross and three-leaved point, and sometimes as many as seven leaves are used. Fig. 7, shows an end view of the drill. The cross is generally adapted for machine drills and will sustain a heavier blow without breaking than a chisel point. All of these cut out the entire size of the hole as is shown at No. 6, which shows the form of the cuts at the bottom of the hole. No. 4 shows a double drill, (front and side view) two chisel points with the edges set parallel; 4, shows the manner in which it operates. It cuts around on the sides of the hole and the center flakes off, thus saving a large amount of cutting in drilling a hole.

This ingenious arrangement was invented by Charles Braids of Copperopolis, twelve or fourteen years ago. No. 5 represents a side and front view of a modification of this drill; the cutting edges are rounded so as to conform to this side of the hole as is shown at Fig. 5. This cuts a still smaller portion of rock, as is shown at fig. 5. This form of drill bores a hole with less expenditure of power than any other known form; the chips are larger, showing less cutting than when they are finer.

No. 6 represents a curious form which is sometimes used for leaving a centre for holding a tool for chambering out this pattern of a hole. One of the greatest improvements in blasting rocks, that has been made in later times, is the use of Giant Powder. By its great explosive force as much execution can be done with an inch and a quarter hole as by an inch and a half charged with ordinary gunpowder, reducing the work of drilling as eleven to seven, and one man with a hand hammer and a small drill can penetrate this rock nearly as fast as two men with a larger drill.—*Mining and Scientific Press.*

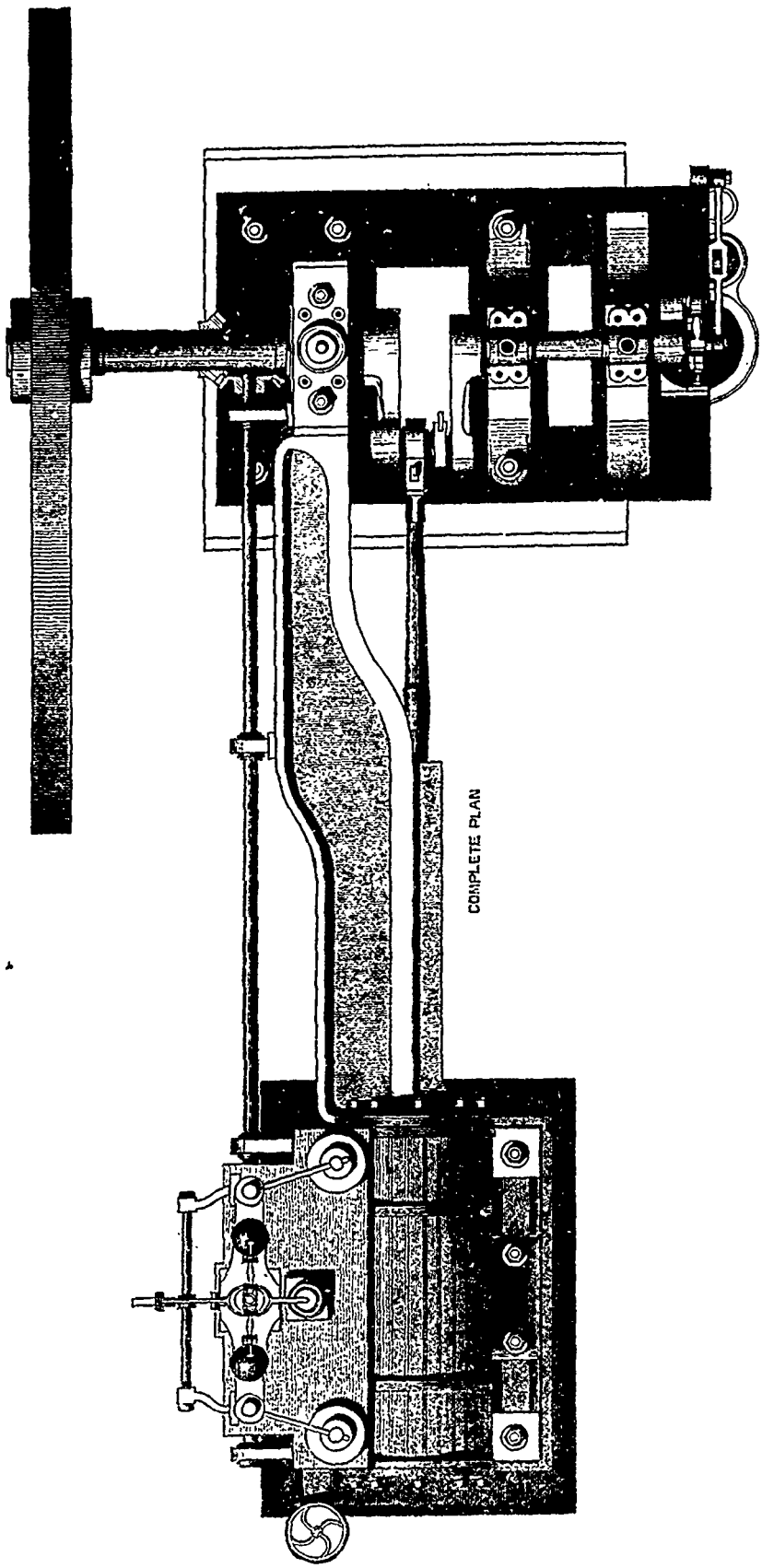
LOOKER'S VENTILATING BRICKS.

Mr. Benjamin Looker, of Kingston-upon-Thames, thus describes this valuable invention in the specification of his patent recently filed:—

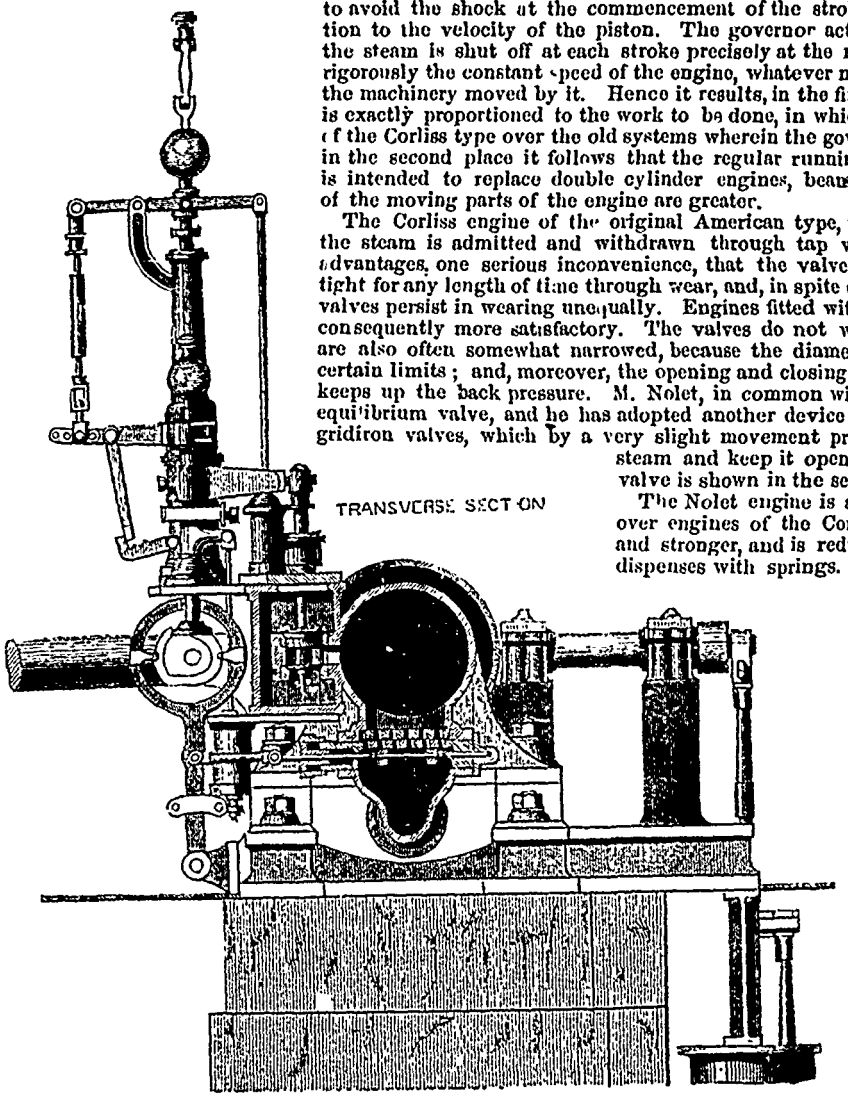
My hollow ventilating bricks are to be constructed as parallelograms, though they may be constructed in other forms if desired, but open at the ends with internal ridges or protuberances extending from end to end so as to provide grooves therein for the purpose hereafter described.

At each end of these bricks or slabs, portions of the sides are removed, or notches made so that, thereby, when two bricks or slabs are brought end to end, an opening on each side shall be constituted, so that when these bricks or slabs are laid or set in position in a line, a number of ventilating openings will be provided which may be opened and closed, or partly opened or closed by means of sliding boards or plates, which should be provided at the lower edge with small rollers to facilitate motion, and placed in the grooves formed in the tops and bottoms of the slabs or bricks (by the ridges or protuberances aforesaid), such sliding boards or plates being made with corresponding openings to those above-mentioned, in order that by bringing these last mentioned openings opposite the said openings in the line of bricks or slabs, the ventilating holes may be opened, and by withdrawing the said boards or plates from that position, the ventilating openings can be closed. Openings, if required, are made (in the sides of the bricks or slabs) of the same character and for the same purpose as above described; and in some cases, if allowed, a brick or slab of the above internal form, but without the notches or parts of the sides removed as above described are used if interposed between the others.

When these bricks or slabs are used in constructing horticultural structures, especially those known as "Lookers," a line of these bricks is placed along the base or lower part of the structure, so that, by opening and shutting the ventilating openings aforesaid, ventilation of the lower part of the structure may be provided, and by opening the top lights, or in "Looker's" structures removing the caps or ridge tiles, top ventilation will be provided.—*Scientific and Literary Review.*



CONDENSING EXPANSIVE ENGINE.



THE NOLET ENGINE.

