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CANADIAN MAGAZINE OF Science and the Industrial Arts.

Patent Office Record.

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TECHNICAL EDUCATION OF THE ARTISAN CLASS.

It is only recently that Canada has become to any considerable extent a manufacturing country, and consequently the value of thechnical education in matters connected with manufacturing is little understood or appreciated.

It is, however, a matter of very great importance to the well-being of the whole country, that as our manufacturing industries increase, practical scientific instruction should be provided for those who are to be employed in them.

This cannot be accomplished by the existing system of public instruction, excellent as it undoubtedly is for general purposes. It is a special work, and will require the application of special means for its accomplishment.

A system of instruction, intended to meet this want, has been in force in the Mother Country for a number of years, which seems to work very satisfactorily, and might, with some slight modifications, be adopted with great advantage here.

The prinipal features of that system may be thus described: There is a department of the British Government known as the Science and Arts Department, organized for the express purpose of encouraging and promoting instruction in Science and Art, both theoretical and practical. In cities, towns, and other districts, when considered desirable, classes are formed under the direction and control of the Science and Art Departmen acting through local committees.

The duties of these committees are to organize the schools, engage teachers, and generally superintend the management of the schools; to pay the salaries of the teachers, rent of rooms, and all other incidental expenses connected with the organization of these schools. A sum of money is voted annually by Parliament, and distributed among the schools according to the results as determined by the examinations at the close of the season.

The Schools are opened in November and closed about the end of March, tha classes meeting in the evening from seven to nine o'clock. The teachers are usually selected from men who are actively engaged in practical scientific employments, such as those in which instruction is to be given. They are generally men occupying prominent positions among the workmen, such as managers, draughtsmen, foremen, or even workmen who have obtained certificates of qualification to teach, thus combining all the advantages of practical and theoretical instruction in the same teachers.

A staff of Government Inspectors are employed to visit the schools to see that they are properly conducted and working to advantage. They inspect the work done, both as to quantity and quality, and send their reports to the Department in London.

At the close of the season the registers of attendance, etc., are all returned to London, and the examinations begin. They are of three grades—Elementary, Advanced, and Honours, and each grade has two classes—1st. and 2nd.

The papers are examined by professors appointed by the Government, and they report the result of the examinations to the Department in London.

The local committee then make a claim upon the appropriation, or money voted by Parliament, for a sum corresponding to the results of the examinations, a first-class allowance being £2, a certificate, and a Queen's prize, while a second-class secures £1 and a certificate.

The moneys so received are applied in payment of teachers' salaries, and other incidental expenses connected with the organization and maintenance of these schools.

These payments constitute the whole of the Government assistance to the Committees, and the certificates are the only compensation to the students, generally.

Scholarships for general excellence are sometimes granted to students who show exceptional ability, with a view to assisting their further progress toward honourable distinction. These classes do not either detract from, or come into collision with other educational institutions, in any way whatever; they rather assist, and go hand in hand with them, many students of colleges gladly availing themselves of the opportunity of attending these evening classes, and thus securing a practical knowledge of the subjects taught that can otherwise only be obtained in the workshop.

Such classes would be of very great value to the agricultural class in this country, seeing that the programme includes the science of agriculture along with the other sciences and arts.

There is reason to believe that the Educational Departments are not indifferent to these matters. Successful manufacturing requires skilled workmen, and the sooner such classes are engaged here the better. Who will move first?

The importance of this subject should recommend it to the earnest consideration of both the Local and Dominion Governments.

We shall be glad to receive communications from parties who may feel interested in these matters, to learn their views, to give further information if desired, and to encourage and promote such organizations by any means in our power.

GAS AND ELECTRIC LIGHTING.

The subject of supplying the maximum illuminating power at the minimum of cost is an important one for large corporations, companies and the general public.

Gas is beyond doubt the most economical, but the difference in cost between the two systems of lighting is not such as to preclude the rapid advancement and application of Electric Lighting, the numerous and convenient advantages of the latter combined with its novelty and popularity give at once an important standing.

Some of the best towns and cities in the Dominion are more or less lit up with it both by private and public contract.

The Gas Companies are trying to minnimise as much as possible the effects of this competition by reducing the price of gas and by supplying better burners and lamps, etc. than hitherto.

THE BRITISH NAVY.

Quite a sensation was caused lately in England by the circulation of reports from supposed well informed circles regarding the weakness of the English Navy as compared with other Powers. The subject had been become a burning one, and among the first political questions of the day.

It is quite evident that Englands supremacy is being gradually approached, and although she is still mistress of the sea, her superiority is not such as to enable her to successfully fullfil her large and ever increasing obligations.

The subject is being greatly agitated at present and it is gratifying to know that the Imperial Government are determined to rectify matters as speedily as possible.

We intend later on to take up this matter and give our readers full statistics and both facts and figures.

THE GREAT EASTERN.

It appeas that this once famous and monster steamship is being thoroughly overhauled, and got ready for another passage across the Atlantic. It is undergoing the necessary repairs at Milford Haven, and will take some months before being ready for sea. It will be used for carrying exhibits from England to the great Exhibition at New Orleans; and when there, will be utilised and fitted up as a floating Hotel moored in the great Mississippi River.

The idea, although not altogether novel, is a good one, and we trust it will prove a success both to the public who may patronize it during the Exhibition and to its owners.

THE AUSTRALIAN MAIL SERVICE.

Considerable dissatisfaction has arisen lately regarding the time taken to deliver the mails from London, *via*. San Francisco, which ranges from 37 to 39 days. It is asserted that the service could be considerably expedited. We in Canada are highly favoured, compared with our Australian brethren in this respect, and still we complain occasionally.

THE WESTINGHOUSE AIP BRAKE.

The Westinghouse air brake, so extensively used both here and abroad, has been brought into special prominence in England lately, where the public are demanding that it shall be applied on all railways, to the exclusion of vacuum and other brakes, which have proved to be less efficient. Since the accident at Penistone, on the Manchester, Sheffield and Lincolnshire railway, last July, in which over 20 persons were killed and as many more injured, the engineering press has been incessant in urging that the Westinghouse or an equally reliable auttomatic brake be used on all the English railways. The conclusions reached as to the efficiency of many of the railway brakes now in use in England have received further confirmation from the locomotive engineers, who, before all others, are interested to the extent of life and limb in having the best brake under their control. Not long ago one of their number sent a letter to the London *Times*, in which he expressed himself very strongly in favor of the Westinghouse brake, saying that with none of the other systems did he feel the same security, and when using them was always prepared to apply the hand brakes. The prominence which was given to this letter in many of the engineering journals called forth a second letter from a similar source, in which the writer corroborated all the statements of his fellow-engineer. Such strong evidence, upheld by both theory and practice, and bearing common testimony to a danger and the means of avoiding it, would undoubtedly before this have resulted in the desired change had it not been that certain parties largely interested in English railways, as well as in a particular brake, have put forth every endeavour—even, it is said to the extent of tampering with the accident returns—for the purpose of detracting from the merits of the Westinghouse to the advantage of some other brake and their own predilections. Seemingly as a proof of the efficiency of the Westinghouse brake there occurred in England some weeks ago a railroad accident closely resembling the one at Penistone in everything except loss of life, the escape in the second instance having been due to the excellent working of the Westinghouse brake. Despite all opposition, therefore, it is highly probable the demands of the public will soon be acceded to.

A new method of sheathing ships has just been tried at Swansea, Wales. The copper or yellow metal plates are attached to the iron by means of an adhesive preparation of rubber. An intermediate rubber sheet insulates the two metals. Before applying, the bottom of the ship is thoroughly cleaned. The results of the trial are awaited with great interest, as the method offers great facility in repairs.

CHIMNEY CONSTRUCTION.

The important part fulfilled by a chimney renders it especially desirable that it should be of ample size, well-proportioned and properly built. The function of a chimney is primarily to furnish a sufficient supply of oxygen to the fuel to effect its combustion. The first point to be considered is stability. This is sometimes a matter of some difficulty, but if proper care is exercised the condition may always be attained. A good foundation is the first requisite. Most failures of chimneys have occurred through insecure foundations, which have settled unequally. Where practicable, the load on a chimney foundation should not exceed 2 tons per square foot in compact sand, gravel or loam. Where a solid rock bottom is available for foundation, the load may be greatly increased. If the rock is sloping, all unsound portions should be removed, and the face dressed to a series of horizontal steps, so that there shall be no tendency to slide after the structure is finished.

One very strong reason for making a chimney foundation as broad as possible is the fact that in high winds the pressure on the foundation may be largely concentrated on the leeward side of the shaft so that in some localities where the prevailing winds are quite strong their effect alone may be sufficient to cause unequal settling unless precautions are taken that the foundation is amply large. But in ordinary cases, with short stacks, no trouble need be experienced, for if the base of the foundation be only slightly larger than the shaft it will be sufficiently firm. In the case of large chimneys, however, too great caution cannot be observed. Careful calculations should be made, and the design of the stack so modified, if necessary, that all doubt regarding stability may be removed. All boiler chimneys of any considerable size should consist of an outer stack of sufficient strength to give stability to the structure, and an inner stack or core independent of the outer one. This core is by many engineers extended up to a height of 50 or 60 feet from the base of the chimney, but the better practice is to run it up the whole height of the chimney; it may be stopped off, say, a couple of feet below the top, as shown in Fig. 1, and the outer shell contracted to the area of the core, as shown in the engravings; but the better way is to run it up to about 9 or 12 inches of the top, and *not* contract the outer shell. But under no circumstances should the core at its upper end be built into or connected with the outer stack. This has been done in several instances by bricklayers, and the result has been the expansion of the inner core, which lifted the top of the outer stack squarely up and cracked the brickwork.

In the accompanying engravings, Fig. 2 shows an external and Fig. 3 a sectional elevation of a chimney such as we would recommend for small batteries of boilers, where the height of the chimney does not exceed 100 feet. For a height of 100 feet we would make the outer shell in three steps—the first, 20 feet high, 16 inches thick; the second, 30 feet high, 12 inches thick; the third, 50 feet high and 8 inches thick. These are the minimum thicknesses admissible for chimneys of this height, and the batter should be not less than 1 in 36 to give stability. The core should also be built in three steps, each of which may be about one-third the height of the chimney—the lowest, 12 inches; the middle, 8 inches, and the upper step, 4 inches thick. This will insure a good, sound core.

Fig. 1 shows a plain, simple finish for a chimney top, but one which looks neat if it is well proportioned. Care should be taken, however, that it is not made too short in proportion to the length of the shaft, or it will look "squat." The finish of a chimney should be such that it harmonizes with the style of the surrounding buildings. It costs no more thus, and looks vastly better. The top of a chimney may be protected by a cast-iron cap, Fig. 5, or perhaps a cheaper and equally good plan is to lay the ornamental part in some good cement, and plaster the top with the same material.—*Ex.*

JAMES MONTGOMERY.—James Montgomery, a mechanical engineer and inventor, died at his home in Philadelphia on the 28th of December. Mr. Montgomery was well known in mechanical circles at one time as the inventor of the boiler that bore his name. H entertained extravagant hopes of the saving that could be effected by lengthening the channels through which the products of cumbustion had to pass, and the result was disappointment. The boiler received some application, but it was extremely awkward to make, and the inventor's enthusiastic advocacy failed to put it into permanent use. Mr. Montgomery was one of the first to put a partition between the tubes to divide the products of combustion.—*Ex.*

GAS AS A MOTIVE POWER.

Gas is a convenient source of power, and in towns where it is already supplied for purposes of illuminating, it is at once obtainable in a conveniently moderate quantity.

Moreover, the principle of adopting a large centre of supply, is, on scientific grounds, economical, for it can be supplied in the state of fuel, and involves no more loss in its transmissions than would occur in the transference of any other fuel. But in spite of many attempts to use it for small motors it has only been recently adopted in Canada, while in England and other countries it has been very much adopted.

The original method of using gas was in conjunction with air in such a proportion as to form an explosive mixture which was ignited, and work obtained by the consequent expansion. This method was extensively applied in Europe, but was to a great extent superseded by what is known as the Otto and Langen Motor, which performed very efficient work and vastly superior to some engines in point of economy which have superseded it, but its noise in working was much against its adoption.

Thus, when the Otto Silent Engine was introduced, the application of gas engines as small motors became quite extended.

The principle of action employed is intended to meet the difficulty of utilizing the energy of the gas consequent upon the sudden explosion in the former engines.

The method of doing this is clearly explained in the specification of the patent, and is, shortly, the introduction of a combustible mixture of gases in such a way, so that upon ignition, instead of an explosion ensuing the flame is communicated gradually from one particle to another, thereby effecting a gradual development of heat, and consequently a corresponding gradual expansion of the gases, which enables the motive power so produced to be utilized in the most effective manner.

It must be confessed, however, that the Otto Engine is not perfectly regular in its action when doing light work. Combustion does not take place every revolution. At the same time, with a proper, uniform load, and heavy fly-wheel, this is hardly appreciable, and seems to be a benefit to the cylinder, which during single acting is thereby only heated when combustion takes place, and may account for their running without need of repair for a long period; and when it is considered that the Otto Engine can be run for about 50c. per day, the result is most satisfactory.

The theory of gas engines is yet imperfect, but the absence of a boiler in connection with them gives them a great advantage over a steam engine for small, light work. Gas engines for light work and under certain conditions, is a step in the right direction, and their popularity is likely to be maintained.

THE ORIGIN OF PAPER.

The Chinese claim the honor of producing the first paper ever used in the world. According to their chronology the invention dates as far back as the first century. Their claim is probably a just one, as the Japanese have still in existence certain data in regard to the exportation of paper from Corea to Japan between the years 280 and 610 A.D. Previous to this invention printing had been done upon cotton or silk. Owing to the conflicting statements of various chronological writers, it is impossible to locate the precise date of its first introduction into Europe. Deductions from the mass of evidence would seem to place it somewhere in the thirteenth century. Japan became the first rival of China, and so proficient did she become in the art that she far outshone the original inventors, and eventually took the stand which she now holds. There are, even at the present day, certain branches of this industry in which she owns no equal upon either continent. There are now manufactured at Yeddo two hundred and seventy different varieties of paper. They use bark, leaves and bamboo for producing their pulp. They change the quality of their paper by various combinations of these ingredients. The paper manufacture of the present age, possessing all the advantages derived from centuries of scientific and mechanical inventions, must find it very difficult to realize the intricate and laborious processes accompanying the earlier career of this great industry.—*Exam Ind.*

IT is reported that the Canadian Pacific Railway Company has definitely decided to make Coal Harbor, at Burrard Inlet, the western terminus of the railway, in place of Port Moody.

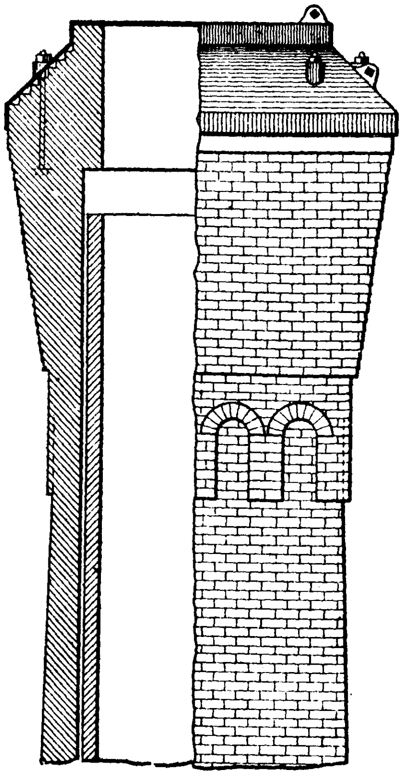
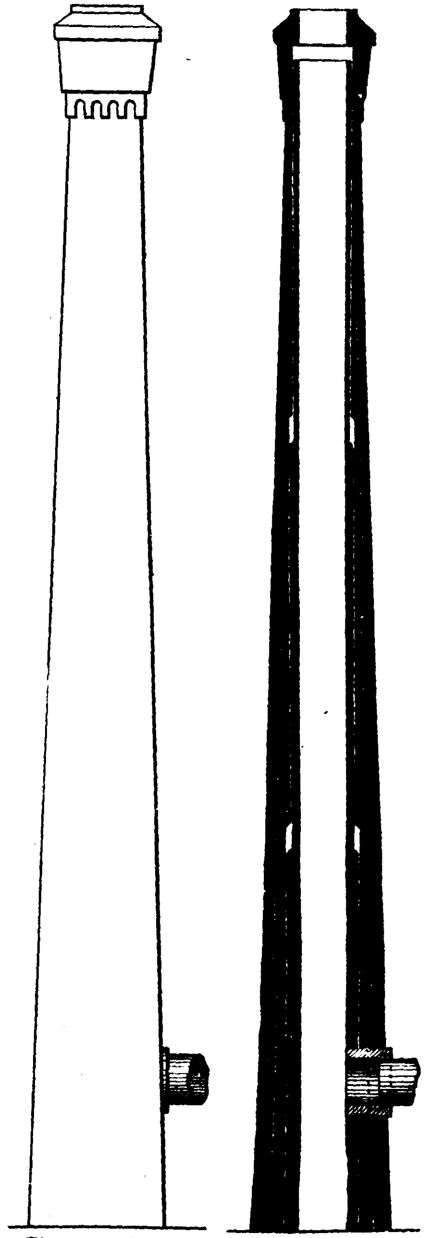


Fig. 1.—*Finish for a Chimney Top.*



Figs. 2 *and* 3.—*External View and Sectional Elevation of Chimney.*

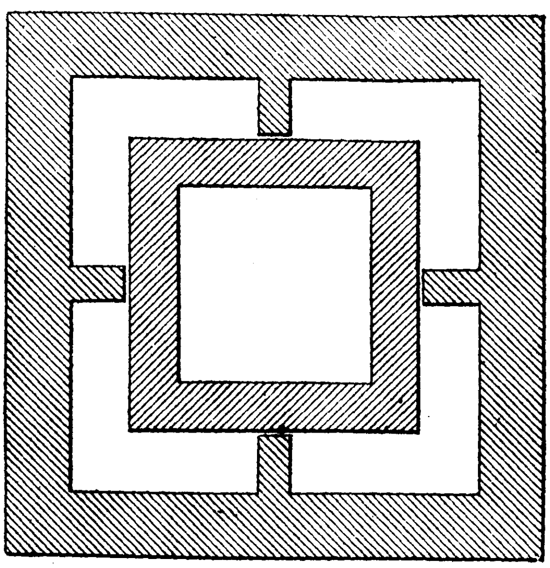


Fig. 4.—*Cross-Section of Chimney.*

CHIMNEY CONSTRUCTION.