We illustrate on this and the opposite page one of the highly economical engines of Messrs Nolet et Cie., Engineers, Ghent. The illustrations are from the *The Engineer*.

It will be seen that after the manner of the Corliss and Allen engines, it is supported on two sole plates, one carrying the cylinder, the other the crank shaft. The connection between the two is completed by a cast iron beam fitted with slide bars for the crosshead to work in. The condenser and air and feed pumps are placed below the bed plates, and the latter are worked by means of a counter crank and drag link. The steam is supplied to the cylinder by means of two separate valves, and there are two exhaust ports placed at the extremities of the cylinder to separate completely the steam ports from the exhaust ports, so that the steam coming from the boiler is kept apart from that to be condensed, and so does not enter the cylinder through ports already cooled by the spent steam. The closing of the admission valve is in a way instantaneous, and is not gradual, as in all those of the ordinary slide valve type. With this arrangement expansion is not sacrificed. Diagrams taken from this engine show remarkably well when compared with others, as in them, when examined with those taken from engines of the old type for corresponding abscissæ of the curve which represents decreasing pressure during expansion, the ordinates are often greater. The exhaust is kept open till the last moment, hence the back pressure on the piston in the direction of the condenser or the atmosphere is relieved. On the other hand the admission port is opened gradually, to avoid the shock at the commencement of the stroke, and to admit the steam in proportion to the velocity of the piston. The governor acts on the valves in such a manner that the steam is shut off at each stroke precisely at the necessary moment, in order to maintain rigorously the constant speed of the engine, whatever may be the work put upon the engine by the machinery moved by it. Hence it results, in the first place, that the consumption of steam is exactly proportioned to the work to be done, in which lies the great superiority of engines of the Corliss type over the old systems wherein the governor is made to act on a trottle valve; in the second place it follows that the regular running of this engine is exceptional, and it is intended to replace double cylinder engines, beam engines, &c., wherein the resistances of the moving parts of the engine are greater.

The Corliss engine of the original American type, together with its derivatives, in which the steam is admitted and withdrawn through tap valves, present, in the midst of many advantages, one serious inconvenience, that the valves are not capable of being maintained tight for any length of time through wear, and, in spite of many attempts to cure the evil, these valves persist in wearing unequally. Engines fitted with valves other than of the tap form are consequently more satisfactory. The valves do not wear out so easily. The exhaust ports are also often somewhat narrowed, because the diameter of the valve can only fall within certain limits; and, moreover, the opening and closing of the exhaust occur gradually, which keeps up the back pressure. M. Nolet, in common with the Sulzer system, makes use of an equilibrium valve, and he has adopted another device in making use for the exhaust of two gridiron valves, which by a very slight movement provide a large passage for the exhaust steam and keep it open during the whole of the stroke. This valve is shown in the section of the engine.

The Nolet engine is also held to possess other advantages over engines of the Corliss type. The valve gear is simpler and stronger, and is reduced to a smaller number of parts, and dispenses with springs.

Referring to the engravings, it will be seen that on a shaft worked by the crank shaft there are two eccentrics for moving the steam valves, and two for the exhaust. The latter communicate short oscillations to a rocking lever for working the gridded valves of the exhaust. At the commencement of each stroke one of the eccentrics raises a spindle, on which is fitted a sleeve, carrying an arm attached to the valve. At the commencement of its lift this spindle engages with the sleeve, but this latter carries a particularly curved lever; the sleeve scarcely commences to rise when this curved lever engages with a catch on a freely working arm belonging to the governor; the sleeve is then released from the spindle, and the valve closes instantly by reason of the counterweight with which it is provided, the spindle meanwhile continuing to ascend. Now it is evident that as the moment the valve closes is dependent upon the position of the governor, any variation whatever in the speed of the engine, from stroke to stroke, being promptly felt by the governor, operates to close the valve more or less quickly in order to keep the speed even.

THE DETROIT RIVER TUNNELS.

The works on these tunnels have been suspended indefinitely from want of funds, and the connection of the United States with Canada is therefore for the present abandoned. The original plan contemplated the connection of the Great Western Railway of Canada with the Michigan Central Railway, at Detroit, Michigan, by two independent tunnels of masonry, each 15 feet in diameter, driven under the bed of the river. Each tunnel was to have been 8,568 feet in length. The preliminary work consisted in drifting a small tunnel 5 feet in diameter, intended as a drain for the two larger works, and it is upon this small tunnel that considerable labour has been expended. Headings were made on both sides of the river, and when orders were given to stop the works, these headings had been carried 1,700 feet in all, or 1,220 feet on the American side and 480 feet on the Canadian side.

THE SOUDAN RAILWAY EXPEDITION.

Our last issue contained a map and a description of the scheme of railway communication between Upper and Lower Egypt, suggested to the Khedive by Mr. John Fowler, and surveys for which were made in 1872. The various cataracts which obstruct the navigation of the Nile in its long and circuitous route between Khartoum and Assouan, render useless this great and natural line of water communication, and made it necessary, if the extensive and fertile districts of the Soudan are to be developed, to establish some other link between the great producing grounds and their points of demand in Lower Egypt. Moreover, as we have stated, this projected line of railway, joining the Soudan to Wady Halfa above the First Cataract, though in itself 560 miles in length, is to form only the first length of a great through line to the west shore of the Red Sea, which shall, when it is completed, enter into direct competition for the conveyance of passengers and merchandise with the Suez Canal route.

The complete project which is now under the consideration of His Highness the Khedive of Egypt, and which, in all probability, will be decided upon shortly, consists of the formation of a direct line of inland communication between the Mediterranean and the southern end of the Red Sea, by which means not only will a most important saving in time be effected, but the almost intolerable dangers and inconveniences of the Red Sea passage will be entirely avoided.

The proposed new route between the Mediterranean and the Red Sea will be 1900 miles in length. Commencing at Alexandria, the existing railways terminating at Roda will cover 310 miles of the distance. At Roda the passengers will be transferred to light and swift steamboats, and for 600 miles southwards the Nile will form the highway for inland traffic. Perhaps the most interesting portion of the Nile will thus be traversed by travellers, and an additional feature of interest will be the crossing of the First Cataract by Mr. Fowler's ship railway, which, it is understood, is to be commenced forthwith.

The termination of the preceding link of river communication will be at Wady Halfa—the commencement of the Soudan Railway. A transference from steamboats to railway will therefore take place at this point, and the 560 Miles in length of the Soudan Railway will be quickly traversed. This takes us to Shendy, and from Shendy to Massowah—the port on the Red Sea where the sea passage will be again resumed—is but a distance of 430 miles, which will be accomplished by an extension of the Soudan Railway. There can be no doubt that this important line of inland communication will produce almost incalculable results as regards the development of the resources of Egypt. The products of the rich valley of the Nile will have ready access to the markets of the world in every direction; thus native productions will be stimulated, and in return the manufactures of the western world will find a market in previously inaccessible regions. At the same time the facilities afforded by the overland route for through communication with India and the East cannot be too highly appraised, either as regards time or comfort. Meantime the local traffic upon the Soudan Railway will, according to Mr. Fowler's report, be considerable, comprising all the varied articles of freight which now converge by the various camel routes that meet at Metemmeh, on the Nile, opposite the southern terminus of the line, as well as from Khartoum up, and from Berber down, stream. In addition to this freight, there will be created a new traffic in the corn, cotton, and other vegetable produce grown in the Soudan, so soon as there is a means provided for its export. As we have already stated, Mr. Fowler has wisely selected a 3 ft 6 in. gauge for this line, for the obvious reasons that it combines ample capacity for a large and mixed traffic (varying from pressed or half-pressed cotton, coming down north ward, to machinery going south), with the greatest economy in construction, maintenance, and working.

The surveying expedition, eighteen in number, including the chief, Mr F. Graham, was organised in London, and sailed from Southampton on the 16th September, 1871. Tents, stores, and all the necessary impedimenta were despatched with the staff, which, on arriving at Alexandria, was received by the Egyptian officials, and no time was lost in preparing for the journey, beyond that required for unloading the stores at Alexandria, and transhipping them again at Cairo on the river boats destined to carry the expedition as far above the First Cataract as should be found practicable. It was arranged that a steamer should tow four of the native boats or Dahabeahs, and carry, besides, the bulk of the stores, whilst the staff was divided into two parties of four each in the smaller, and two of five each in the larger boats. As it was probable that the nature of the work would compel the expedition to work in pairs, a further subdivision was effected, by which all necessary arrangements were made for forming eight separate parties, each being fully provided with stores, a dragoman, cook, &c. As events turned out, however, this subdivision was unnecessary, for, with few exceptions, the surveys were completed in parties of four.

The four Dahabeahs left Cairo astern of the light paddle-wheel steamer on the 5th of October, about seven days after the time of high Nile. As during these seven days the water level had fallen some 14 in., it was necessary to push forward as rapidly as possible in order to reach the foot of the First Cataract, when the difference in the water level above and below the falls should be comparatively slight, but owing to the prevalence of strong adverse currents, the steamer with her heavy train astern did not make such rapid progress as was anticipated, and she was thirteen days in reaching Assouan, at the foot of the cataract

The sketch on page 56, shows a pair of Dahabeahs lashed together, and conveys a good idea of the type of vessel. The average length of these boats is about 100 ft., the beam 15 ft. the depth of hold 4 ft., and the draught of water 2 ft. 6 in. They draw, however, more water forward than aft, being built in this way in consequence of the common incident of running aground on shallows, when with the light draught aft it is easier for the crew to get them afloat again We shall publish next month a drawing of one of the fastest boats of this class, a modern affair altogether, and an innovation on the time-honoured practice of Egyptian shipwrights, being built of iron

With a fair wind this Dahabeah could make a speed of 10 miles an hour, but the light draught of these vessels, and the large surface of their cabins, deck houses, &c., when exposed to any but a fair wind, prevent them from having good sailing qualities of any kind beyond that just mentioned—of sailing free That they would be improved by the addition of leeboards there is little doubt, and these would have been introduced long since, no doubt, did not eternal custom prohibit alteration As a rule the Dahabeahs sail up the Nile about November, before a fair and prevailing north wind, which carries them as far as the First Cataract. Indeed, this wind blows for about six months in the year, and in going up stream the good sailing quality of the Dahabeah is seen to advantage In returning, however, with the current, and against the wind, other characteristics are developed, and it is then manifest how greatly the improvement mentioned above would add to their sailing power.

The vessels shown in the sketch are arranged almost invariably with a cabin on deck, two others forward of the saloon, two lavatories, two other cabins similar to those forward, and a large saloon in the stern, frequently used for the harem or ladies' cabin. The kitchen is in the open air, and placed forward of the foremast, a wooden screen usually keeping it out of sight from the after-part of the boat The deck on the cabins is generally provided with an awning, and forms the favorite resort of passengers by day, but is given up at night to the captain, dragomen, &c., for their sleeping accommodation. This deck is approached by a ladder placed on each side. The floor of the saloon and cabins is generally from 1 to 2 ft, below the level of the deck. The space under sleeping berths sofas, &c., is fitted with lockers and drawers.

The method of towing the Dahabeahs is that shown in the sketch. Each pair is made fast together fore and aft, and the tow ropes are crossed so that the line from the port quarter of the steamer is made fast to the starboard bow of the starboard Dahabeah, and *vice versâ* The object of this arrangement is to prevent the boats from swerving when any current catches either bow, the tendency being immediately corrected by the tow rope. This system is almost universally adopted on the Nile.

The hours of sailing are limited between sunrise and sunset, the towing steamer does not anchor, but merely lies alongside the bank, while the Dahabeahs take their regular order also alongside the bank, as shown in the sketch. The boats are moored to posts, which are carried on board and driven into the ground at night, if no natural moorings present themselves.

Frequently the surveying expedition was met by a guard of honour at the halting-places, despatched by the shiekh of the

district; this guard, which usually consisted of four Arabs, two armed with poles, and two with ancient battle-axes, formed in all cases sufficient protection during the night, as no occasion for their services ever arose.

In ascending the Nile at the season chosen by the expedition, sand-banks present little or no difficulty, and the course taken is therefore far more direct than at low Nile, when the numerous bends in the river have to be carefully traversed, and the deepest channels selected by the experienced Nile pilots.

The mainsail carried by the Dahabeahs is similar to those with which one is familiar in many Mediterranean ports. The spar or yard carrying the sail is seldom lowered, and is usually about the length of the vessel (100 ft.), made in two lengths, and jointed. The sail is reefed in the usual way. The mizzen or after-sail is similar in shape. Each Dahabeah usually requires a crew of six sailors, and a reis or captain. It is steered by a tiller about 6 ft. in length, the steersman's place being on the upper deck. In descending the Nile it is often necessary to employ sweeps, the hatches of the vessel are taken off, and the crew stand on the floor, so that their arms are brought to gunwale or rollock level. The length of stroke taken being about 8 ft, the men stand to their work, walking forward at each stroke, and pulling through. In rowing down stream it is usual to increase the crew to ten or twelve men.—*Engineering.*

(*To be continued.*)

A Trip through Mexico.—The correspondent of the *Morning Post*, who, we believe, is the only representative of an English journal in Mexico, describes the first journey made over the new railway from Mexico to Vera Cruz. He says:—We left the capital very early in the morning of New Year's day. The Mexican President's train went first—ours followed at a respectful distance. The first stage of our journey—from the capital to Boca del Monte, a distance of 150 miles—was uneventful. The line for this distance is quite level, and its construction would have been easy had not the numberless ravines and watercourses with which it is crossed necessitated the construction of as many bridges. At Boca del Monte—which we reached before noon—the President and his party had been regaled with a bountiful breakfast. They had here been met by the Governor of Vera Cruz and his suite, and here also the President's carriage was replaced by a very elegant saloon carriage, so arranged that its occupants could see the beautiful scenery over which the line now passed without running from one side of the carriage to the other. The engine which drew his train, as also that which drew ours, was one of the Fairlie patent, with steam brakes, which were highly useful in regulating the speed of the trains when descending the fearfully steep grades on which we entered after leaving Boca del Monte, for from this point the character of the country suddenly changes. We left behind us the dull and dreary plains, and plunged at once into another world—a world of mountains and valleys, tropical vegetation, bottomless ravines, and steep precipices. Immediately east of Boca del Monte the road runs through a tunnel, then plunges upon a narrow iron bridge which seems suspended in the air, and which spans a ravine of which you can scarcely see the bottom; and then goes whirling down a descent of sixteen miles, with a fall of 1 in 25—the longest gradient of this proportion in the world. It was considered unsafe to allow our train to run down this descent in one connection. It was divided into two, and so it happened that as we looked from our windows we saw the President's train under our feet and the other half of our train over our heads. The end of this exciting flight brought us at six o'clock to the charming valley of the Orizaba, and in the delightful city of that name we remained that night and the next morning, resuming our journey to Vera Cruz the following afternoon. From Orizaba to the coast is eighty miles, and on the way we crossed the Metlac River, which runs through a ravine 1000 ft. wide and 500 ft. deep. Instead of crossing the ravine on a bridge, the railway runs down the side of the valley, crosses the river on a low bridge, and then climbs up the opposite side. The road here goes through a succession of cuttings and tunnels, and over a number of small bridges, and nothing can be more strange and picturesque than this portion of the route. The descent on the western side of the ravine is 1 in 33, and the metals here are laid on the solid rock through which the route has been cut. Soon afterwards we come to Fortin, 70 miles from Vera Cruz, and from this point onwards the scenery is wonderfully beautiful and varied. Our train had preceded that of the President from Orizaba, so that he did not arrive until nine o'clock at night. The station and the city were illuminated, and there was a grand ball at the theatre. The President remained in Vera Cruz until the afternoon of the 5th, and during these three days there was a constant succession of festivities. I do not know but that you have often regarded me as too sanguine when I have told you not to despair of Mexico. But now my faith in her is stronger than ever. We have completed our first railway.

FLEXIBLE SAW AND TOOTH FILING APPARATUS.

We illustrate on page 60, from the *Scientific American*, an invention of the above description, recently patented in the United States by Messrs. Frey, and Sheckler and Co., Eagle Machine Works, Bucyrus, Ohio.

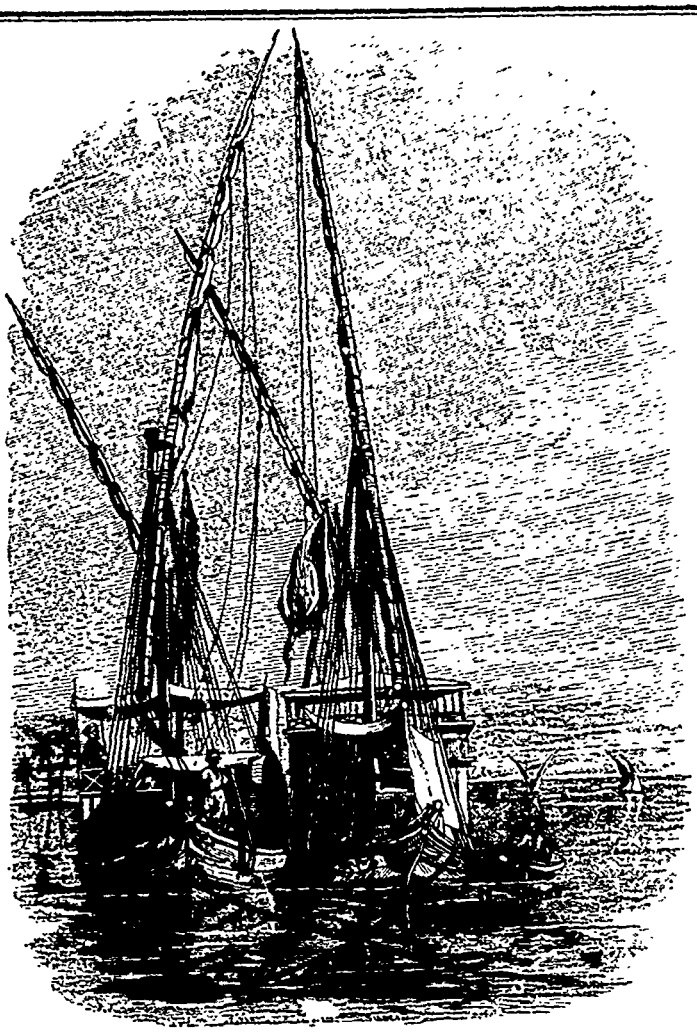
This invention consists in an abrading wheel of emery or corundum, hung upon a flexible frame and set in rapid motion. By means of a handle, it is controlled by the operator, and may be placed at any angle to the article to be filed. The device is especially applicable to the gumming of saws, circular or upright, and the sharpening of molding bits or similar tools.

The working portions are composed of a movable frame, A, which, by a ball joint, is hung on the main frame, B, so that the grinding wheel, C, has a universal movement controllable by the handle, D. Still freer motion is afforded by a second joint on the frame, A, or the latter may be so arranged that only a straight up and down or side motion can be imparted to the wheel, which is thus kept square to the work. The lever and weight shown serve to balance the frame and wheel, and so relieve the hand of the operator.