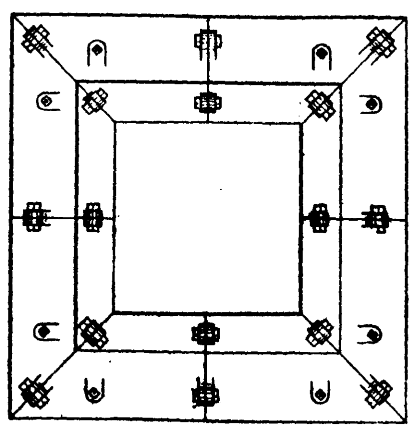
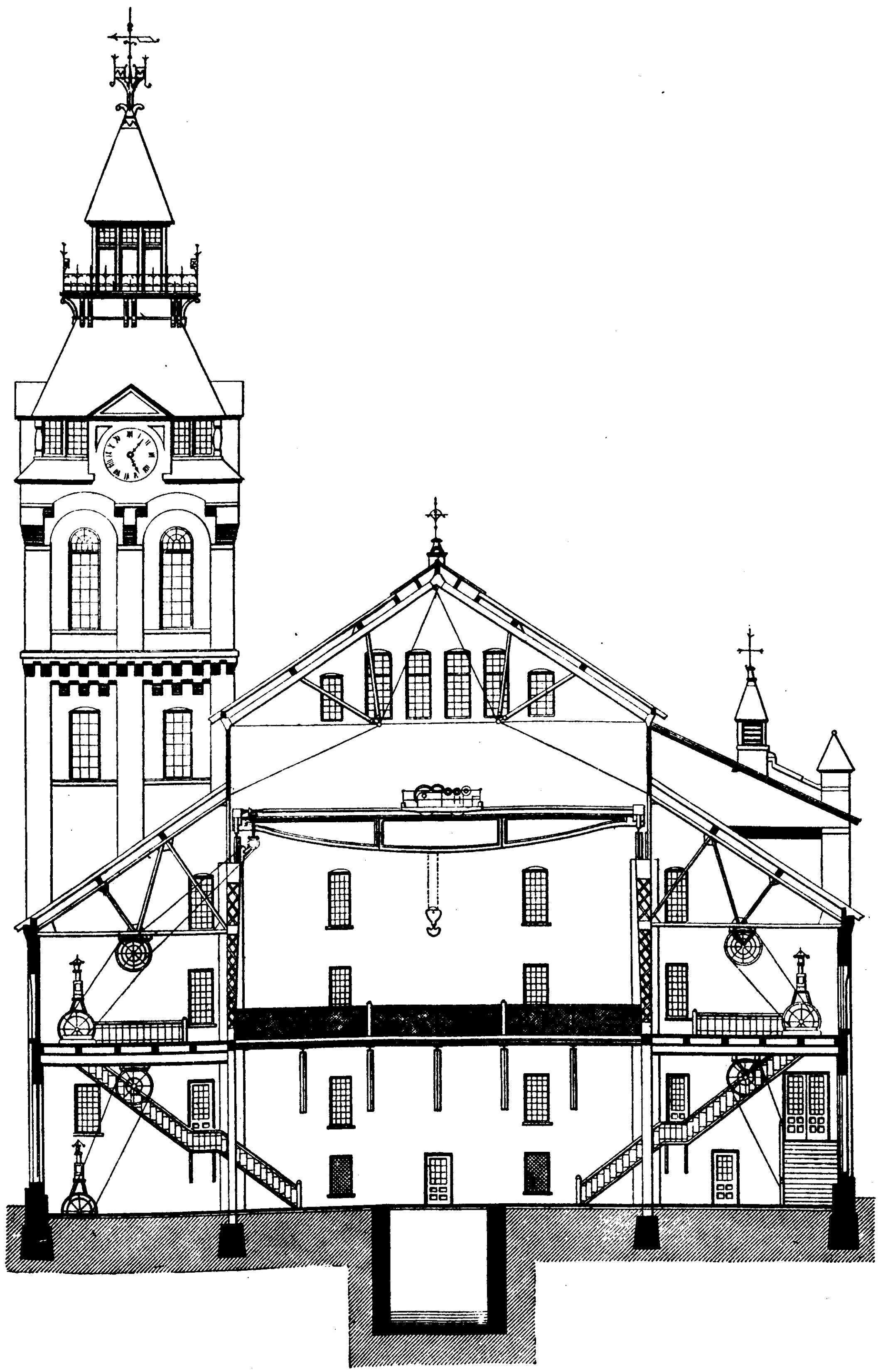


Fig. 5.—*Cast-Iron Cap for a Chimney Top.*



NEW MACHINE SHOP OF THE DICKSON MANUFACTURING COMPANY, SCRANTON, PA.—CROSS SECTION AND ELEVATION OF TOWER.

COMPOUND PORTABLE ENGINE.

We illustrate above a new pattern of compound portable engine constructed by Messrs. Richard Hornsby and Sons, Limited, of Grantham, and which was exhibited by them at the Smithfield Show at the Agricultural Hall. This engine may be regarded as a development of the type of portables with which Messrs. Hornsby and Sons' name has been so long identified, namely, that in which the cylinders are inclosed in a steam dome which forms the upper part of the firebox casing. Thus in the engine now illustrated it will be seen from the annexed section that the two cylinders, steam chests, and connecting steam passage between the high and low pressure cylinders are all cast in one and are entirely immersed in the raised firebox or steam dome of the boiler; most efficient steam-jacketting is thereby obtained, the connecting passage from the high-pressure cylinder exhaust, to the low-pressure steam chest (the latter acting as the intermediate receiver), as well as the cylinders, being entirely surrounded with steam at the full boiler pressure. Waste-water cylinder cocks are thus dispensed with, as the cylinders being always as hot as the steam, no condensation can take place, and the steam supply being practically in such a dome quite dry, no water ever gets into them. The dome and boiler is entirely cased with wood and sheet iron.

The cylinders have been designed so that the pistons and slides are as easily got at from behind as in an engine of the ordinary type. The piston rods pass through necks, which latter are held very simply by a nut outside the boiler steam dome front, thus staying the boiler at the same time. The three slide spindles and the exhaust pipe are all contained in a trunk, which also projects through the boiler dome front, a gland and packing being arranged round it to make a steam-tight joint, so that by simply taking off the two nuts that hold the cylinder necks, and the nuts that hold the back flange, the cylinders can readily be removed, should occasion require. The engine is also fitted with automatic expansion gear, arranged with Messrs. Hornsby's patent eccentric controlling gear.

The engine is mounted on a wrought-iron fore-carriage and road wheels. The outside firebox top proper is still retained, the dome being rivetted on the top of it, so that the necessary strength and stiffness is obtained to take the working strains of the engine. This dome is also of such a shape as to require but little staying circumferentially. The boiler is of steel, and is stayed for a working pressure of 140 lb. to the square inch.

The particular engine shown by our engravings is rated by the makers at 8 horse-power, its chief dimensions being as follows:

ENGINE.	ft.	in.
Diameter of high-pressure cylinder	0	5
" low " "	0	9
Stroke	1	0
Revolutions per minute	160	
Diameter of flywheel	4	6
Width "	0	6½
BOILER.	**sq.**	**ft.**
Grate area	4.4	
Firebox heating surface	30	
Tube " "	95	
Total " "	125	

A NEW POWER SCREW PRESS.

The usefulness of the screw form of press for various operations in connection with sheet-metal work cannot be denied, and a considerable number of these presses of the hand variety are in use in this country, notwithstanding the apparent advantages which other styles of presses possess over them either in first cost, space required for operation, capacity, or expense of running by hand instead of doing the same work by power. A German manufacturer has introduced a form of screw press the motion of which is derived from a horizontal shaft belted to the main shaft in the apartment in which it is employed. The engrading shown herewith, shows all the essential features of the device.

It is evident that the motion of the press, although operated by power, is essentially the same as a hand-screw press. The operator has only to move the swinging lever a short distance between the strokes of the press, in place of turning a long handle counterbalanced by a weight through a considerable arc of a circle.

FIRE-ESCAPE.

Owing to so many lives being sacrificed in recent years through the dread enemy of fire, the escapes from same have become the subj ct of inventive genius. Many of these fire-escape devices have proved themselves unreliable and unsuitable, but the one Illustrated in our present number appears to contain all the elements of perfect safety and certainty of effective action. It is not an easy matter to combine all the required *desiderata* in a complete and perfect fire-escape, but the one before us, judging from examination and the severe tests lately made of it in the presence of experts, show, without any doubt whatever, that it must take at once high rank among the best fire-escapes at present in service.

It will be seen that the device, which is patented, is exceedingly simple in construction and certain in action. It merely consists of a small framework mechanism enclosed by a case, which measures 18 x 8 x 8. The rope which the fugitive lays hold off is provided at one end with a leather strap to more securely attach it to the person, while the other end runs over a loose pulley to a drum on the main shaft of frame, which, by gear, operates a third shaft; on this shaft is fixed a fan, running at about three times the speed of descending rope, and by its rotary motion in free air produces the necessary resistance to just allow the person attached to rope to fall freely at an easy and safe rate.

The machine is, of course, placed conveniently near to a window, and it is said that a person can descend from a three-story house and alight on the ground as gracefully as jumping out of a carriage, while the time occupied would not much exceed 15 seconds. Surely there is not much to complain of in this behaviour.

Mr. Dittrick, who is the inventor, affirms that they can be made at such a low rate of cost that no building can be excused for not having one.

FIVE TON DECK CRANE.

The illustration gives an idea of how a steam crane can be applied on board ship for general lifting and hauling purposes. The design is most simple and compact, and, being for steam power, the engines and gearing, &c., are plain and convenient to handle and get at. These cranes are a great saving in time and money by doing the work quickly, cheaply, and efficiently.

CENTRIFUGAL PUMPING ENGINES.

We illustrate a pair of very fine combined circulating pumping engines manufactured by Messrs. W. H. Allen and Co., of York-street Works, Lambeth, for the new steamer *Umbria*, the latest addition to the Cunard Line. These engines, which form parts of the main engines of 13 000 horse-power, are of unusually large proportions, and are capable of delivering each 10,000 gallons per minute to a height of 30 feet. They have been made with extra large discs so as to revolve at a moderate speed. The engines have cylinders 15 in. in diameter by 12 in. stroke, and the parts are proportioned for working with a steam pressure of 110 lb. per square inch. The arrangement of the engines is such that either engine can work either pump, and especial attention has been paid to the designing of all details and particularly to the provision of efficient means of lubrication.—*Eng.*

A WELL-DESIGNED MACHINE SHOP.

We lay before our readers the plans of the new machine shop of the Dickson Manufacturing Company, of Scranton, Pa., which possesses striking features as to construction. The architectural designs for the building were made by Mr. I. G. Perry, of Binghampton, N.Y., while the construct.ve designs were in charge of the consulting engineer of the company, Mr. E. D. Leavitt, Jr., of Cambridgeport, Mass. The arrangement and distribution of the tools in the shop are the work of the superintendent of the company, Mr. Sidney Broadbent.

As will be seen from the accompanying plan, the building is substantially a modification of a one-story shop, and covers 223 feet by by 100 feet of ground, of which space the machine shop proper occupies 196 feet by 90 feet, which, togother with two galleries 25 feet wide running lengthwise on two sides in the interior of the building, gives an available floor space of nearly 29,000 square feet. The remaining part of the ground on the Vine street end of the building is occupied by a four-story building, terminating on the corner of Penn avenue and Vine street in a five-story tower.—*Ex.*

THE PROCESS BY WHICH STEEL PENS ARE MADE.

A REPRESENTATIVE of the New York *Sun* has been investigating the steel pen manufacturing business of this country, and reports as follows:

About a million gross of steel pens are worn out every year in the United States. What becomes of them? Twenty years ago most of the steel pens used in this country were imported. Now comparatively few are imported, and there are several factories in the country in which they are made in large quantities. One factory is in Connecticut, another is in Pennsylvania, and a large one is in Camden. The manufacturers say that the industry has been fostered by the protective tariff, and that if the tariff were to be taken off, the market would be flooded with cheap steel pens at lower prices than ours and of inferior quality. At present the importation of foreign pens is mainly confined to high priced articles.

It was at first doubted that steel pens could be made in this country, but it was soon learned that the requisite skilled labor could be obtained for high wages, and the success of the pioneers led one manufacturer after another into the business, until now the field is pretty well supplied. Most of the work on these little instruments is done with the aid of very nice machinery worked by women and girls. The steel used is imported, because it is believed that the quality is more uniform than American steel. This uniformity of quality is necessary because of the very delicate tempering required in the manufacture of the pens. That mysterious quality of steel which gives different grades of elasticity and brittleness to different colors of steel is a quality that requires expert manipulation on the part of the workman who does the tempering. He must know the nature of the material with which he works, and with that knowledge must exercise a celerity and skill that seizes upon the proper instant to fasten the steel at a heat which insures the requisite quality.

First the steel is rolled into big sheets. This is cut into strips about three inches wide. These strips are annealed, that is, they are heated to a red heat and permitted to cool very gradually, so that the brittleness is all removed and the steel is soft enough to be easily worked. Then the strips are again rolled to the required thickness, or, rather, thinness, for the average steel pen is not thicker than a sheet of thin letter paper. Next the blank pen is cut out of the flat strip. On this the name of the maker or of the brand is stamped. The last is a very importent factor. There are numbers that have come to be a valuable property to manufacturers. Many clerks say they cannot work to advantage unless they have particular styles of pens. The result is that by passing the word from one writer to another a market is soon created for a favorite style. Each steel pen has therefore to be stamped with sufficient reading matter to identify it thoroughly. The stamping is done with very nicely cut sharp dies that cut deep and clean, so that the reading matter will not be obliterated by the finishing process. Next the pen is moulded in a form which combines gracefulness with strength. The rounding enables the pen to hold the requisite ink, and to distribute it more gradually than could be done with a flat blade.

The little hole which is cut at the end of the slit serves to regulate the elasticity, and also facilitates the running of the ink. Then comes the process of hardening and tempering. The steel is heated to a cherry red, and then plunged suddenly into some cool substance. This at once changes the quality of the metal from that of a soft, lead-like substance to a brittle, springy one. Then the temper of the steel must be drawn, for without this process it would be too brittle. The drawing consists of heating the pen until it reaches a certain color. The quality of the temper varies according to the color to which the steel is permitted to run. It is the quick eye for color and the quick hand to fasten it that constitutes the skill of the temperer of steel. When the steel is heated for tempering, it is bright. The first color that appears is a straw color. This changes rapidly to a blue. The elasticity of the metal varies with the color, and is fastened at any point by instant plunging in cold water.

The processes of slitting, polishing, pointing, and finishing the pens are operations requiring dexterity, but by long practice the workmen and workwomen become very experts There have been few changes of late years, and the process of manufacture is much the same that it was twenty years ago, and the prices are rather uniform, ranging from 75 cents to $4 a gross, according to the quality of the finish. The boxes sold almost universally contain a gross.

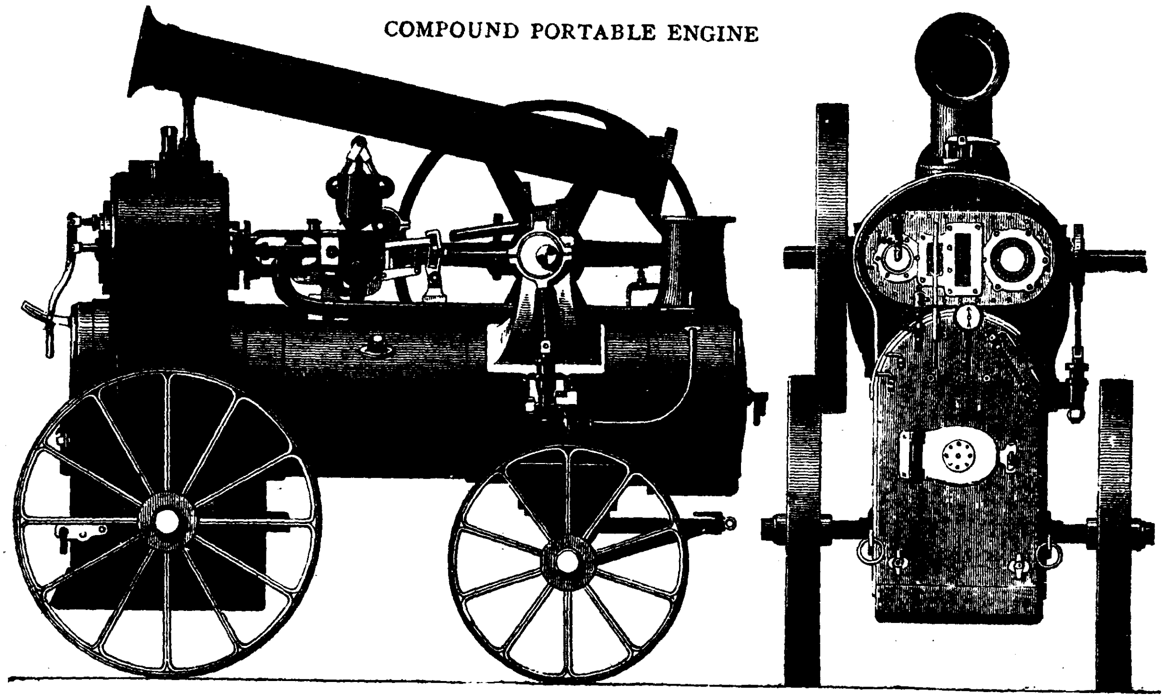
Fancies come and go in the styles of pens as in other fashions. One American maker alone turns out about 350 different patterns. Some are very odd, such as the stub pens, the draughtsman's pen, which makes two parallel lines at once; the mammoth pen, suited to use on rough paper; and the pen with the turned-up point, that writes a thick mark, yet runs smoothly over the paper. Then there are delicate pens for ladies, pens that make a fine hair line and yet can spring out to a heavy shading. Already the American steel pens have become famous abroad, and many are exported. Many pens are made of other metals besides steel. One kind is the German silver non-corrosive pen for red ink. Another is an imitation gold pen made of non-corrosive metal. There are pens of all colors and sizes for all trades and professions.—*Ex.*

ARTIFICIAL FUEL MACHINERY.