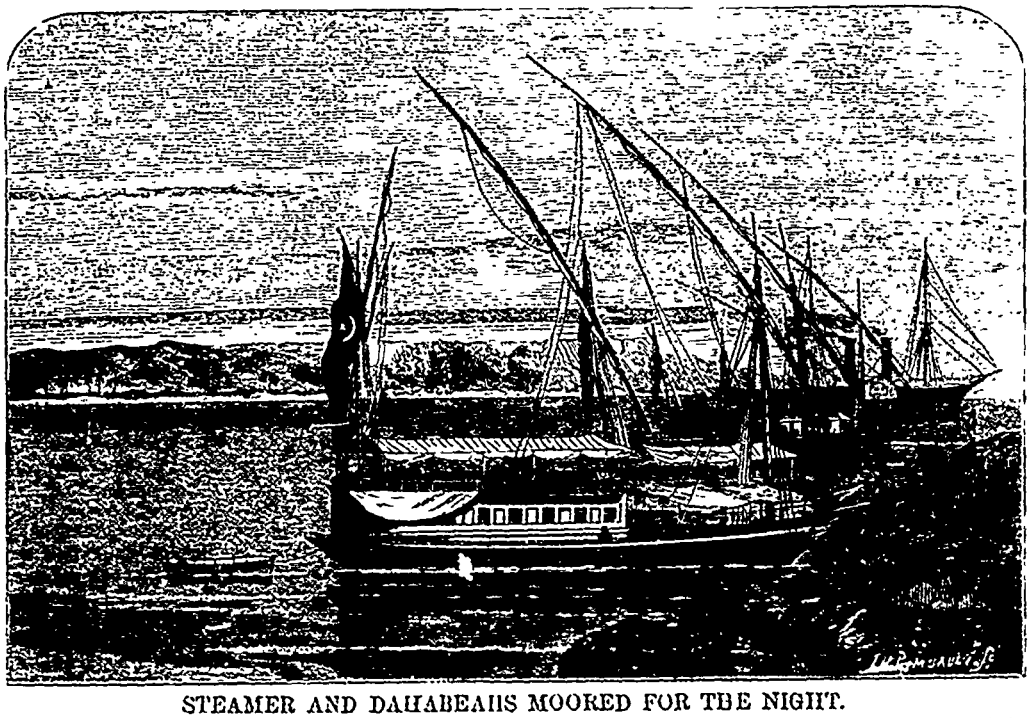
The illustrations represent the adaptations of the machine to various purposes. Fig. 1 shows it arranged for use in circular-saw mills. The apparatus is placed immediately behind the saw upon the plank, on the side where the teeth turn up, the shaft of the emery wheel being in line with the blade. The countershaft is attached to the back end of the plank in a direct line with the driving pulley of the engine. The belt or cord is placed upon the small pulley of the machine, then around the pulleys on the countershaft, turning an angle thence to the driving pulley. The operator applies the wheel, which revolves at the rate of from 1,500 to 2,000 revolutions per minute, to the saw by means of the handle.

Fig. 2 represents the machine as applied to the dressing of muley, drag, or cross-cut saws, and also to circular saws when removed from their mandrels. The appliances for holding the implements are the principal features, and are clearly depicted in the illustration. Fig. 3 shows the apparatus adapted to shaping molding bits or cutters for wood working machinery. The adjustable device for holding these tools is represented at G, in Fig. 4. It can be readily removed from the bar, H, by loosening a set screw. The arrangement shown in Fig. 2, for holding saws, may then be substituted and fastened in place in a similar manner.

Nicaragua Ship Canal.—The last United States exploring expedition was, according to the latest accounts, encamped near Virgin Bay on the Lake of Nicaragua, having gone up the San Juan river by a tedious voyage in a steamer. The river San Juan is said to be filled with rocks forming rapids in one place half a mile long. In case the San Juan is selected as the outlet on the Atlantic side, long dams will have to be built, and canals will have to be constructed. From the camp, near Virgin Bay, two exploring parties have been sent out to investigate the country, resuming the surveys at the points at which the work was left off last year. The line across the ridge between the Pacific and Lake Nicaragua having been found impracticable, another line, commencing at the Gonzales river, which empties into the lake 20 miles further south, will be surveyed at once. Still further south, another exploring party is also engaged in seeking a route to the Pacific. Until the Pacific side is thoroughly explored, operations will not be commenced on the country between the lake and the Atlantic. The chief difficulties, it is believed, will be found on the Atlantic side.



TOWING DAHABEAHS UP THE NILE.



STEAMER AND DAHABEAHS MOORED FOR THE NIGHT.

Fig 1 (Bessemer)

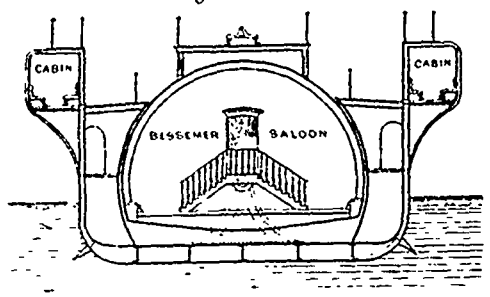


Fig 2 (Dicey)

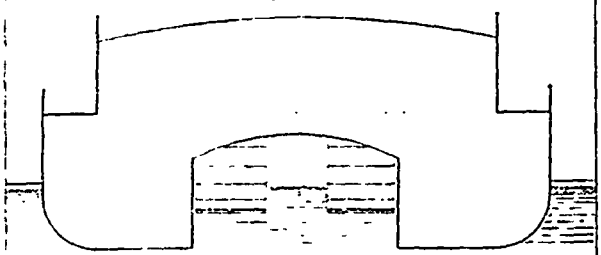
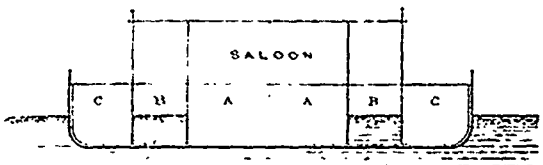


Fig 3 (Mackie)



A Main Hull Engines &c
B Waterways
C Outer Hull, Cargo &c

RIVAL STEAMSHIPS FOR THE CHANNEL PASSAGE.

The immense proportions attained by the commerce between England and France and the constantly increasing passenger traffic have led to the most extravagant proposals for tunnels bridges and other engineering works. The capital demanded for the carrying out of such works is, however, so enormous that there is little prospect of any of them being carried out in our day. More reasonable proposals are those which look to the use of the existing harbours, improved to such an extent as will make them safe and easy of access to vessels of the peculiar type it is proposed to construct.

The great drawback to all locomotion by sea is sea sickness. In our last issue we illustrated Mr Bessemer's newly invented cabin. Steamships calculated to carry the swinging cabin have been designed by Mr E J Reed, C B The following description is taken from information furnished by the designers.

"These steamships are double-ended, and are propelled by four large paddle-wheels, two at each side The ends are kept low for the purpose of reducing the motions produced by the action of the wind and of the sea, and the middl portion is made sufficiently high to enable them to steam at a high speed against the worst seas they will have to meet A rudder is fitted at each end with means for locking, so that the ship will be able to steam in either direction, and will not require to be turned round in harbour.

"Each steamer will be 350 ft. long, 45 ft. wide along the deck beam and 65 ft. wide across the paddle-boxes. She will draw 7 ft. 6 in. of water and be propelled by two pairs of engines of the collective power of 4,600 horses.

The great peculiarity of these ships is that each will contain a Bessemer saloon suspended in the middle of the ship (see fig 1). The Bessemer Saloon will form by far the finest cabin that has ever been fitted in a ship. It is supposed that the great length of the vessel, the speed at which it will be propelled, and the peculiar construction of the saloon will totally prevent sea-sickness in even the most delicate passengers.

Another plan, remarkable for its divergence from the ordinary form of ships is the double steam-ship proposed by Captain Dicey. A sketch of this type of ship is given (in section) in Fig. 2.

Imagine that an ordinary ship, 45 feet broad, and 350 feet long, is sawn right down the middle, longitudinally, that the two halves are separated by an interval of 30 feet; that a flat side is then fitted on the inner side of each half ship, and that they are then bridged together by a strong platform, which connects them rigidly There is thus a clear waterway, or rectangular canal, 30 feet wide, along the whole length of the ship, right down the middle, open at both ends and at the bottom, but covered as the top by the lower deck of the saloons. Propulsion is effected by a pair of ordinary paddle-wheels placed in this canal, right amidships—one paddle being close to each flat side, with a clear waterway ten or twelve feet wide between them.

Ships of this kind are remarkably steady in a rough sea and are admirably adapted to secure immunity from sea-sickness.

The objections are, that these vessels are unhandy, and steer badly, and that their form is ill adapted for speed. These are very serious faults, and render them unsafe vessels for the channel service. Our mail steamers frequently find it no easy matter to enter Calais harbour, or to cross Boulogne bar in safety, and they sometimes have to give up the attempt. Now every one who has experience of twin boats with flat sides, is aware that they cannot be depended on for steering in a heavy sea. Their flat sides made them answer the helm very sluggishly, and at the same time give double effect to the tendency of the waves to turn them against their helm. This is a bad quality in the open sea; it might be a fatal quality in attempting to enter or leave a gutway in a cross sea—like Boulogne harbour in a south-wester. The danger is enhanced by defective propulsion.

A twin ship has nearly twice as much wetted surface as an ordinary vessel of the same displacement.

Another proposal, which has been much before the public, is that of Mr. S. J. Mackie, C. E. This is a double-ended and flat bottomed boat, 400 feet long, 90 feet broad, and drawing 6 feet 6 inches of water. A section of it is given in Fig. 3. B and B_1 are rectangular waterways going right fore and aft, differing from that in Captain Dicey's plan by having a bottom as well as a top and sides, and in there being two of them, instead of one central canal. Mr. Mackie's mode of propulsion is by two or three pairs of paddle-wheels working in the rectangular waterways He claims, as the advantage of his design, great steadiness at sea, ample and well-distributed space for the accommodation of passengers, great longitudinal and transverse strength, and the absence of any projections which could receive injury from waves or piers. He also expects to attain high speed.

ENGINES OF THE STEAM LAUNCHES "BUJAK DERE" AND "GENERAL ADMIRAL."

We illustrate at pages 48 and 49 engines fitted to the steam launches "Bujak Dere," and "General Admiral," by Messrs. Crichton, of Abo, Finland. The "Bujak Dere," is 46ft. long, and 10ft beam She was transported on the deck of a steamer to Constantinople, for the use of the Russian Ambassador there. The "General Admiral" is nearly the same size, she was taken in pieces to Moscow, and there put together for the use of Mr. Mayne, the Commodore of the Moscow Yacht Club. Both boats are of iron, and the "Bujak Dere" is very handsome. The other is too flat, being constructed to draw very little little water. Both boats are elegantly appointed. The drawings of the engines, for which we are indebted to *The Engineer*, explain themselves. They are fitted with ejectors, injectors, and donkey pumps. They obtained the large gold medal at the Moscow Exhibition last year.

CEMENTS.—(*Concluded.*)

CEMENTS FROM CASEINE.

For glass, porcelain, stone and wood, the very best cement is made of a suitable quantity of old cheese rubbed fine and mixed with water to a thick magma, and a fourth part of pulverized lime added.

A still stronger cement for the same purpose is made by slaking 1 pound of quicklime in water, and mixing with ¾ pound pulverized lime or sandstone and 1 pound pulverized cheese. Before using, it is well to moisten the fractures or edges with warm water.