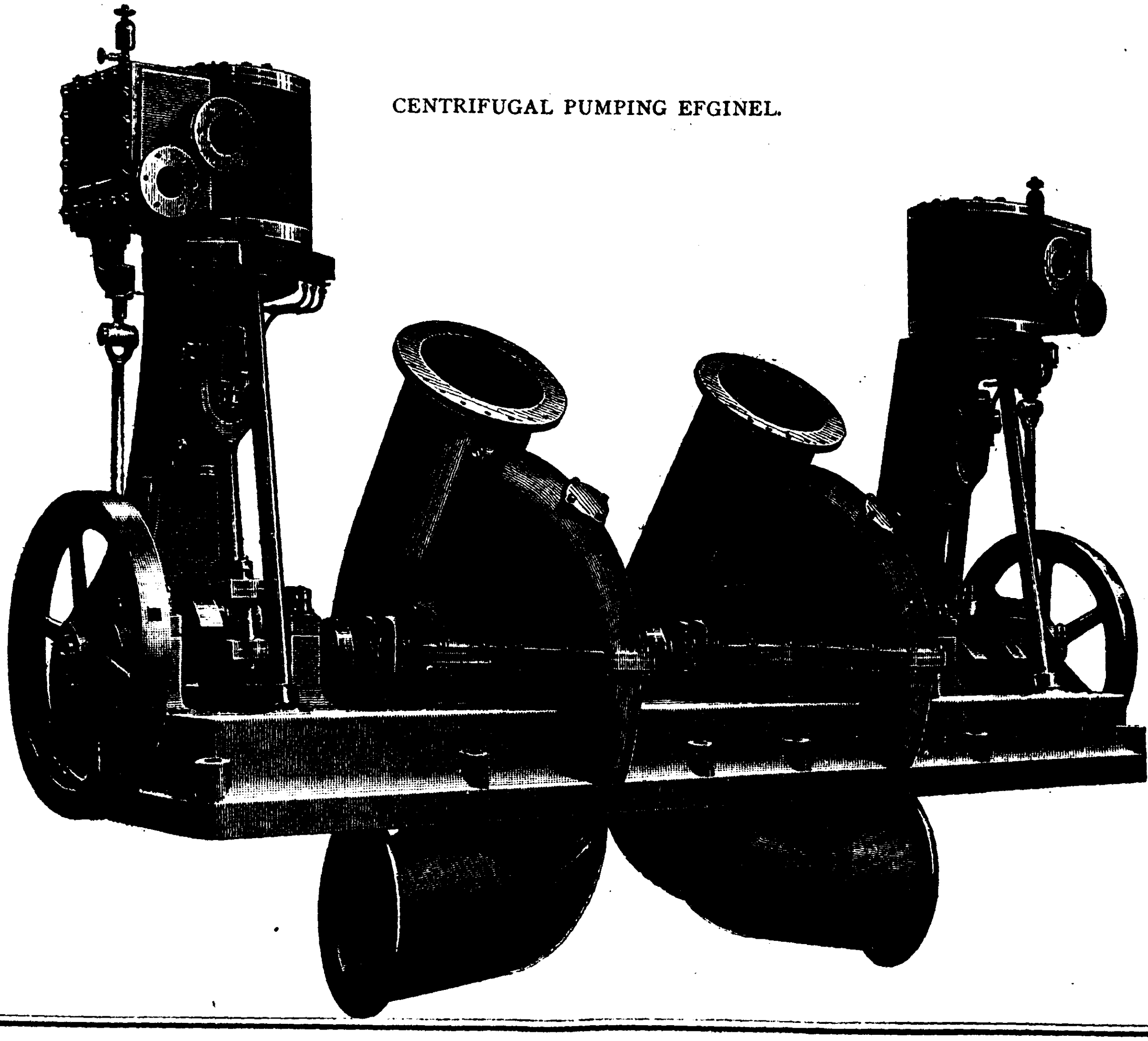
A RECENT issue of the "Bulletin de la Société de l'Industrie Minerale," France, contains an interesting contribution relative to the manufacture of artificial fuels, describing the different operations gone through, the preparation of the fuel mixtures, etc., and also two fuel presses brought out by a French engineer, M. Couffinhall. One of these machines, notwithstanding its ingenious arrangement, was soon found objectionable, owing to its rapid wear and the impossibility of attaining a high speed without shock. In order to overcome these difficulties several modifications in design were effected, resulting ultimately in the machine which we illustrate on page 000 and 000. The shaft A transmits motion to the press either direct from the engine or from a counter-shaft, and is accordingly furnished with a pinion, B, turning the spur-wheels C C', the latter being mounted on shafts D and D', which, by means of cranks E E', work the rods F and F' and the piece H. This, in turn, imparts motion to the two levers I and I' which operate the pistons J and K, the former compressing the material and the latter expelling it from the molds. The central piece X' serves as a guide for these two pistons. The arms L L' are connected with the upper ones in the manner shown, and also carry compressing pistons. It is, of course, desirable in a machine of this kind to be able to exert various pressures according to the character of the material operated upon, and to this end the working parts should be elastic, so to speak. The shaft O (Fig. 2) is capable of sliding in the slot *a*, and is carried by a piston, *p*, working in a hydraulic cylinder, T, shown in section in Fig. 4, and permitting regulation of the pressure exerted on the fuel bricks. This cylinder, which is firmly bolted to the bed-plate of the machine, is furnished with two valves (Fig. 5), one opening inward and the other outward. If the compressing piston J in moving downward meets with a resistance greater than that offered by the water in T, the valve opening outward permits the water to escape and the piston *p* to travel upward, carrying with it the arms I I'. The parts ultimately resume their initial positions due to their own weights, the valve being provided with a spring, and the pressure to be exerted by the pistons J can readily be changed by increasing or decreasing the tension of this spring. Correct movement of the plate Q (Figs. 1 and 3) which contains the molds for the fuel bricks is insured by a drum, R, furnished with peculiarly shaped grooves in which slide the rollers S. The gear-wheel *q* works the shaft of the mixing apparatus (not shown in the cuts), and itself receives motion from a pinion mounted on the main shaft A. The finished bricks are thrown on a rocking-table, U, shown in Fig. 2, and the molds are filled by means of an ordinary distributor, V. The spring *r* in Fig. 4 serves to bring the lower arms L back to their original positions after having aided in partially compressing the fuel mixture. The presure capable of being attained amounts to about 4300 pounds per square inch. The press carries from 12 to 14 moulds, the finished bricks being about half as high as they are long. The machine is built in four different sizes by Messrs. V. Biétrix & Co., of Paris, and is understood to have already given excellent results in practice. Several of the presses thus far turned out have been furnished with special engines, a feature which will be appreciated unless the power necessary can be obtained equally well from an engine already set up in the place where the machines are to be used.—*Ex.*

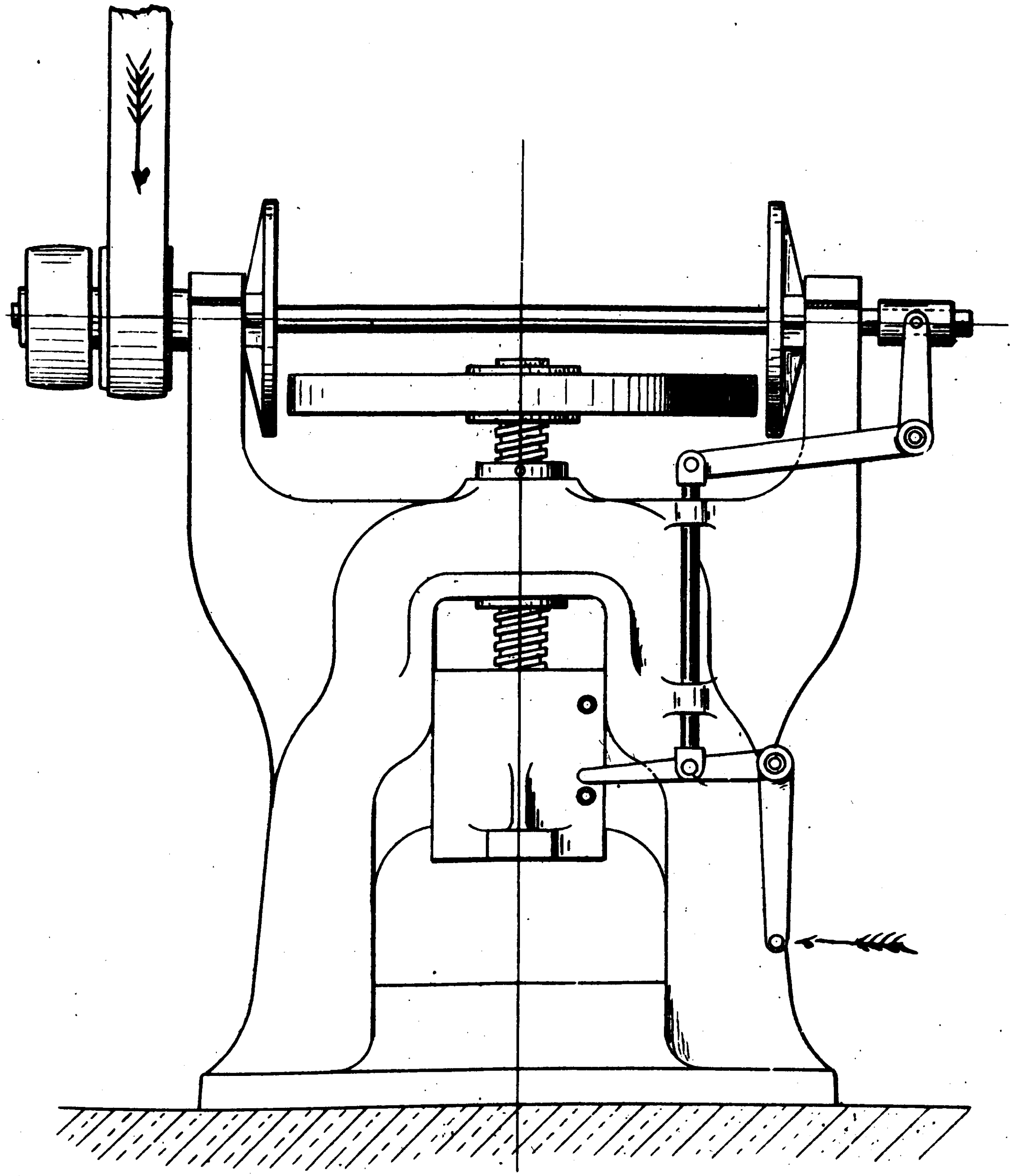
MANGANESE is found in deposits of various oxides extending through the Atlantic States from Maryland to Georgia.

COMPOUND PORTABLE ENGINE



CENTRIFUGAL PUMPING EFGINEL.





NEW POWER SCREW PRESS.

NEW DESIGN FOR A TOBOGGAN SLIDE.

The structure shown in illustration for a toboggan slide is sufficiently explicit as to require little explanation.

The design is meant to suit a locality where natural sloping ground suitable for the sport is either inconvenient or difficult to procure—the erection being entirely on level ground.

It will be noticed that the design provides for six slides with stairways on each side, this arrangement can be altered at wiil to suit circumstances ; because in many cities and towns three slides with stairway on one side only would be ample.

The Band stand and Promenade bridge is a new feature, but a very desirable one for large and popular public slides, as it enables the sight-seers to cross and recross the tracks at pleasure while viewing the sport to greater advantage. The Band floor is slightly elevated to permit of people passing underneath while crossing the bridge, while the bridge floor is high enough to allow toboggan parties to slide through below.

The Electric Light is placed to the best advantage, of course, the slide is continued past the Promenade Bridge, but being on the plain level is not shown.

The Refreshment Rooms are conveniently located below the stairways of the Band stand, and the Caretaker's offices and apartments, etc., can be built between trestling below top of slide if required, and in a similar manner Store-rooms can be fitted up for the accommodation of the members' toboggans.

The design will, we trust, be serviceable to many who contemplate building a really good public slide—the dimensions can be made to suit school-children, because in most cases 40 feet high would suffice instead of 80 feet as shown on illustrative design. The cost of material and erection, etc., can easily be ascertained from practical men and we see no reason why toboggan slides should not be built in every ordinary sized town in Canada and the northern States. The sport would amply repay for trouble and cost not to speak of the health-giving advantages.

EFFECTS OF THE IMAGINATION.

Many years ago a French physician, author of an excellent work on the effects of imagination, wished to combine theory with practise in order to confirm the truth of his propositions. To that end he begged the Minister of Justice at Paris to allow him to try an experiment on a criminal condemned to death. The minister consented, and delivered to him an assassin of distinguished rank. Our *savant* sought the culprit, and thus addressed him :—"Sir,—Several persons who are interested in your family having prevailed on the judge not to require you to mount the scaffold, and expose yourself to the populace, he has, therefore, commuted your sentence, and sanctions your being bled to death within the precincts of the prison. Your dissolution will be gradual, and free from pain.

The criminal submitted to his fate ; he thought his family would be less disgraced, and considered it a favour not to be compelled to walk to the place of public execution. He was conducted to the appointed room, where every preparation was made beforehand ; his eyes were bandaged, he was strapped to a table, and, at a preconcerted signal, four of his veins were gently pricked with the point of a pin. At each corner of the table was a fountain of water so contrived as to flow gently into the basins placed to receive it. The patient believed that it was his blood he heard flowing, and gradually became weaker, and the conversation of the doctors in an undertone confirmed him in his opinion.

" What pure blood !" said one. " What a pity this man should be condemned to die ; he would have lived a long time."

" Hush !" said the other ; then approaching the first, he asked him in a low voice, but so as to be heard by the criminal, " How many pounds of blood are there in the human body ?" " Twenty-four. You see there are ten pound already extracted ; that man is in a hopeless state."

The physicians then receded by degrees, and continued to lower their voices. The stillness which reigned, broken only by the sound of the dripping fountains, the sound of which was gradually lessened, so affected the brain of the poor patient, that although a man of very strong constitution, he fainted, and died without having lost a drop of blood."

DESIGNS for building two British war ships have been received on the Clyde, in Scotland. Messrs. Napier & Sons have received an order to build two engines of 8,000 horse-power each for the Russian Government.

IRON LIGHTHOUSES.

There are now being completed at the Russsel Car Wheel Foundry, at Detroit, Mich., three iron lighthouses—one for the pier at the entrance of the Detroit River, one destined for Sand Beach, and a large beacon lighthouse for the pier just outside of Cheboygan. The lighthouse for the Detroit River pier and the beacon light are now completed, and are standing in the yard at the works, ready to be taken apart and shipped. The Detroit River lighthouse is an immense iron structure, the top of which as it now stands, towers above the houses. This lighthouse has a round iron shell, with iron floors and stairs inside. The outer shell has a diameter of 22 feet at the base, and is conical in form to the height of 36 feet having a diameter at that height of 18 feet. The promenade deck, supported by brackets from the main deck, projects over to a diameter of 24 feet. From the promenade deck is a circular watch tower, 11 feet in diameter and 7 feet high. On this is the lantern deck and lantern-house, which, like the remainder of the tower, is constructed of cast iron. The roof and cowl-piece are made of heavy copper. The tower from the base to the top of the lantern cowl is 51 feet, and from the base to the focal plane 44 feet 4 inches. The inner floor plates are supported by a centre column of cast iron, which is hollow and answers the purpose of a chimney and for ventilation. The outside of the floor plates rest upon a lining wall of masonry. The floors are three in number, and make four excellent living-rooms for the keeper and his family, the shell being pierced for light. Each floor is connected to the one above by a handsome winding stairway of cast iron. The castings are all flanged, having a uniform thickness of ⅝ inch. Every joint in the structure is planed and fitted so closely that it can hardly be discerned, thus making the whole perfectly water-tight. An outer vestibule of cast iron, the ornamental window-caps and the neat iron railing around the promenade and lantern decks make the whole present a graceful and handsome appearance. The Sand Beach lighthouse is exactly the same as the one just described, and will be finished in about two weeks. The lanterns on both these houses are decagonal. The only wood about the whole structure will be that placed on the ceiling of the third floor and on top of the first floor. Each of these lighthouses weighs 80 tons, and will be taken apart in a few days annd delivered to the Lighthouse Board, whose engineers will place them on the cribs this fall.

The Cheboygan beacon light is a considerably smaller structure, entirely of cast iron. The contract for this light was made with the Lighthouse Board at Washington, the plans being prepared by the late F. U. Farquhar, major of engineers. This style of lighthouse is used extensively on the sea-coast, but there is only one in use on the Great Lakes, which is at Charlotte, marking the entrance to the Genesee River. The form of this structure is octagonal. The main tower from the base to the lantern deck is 21 feet 8 inches ; the focal plane, 26 feet 8 inches, and to the top of the lantern cowl, or length over all, 33 feet. The shell is made in six courses, each course containing eight pieces, all being a uniform thickness of ⅝ inch. Each plate is strengthened on the inside and the joints, which are flanged and planed. There is one landing, and a spiral stairway leads to the second floor, and from the lantern tern deck is gained by a neat iron ladder. The base of the main tower is 12 feet 10½ inches wide, and the lantern deck is 12 feet across. The lantern is built upon this deck, and it is octagonal in form, with a base 7 feet 1½ inches wide. The heavy mouldings on the base of the main tower and cornice, the projections of the main door and three square and four round windows, and the hand-railing around the lantern deck, give relief to the general plan of the structure, and as it now stands in the yard of the works it presents a very picturesque and unique appearance. The tower will be fastened to heavy oak timbers, in the crib by 2-inch bolts. The weight of this tower is 25 tons. This large iron house will be taken apart and erected on the pier by the constructors, according to contract. The plans for the Detroit River and Sand Beach lighthouse were prepared in the office of the foundry, under the direction of Charles E. L. B. Davis, captain of engineers, and engineer for the Tenth and Eleventh Lighthouse districts.

THE LACHINE BRIDGE.—Stephens, president of the Canada Pacific railway, has deposited with the department of railways and canals plans of a new bridge across the St. Lawrence river, at Lachine, near Montreal. The estimated cost of the structure is $3,000,000.

LECTURE ON "FREE WILL."

Delivered before a Scientific and Literary Society in Montreal.

In the History of Science *no* higher example of intellectual conquest are recorded than those which this age has made its own. One of the most salient of these I propose with your permission to make the subject of our consideration upon the present occasion.

To judge of the total scientific achievements of any age, the standpoint of a succeeding age is not only desirable but necessary. We sometimes hear the science of our time described and contrasted to its disadvantage with the science of other times.

I do not think that this will be the verdict of posterity.

It is pretty generally admitted now that the man of to-day is not the chance being some would have us believe, but the child and product of incalculable antecedent time.

His physical and intellectual textures have been woven *not* by him, but for him, during his passage through phases of history, influence and forms of existence which lead the mind back to an indescribable past.

One of the qualities man has derived from that past is the yearning to let in the light of principles on the otherwise dark phenomena.

He has been described as the restless cause-seeking animal in whom facts excite a hunger to know the sources from which they spring, or to put it mathematically, the why and the wherefore.

Never, I venture to say, in the history of the world, has this longing been more general, both among scientific minds and the public, than during these last 30 or 40 years. A longing which is highly creditable to our times and must prove in the end beneficial to all departments of thought, especially religious truth.

The celebrated Robert Boyle regarded the Universe as a machine; Mr. Carlyle prefers regarding it as a tree. He loves the image of the tree better than that of the Strasburg clock.

A machine may be defined as an organism with life and direction outside, a tree with life and direction within. I close with Carlyle's conception. The order and energy of the universe I hold to be inherent, the expression of fixed law, all as predetermined and exercised by what Carlyle would call an Almighty clockmaker.

But the two conceptions are not so much opposed to each other after all as they equally imply the interdependence and harmonious interaction of parts, and never was such harmony and interdependence so clearly recognized as now. Our insight regarding them is not so vague as in early times which used to be oftener affirmed by the Synthetic poet than by the scientific man.

The interdependence of our day has become quantitative as well as qualitative, leading, it must be added, into that inexorable reign and law which so many gentle people regard with dread.

It is not given to any man however endowed to rise spontaneously into intellectual splendour, without the parentage of antecedent thought.

Great discoveries grow—here as in other case, we have first the seed, then the ear, then the full corn in the ear, the last member of the series implying the first. Thus, as regards the law of gravitation, with which the name of Newton is identified, notions more or less clear, were entertained before Newton's transcendent mathematical genius raised it to the level of a demonstration.

The whole of his deductions, however, rested upon the inductions of Kebler. Newton shot far beyond his predecessors, but his thoughts were rooted in theirs, and a just redistribution of merit would assign to them a fair portion of the honors of discovery.

Many illustrious names are associated with the conquests achieved and embodied in the great doctrine known as the "Conservation of Energy," without even its limitation to the physical world, because the uncertainty and difficulties of proof do not preclude its application to the metaphysical world as well.

This doctrine recognizes in ths material universe a constant sum of power which remains quantitively immutable. This doctrine you will observe deals not with material or physical agents alone, but with what may be classified as metaphysical, viz., energy or power, it is here the existence of these forces, for such they are,—are only made known to us through these observations on physical agents, for example, Heat is not a substance but a force which is known to us only through its effects on material, and beyond the results of its operations on material and physical agents, we practically know nothing about it whatever.

The doctrine of "Conservation of Energy" coupled with its twin brother "Non destructibility of Matter," presents a theme of extreme grandeur.

By way of getting to the main point of the subject of Essray by illustration, let us refer here to one exemplification of this interesting and important doctrine.

The sun warms the tropical ocean, converting a portion of its liquid into vapour which rises in the air and is recondensed on mountain heights returning in rivers to the ocean from whence it came.

Water which was formerly at the sea level has been lifted to a position from which it can freely fall by the action of gravity. Millions of tons of water in a gaseous state are being continually lifted by the suns work ready for recondensation. after this condensation gravity comes into play, pulling the showers down upon the hills, and the rivers thus made discharge into the sea.

The disappearance of heat which took place in raising the water, because heat and work are synonymous terms, immediately reappears the moment condensation takes place inthe atmosphere. Every rain-drop which smites the mountain-top or valley below, produces its definite amount of heat, every river develops heat by the clash of its cataracts and the friction of its bed. Compare then the primitive loss of solar warmth or heath, with the heat generated by the condensation of the vapour and by the subsequent fall of water from cloud to sea. They are mathematically equal to each other.

No particle of vapour was formed and lifted without being paid for in the currency of solar heat, no particle returns to its own level and liquid state without the exact quantitative restitution of that heat. With inexorable constancy the one accompanies the other. Has this uniformity in nature ever been broken? The reply is "Not to the knowledge of Science."

What has been here stated in regard to heat and gravity applies to the whole of inorganic nature.

When I lift a weight or throw a stone, or run a race, or climb a mountain, or wrestle in football with my comrade, am I not conscious of calling force into active play for the sole purpose of expending it. Let us look to the antecedents of force. We derive the muscle and fat of our bodies from what we eat, because animal heat is due to the slow combustion of this fuel.

In the body the blood nourished by the dijested food, plays the part of oil in a lamp, consuming the oxygen diffused in and around it, and like any other fuel, producing heat. My arm is now inactive, and the ordinary slow combustion of my blood and tissue is going on. For every grain of fuel thus burnt a perfectly definite amount of heat has been produced.

If I contract my biceps muscle without causing it to perform external work, the combustion is quickened and the heat is consequently increased, this additional heat being liberated in the muscle itself. But again if I lay hold and lift a 56 lb. weight through the vertical space of a foot, a certain quantity of heat is missing in my muscle equivalent to the heat which would be generated precisely by the same weight falling to the gronnd, my muscular heat is thus transferred to external space.

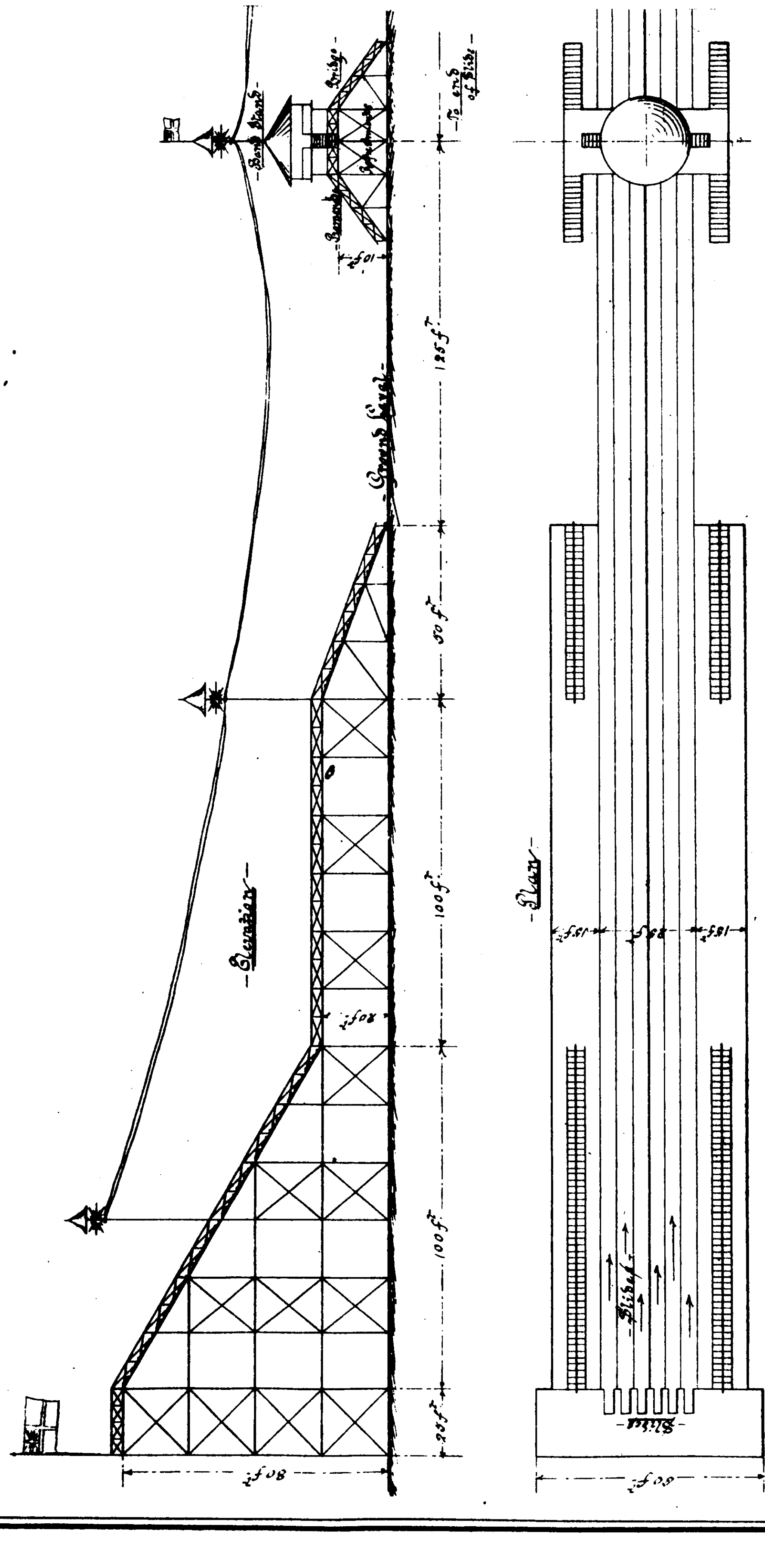
All this confirms the conclusion that the force we employ in muscular exertion is the force of burning fuel, and that part of the burning fuel is used up even in the operations of the mind and will act simultaneously with the physical exertion.

In the light of these facts the body is seen to be as incapable of generating energy without expenditure as any other agent or agents combined.

Or in other words, the body in performing work falls into the category of a machine, while the mind and will belongs to a totally distinct and different category unknown to any existing machine. This, I term, the rock of distinction upon which so many Scientists well disposed towards religious truth as also many unbelievers make shipwreck of themselves, they forget that while man partakes of a simple piece of organized mechanicism there is a something individually distinct to account for all our motions and actions.

By turning the handle of an ordinary electro-magnetic machine, a thin platinum wire may be made to glow at a white heat and even be fused. This is by reason a very remarkable result. From the muscles of the arm at a temperature of 100°,

TOBOGGAN SLIDE.



MINERAL WATER MACHINERY.

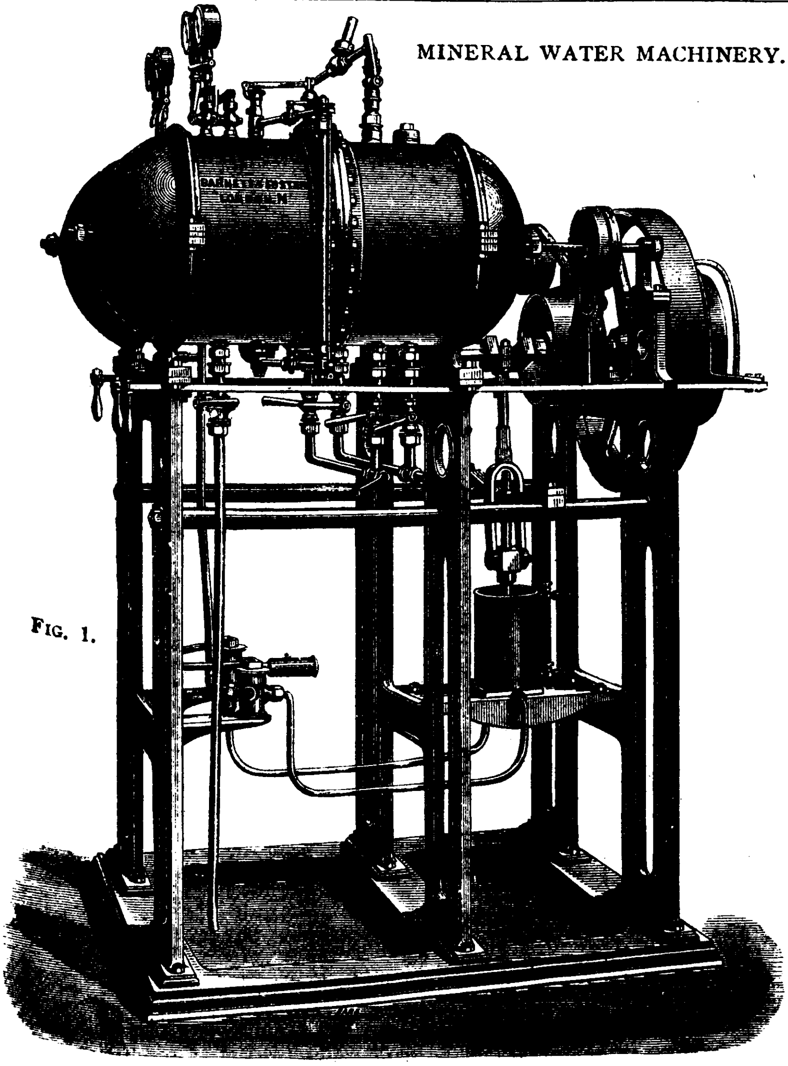


FIG. 1.

FIG. 2.

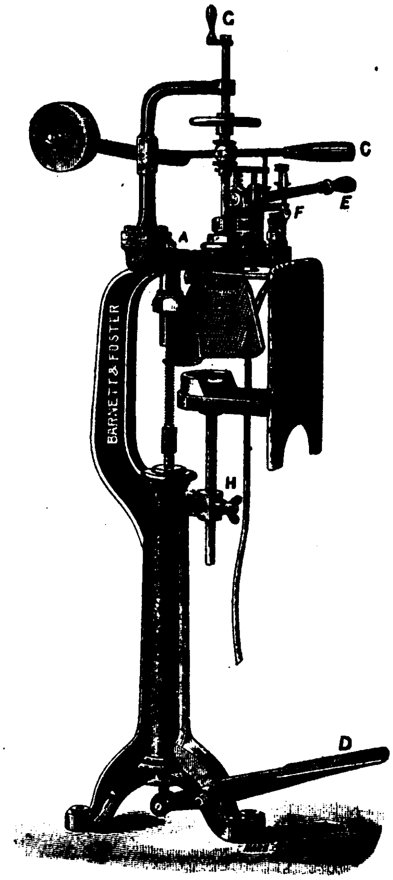


FIG. 3.

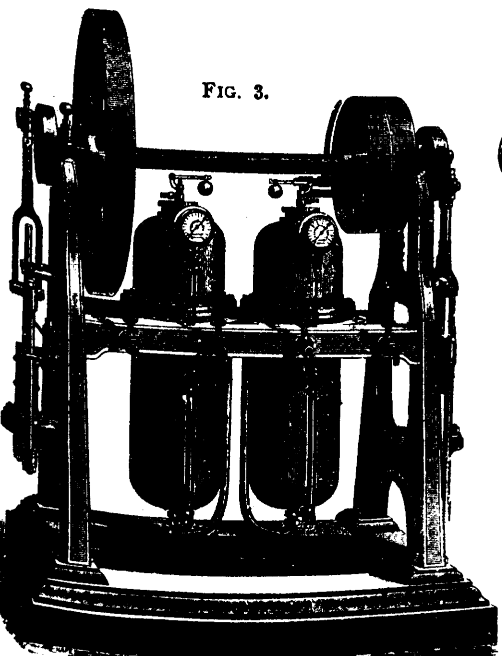


FIG. 4.

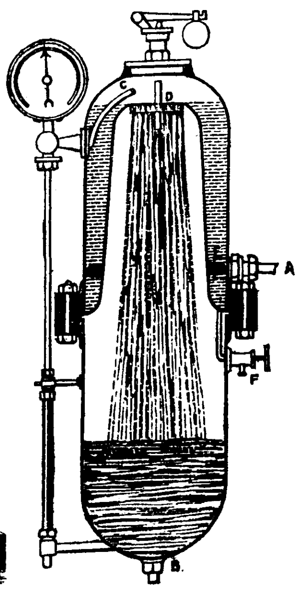
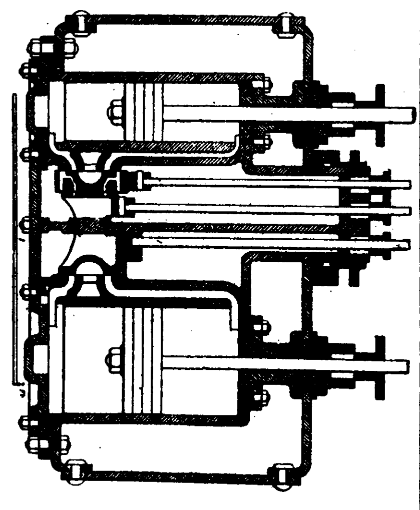


FIG. 5.



we extract the temperature of molten platinum which is many thousand degrees, the supposed miracle here is the reverse of that of the burning bush mentioned in Genesis. There the bush burned but was not consumed—here the blood is consumed but does not burn.

The matter of the human body is the same as the world around us, and the forces of the body identical with those of inorganic nature. The body is an apparatus effectual and exquisite far beyond all others in transforming and distributing the energy with which it is supplied, but it possesses no creative powers, although governed and controlled by the mind and will.

Thus for every action of the organism belongs either to the domains of physics or chemistry. But, you say, I can contract the muscle of my arm. What enables me to do so? Is it, or is it not the direct action of my will?

The answer is the action of the will is mediate not direct—over and above the muscles the human organism is provided with long whitish filaments of medullary matter which issue from the spinal column, being connected by it on the one side with the brain and on the other side with the muscles. Those filaments or chords are, as you know, the sensor and the motor nerves, the former convey external impressions to the brain, the latter convey the behests of the brain to the muscles or back to the external world again, this latter being the reverse of the first. Here, as elsewhere, we find ourselves forced to the conclusion that the brain is the seat of this mediate action or force.

Nervous impressions were 30 years ago generally thought to be transmitted, if not instantaneously, at all events with the rapidity of light or electricity, and very few believed Helmbolt when he published the result of his experiments on nervous transmission.

While sound, or more strictly speaking, ærial vibrations travel at the rate of 1000 ft. per second, and light or electricity at the rate of about 200,000 miles a second, the nerves transmit their impressions at the rate of only 70 ft. per second which in these fast times is certainly very slow being only equal to the speed of an ordinary express train, it is not to be wondered then that Helmbolts results were startling.

This point may be summed up as a certain clever writer has, by reference to the case of a whale struck by the harpoon on the tail. If the animal were 70 ft. long a second would elapse before the disturbance could reach the brain. You will notice here I am citing the example of a whale, not that I would have you think we are connected by some link and such forms of life in the same animal kingdom, but rather because the experiments in the kingdom are not dissimilar in their results. Of course I admit that some nervous systems are more sluggish than others. Then again some contend, that all nerves practically convey at the same rate of speed, the sluggishness becoming apparent by the inactivity of the brain action.

In the case of the whale which owing to its size, furnishes a good example, the impression from without after reaching the brain requires time to throw it into molecular condition necessary to consciousness and reflex operation through the motor nerves. Then, and not till then, is the command given to the tail to defend itself. Another second must elapse before the order reaches the tail, so that more than two seconds transpire between the infliction of the wound and the muscular response of the part wounded, the peculiarity of this action is the consciousness and the certainty that the message was from a certain point in the tail and not for example an indeterminate point in the body. This last thought in itself is a miraculous and mysterious theme in itself.

Just then consider that the interval required for the kindling of consciousness would far more than suffice for the destruction of the brain by lightening or say a rifle bullet.

Before the organ can arrange itself it may therefore be destrayed, and in such a case we may safely conclude that death is often painless. Seeing, hearing and the nerves connected with them enable us often to save from inpending danger, but the other senses in this respect are deficient. Hence the especial value of seeing and hearing, or better, the organs of the eyes and ears. You can easily picture the safe position the whale might have placed herself in, had she seen the impending danger and have been conscious of it.

We all know the effect produced on a nervous organization by a slight sound which causes affright. An ærial or vibratory wave containing practically no energy, can throw the whole human frame into a violent mechanical spasm. The eye may be appealed to as well as the ear, a few marks on paper containing no life or energy in themselves, can produce results out of all proportion to the means employed according as the information or news is good, bad or indifferent.

We can have a complex means of action involving terror, hope sensations, calculations, ruin, safety or victory compressed into a moment. What is the cause of all this—impulses of the nerves? but whence this impulse? from the centre of the nervous system.—But how did it originate there? This is the critical question, and as explanation is condition by knowledge we are unable to answer. Sure are we however that all these influences were conveyed from some intelligent source through unthinking agents to other intelligent sources and produced results which they were more or less intended to. This indissoluable link between mind and matter, between the seen and the unseen is beyond our present undertaking and effort.

But you say you have not told us where is the man, who or what is it that sends and receives those messages through the bodily organisms?

Do not the phenomena point to the existence of a self within-the-self? You picture the muscles as hearkening to the commands and the senior nerves as the vehicles of incoming intelligence.

Are you not bound to supplement this mechanicism by the assumption of an entity which uses it? In other words are you not forced by your own exposition into the hypothesis of a free human soul?