A so-called caseine waterglass is made as follows: — The caseine of skimmed milk is separated from it by the addition of acetic acid, filtered, and the acid washed out with water The pure caseine thus obtained is mixed with six times its volume of concentrated waterglass. This cement is thoroughly commendable, and well repays the trouble taken to make it.

An excellent cement for artificial meerschaum, and one that may be used to give consistency to silk goods or to coat artificial flowers and court plaster, to give more adhesiveness and firmness, is made by rubbing two to four parts of the above caseine with cold borax solution till a thick liquid is obtained that becomes clear on standing. This also renders goods waterproof.

WATERGLASS CEMENTS.

For glass, earthenware, porcelain, and all kinds of stoneware, these cements are excellent. A cement for glass and marble is prepared by rubbing together one part of fine pulverized glass and two parts of pulverized fluorspar, and then adding enough waterglass solution to give it the consistency necessary in a cement.

Waterglass mixed with hydraulic cement to a thick dough makes a good cement for the edges and joints of stone and marble slabs. It is well to mix but little at a time, as it hardens very quickly.

LIME, GYPSUM, CLAY AND CEMENT, MIXED WITH WATER, OIL OR BLOOD.

For cementing stone and for filling crevices in buildings, before they are painted, the masons use a cement made of fresh blood, slaked lime, brick dust, broken up coal ashes, hammerslag and sand in all proportions. This excellent cement hardens quickly, and offers great resistance to the action of the weather.

A lime cement for connecting water pipes, bathing tubs, etc.; a mixture of two-thirds fine brick dust, two-thirds unslaked lime, and two-thirds hammerslag, is made and stirred up with lye or hot oil to a stiff dough.

Another cement, intended to render Hessian clay retorts impenetrable, is obtained by rubbing freshly slaked lime into a concentrated solution of borax. The solution is applied with a stiff brush and allowed to dry, after which it is heated until the glazing begins to fuse.

Clay mixed with water and fresh warm blood, containing some unslaked lime, is used in Germany to close joints in stoves. The cement is applied while the stove is hot. Wood ashes, fire clay and salt mixed with water is used for the same purpose. Fat and burnt clay, in equal proportions, moulded with water into a dough, is also used.

Plaster of Paris mixed with water and a cold solution of alum is an excellent cement for stoneware. It sets slowly, but becomes as hard as stone.

IRON CEMENTS.

Their essential constituents are iron filings or borings. By the addition of some common salt or sal-ammoniac they are rapidly oxidized, and the cement being thereby increased in volume completely fills the crevices where it is put. An excellent luting or cement for the joints and crevices in iron surfaces, and for rendering tight cast-iron steam and water pipes and water tank is made of filings of cast iron. The filings are sifted to obtain those of the size of a grain of rice, and then rubbed with horse urine and one-half part salt ammoniac, well worked together, and an equal quantity of flowers of sulphur added. The mass is hammered until its gets warm, and then cold, and, finally, it begins to be brittle. In this condition it is put in the joints, and soon hardens. The surfaces where it is applied must be free from rust. Greasy and oily substances are most readily removed by rubbing with cotton dipped in benzine. The cement keeps best under water.

Another good iron cement is made by stirring 5 parts clay, 1 part salt, and 15 parts iron filings together with vinegar to a magma. It will stand heat, and is used for bellows and air pipes.

OIL CEMENTS.

An excellent oil cement for porcelain and for luting of retorts, flasks and porcelain evaporating dishes is obtained when ordinary brick dust is powdered, sifted and mixed with an equal quantity of red lead, and then rubbed, under great pressure, into old boiled linseed oil to a thick paste, which is mixed with coarse sand to the stiffness of cement. When a dish is to be covered with it, paste is applied before the sand is put in, and the sand then strewn upon it. The dish is afterward exposed to a steady heat for a long time.

For larger vessels take 6 parts litharge, 4 parts fresh-burnt pulverized lime and 2 parts white bole, and mix with cold linseed oil.

To fasten metallic letters to a smooth surface a cement is made as follows :—30 parts copal varnish, 10 parts linseed oil varnish, 6 parts crude oil of turpentine, 10 parts glue dissolved in a little warm water, and 20 parts pulverulent slaked lime. It is very pliant and soon hardens.

To unite copper and sandstone, take 3½ parts white lead, 3 parts litharge, 3 parts bole, 2 parts broken glass, and rub up with two parts linseed oil varnish.

As a polish for gravestones, basins, etc., a paint is made of 9 parts of finely sifted and burnt brick clay and 1 part litharge, mixed with a sufficent quantity of linseed oil.

For connecting cast-iron water pipes, 12 parts Roman cement, 4 parts white lead, 1 part litharge, and ½ part colophonium are pulverized and mixed; from 2½ to 3 pounds of it is triturated with old linseed oil, in which is boiled 2 ounces of colophonium.

Another for the same purpose is made of equal parts of burnt lime, Roman cement, potters' clay and clay, separately well dried, finely ground, sifted, well mixed and triturated with linseed oil. Common lead lute for stopping openings in apparatus is best made from litharge and red lead mixed with old boiled oil. In oil cases the surfaces must be clean. They stand well under water.

As lead lutings are somewhat expensive, the following is recommended :—Take 2 parts red led, 5 parts white lead, and 5 parts of the finest clay, and mix with boiled linseed oil.

A good oil cement for wood, especially for antique carvings, is made of 1 part pulverized slaked lime and 2 parts rye flour, mixed with linseed oil varnish. It takes any desired colour and polish.

To make water holders tight we may use pulverized slaked lime and cod-liver oil.

A cement to make chemical apparatus tight can be prepared from oil cake or pressed almond cake rubbed with water.

MISCELLANEOUS CEMENTS, ETC.

Furniture polish :—Moisten 120 parts beeswax with oil of turpentine, and add 7-5 parts finally pulverized resin, and enough aniline red to give the desired mahogany colour.

Oil cement :—100 parts red lead, 250 parts white lead, 200 parts pipe clay; mixed with boiled oil.

Water cement :—100 parts slaked lime, 190 parts brick dust, 160 parts sand, 50 parts blacksmiths' dross, 50 parts powdered lime; mix with water.

Another :—600 parts iron filings, 100 parts ignited sand, 100 parts powdered slaked lime; mix with water.

Iron and blood cement :—100 parts pulverized lime, triturated with bullock's blood, 280 parts cement, and from 5 to 10 parts iron filings.—*Journal of Applied Chemistry.*

It has been noticed in Kansas that the buffalo grass of the prairies gradually disappears and is replaced by other grasses, as the country becomes the home of civilized men.

THE VENTILATION OF SMALL HOUSES.

We condense the following from a paper read by Dr. J. Baker Edwards, at the rooms of the Natural History Society in this city.

At the last meeting I dwelt with much emphasis on the fact that the exhalations from the skin and from the lungs of human beings are not justly estimated by the mere chemical products of combustion (*i. e.*, by the amount of oxygen consumed and by the amount of carbonic acid and steam produced.) Such an estimate is only one element in the general calculation.

Any one who has attended a crowded police court for a few hours must realize the fact that the air becomes laden with "dirty smells" arising from organic matters given off from the bodies and clothing of the multitude, and which may more properly be regarded as *vapours* than as gases. These condense continually in woollen clothing, drapery, and bed-clothing, and the first mode of ventilation to which I would call attention, and which is worth the notice of every householder, is the great value of periodically turning out every article of clothing and of drapery to get a thorough ventilation in the fresh air.

The practice, which is only occasionally observed, of putting blankets, coats, &c., out of the window, especially in the sun's rays, is of inestimable value, and ought to be universal. The relief thus afforded to invalids confined to one room I have myself experienced, and been grateful for; and the value of such disinfection, as well as the process of heating to 212° the garments of patients recovering from infectious disorders, should not be lost sight of.

A second mode of indirect ventilation is by the frequent lime-washing of the basement premises of small houses. Lime and carbolic acid have each great purifying powers, and when combined and used every month or so, will purify most effectually air which is otherwise musty, fusty and unwholesome. The cellars of the smaller class of houses are frequently damp and unhealthy. A plentiful use of the lime-wash is the best remedy for this. It is bad economy to devote the basement of a small house to the rats; it should be clean and habitable.

3rdly. The use of carbolic soap in scrubbing floors is highly to be recommended. Moreover, during the summer months, the house will be much sweeter and cleaner if curtains and carpets are rolled up and put away. In this climate they are worse than useless in summer, and are only harbourers of dust and insects.

4thly. The stovepipe holes are the proper apertures for ventilation during summer. It is an absurd practice to stop them up. They may be made available for the very best means of ventilation, and the mode I now exhibit, and for which I have made application for a patent, is, I think, a cheap and perfect ventilation, but if this is too dear at a dollar you may nail a piece of perforated zinc over your stove-pipe hole and obtain a great deal of comfort therefrom during the summer.

Furthermore, if you have good clean lime-washed basements and kitchens, you can keep your house much cooler and less oppressive if you keep your double windows on during the summer, and only open them at night. The coating of air between the windows arrests the heat rays of the sun, and keeps the house cool. For winter the chief object in a small house is to equalize the temperature so that there shall be no chill in passing from one room to another, or from a room to the stair-case. The hall stove usually accomplishes this; it is desirable that water should always be kept evaporating upon it to moisten the heated air. Comfort will be best secured by pasting paper round every double window and nailing list round every door to fill up all chinks and crannies, let all the fresh air come up from the basement, and ventilate by the chimnies or by the attic. In rooms which are apt to be over-heated at night from the use of gas, or stove heat, the best contrivance is a ventilator such as I have described, placed in a T pipe in place of the elbow of the stove. This may be regulated if the stove be burning, by a damper. A similar use of the ventilator in a kitchen stove would carry off all the smell of cooking which now generally ascends the staircase of small houses, and is not always agreeable.

Simple attention to these hints will afford tenants the comfort of a good ventilation at a very small expense, and if these or similar precautions be neglected by them, I fear landlords will in vain seek for any perfect system of automatic ventilation. To obtain a good draught from the chimney top without back smoke, I recommend the form of chimney now exhibited, which should be made in galvanized iron, and which will under almost all circumstances insure an ascending current of air sufficient to ventilate several apartments. It consists of three T pipes put together, and is both cheap and efficient. Lastly, I call your attention to a simple form of ventilation for hanging windows, consisting of an oval tube of perforated zinc, containing a hanging curtain for the exclusion of dust, which is so great a nuisance and a foe to ventilation during some months in the year in this city.

One of the forms in which this useful contrivance is now offered to the public is represented in the accompanying illustration.

Its object is ECONOMY, EFFICIENCY, and READINESS OF APPLICATION. It is adapted to things *as they are*; and furnishes a cheap and ready improvement thereon, which may be at once adopted with advantage in every household which is provided with "a stove-pipe hole," and where is the house in Canada without one?

The simple principle of the hanging curtain, placed between two perforated surfaces, ensures a current of air, inwards to the chimney, whenever the atmosphere in an apartment becomes heated and before it becomes oppressive. Cold air falling as a down draught in the chimney is on the other hand distributed in fine streams by the perforated back, and closes the curtain. Soot and smoke are thus prevented from entering the chamber, and the ventilator can only act, and will act constantly, as a vent for overheated air and the products of its combustion. By its constant action an oppressive condition of the air is effectually prevented.

The principle is adapted to much larger application, but the above is the every day—and every house—convenience which will meet the requirements and the pockets of the multitude of Canadian householders.

NEW MAGNETO-ELECTRIC MACHINE.—We have had an opportunity of witnessing the trial of a magneto-electric machine, which appears to be likely to give satisfactory results. The machine in question was made in France, but Messrs. Whieldon and Clarke, of Westminster Bridge-road, at whose works it now stands, are engaged in building a larger machine on the same principle. It will be remembered that in Wilde's machine the large electro-magnets were excited by an induced current derived from a row of small steel magnets, between which worked a Siemens armature. The present machine dispenses with the permanent magnets, the induced currents being made to circulate round the soft iron magnets which produced them. To Siemens and Wheatstone is due the proposal that such a machine should be constructed. Iron has usually some traces of permanent magnetism, especially if it has once been magnetised, and this magnetism is sufficient to induce feeble currents in a revolving armature. These currents are sent round the iron magnet, thus increasing its magnetism. Ladd also constructed a machine which embodied the principle. By the rotation of one Siemens armature, he obtained an induced current from a soft iron magnet, which he in turn further excited by the induced current. A second Siemens armature then collected the induced current from the other end of the magnet for use. The machine—at the trial of which we were present—consists of a row of modified horseshoe electro-magnets, surmounted by another row of inverted similar electro-magnets, the poles consequently being face to face, but of course separated by a space. In the central space there revolves a drum carrying the armatures, one armature being supplied to every pair of magnets. The armatures are simply rings or hoops of soft iron, surrounded by a number of helices containing wire. The ends of the wires of each helix are brought down to the shaft of the drum, each insulated from the other, and thence the currents are collected in the usual way. Pieces of iron attached to the poles of the magnets partly embrace without touching the armatures. In the machine in question there were three armatures, one of which was sufficient to excite all the magnets by means of the induced currents, as above described, and the other two were sufficient to provide a powerful current, which gave an excellent light in one of Mr. Ladd's lamps. The power required to drive the machine was about 3½ or 4 horse.—*Engineer.*

Fig. 1

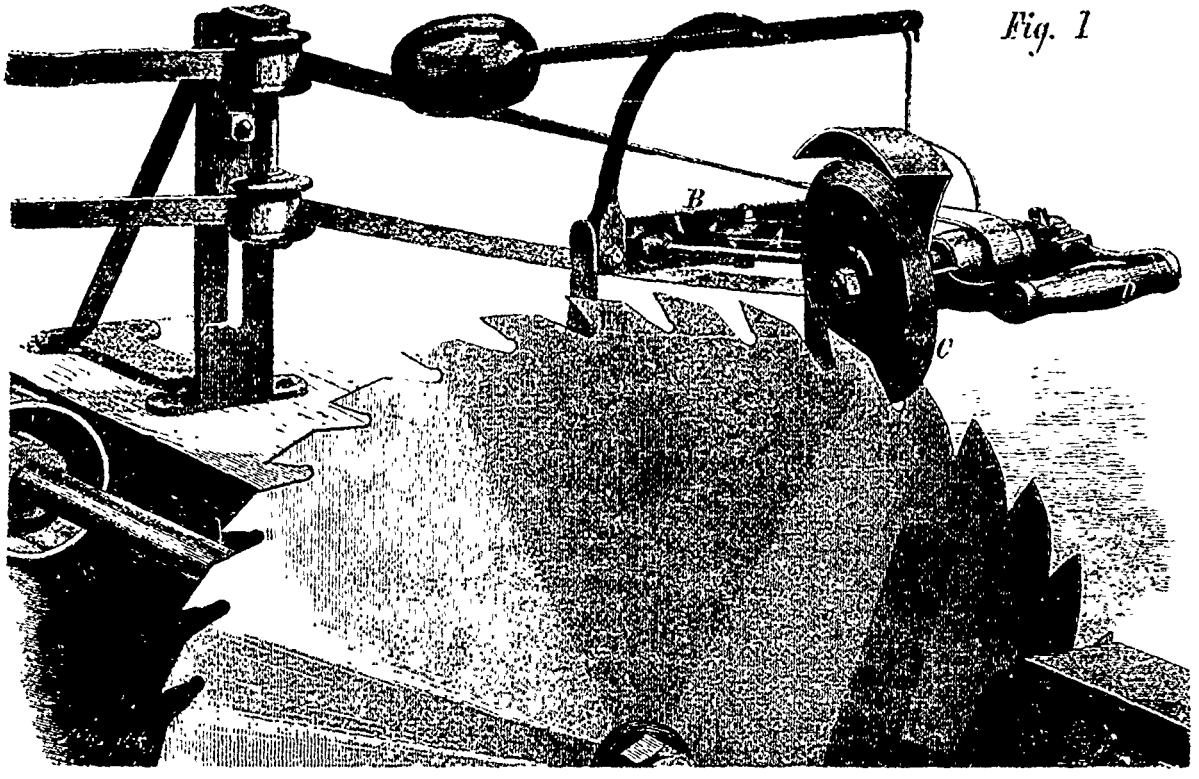


Fig. 2

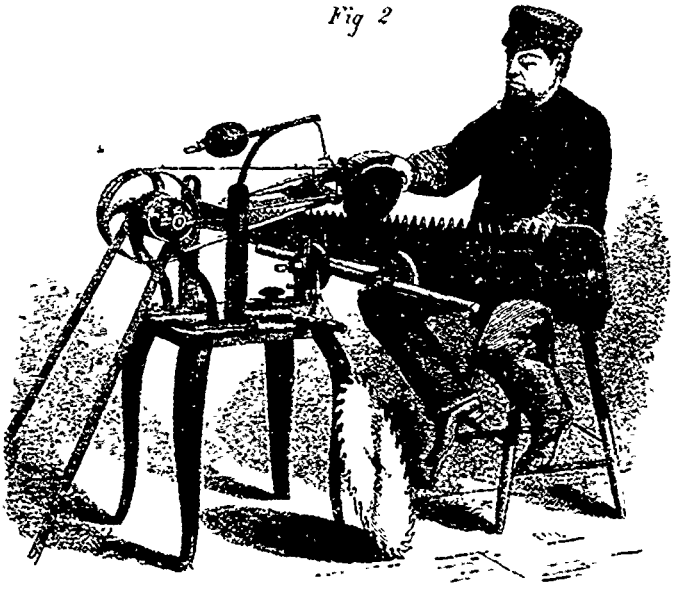


Fig. 3

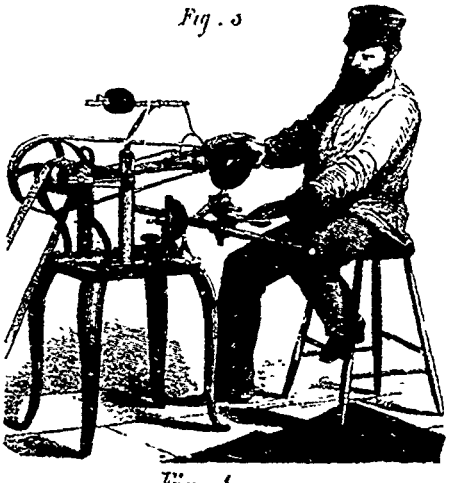
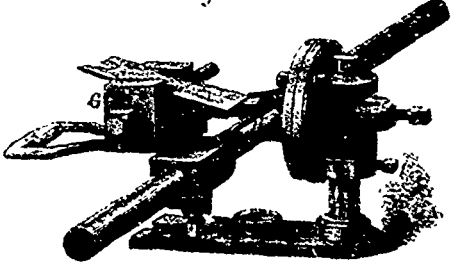
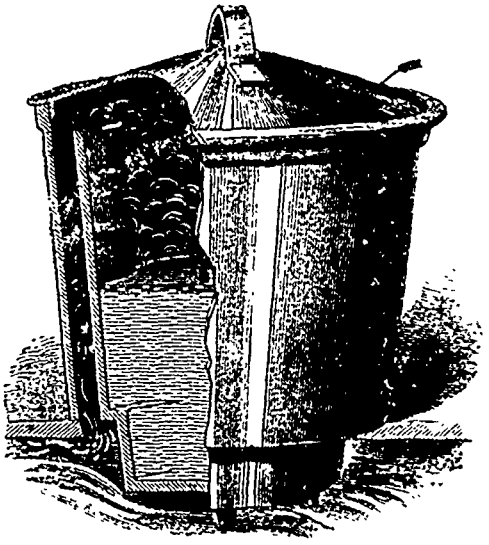


Fig. 4

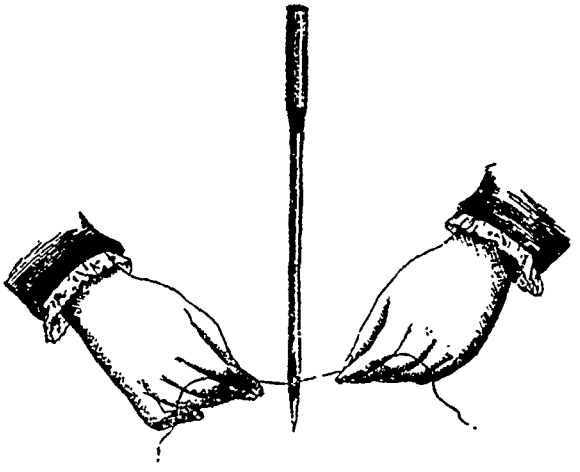


FLEXIBLE SAW AND TOOTH FILING APPARATUS.