That hypotheus may at least be offered as an explanation or simplification of a series of phenomena more or less obscure,—although adequate reflection shows that instead of introducing light into our minds it increases our darkness. You certainly do not in this case explain the unknown in terms of the known which is really the method of science, but you explain the unknown in terms of the still more unknown.

The warrant of science extends only to the statement already made or implied that terror, hope, sensation, etc., are phenomena produced by, or associated with the molecular changes set up in a previously prepared brain. But the scientific view is not without its own difficulties.

(*To be continued.*)

WHAT is claimed to be the largest grain elevator in the world has been erected at Newport News, Va. It is 90 feet wide, 386 feet long, and about 164 feet high, with engine and boiler rooms 40 by 100 feet high. The storage capacity of the house is 1,600 bushels, with a receiving capacity of 30,000, and a shipping capacity of 20,000 bushels per hour.

EXPECTED ADMIRALTY ORDER FOR THE CLYDE.—It is stated that at the least two designs for warships have been forwarded from Clyde shipbuilding firms to the Lords of the Admiralty for inspection, in the hope that the Government may see fit to place some orders for such vessels in this great centre of the shipbuilding industry. One of the designs is said to be for a sort of combination of the type of the Nelson and Northampton (built, respectively, by Messrs. Elder & Co. and Messrs. R. Napier & Sons), and that of the Esmeralda (recently built by Sir William Armstrong, Mitchell & Co.), about 450 feet long, and with enormous engines to work up to something like 15,000 horse-power. The other is understood to be of the Leander and Phaeton type (lately constructed for the Admiralty by Messrs. Napier & Sons), having steaming power sufficient to giae a speed of 20 knots per hour, and to carry a large number of light guns.

MESSRS. MERRYWEATHER AND SONS' WORKS.—During the past week a trial has taken place at the works of Messrs. Merryweather and Sons, of two of the most powerful steam fire engines in the world, constructed for the corporation of Liverpool. Steam was raised in the boiler of No. 1 engine (which indicates 100 horse-power) in 9½ minutes, and the steamer was tested for its fire-extinguishing powers. A jet was thrown 300 ft. with great force, the engine being capable of working twelve streams simultaneously. A satisfactory trial has also been made of one of the fifteen steam tramway locomotives now being constructed for the North London Tramways. These engines have cylinders 7½ in. in diameter by 12 in. stroke, and are each capable of drawing three loaded cars at a speed of eight miles per hour, and at a working cost of 30 per cent. less than horse-power. It is expected that the whole of these engines will be running in the course of the next two months.

MINERAL WATER MACHINERY AT THE HEALTH EXHIBITION.

Messrs. Barnett and Foster, of Eagle Wharfroad, N., had a complete mineral water factory in miniature in full operation during the Exhibition. Perhaps the chief point of interest in this exhibit, however, was the application of a mineral water machine to the bottling of beer. We give a general view (Fig. 1) of a machine use for this purpose. The beer is placed in one of the large cylinders shown, each of which is capable of holding one barrel. Air is then exhausted from the cylinder by means of the pump beneath. When the air has all been exhausted, carbonic acid gas is forced in by the same pump, until it reaches a pressure of 20 lb. to the square inch, when bottling may be proceeded with. The two cylinders are worked alternately, so that time may not be lost in charging. The conversion of the pump, from a vacuum to a force pump, is simply effected by means of two-way cocks which convert the suction into the delivery branches, and *vice versâ*.

The effect of forcing carbonic acid gas into the liquor is the same as if the beer were allowed to remain a long time in bottle, excepting that there is no thick deposit when the gas is introduced mechanically, as is the case when it is generated in the usual way by fermentation. In the mechanical process, too, the beer is fit to drink immediately it has been bottled, a point of considerable importance from a commercial point of view. The corking and bottling machine used in connection with the above apparatus is shown in Fig. 2 and is of a new design recently patented by Mr. Foster.

With this machine a screw stopper, larger than the outside part of the neck of the bottle, can be used, a great advantage, as a firm hold can be obtained for unscrewing by hand. The first operation in filling a bottle, the apparatus having been previously connected up by two pipes to the aërating machine, is to lower the handle C and place a stopper into the open connection above the space marked B. The stopper which is of lignum vitæ, is of the screw class, and has a flat head, which, as we have said, overhangs the neck of the bottle. On the lower part a thread is cut, and there is a corresponding thread in the inside of the neck of the bottle. The stopper when placed in the machine, is jammed into a cone clutch on the lower end of the vertical spindle. terminating at G. The lever C is then allowed to resume its former position, and the spindle, together with the stopper is drawn upwards out of tho way. The neck of the bottle is then inserted at B, the bottom of the bottle resting on the stand shown, which is adjustable, as to height, by means of the thumb screw H. It is now requisite to make connection between the bottle and the cylinder containing the beer under pressure, and this done in a very ingenious manner. The part of the apparatus above B, into which the neck of the bottle is thrust consists of a cylinder in the walls of which there is an annular space cast. The inner wall of the cylinder, so formed, is cut away for a short distance all round, so that there is an annular opening from the interior of the cylinder leading into the space mentioned. This opening, however, is stopped by a flat ring of india-rubber, which is really a short length of india-rubber tube, and which is firmly attached to the casting forming the cylinder. The annular space referred to, which is, of course, at the back of the india-rubber, can be put under hydrostatic pressure by means of a small hydraulic pump shown at A, and which is worked by the foot lever D. The neck of the bottle having been placed in the cylinder, the pressure is applied, and the india-rubber ring is forced against the neck of the bottle just below the top collar. The two pipes referred to, which connect with the aërating cylinders lead into the space above the india-rubber ring, and it is obvious therefore that a connection is made between the machine and bottle, if the cocks by which the connecting pipes are controlled are open, so that the beer or other liquor can be conveyed from one to the other. The reason that there are two connecting pipes is to prevent frothing or "fobbing," as it is generally called, in bottling. The beer being under a pressure of 20 lbs. or so above that of the atmosphere, and the bottle being subject only to the atmospheric pressure, a violent rush of liquor to the bottle would take place as soon as the connection was made by opening the cock so that the bottle would contain nothing but froth. In order to prevent this the second pipe leads to the space above the beer in the aërating cylinder, and by opening a cock the bottle is first put under the same pressure as that in the cylinder. The beer will then flow easily down by its own gravity and no frothing will take place. Having filled the bottle it remains to screw the stopper in. This is done by means of the handle G, the turning of which rotates the vertical spindle. The latter works through a stuffing box into the chamber in which the neck of the bottle is placed, as already explained. It will be remembered that the stopper is held by a clutch, which is in the shape of a cone, on the end of this spindle. By means of the lever C the whole is lowered until the stopper touches the mouth of the bottle, when a few turns of the handle G cause it to enter into the neck and screw it firmly home. The operation is then complete and the pressure forcing inwards the india-rubber ring can be released, and the bottle removed to make way for another. In the engraving, E is the lever of the filling valve and F a snifting valve used in botting mineral waters.

This machinery enables light beers, which are not fit to undergo the ordinary fermentation process, to be bottled. Creating a vacuum above the beer has the effect of removing the atmospheric air contained in the liquor, which does so much towards making bottled beer often taste flat and insipid. At the same time a considerable quantity of the alcohol is also removed. Beer bottled in this way is more sparkling than usual, on account of the large amount of carbonic acid gas it contains and the absence of atmospheric air. It is said, also, that persons of weak digestion who cannot take ordinary beer can drink this with impunity.

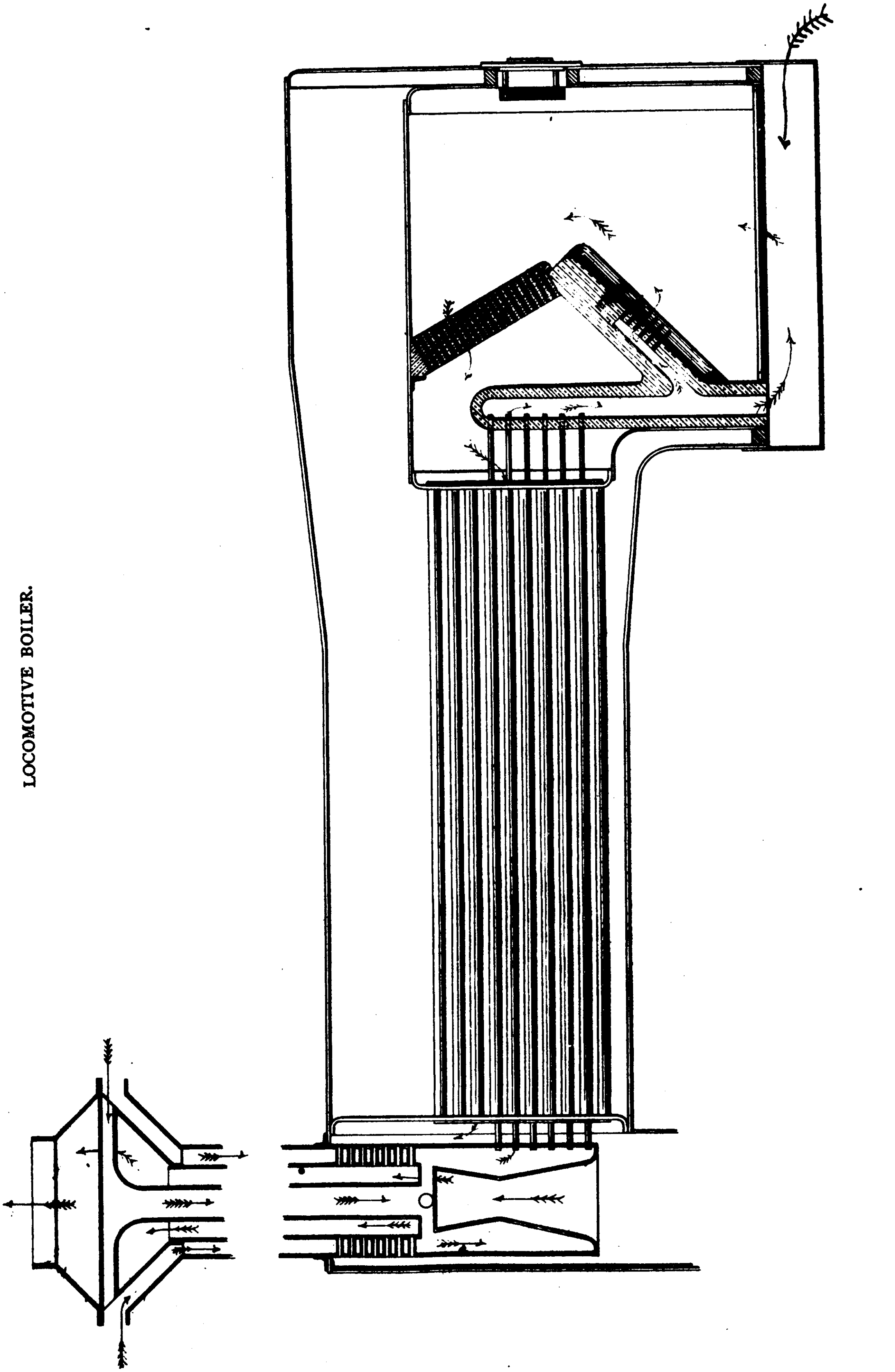
Messrs. Barnett and Foster were also manufacturing aërated waters on their stand. For this purpose they had one of the "Niagara" machines, with bottling machines connected for filling syphons, corked bottles, and variour descriptions of patent bottles. The principal novelty in the Niagara machine is the condenser, in which the agitation is not carried on by mechanism, but by the rising of gas through the water and the falling of the water in a finely diffused spray through the gas. Fig. 4 shows the action. The water and gas are pumped together at A into the space between the inner and outer casing as shown, and a certain amount of gas is there absorbed, as it forces its way through the water to pass to the central space. At D there is a perforated diaphragm through which the partially charged water falls, taking up a further quantity of carbonic acid gas while dropping to the bottom of the cylinder, where it is drawn off at B fully charged. The pressure is shown by a gauge communicating with the interior at C, and a gauge glass is provided for showing the height of the liquor in the apparatus, so that the rate at which it is drawn off may be regulated.

In Fig. 3, we give an illustration showing a general view of a new design of aërated water machine which this firm has recently introduced. The principal novelty consists in the arrangement of the two cylinders, the general principle being similar to that already described.

In the exhibition one gas-producing plant served to supply gas for both the mineral water and beer apparatus. To provide against the chance of the gasholder bell collapsing in the event of all the gas being exhausted through accident or carelessness, a special provision is made. A metal case similar to that of a dial pressure indicator is provided and is fitted with a prepared diaphragm, which will break at pressure less than that which would collapse the bell. An electric bell is also fixed which begins ringing directly the bell falls below a certain point, so that there is always warning of a failure of gas. In the machinery exhibited however, these precautions were not absolutely necessary, as the production of gas was automatically carried on, the agitator in the generator being driven from the shafting above, whilst the acid-feeding arrangement was controlled by a line and spring acting upon the acid tap. In this way the rising and falling of the bell caused the proper amount of acid to be admitted to the generator as required to make up for the gas drawn off.

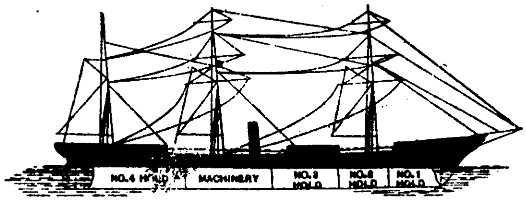
There were several other machines at work on this stand, in addition to which a number of showily got-up machines were exhibited not working. Large quantities of beer and aërated waters were bottled and manufactured in the Exhibition, and these were sent out in the ordinary course of business.—*Eng.*

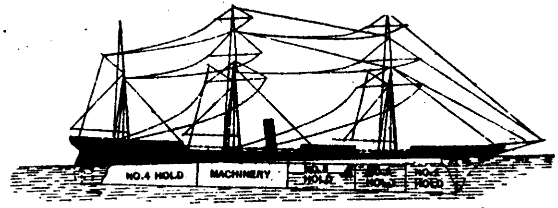
Prof. Calvert has recently made the interesting discovery, by practical tests, that the carbonates of potash and soda possess the same property of protecting iron and steel from rust as do those alkalies in a caustic state. Thus it is found that, if an iron blade be immersed in a solution of either of the above carbonates, it exercises so protective an action that that portion or the iron exposed to the influence of the damp atmospheric air does not oxidize, even after so extended a period as two years.—*Ex.*



LOCOMOTIVE BOILER.

BULKHEADS IN SHIPS.





Bulkheads in Ships.—Fig. 1.—*Bulkheads Stopped Too Low. Fig.* 2.—*Leak in No.* 1 *or No.* 2 *Hold. Vessel Goes Down.*

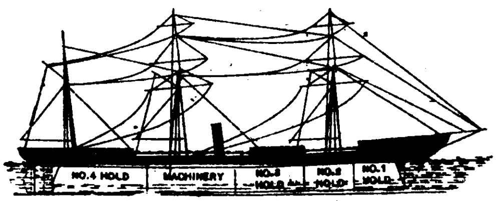


Fig. 3.—*No Bulkheads. Result of a Leak. Vessel Floats.*

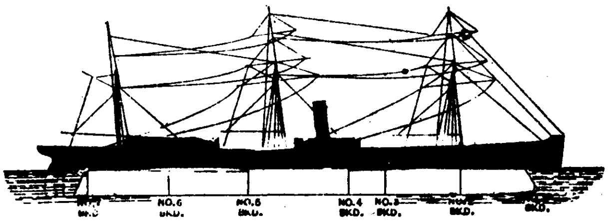


Fig. 4.—*Bulkheads Carried High.*

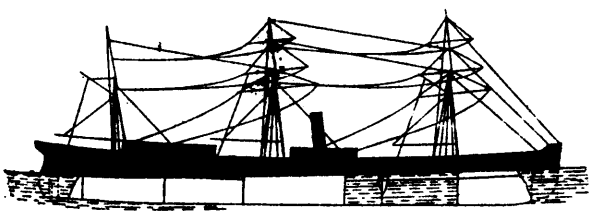


Fig. 5.—*High Bulkheads. Two Holds Full .Vessel Floats.*

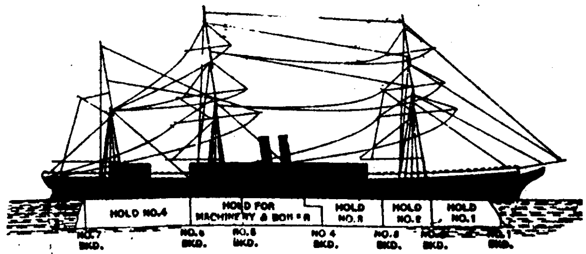
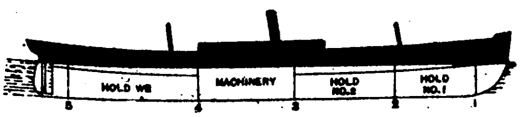
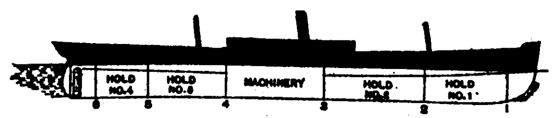


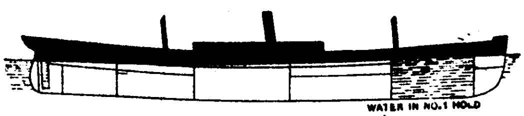
Fig. 6.—*Water-Line Bulkheads. Common Arrangement.*



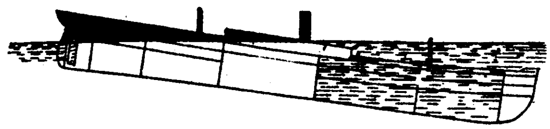
Model A.—Badly Planned Bulkheads.



Model B.—Well Arranged Bulkheads.

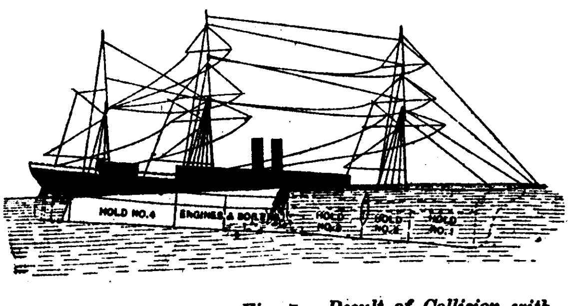


Model B with Forward Compartment Filled.



Same Model with Two Compartments Filled.

Bulkheads in Ships.—Fig. **8.—*Behavior of Models in the Water.***



Bulkheads in Ships.—Fig. 7.—*Result of Collision with Water-Line Bulkheads.*

The sketch of Loco. Boiler was designed some time ago to suit the burning of soft peat fuel.

The air inlet for furnace combustion begins at the top of the chimney just where the outlet for escape gases takes place, so that the idea of completing a perfect cycle with the gases for combustion is very good, because the escaping heat is partially carried back while the chimney draft as maintained by the blower or exhaust steam.

The ingoing hot air is conveyed from front smoke-box to furnace through small tubes lying inside of boiler-flues. The arrows indicate the direction of in-let and out-let gases.

We present the design merely as a novelty embodying a very valuable principle.