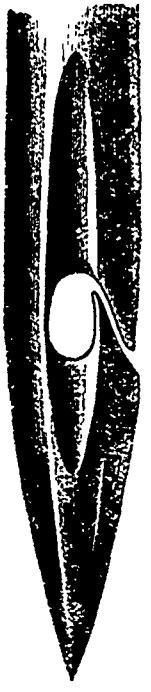
A PAGE OF SUNDRIES.



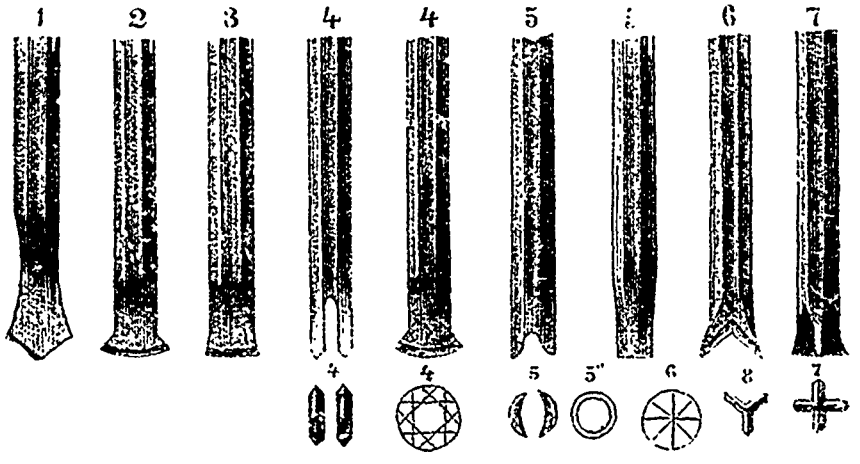
CULINARY BOILER.



THREADING THE SUPLEE NEEDLE.



ENLARGED SUPLEE NEEDLE.



DIFFERENT FORMS OF DRILL POINTS.

WIRING THE WORK.

Mr. Humphrey Turner, of the Cardigan Steel and Wire Mills, has patented an invention of his for applying wire to building and other purposes The invention consists in the application of wire, steel cut in strips, or iron rolled to particular patterns, for walls, ceilings, roofs, and floors of buildings, it is also applicable for large cisterns, water-tanks, brewers' squares, and other vessels. In the erection of a house it is thus applied. The foundation is laid and brought up 12 in or 18 in. above the ground. Iron, cast metal standards, and straining posts are fixed at certain distances To these wire is attached from ¼ in. to 2 in. apart, and is strained from the posts through holes in the standards Panels and proper stay posts are then fixed inside the wire at proper distances, according to the thickness of the walls required. The walls are formed by means of a concrete, and while this is being laid on inside, the plasterer may carry on his work on the outside, by laying on a better material consisting of cement and sharp sand. The walls being brought up to the height required for the first floor, iron plates are laid upon them with holes for the wire to pass through An iron or cast metal beam is then thrown across the centre of the rooms from wall to wall, and when the walls are complete, the wire is strained upon them through the plates; and in this way the whole of the building is securely tied. Mr. Turner claims that the wires will supersede the use of floor joists of wood, and will form beds for concrete floors. They will also answer on the under side as laths for the plastered ceilings, and the plastering may be carried on at the same time as the laying of the floors in concrete. The next floor is completed in a similar manner. When the required height is reached, the plates and beams are laid so as to give a proper fall for the water, and a wall is carried on the top of the plates for 3 ft. or 4 ft. The wires are then strained across the whole of the top and on these concrete is laid, thus doing away with rafters and slates. Mr. Turner contends that the only wood required in the construction of a dwelling-house will be for doors, cupboards, window sashes, and panes. The stairs may be of concrete or wood. Houses thus built would be almost fire-proof, and no vermin could get a lodgment in the floor and skirting boards, because they would be made of solid concrete.—*Builder.*

MISCELLANEA.

Florida is shipping alligator hides to Europe.

The Japanese coast is to be lighted with mineral oil.

Peat was being used in Fond du Lac, Wisconsin, more extensively last winter than ever before, both in offices, residences, and for making steam. The results are said to be generally satisfactory.

The International Railroad will cross the Rio Grande at Toledo, and one branch of the Missouri, Kansas, and Texas road will cross it a little above Rio Grande City, near the mouth of San Juan River.

An association for the promotion of exploration in Africa has been formed at Berlin under the name of the African Society. Dr. Schweinfurth, the botanist, and Dr Peterman, the geographer, are among its founders.

The Vienna Exhibition.—The *Tageblatt* states that Austria has come to an understanding with the other Governments that no decorations are to be given in connection with the Vienna Exhibition.

Ebony weighs eighty-three pounds to the cubic foot; *lignum vitæ*, the same; hickory, fifty-two pounds; birch, forty-five pounds; beech, forty; yellow pine, thirty-eight; white pine, twenty-five; cork, fifteen, and water sixty-two.

In Egypt mummies have been found with teeth filled with gold, and in Quito a skeleton has been discovered with false teeth secured to the cheek bone by gold wire. In the museum at Naples, among some of the surgical instruments discovered at Pompeii, there is a facsimile of Sims' speculum. In the ruins of Nineveh, Layard found several magnifying glasses.

Progress of the Hoosac Tunnel in March, 1873 —Heading advanced from east end westward, 155 feet; from west eastward, 162 feet; total extension of headings during March, 317 feet. Total lengths opened to April 1st, 22,793 feet, remaining to be opened, 2,238 feet, being 402 feet less than half a mile.

The Central Pacific Railroad Company are constructing wharf and warehouse facilities on an extensive scale at Knight's Landing, in Yolo county, California, for the accommodation of the grain and other traffic from the Upper Sacramento river and valley.

Prof. Rankine says the weight of rails per yard in length should equal fifteen times the greatest load on the locomotive drivers in tons. Perdonet, in France, takes twelve instead of fifteen. The United States Philadelphia and Reading Railway Company, on rails made with great care by the company, prefer not to exceed 4 tons on a 64 lb. rail.

It is a well known fact that iodine, when dissolved in liquids containing tannin, cannot be detected by the ordinary starch test. Tessier has found, however, that on adding to such a solution a few drops of a neutral solution of chloride of iron, the iodine is at once set free, and can be detected by covering the test glass with a watch glass or an inverted funnel, coated on the inside with a starch paste.

The total value of the *Atlantic* steamship was probably over £100,000. She was of 3, 535 tons, and 600-horse power, and was built at Belfast in 1870 for the Oceanic Steam Navigation Company (the White Star line), of Messrs. Ismay, Imrie, and Co., of Liverpool. Her number of saloon passengers was 33, and of steerage 760, while the crew amounted to 136.

At a recent meeting of the Frankfort Polytechnic Association, Professor Boettger exhibited a novel kind of ink, which is admirably adapted to take on journeys and exploring expeditions. White blotting paper is saturated with aniline black and several sheets are pasted to form a thin pad. When wanted for use, a small piece is torn off and covered with a little water. The black liquid which dissolves out is a good writing ink. A square inch of the paper will give enough ink to last for a considerable writing, and a few pads would be all that an exploring party need carry with them. As water is always available, the ink is readily made.

The New York *Bazaar* says:—It was a pleasant story, but not exactly true, that Professor Tyndall proposed to give all the money he made here for the foundation of something scientific. He has made a handsome sum, though not so much as is generally supposed. The agents and such have taken the lion's share. In Philadelphia he got at the rate of $500 out of $1,500 profit, in Washington $2,000 out of $5,000; in Boston he cleared $3,000. But he made the most in this city and Brooklyn, where everything after the bare expenses went to him. In these two cities he has "salted" about $13,000. After paying all expenses he will take home with him about $15,000, which on the whole, is what printers call a "fat take" for three months' work. He expresses himself as delighted with everything and everybody in this broad Western expanse.

Palæontology.—On the estate of Baron Busche Streithorst, of Thale, in the Hanoverian Harz Mountains, a very curious throve has been made in the shape of a well-preserved mammoth skeleton, whether of the megatherium or dinotherium description is not mentioned. This antediluvian relic measures 15 feet in length and 9 feet in height, and includes four teeth weighing 7lbs. each, and two powerful bent tusks 5 feet long, in such a state of preservation that they might compete with ivory powder for the manufacture of jelly. The hip and shoulder sockets measure from 7 to 8 inches diameter The monster was discoverered in an old clay and marl pit, five feet below the present level, or from 80 to 90 feet below the original one.

The size of the sun may thus be comparatively shown:—If the earth were represented by a ball 2½ in. in diameter, the sun would require a ball of 18ft. in diameter. If the earth were placed at the centre of the sun, the moon would be so far inside the sun's surface that there would be almost room for another moon beyond, the distance of the moon from the earth being 240,000 miles, and of the surface of the sun from its centre 430,000 miles. In bulk, the sun is a million and a-quarter times larger than the earth; that is, it would take that number of earths rolled into one to make up the bulk of the sun. It would not take that number to make up the weight of the sun, for the sun is lighter, bushel for bushel, than the earth. It weighs about 325,000 times as much as the earth. With that enormous mass, the force of gravity must be twenty-eight times as great as on the surface of the earth; so that the weight of an ordinarily heavy man on its surface would be about two tons.

THE ROTUNDA FOR THE VIENNA EXHIBITION.

We have already given some particulars and an illustration of the building erected for the Vienna Exhibition. Let us add a few statements made by the correspondent of the *Journal of the Franklin Institute*:—

Accurately stated, the exterior diameter of the Rotunda is 107·83 metres, and its height 84·1 metres. A rounded roof, supported upon thirty-one iron columns, 24·35 metres high, rises, with an angle of 31°, to a height of 48·2 metres, and is terminated by a central ring of 30.9 metres diameter. The exterior of the roof is covered smoothly with sheet metal, and, viewed from below, has the appearance of a smooth truncated cone. Upon this conical roof is placed a so-called observatory, composed, like the rest of the structure, entirely of iron, the outer diameter of which is 32·4 metres, and the height 10 metres. Upon this, finally, there is placed another building, 8 metres in diameter, and 18·5 metres high, which terminates in a crown, whose highest point is 84·1 metres above the flooring below.

At a height of 23 metres in the interior of the Rotunda there is placed a gallery, directly against the pillars, having a breadth of 142 metres. This may be reached by two stairways, on opposite sides of the Rotunda, or by two elevators, introduced for the purpose.

The entire space covered by the Rotunda measures 338·8 metres in circumference, and the surface covered by the roof measures 9,405 square metres, the interior circumference is 319 6 metres, and the space available for the purposes of the Exhibition and accommodation of the visitors is 8,129 square metres.

To give an idea of the forces operating upon the various portions of this structure, a few data are attached.

The vertical pressure upon one of the iron columns of the Rotunda=109 tons. Pressure on the lower portions of the radial rafters=211 tons; horizontal strain on same=181 tons Tangential strain on the lower roof ring=863 tons. Pressure on the upper ring, upon which the observatory rests=217 tons. The total weight of the structure of the Rotunda may be stated in round numbers at 80,000 hundred-weight (Zoll centner), or about 4,000 tons. The pillars rest upon *béton* foundations, which were prepared for this purpose as early as October 30th, 1871.

Lake Superior Mines.—The statement has frequently been made that the shipments of iron ore from the Lake Superior mines this year will reach enormous figures. According to estimates made last fall 800,000 tons were to be shipped from Escanaba alone, and adding the probable shipments from Marquette and L'Anse, and possibly from Ashland, the grand total of shipments from the Lake Superior mines this year were to reach nearly, if not quite, 1,500,000 tons, against about 900,000 tons last year. It is now said, however, that present prospects do not warrant any such conclusion. The iron markets are falling, and it is expected that the demand for iron must decrease, and prices decline, being far in advance of those the iron manufacturers are willing to pay. Of the whole prospective product there have been but about 300,000 tons entered upon as sold at "the market price." In order to get out anything like the amount of ore estimated last fall to be shipped this year, a heavy force in the mines would be required; but mines in work are run very light, the owners not being willing to take the risks of the market. From this it is inferred that the estimated product for this year is too high, and that in reality it will not be very much in excess of last year.

RAILWAY MATTERS.

Car Wheels and Axles.—It is stated that 104 patents have been granted in this country upon car axles and wheels having the idea in view, of making car wheels to run independently, as in turning a curve.

Sutro Tunnel.—The Territorial *Enterprise* of the 11th says: It was yesterday reported that Adolph Sutro had succeeded in negotiating in Europe a loan of $3,000,000 for the Sutro Tunnel Company. What foundations there may be for the report we are unable to say.

The railroad tunnel at Baltimore, which is to unite the roads on the north and south sides of the city, is to be completed before the end of June, and, until the completion of the Broadway Underground Railway in New York, will form the largest underground railroad possessed by any city in America.

Automatic Railway Couplings.—In reference to the premiums proposed to be offered by the Association of German Railway Companies for the best system of Automatic Couplings for Railway Carriages, we understand that the full details and arrangements are not as yet definitively decided upon; but in the course of a few weeks the particulars will be made known by the *Geschaftsfuhrdeen Direction Deutscher Esenbahn Verwaltungen* at Berlin.

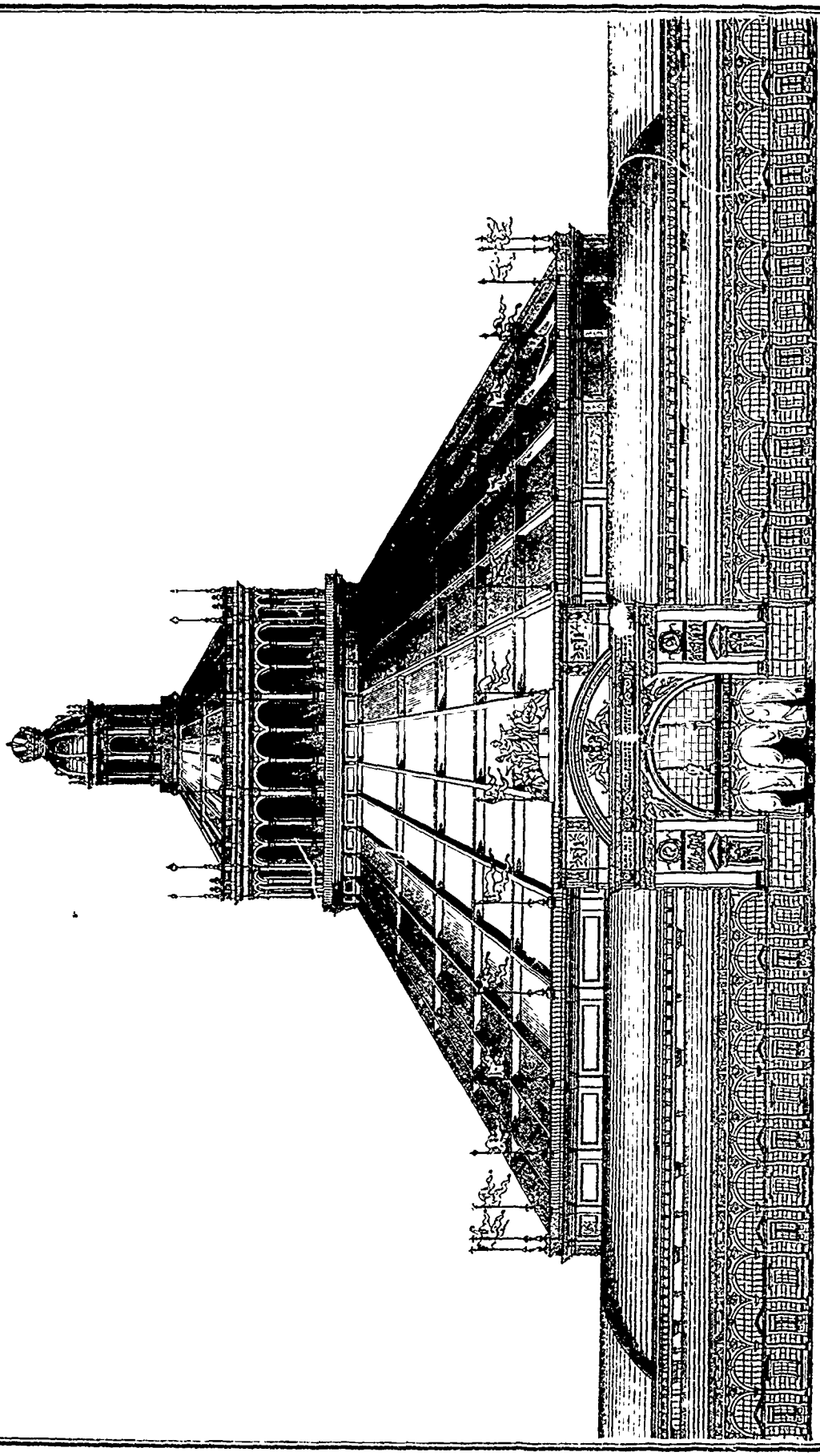
Fireless Locomotive.—Dr. Lamm's "fireless locomotive" has been introduced to the inhabitants of Brooklyn. The machine consists of a thickly-clothed and strong reservoir and a small steam-engine. Into the reservoir, water, at a very high temperature, is forced from a stationary boiler, and sufficient steam is thus obtained to propel an ordinary car at twelve miles an hour. During the first half of the journey this pressure fell to 90lbs., but decreased less rapidly in the second half, when the gauge showed 65lbs. at the termination of the six miles. The journey appears to be continuous.

The importance of railroads in the development of the resources of the American States may be estimated from the fact that the cost of transporting Indian corn or wheat over an ordinary highway is about twenty cents per ton per mile, while those cereals may be moved upon railroads at one and one-fourth per cent. per mile.

It is expected that in a few years Germany will equal, if not surpass, England in her resources. She is now constructing a new network of strategical railway, which will extend in extent four thousand kilometres. The backward state of France has occasioned some natural annoyance, and the French press urge the importance of making some vigorous efforts to make up for past deficiencies. They point out that the General Councils have given a veritable *pronunciamento* in favour of multiplying the railways. If she cannot do better, they trust that France will prove sufficiently ambitious to raise herself to the level of Switzerland and Denmark in the statistics of railways.

Constantinople Tramways.—The report of the directors of the Constantinople Tramways Company for 1872, states that the company's four original lines of tramways were in full work eight months before the period stipulated. There are 16,000 metres of tramway, and 5,000 metres of omnibus lines at present worked by the company, or rather over 13 miles in all. These lines were served last year by 64 vehicles. The number of passengers conveyed last year was 5,035,042, who paid 6,515,597 piastres. The present number of passengers ranges from 125,000 to 130,000 per week, and this number, it is expected, will increase when the fine season sets in to from 180,000 to 200,000. The company's staff consists of 431 persons, exclusive of fore-runners. The return realised upon the shares last year was at the rate of 6 per cent. per annum.

A Reporter of the Hartford, U.S., *Daily Times*, thus describes Smith's vacuum brake, which is in use on the road between that city and New Haven: "The apparatus is simply an air ejector placed in the cab of the locomotive, which is connected by pipes and hose to a flexible air chamber, similar in construction to an accordion, and this is connected to the brake rod underneath each car. The engineer, by opening a steam valve, produces a vacuum in the ejector, causing the expulsion of air from the flexible air chamber, bringing the heads of the air chamber together, which movement contracts or shortens the brake rod and applies the brake. The moment the engineer opens the air valve, the pressure is instantaneously relieved The pressure is applied externally and gradually, and is applied to the rear car first. This obviates the breaking of couplings and hose; and the jerking, unpleasant motion of the cars that accompanies the usual method of applying the brakes is done away with. Another advantage is, that when the vacuum is produced it draws the hose coupling and joints together, while other power brakes, operated by inward pressure, strain and open the couplings and joints.



VIENNA UNIVERSAL EXHIBITION; CENTRAL ROTUNDA.