TIN PLATE NOMENCLATURE.

The changes which has latterly taken place in the manufacture of tin and terne plates have been so extensive and wide reaching that it is plain that corresponding alterations will have to be made in the nomenclature and classification of those articles. Some of these alterations in the methods of manufacture are not of yesterday's growth, but other of the changes, such as those caused by the substition of steel for iron, have come about so rapidly that the existing terms of the trade do not meet the exigencies of the situation and consequently need a wide and liberal revision. It has long been known that "charcoal" plates have not been made from charcoal iron for many years past, but the term is still in existence, just as is that which more correctly designates coke plates as being made of iron in the manufacture of which that fuel has been used. It seams certain, therefore, that we need some term which shall more accurately describe the iron plates with "charcoal finish." Then, again, there are several kinds of steel plates which are roughly classed in a corresponding categorp, some being of Siemens, or "mild" steel, while others are of different grades of Bessemer steel. Here, therefore, are further wants which should be met if the trade is to be conducted on an inteligible and exact basis. To some persons "steel" is steel by whatever process the material so styled may be produced ; but practical men who are posted up in the progress of steel manufacture do not need to be reminded that there is as much difference between the various kinds of steel as between common puddled bar and the best Swedish hammered bar iron. Tin plates of steel, therefore, require grading, not only as to the material, but also as to the tinning, so as to distinguish between the so-called "charcoal" and "coke" finishing. If any maker thinks fit to add to this grading some mark to specify and guarantee the amount of tin deposited per box of each size, etc., of plate, he will probably reap a suitable reward for his courage and enterrprise. Then we have the ordinary cokes of iron with the usual finish. These seem to need revision less than some other varities, but they should also be overhauled whilst thh general changes are receiving attention. Lately also quite a special demand has sprung up for wasters, which demand has proved so considerable and profitable that more than one or two manufacturers have laid themselves out to supply it so successfully that their plates have never reached the stage of completeness or finish. In other words, some of the mills are turning out wasters in large quantities, not as the legitimate weedings from their production, but as the sole output of their works. These, therefore, now need classification and specific names, inasmuch as they represent the introduction of a totally new element into the trade. All these are points which should receive attention at the hands of the makers, who cannot close their eyes to the changed condition of the trade, or remain ignorant of its possibilities in the near future. Swansea is gradually usurping much of the American shipping business of Liverpool, and, if the manufacturers of South Wales are wise, they will so attend to their own affairs as to render themselves much more independent than they have ever been heretofore of the control of the financers of the Mercy seaport.—*Ironmonger.*

A YORKSHIRE paper says that an inventive genius in Leeds has just "got up a stove which saves three-fourths of the coal, while the ashes it makes pay for the remainder."

Domestic Information.

THE ART OF EARLY RISING.

THE proper time to rise is when sleep ends. Dozing should not be allowed. True sleep is the aggregate of sleeps, or is a state consisting in the sleeping or rest of all the several parts of the organism. Sometimes one and at other times another part of the body, as a whole, may be the least fatigued, and so the first to wake, or the most exhausted, and therefore the most difficult to arouse. The secret of good sleep is, the physiological condition of rest being established so to work and weary the several parts of the organism as to give them a proportionally equal need of rest at the same moment ; and, to wake early and feel ready to rise, a fair and equal state of the sleepers should be secured ; and the wise self-manager should not allow a drowsy feeling of the consciousness or weary senses, or an exhausted muscular system, to beguile him into the folly of going to sleep again when once he has been aroused. After a very few days of self discipline, the man who resolves not to doze, that is, not to allow some part of his body to keep him in bed after his brain has once awakened, will find himself, without knowing why, an early riser.

THE QUININE HABIT.

WHAT AN OBSERVANT DOCTOR HAS TO SAY ABOUT IT.

SAID a distinguished medical practitioner who has grown gray in his profession, speaking of the report that the use of quinine as a stimulant is becoming a very common habit among men and ladies in society—

"Yes, it is unquestionably true that the great increase in the sales of quinine during the last five years by retail druggists is very largely referable to what may be styled the quinine habit ; and it is fully as frequent among women in society as it is with men whose nerves are over-taxed by hard work. And I may say to you, though many will dispute it, that of the two, the quinine habit in its ravages, when once thoroughly established, is more difficult to break, and more dangerous in every respect than the habitual use of opium or its preparations.

"Few save practising physicians are aware of the tremendous potency of this drug in its effects upon the nervous system. As you know, depending upon the quantity taken, quinine possesses four very distinct properties—being in very small doses tonic and nervine, in moderate doses directly stimulant, in large doses sedative and soporific, and in very large doses intoxicating—producing a peculiar species of drunkenness, similar in its features to masked epilepsy, in which, while performing customary actions and talking with the coherence of a person in the full possession of his senses, the victim is really perfectly unconscious of what he is doing and totally irresponsible.

"There is no question that the regular use of the drug as a stimulant is rapidly increasing among the higher classes—the fact is one of the most lamentable that has come under my notice for years. The way in which a man gets into it in the first place is very simple. He feels a little unstrung and out of tune, perhaps, and so consults the family physician, who suggests a few doses of quinine. In a day or two he feels singularly improved ; his brain is clear and bright ; the physical energies seem to have renewed their youth. Elated with the results, whenever he feels down-spirited or out of sorts, he resorts, of course, to the remedy that has once served his purpose so well ; and very soon has acquired the habit of using the drug in regular daily doses. In three months, so insidious are its effects, the quinine habit is fully established, and the probability is that the man (or woman, as the case may be) has not long to live. Worse still, so peculiar are the effects of the salt on the nervous system, there is a strong probability that the victim will die of suicide ; for it is a singular fact that no tonic in the *materia medica* acts so directly and rapidly to produce suicidal predisposition and impulse. Morphia has no such effect, deplorable as its ravages are.

"The morphia habit generally transforms the most truthful man or woman into the most inveterate liar in the course of two or three years—a romancer of the wildest type. On the other hand, while quinine produces no perceptible effect on the veracity, it leads to a nervous irritability that is intolerable alike to its victim and his associates, and frequently ends in the sudden development of suicidal mania.

"Again, a patient may be reduced to the verge of the grave by morphia, and still recover a remnant of physical and nervous energy when the drug has been eliminated from the system; but when once the system gives way under the cumulative influence of quinine the breakdown is irrevocable.

"In the course of an experience embracing thirty-five cases of the quinine habit in its later stages, during the last two years, I have never seen a case in which the victim was good for anything after the habit was broken, and as a rule the patient collapses and dies if the withdrawal of the stimulant is preserved in. Knowing these facts, I cannot tell you how I dread to prescribe quinine to men a little fagged out with overwork, and I think it is time that medical men began to be as cautious with it as they are with morphia."

Varieties.

A SCIENTIST asserts that a bee can only sting once in two minutes. We would respectifully submit that this is often enough.

THE gentleman so often spoken of in novels who rivetted people by his gaze has obtained employment in a boiler manufactory.

"REMEMBER, sir, that you owe something to your constituents," said one member of a town council to another. "Humph," said the other, "if you owe anything to your constituents, all I've got to say is that you're lucky. Why, there are not a half-dozen voters in my ward that have not borrowed money from me."

A CLOCK is being introduced in Europe, warranted to run five years without winding or regulation. The Belgian Government placed one in a railway station in 1881, and it has kept perfect time ever since without winding. This is the nearest approach to perpetual motion that we have yet heard of.

DARWINISM.—A gentleman called upon a professor of natural history just as he was preparing to go out. "Perhaps I disturb you?" said the visitor. "Oh, not at all." "You were, no doubt, intending to make some important scientific investigations, and my visit——" "You don't disturb me in the least, I tell you, quite the contrary. I was about to collect materials for my work on monkeys; pray be seated?"—*La Chronique.*

AN Englishman and a Scotchman had a dispute as to which of their respective countries had produced the most eminent men. Every man of note was claimed by the Scotchman as that of a man born north of the Tweed, Till finally the Englishman said:—"Surely you won't claim Shakspere as a Scotchman?" "No," replied the canny Scotchman, "but ye'll maybe admit that he was maist clever eneuch to be ane?"

INDIAN INK.—Indian or Chinese ink, an article much used by draughtsmen and others, is made essenticlly of lampblack, formed into cakes by means of some glutinous or adhesive substance, such as gum-water. The lampblack is said to be made in China by collecting the smoke of the oil of sesami. A good Indian ink is made with ivory black ground to a fine powder made into a paste with weak gum arabic water, and then formed into cakes.

FAR TOO SAFE.—AN ingenious mechanic in Birmingham constructed a safe which he stated to be absolutely burglar-proof. To convince the incredulous of the fact, he placed a one thousand pound note in his pocket, had himself locked in the safe, and declared that he would give the money to the man who unfastened the door. All the blacksmiths, carpenters, and burglars in the country have been boring, and blasting, and beating at the safe for a week with every kind of tool and explosive mixture known to science, and the man is in there yet! He has whispered through the keyhole that he will make the reward ten thousand pounds if somebody will only let him out. He has convinced everybody that it is the safest safe ever invented. Fears are entertained that the whole concern will have to be melted down in a blast furnace before he is released, and efforts are to be made to pass in through the key-hole a fire-proof jacket to protect the inventor while the iron is melting.

Engineering Notes.

AFTER a personal inspection of the Panama Canal works, Captain Bedford Pim has complimented the French projectors on what they have done; but he has arrived at three conclusions which are adverse to the ultimate success of the scheme. He says a canal upon the sea level cannot be completed for any reasonable sum, nor within any reasonable time; that the yellow fever has become endemic and deadly; and that the project involves a proposal of the secession of the State of Panama from the United States of Columbia, with the ultimate idea of French protection.

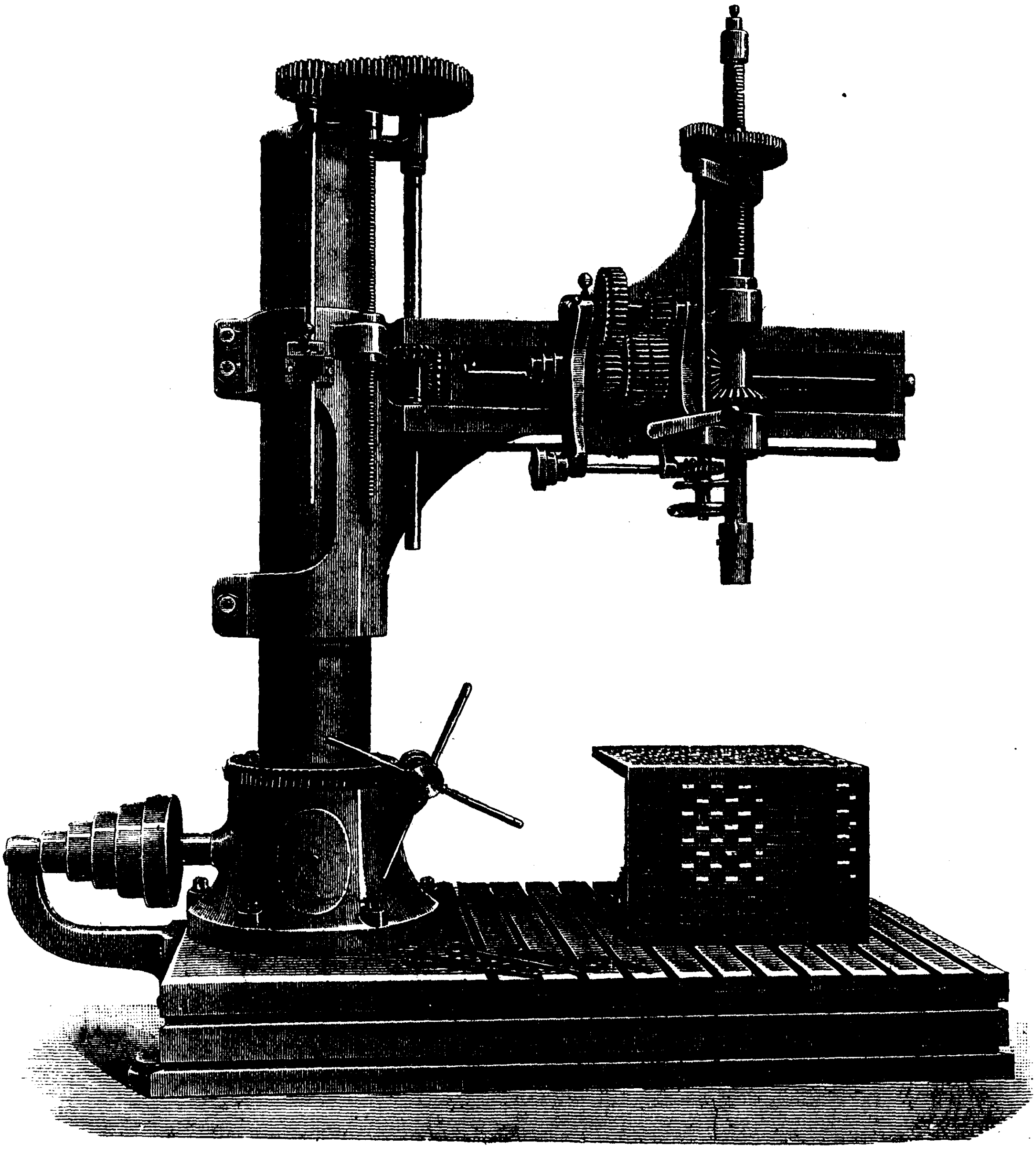
An experienced mechanic states that to harden cutters without breaking them it is better to bring the finished piece to a red heat and lay it down to get quite cold, when it may be reheated and hardened in the usual manner without danger. This seems to be in harmony with the practice, now common in some shops, of first annealing the next blank, next working it approximately to size and then re-annealing, and finally finishing the cutter, die or other tool, and hardening and drawing the temper in the usual way. In some instances, where the least springing of the finished article, would be a serious objection, the article is annealed a third time before it undergoes the finishing operation.

A GREAT LAKE EAST OF HUDSON'S BAY.—Mr. F. H. Bignell, of a Canadian geographical society, has just returned from an exploring expedition to the north-east of Quebec, an expedition which left in June last, to discover, if possible, a great inland sea which has for some time been identified with Lake Mistassini, just north of the Province of Quebec. Mr. Bignell did not belong to the main expedition, which was equipped for an eighteen months' stay, but he reports having navigated 120 miles on a great lake, which he assumes to be an expansion of Rupert River, without having really reached the body of the lake. He says it lies from southwest to southeast, stretching toward the Labrador coast, between low-lying banks, and probably covers as much area, at least, as Lake Superior. The existence of such a body of water in this hitherto almost totally unexplored region has heretofore been the subject of many rumors, and further authentic reports will be looked for with great interest.

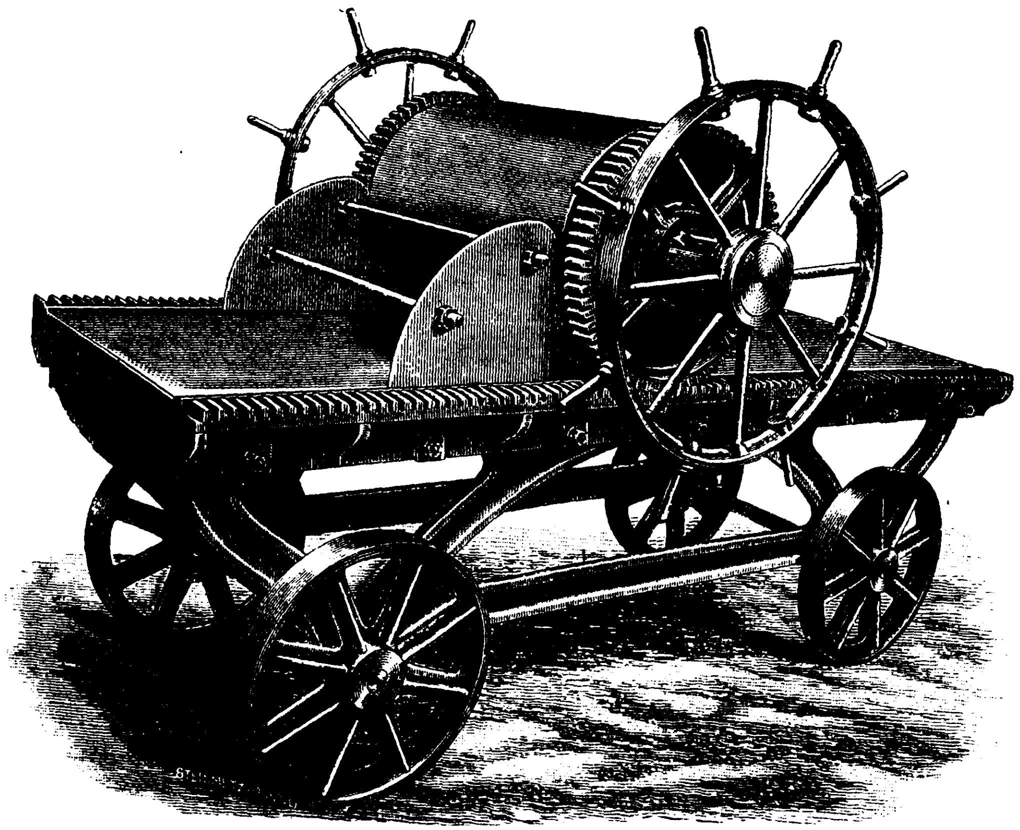
ELECTRIC LIGHT SPECTACLES.—Dr. W. H. Stone, F.R.S., who recently read a paper on the physiological bearing of electricity on health, at the International Health Exhibition, on the occasion of the conference held there by the Society of Telegraph Engineers and Electricians, has devised a pair of spectacles or eye-protectors for persons who are in the habit of working by or with electric light. The spectacles consist of front glasses of blue with attached side glasses or "blinkers" of red glass. The danger to the eye from the incandescent lamp is likely to arise from the red or heat rays, that from the arc lamp is due to excess of blue or actinic rays, hence the use of two glasses. In looking at the incandescent light through the blue glasses, the glare is removed and irritation from the intense yellow and rays prevented, which after folding down the red side glasses over the blue front ones, the arc light can be looked at with safety through the joint media. The tints of the glasses are selected and combined by the help of the spectroscope.

LONG DISTANCE TELEPHONING.—The most remarkable piece of telephoning yet attempted has been just accomplished by the engineers of the International Bell Telephone Company, who successfully carried out an experiment by which they were enabled to hold a conversation between St Petersburg and Bologne, 2,465 miles. Blake transmitting and Bell receiving instruments were used, and conversation was kept up, notwithstanding a rather high induction. The experiments were carried on during the night, when the the telegraph lines were not at work. The Russian engineers of this company are so confident of further success that they hope shortly to be able to converse with ease at a distance of 4,665 miles; but to accomplish this astonishing feat they must combine all the conditions favourable to the transmission of telephonic sounds. If it is found possible to hold audible conversation at such extraordinary distances, it is possible that this fact will be speedily improved upon, and we shall be enabled to converse freely between London and New York, and by and by between London and the antipodes.

RADIAL DRILLING MACHINE.



GLASS ROLLING TABLE.



THE annexed illustration shows a strong and well-designed radial drilling machine, which has recently been brought out by Messrs. George Booth and Co., Halifax for engineering and shipbuilding purposes. The machine contains several noticeable improvements upon the ordinary form of radial drilling machines, and is constructed with external and internal columns. The internal column is securely bolted to the foundation plate and the external colum is bored, turned, and secured to the internal column by three T bolts working in a circular groove. One of the features of this machine is that the radial arm can be completely rotated or adjusted as required by means of a worm-wheel and handle shown on the engravings on the base of the external column. The radial arm can be raised and lowered 3 ft. 4 in. by power, and the machine will admit objects up to 6 ft. in height under the spindle. Another feature is that the saddle carries the double gearing which is very convenient for being readily engaged and disengaged, besides dispensing with a great amount of torsion of the driving shafts which are between the driving cone and the spindle. The spindle is of steel 2⅝ in. in diameter and is carried in a long cast-iron socket, the bottom end of which is conical; the top is fitted with lock nuts for adjustment when wear has taken place. The self-acting feed motion will give a traverse 16 in. deep and the feed screw is fitted with two brass nuts, one being so arranged that it can be adjusted to prevent backlash of the spindle. The saddle is moved along the radial arm by means of a screw, bevel wheels and handle, conveniently placed for the workman. The maximum range of the spindle is 6 ft. radius from centre of column to centre of spindle and minimum 2 ft. 8 in. radius. The foundation plate is 7 ft. 9 in. long, 4 ft. 4 in. wide on face, and 12 in. deep. It is planed on the top and front and the T slots on the front are planed out. The loose angle table is 2 ft. 9 in. long, 2 ft. wide on the top, and 1 ft. 9 in. deep, accurately planed. Steel gearing is largely applied to the machine, and the workmanship is of the makers' usual high class. The principal wrought-iron parts, where needful, are properly case-hardened. These machines have already been supplied to some of the principal firms in Great Britain.—*Eng.*

GLASS ROLLING TABLE.—We publish an illustration of a machine constructed by Messrs. Robert Daglish & Co., St. Helen's Engine Works and Foundry, for rolling out cast glass into sheets. As will be seen the table is portable, being mounted on four wheels so that it can be moved with ease to any part of the glass works. The moulding tables are of cast iron, and of widths varying from 2 ft. 9 in. to 4 ft. 2 in. The surface is either plain, ribbed, checkered, or formed with any device which it is desired to impress on the glass. On each side of the table a rack is mounted on the frame of the carriage, and gearing into each rack is a toothed wheel mounted on a shaft, which also carries a plain iron drum the width of the table. The melted glass is poured on the table in front of the roller, which is then passed to and fro by means of the hand-wheels shown, and the glass is thus spread out into a sheet. An adjustable guide is placed at the back of the roller to regulate its travel, and means are provided of varying the thickness of the sheet rolled.—*Eng.*

Engineering Notes.

LIGHTING AN EXPRESS TRAIN.—The London and North Western R. R. Co., of England, has for three months past been lighting an express train, running between Manchester and Liverpool, with the electric light. A small engine carried upon the locomotive tender is fed with steam from the boilers and drives a Siemens regulating dynamo, supply current for 19 Swan incandescent lamps of 20 c.p. each. A pilot lamp is carried on the locomotive which indicates the burning of the lights in the train, and a spring ammeter shows the strength of the current. The lamps are kept burning day and night and the experiment is considered an entire success.

HEAVY ORDNANCE FOR HARBOR DEFENSE.—The armament board appointed by Congress to make tests of artillery have made a report recommending that the following described guns be procured at the earliest date practicable for the defense of our harbors. One hundred and twenty-five eight-inch guns, to carry projectiles weighing 285 pounds; 226 ten-inch guns, to carry projectiles of 575 pounds; 306 twelve-inch guns to carry 894 pound projectiles; 50 16-inch guns, to carry projectiles of 1,631 pounds; 512 12-inch mortars, to carry 610 pound projectiles. These guns will have a penetrating force, at 5,000 yards, through a thickness of iron as follows: Eight. inch caliber 10.39 inches; 10 inch caliber, 15.16 inches; 12-inch caliber, 18.15 inches; 16-inch caliber, 22.20 inches.

THE WEALTH FROM INVENTIONS.—Senator Platt, in his vigorous speech in Congress last winter in support of our patent laws, claimed that two-thirds of the aggregate wealth of the United States is due to patented inventions. That two-thirds of the $43,000,000,000 which represents the aggregate wealth of the United States rests solely upon the inventions, past and prasent, of this country.

Mulhall, in his "Progress of the World," writes that in effect the invention of machinery has given mankind an accession of power beyond calculation. The United States, for example, make a million sewing machines yearly, which can do as much work as formerly required 12,000,000 women working by hand. A single shoe factory in Massachusetts turns out as many pairs of boots as 30,000 boot-makers in Paris. —*Exchange.*

THE LARGEST ENGINE ON THE LAKES.—The *Australasia*, launched at Bay City, Mich., several weeks ago, besides being the largest wooden craft ever built in that region, has probably the largest engine on the lakes. The extreme length of the vessel measures 305 feet; length of keel, 285 feet; breadth of beam, 40 feet; depth of upper hold, 22 feet; depth of lower hold, 12 feet; between decks, 10 feet. She is a double-decker, and has seven hatches, and her cost is estimated at $150,000. The engine is compound, the high-pressure cylinder being 30 inches in diameter, and the low-pressure 54 inches, the stroke in both being 45 inches. It was built at the King Iron Works, of Buffalo. The two boilers, of Otis steel, were made by Riter Bros., of Buffalo, and have each an 8-foot shell, 27 feet long. They rest on the lower deck. The shaft is 11 inches in diameters, while the wheel measures 12½ feet.

THE HEAVIEST CLOCK IN AMERICA.—The clock in Trinity Church Tower, New York City, is the heaviest in America. The frame stands nine feet long, five feet high and three feet wide. The main wheels are thirty inches in diameter. There are three wheels in the time train, and three each in the strike and the chime. The winding weeels are formed of solid casting thirty inches in diameter and two inches thick, and are driven by a "pinion and arbor." On this arbor is placed a jack, or another wheel, pinion and crank, and it takes 850 turns of this crank to wind each weight up. It requires 700 feet of three-inch rope for the three cords, and over an hour for two men to wind it. The pendulum is eighteen feet long, and oscilates twenty-five times per minute. The dials are eight feet in diameter, although they look little more than half that large from Broadway. The three weights are about eight hundred, twelve hundred and fifteen hundred pounds, respectively. A large box is placed at the bottom of the well that holds about a bale of cotton waste, so that if a cord should break the cotton would check the concussion.—*Ex.*

THE GREAT EASTERN.—Nearly 25 years have elapsed since the Great Eastern, then and now the largest ship in the world, steamed into the port of New York, and became at once the most popular curiosity of the season. She was more than 1-8 mile long, and drew nearly 30 feet of water, so that the Adriatic, until then much the largest steamer afloat, was a pigmy beside her. She had been designed with reference to a wave theory that promised great steadiness to a vessel more than 600 feet long. She had paddles as well as propeller, and the capacity of her engines was estimated at the until then unheard of figure of 10,000 horse-power. She soon proved a failure, however, in every respect except storage-room; she was not fast, comfortable or profitable. On a few occasions she was used as a troop-ship, and two or three times she laid ocean cables, but even in these capacities she was afterwards supplanted by smaller vessels. Recent improvements in ocean steamers have made her antiquated and expensive, and, all endeavors to make her useful as an ocean steamship having failed, she has been used as a coal-hulk; but the latest idea is to convert her into a large floating hotel. This last is, perhaps, the most graceful compliment of all, and let us hope it may prove an abiding success.

SOLDERING CAST IRON.—There are cases, says the *Scientific American*, where brass requires to be united to cast iron, and drilling and riveting would either make a clumsy job or would weaken the parts. Soldering, if effective, is incomparably the better way. By many mechanics it is supposed to be either a trade secret or a skillful trick to make solder adhere to cast iron, but it is not so. The process differs but slightly from soldering on an already tinned surface, as sheet tin.

If the cast iron is white iron, or a thin casting that has been chilled in the casting—iron not amenable to the file—it should be cleaned from surface impurities by scraping or scouring, and washing in potash water. Then dip it for an instant in clear water, and wash it quickly with undiluted muriatic acid of the ordinary commercial strength. Go over it at once with powdered rosin, and solder with the soldering iron, before the surface has time to dry.

Another plan, and a better one especially for soft gray iron castings, is to file the surface clean, wash as before, wipe it over with a flux made of sheet zinc dissolved in muriatic acid until it is surcharged, or is a saturated solution, and has been diluted with its own quantity of water. Then sprinkle powdered sal ammoniac on it, and heat it over a charcoal or clear hard coal fire until the sal ammoniac smokes. Dip at once into melted tin, remove, and rap off the surplus tin.

THE war ship *Esmeralda*, recently completed on the Tyne, England, for the Chilian Government, is now the fastest cruiser in existence, a speed of 18.28 knots per hour having been developed during her late trial. Her dimensions, as given in the several descriptions which have been published within the past few week, are: Length, 270 feet; breadth, 42 feet; displacement, 3,000 tons; draft, rather over 18 feet. When fully stored, armed and equipped for sea she carries, in addition to several smaller guns, two 25-ton guns, each with a projectile weighing 450 poumds, with a penetrative power at the muzzle estimated at 21 inches of iran armor. The hull is of steel and is framed on the ordinary transverse system, and is not wood-sheathed or coppered. There are three complete decks. The upper or gun deck is some 11 feet above water, and upon it all the heavy guns are carried in the open. The main deck is about five feet above water and is occupied throughout by quarters and cabins for officers and crew. The lower or protective deck is of 1-inch steel, and extends from stem to stern. It is strongly arched in the athwartship direction, and at the middle line is about 1 foot below water, while at the sides this depth is increased to 5 feet. She has twin-screw propellers driven by two independent sets of machinery. The engines are horizontal and on the two-cylinder compound principle, the cylinders being 41 and 82 inches in diamoter, with a stroke of 36 inches.

THE IMPERIAL PALACE AT STRASSBURG.—The work of erecting this splendid building in the capital of Alsace is now making good progress. The total cost is estimated at £133,000, of which sum about half has already been voted by the Imperial Parliament. The foundations and basement are finished, and the ground and principal storeyes as expected to be completed early in 1885, but the rest of the work, including the carpentry and the decorations of the interior and exterior will require three or four years more, so that the palace will not be finished before 1888 or 1889.

Miscellaneous Notes.

Bronze is a mixture of copper and tin, and sometimes lead the proportions of which vary somewhat, but are usually as nine to one. It is often adulterated with zinc, but when this is the case its surface honey-combs on exposure.

An English physician has recently been trying to count the hairs on the human head. Taking an ordinary hairy head the number of hairs per square inch was found to be 1,066. This would give about 128,000 for the entire head, while some would have as many as 150,000.

Poisoned Water.—Dayton, O., has a mysterious case of water poisoning, resulting in the death of 2,000 fish in Sachs & Pruden's aquarium and of the fish in the water works ponds. The water is taken from the water works near Mad river. Several strange deaths have occurred in the past two weeks. The cause is as yet unknown.

Botanists have evidence that trees may attain very long lives. The age of an elm has been estimated at 335 years; that of some palms at from 600 to 700 years; that of an olive tree at 700 years; af a plane tree at 720; of a cedar at 800; of an oak at 1,500; of a yew at 2,880; of a taxodium at 4,000 and of a baobab tree at 5,000 years.

Photographing Faces.—A New York photographer is quoted as saying: "After twenty-five years' experience under the skylight, after photographing over 147,000 people, I have become convinced that in 19 cases out of 20, the left side of the face gives the most characteristic likeness, while to the same degree the right side is the most symmetrical."

Canvas bags, it is said, can be made as impervious to moisture as leather by steeping it in a decoction of one pound of oak bark with fourteen pounds of boiling water, this quantity being sufficient for eight yards of stuff. The cloth from which the bags are made has to soak twenty-four hours, when it is taken out, passed through running water, and hung up to dry.—*Exchange.*

A Canadian Order in Council has been passsed authorizing the representation of the Dominion at the Universal Exhibition to be held in Belgium in May next year, and the Canadian Department of Agriculture is taken steps to carry out the order. Though Canada will not be officially represented at the Inventions Exhibition, which is to be held in London during 1885, Canadian Inventers will be able to exhibit at their own risk, and several have already intimated their intention to exhibit their inventions.

European Armoured Fleets.—Sir T. Brassey, a short time ago, stated at Plymouth that the aggregate tonnage of the effective armoured fleets of leading naval Powers of Europe might be summarised as follows—

	Tons.		Tons.
England	329,520	Russia	83,621
France	201,789	Austria	63,110
Germany	74,007	Italy	55,905

In this computation those ships only were included which were actually ready for sea.

Agricultural Returns for 1884.—The following is a summary of the agricultural returns of Great Britain for 1884, which were collected on June 4. The acreage under cultivation for the five principal crops was as follows:—

Wheat	2,676,477	Potatoes	562,344
Barley	2,159,485	Hops	69,258
Oats	2,892,576		

Compared with the previous year, these figures show an increase in the area devoted to wheat of 2·4 per cent., and increases in potatoes and hops of 3·5 per cent. and 1·8 per cent. respectively, while there are decreases in the area occupied by barley of 5·8 per cent. and by oats of 2·8 per cent.

Newspapers of the World.—A free calculation shows that, including dailies, weeklies, and monthlies, the presses of America annually issue nearly 2,800,000,000 copies per annum, a ceaseless shower of literary snowflakes for ever floating around each remote centre of Angle-Saxon life. Australasia annually distributes upwards of 112,000,000 copies of her home-printed papers, while the annual production of Europe runs up to 7,300,000,000 copies—mingled showers of every conceivable quality, good, bad, and indifferent, every shade of opinion, and on every topic under heaven. A further calculation shows Great Britain to be the best country supplied with newspapers, while Belgium ranks next, and the United States third. The ratio of copies yearly distributable to each person in these three nations is as follows: Great Britain 64·01; Belgium, 59·20; the States, 51·06.

Moulds for castings are now being made from clay and brown earth—a German process, which is said to ensure an article of great durability. Pure clay is ground very fine and kept dry for use; the coal is ground to a degree which is variable according to the kind of casting wanted. The clay and coal are well mixed together, and when the clay is of good quailty a mixture of the two in equal proportions suffice for most purposes. Chamotte meal may be added to make the mould harder, but is not absolutely necessary. The mixture is worked, after the addition of water, into a stiff mass which is used for the moulds, the latter being made in a manner similar to sand moulds, and dried slowly. When this is completed they are washed with a dilute solution of soluble glass and dried again, this operation being repeated three or four times. On becoming perfectly dry the mould is burned to gives it a glossy appearance.

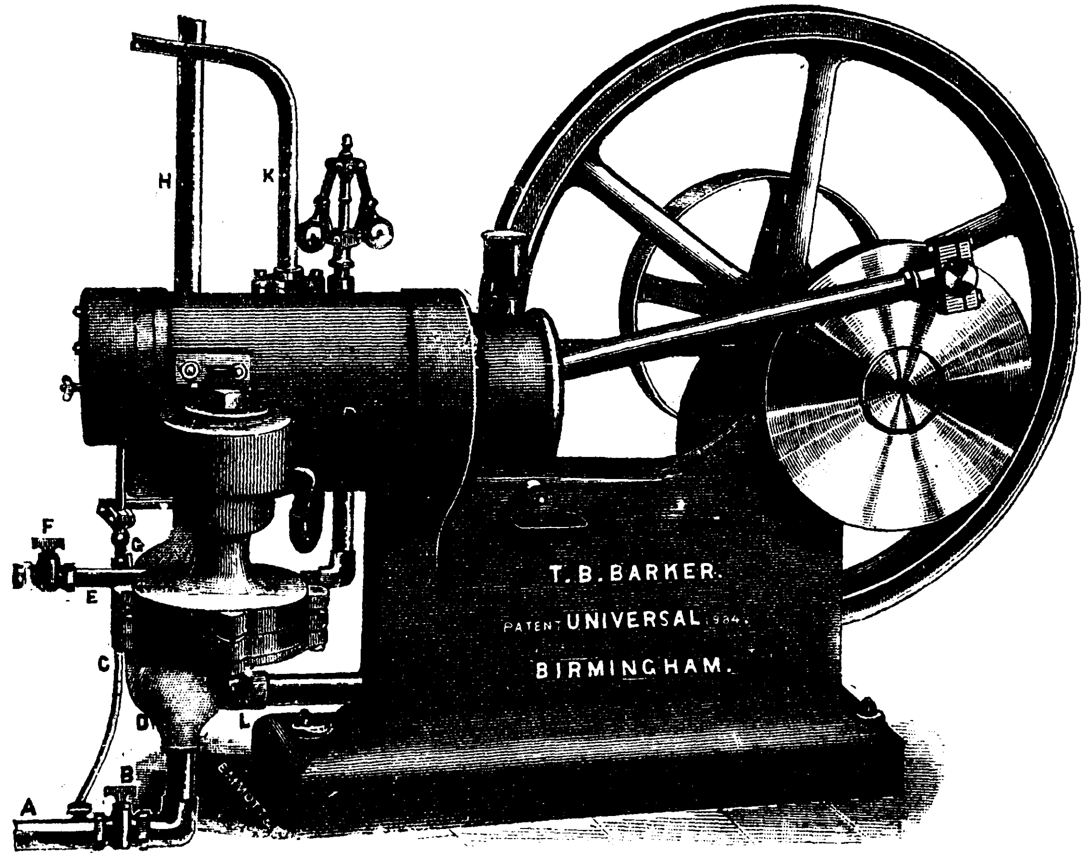
What a Bombardment Costs.—War is not only a relic of barbarism but it is prodigiously expensive. When all nations have become civilized to a sufficient degree, it will doubtless be abolished, not only for reasons of humanity, but on economic grounds as well. The cost of a single round in the bombardment of Alexandria is figured up by the *Pall Moll Gazette* as follows:

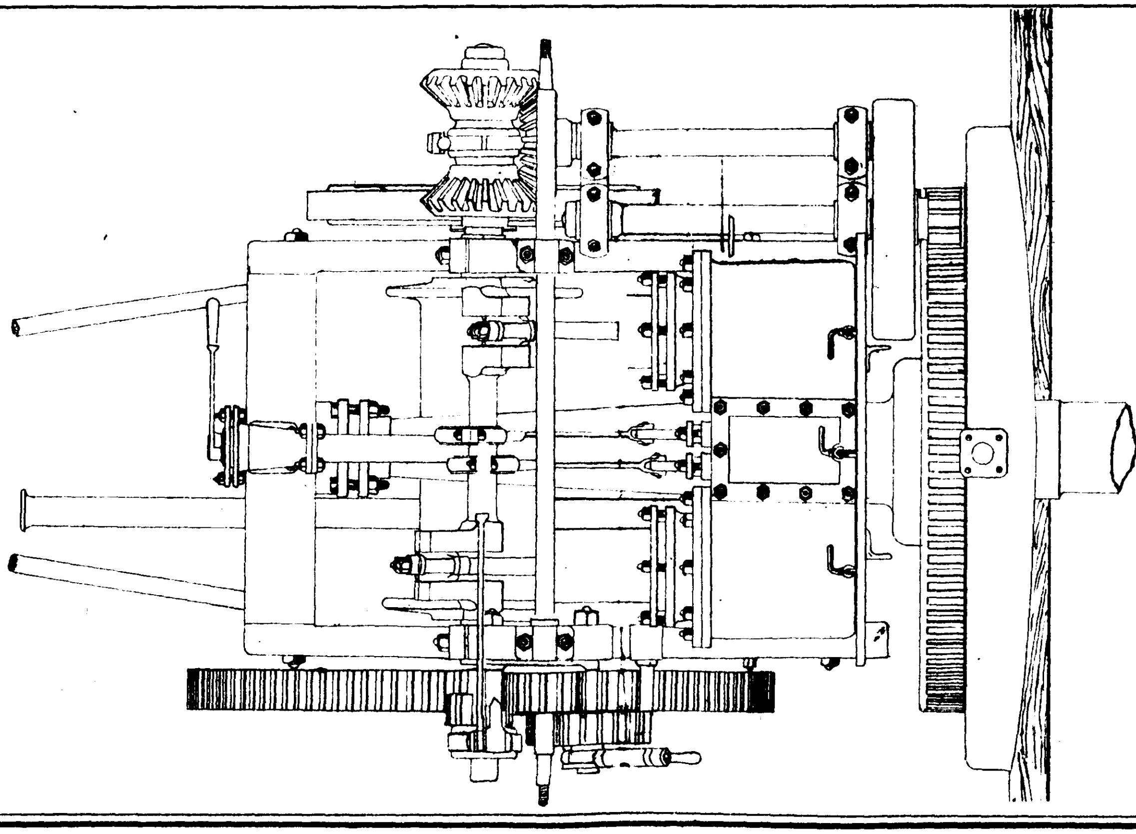
Four 81-ton guns	at £25 10 0	£102 0 0
Ten 25-ton guns	at 7 0 0	70 0 0
Thirty-eight 18-ton guns	at 5 5 0	199 10 0
Sixteen 12-ton guns	at 3 12 0	57 12 0
Eight 9-ton guns	at 2 15 0	22 0 0
Two 6½-ton guns	at 1 15 0	3 10 0
Four 64-pounders	at 0 18 0	3 12 0
Seven 40-pounders	at 0 12 0	4 4 8
Eighty-seven guns		£562 8 0

That is to say, a single shot from each of the eighty-seven guns cost in the aggregate about $2,300. The *Gazette* very pertinently enquires if this is the bill for a single round, what must it be for a day's bombardment? And this is only one item of the vast outlay required to maintain an army and conduct a campaign.

Earth Worms.—An interesting paper on the habits of earth worms in New Zealand is contributed to the New Zealand Institute by Mr. A. T. Urquhart. The species are not named, but with such wonderful opportunities as Mr. Urquhart possesses for making a collection of these, may we hope that, in addition to his following out his painstaking observations as to their habits, he will also advance science by making a careful collection of the forms and placing them in the hands of some of the able naturalists of the Auckland Institute for description? It will be remembered that Darwin assumes that in old pastures there may be 26,886 worms per acre, and that Henson gives 53,767 worms per acre for garden ground and about half that number in corn fields. Mr. Urquhart gives, as the result of his investigations of an acre of pasture land near Auckland, the large number of 348,480 worms as found therein. It being suggested to him that in his selection of the spots for examination he may have unconsciously selected the richest, the experiment was again tried in a field seventeen years in grass. A piece was laid out into squares of 120 feet, and a square foot of soil was taken out of each corner; worms hanging to the side walls of the holes were not counted, and in one hole, where the return of worms was a blank, the walls were crowded with worms. As a result there was an average of 18 worms per square foot, or 785,080 per acre. Although this average is very striking when compared with that of Henson, it is worthy of note that the difference between the actual weight of the worms is not so marked. According to Henson, his average of 53,767 worms would weigh 356 pounds, while Mr. Urquhart finds that the average weight of the number found by him came to 612 pounds 9 ounces. —*Ex.*

THE "UNIVERSAL" GAS ENGINE.





FIVE TON DECK CRANE.

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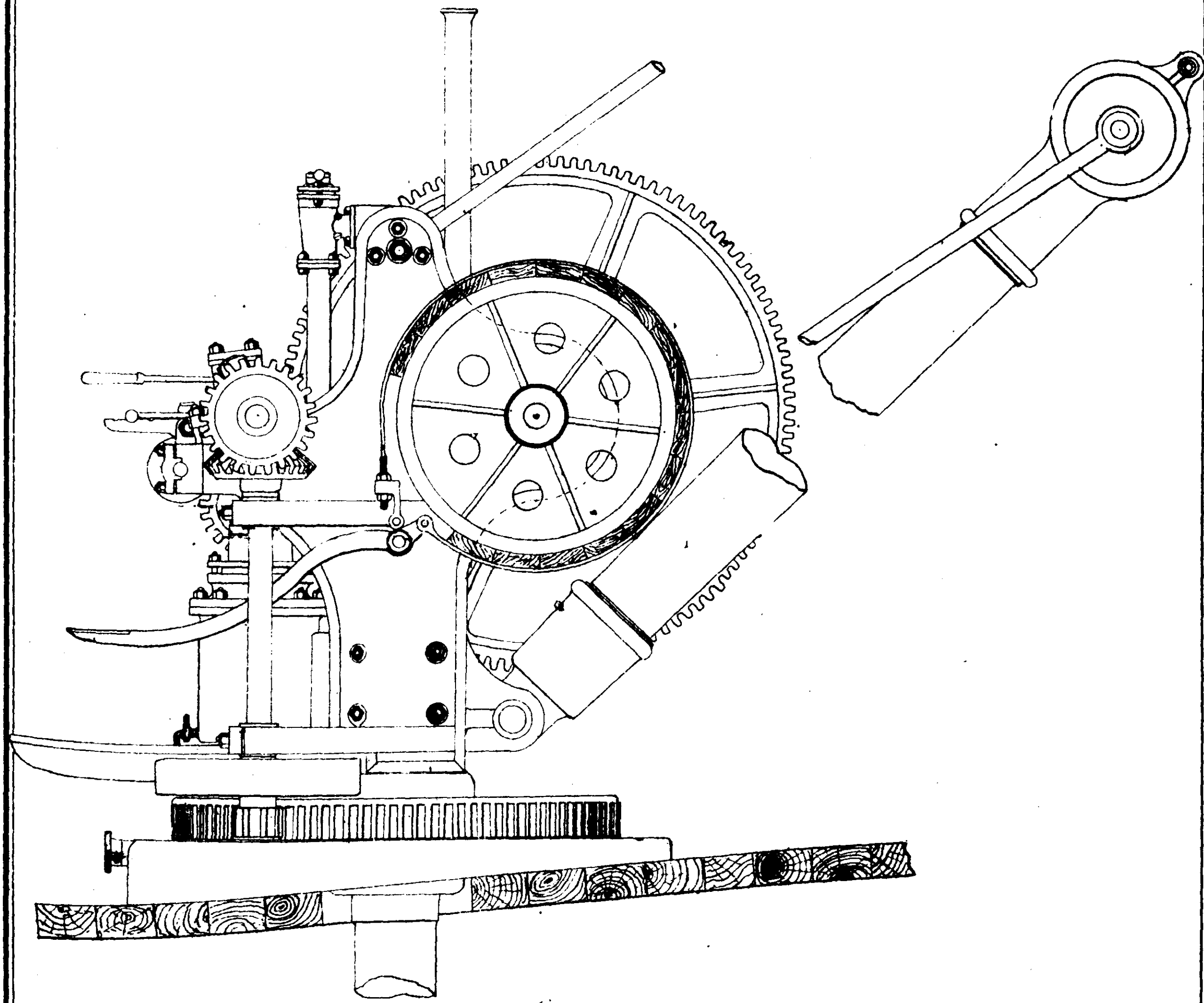


In the West Annexe of the International Health Exhibition there is shown a neat form of non-compression gas engine suitable for moderate powers. It is manufactured by Messrs. T. B. Barker & Co., of Scholefield street, Birmingham, and is named by them the "Universal." The method of its action is exceedingly simple. The piston, in moving forward, draws in behind it a mixed charge of gas and air during the early part of the stroke. When the requisite amount has been admitted, a small port in the end of tub cylinder is exposed and a blue gas flame sucked through it, with the result that the combustible mixture is exploded and the piston driven forward to the end of its stroke. The exhaust valve is then opened and the returning piston drives out the products of combustion ready for the reception of a fresh charge. Referring to the above illustration, it will be seen that the engine has a horizontal cylinder with a long piston, to which the connecting-rod is directly pivotted. The gas and air are admitted through lift valves in the casing at the cylinder end, and are raised by the partial vacuum which is created in the cylinder as the piston moves outwards. The amount of gas which is delivered at each stroke is regulated by the governor, and by a cam on the rotating shaft parallel to the cylinder. This cam is so shaped that at one part of its revolution it presses back a spindle and opens a valve. It does not, however, do this directly but through the intermediary of a movable wedge-shaped distance piece, which stands between the cam and the spindle. This piece is connected to the governor, rising and falling with it, the thick part of the wedge being opposite to the spindle when the engine is running slowly, and the thin part when the speed is greater. When the rate of revolution exceeds a fixed amount, the wedge is raised so far that the gas valve is not opened at all. The main gaspipe is shown at A, and is connected to the flexible bog D, the upper orifice of which leads to the valve controlled by the governor. The exhaust valve is on the opposite side of the engine from the observer, and communicates with the pipe H, its opening and closing being effected by a valve on the side shaft.

The ignition valve is at the end of the cylinder and forms the most novel part of the design. It is a flat disc carried on a central stud, and held against the rear cover by a spiral spring, which can be tightened up by a nut. The periphery of the disc is cut into ratchet teeth which gear with a pawl worked by a small crank at the end of the side shaft. At each revolution of the engine the pawl suddenly moves the disc to the extent of one tooth, and then leaves it stationary until the crank again comes round. A number of fine radial slits or ports are cut in the disc, corresponding to the number of ratchet teeth, and in the cylinder cover there is also a port which for an instant in each revolution corresponds to and is seen through a port in the moving disc. A blue flame from the jet G burns opposite the cylinder port, and when the latter is momentarily exposed, it is drawn into the cylinder and ignites the explosive mixture.

The cylinder is water-jacketted, the fluid entering by the tap F and pipe E, and leaving by the pipe K. The engine is made in seven sizes of $\frac{1}{8}$, $\frac{1}{6}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, 1, and 2 horse-powers, and appears very well adapted for the purposes of small manufacturers, as it is exceedingly simple, and can be readily managed by a person quite unskilled in the management of machinery. The consumption of gas is stated to be from 40 ft. to 50 ft. per hour.—*Ex.*

BULKHEADS IN SHIPS.

The uselessness of bulkheads in ships has recently attracted a great deal of attention. Vessels have gone down after collisions so often where perhaps only a single compartment was flooded, that there has been much discussion as to the value of bulkheads as a protection against accident. Mr. James Dunn recently read a paper at the Institution of Naval Architects, in which he considered the question of the subdivision of the merchant ship by water-tight bulkheads, their efficiency to stand water pressure under all circumstances, and also considered the question whether bulkheads are of any value in securing floating powers for the ship in the event of collision. Incidentally he gave a history of bulkheads, and after considering the strains to which they are exposed, and Lloyds' rule of registry, by which the thickness of the bulkhead plates of all sizes of vessels is determined, he came to the conclusion that bulkheads might be made strong enough to be of the highest value in any ship, and that by the ordinary rules, if the plans were efficiently carried out, bulkheads could be made amply efficient to hold their own in ships of the narrower type. For the last few years a steady tendency has been developed toward greater width in Atlantic steamers, and for these he thought that much stronger bulkheads would be required. One of the most important and interesting sections of his paper was that upon the height to which bulkheads should be carried. Bulkheads are of no use whatever if not wisely placed, carried high enough, and efficiently cared for; they are useless when found, as he had found them, with stiffeners cut, with rivets omitted, with calking neglected, with plates removed, with large holes cut for small pipes to pass through, with sluice holes and no covers, with doors and worthless securities, or with open doors rusted and unmanageable, or with doors in the holds fastened open in such a way that they cannot be closed without "handling," and are out of reach at the moment of danger. He would go further and say that they are not only useless, but that under some circumstances they are positively dangerous. This might perhaps be thought a serious and startling assertion, but he would take the case of a ship illustrated by Fig. 1—and there are many such ships now afloat —in which a good number, a really large number, of bulkheads are provided and distributed as shown, but three of which, it will be seen, are stopped at the deck, which is awash. The bottom gets damaged and springs a leak, say in No. 1 hold, or in No. 2 hold, or in both; and how many such cases had they known where the water enters and gains on the pumps, and slowly, but surely, rises to the top of the dwarf bulkhead, causing the ship to trim as indicated in Fig. 2. The water is then free to flow over the top of the bulkhead and pour into the next hold, the effect of which is inevitably to send her head first to the bottom.

The author held that such a ship would keep afloat with the water in No. 1 hold and in No. 2 hold, provided it is confined by the bounding bulkheads being carried a few feet higher than the natural level. What this natural level is, and to what height the bulkhead should be carried, are points readily determined by the naval architect. But if they are not carried up, but are left as shown—and in too many cases they are so left—then the author held they had better not be in the ship at all, as they would contribute to her loss by keeping the water at one end of the ship and carrying her bows under; whereas, if they are not fitted, the same volume of water, entering as is indicated in the preceding diagram, and not being confined to one end, will distribute itself all through the ship, fore and aft, in which case the trim is preserved, and she will still float in the position indicated in Fig. 3. Here although the freeboard is reduced, she will still be seaworthy; the fires may be kept burning and the machinery going sufficiently long to bridge over the space dividing life from untimely death. Taking two other cases, in one of which the bulkheads were well placed and cared for, and proved that under such conditions they may be of the greatest value—the other case is in all respects a contrast. In the first case they were placed in the positions and carried to the height indicated in Fig. 4. A steamer of nearly 5000 tons ran into this ship in a fog, struck her abreast No. 3 bulkhead, opening up two compartments to the sea; but, fortunately, the bulkheads had been carried to a reasonable height, and the water could not get beyond them; they stood the test; she did not sink, but she kept afloat at the trim shown in Fig. 5, and in this condition steamed 300 miles safely into port. Happily, they are now getting a number of such ships, and many similar facts giving actual beneficial results might be placed before them if time would permit, so he would consider the next case, where we have the same number and a similar disposition of bulkheads as in the previous case; but, unfortunately, some of them are rendered valueless by being stopped at or about the water-line, as indicated in Fig. 6. This sketch represents a large number of first-class steamers now afloat, and should such an accident happen to any of them as has just been described, they would certainly not have the good fortune to complete their journey, as in the last case; but the water, not being confined to the two holds numbered 2 and 3, as it was in the previous case—which is an actual one—will pour over the top of the dwarf bulkhead into the foremost hold, and the ship will soon get into the position indicated in Fig. 7. Water will then be reported to be making in the engine-room, if, indeed, she should not disappear before then.

The author then referred to models exhibited at Spring Gardens. The models are loaded with weighted wood blocks, the blocks being of a bulk to represent the cargo in a passenger ship floating at an ordinary load draft, with each compartment below the upper 'tween-decks appropriated to cargo, having one-half its space occupied—a condition ordinarily assumed at the Admiralty when determining whether a ship is qualified for the Admiralty List—and they fairly represent such a ship as regards their measure of stability. A hold is made through the bottom plating to represent an actual hole about 1 square foot in area, and 8 feet below the water surface in each compartment, and a plug is placed in it, so that by removing a plug any part of the model may be laid open to the water. The first, which we will call A, or the badly bulkheaded model, very soon disappears after the withdrawal of any one of the plugs, because the water, rushing in, soon rises to the level of the water outside, and is then, or before then, free to flow over the top bulkhead into the adjoining hold. Take for example, the plug out of the bottom in way of No. 1 hold. But if the corresponding hole in the good, or B, model is opened up the water soon gets in and finds its level, but it is then confined between the bulkheads, and the model remains afloat. Whatever experiment is made in this direction with the A model, the result is the same—viz., she goes down—so we will dismiss her from further consideration and go back to the B model. Her position with the forward compartment filled is shown in the sketch, Fig. 8, and that sketch also represents the trim she would take if the damage were to occur in the second hold from forward instead of the first, because, although this No. 2 hold may be, and often is, the larger, it is nearer the center of gravity of the water-plane, the leverage is less, and the effect on the trim is modified. Take another case, and open up both the forward holds, Nos. 1 and 2. Of course, we expect that the ship will then go down, because the alteration of trim will be so great that the top of the boiler-room bulkhead, although carried to the upper-deck, is dragged below water and the engine-room becomes filled, and thus we have the forward three compartments full, which would undoubtedly sink her. But suppose we keep the water out of the engine-room, which we can do by making water-tight the casing round the funnel and engine-room hatch to, say, 8 feet above the deck. In smooth water the ship would have buoyancy and stability, even when in this damaged state, and would float, as indicated in sketch, Fig. 8. As an illustration of the great general importance of the subject of bulkheads in merchant steamers, the following statistical details and deductions should be of interest. The advantages of good subdivision are broadly indicated in the annexed table, which shows (1) average number in existence during six years ended December, 1882 ; (II) average annual loss from all causes during six years ended December, 1882 ; (III) average loss per annum.

	I.	II.	III.
Ships qualified for the Admiralty List....	157	15.6	1 in 86
Ships not qualified for the Admiralty List.	3,483	126	1 in 25

These figures are very significant. It appears from them that the chances of loss from any cause are nearly four times as great for a ship not constructed to qualify for the Admirality list as for a ship entered on that List. This proportion is greatly due to the almost absolute immunity from loss by collision of ships on the list, for during the first 4½ years of its existence not one ship was lost from it by collision, although a considerable number of the qualified ships had been in collision, and escaped foundering on account of the safety afforded by their bulkheads. Within the last year, however, they had had six casualities to ships on the list, and among them was our only loss by collision. In that case the whole of the ship—a small one—was flooded abaft the engine-room, the two after-holds being opened to the sea. This was a case such as they have no merchant steamers afloat capable of surviving. During this time the whole of the losses from the Admiralty List—11 in number—have been from drifting on rocks, or otherwise drifting on shore, with the solitary exception above quoted. In the same period 76 ships have been lost which had been offered for admission to the Admiralty List, but had not been found qualified ; of these 17, or 22½ per cent., were lost by collision, and 10 or 13½ per cent., were lost by floundering ; most of the rest stranded or broke up on rocks.

That the general superior character of the ships in the list is of no value in reducing the list of collision is shown by the following comparison. It can be proved that of the entire British mercantile fleet of steamers, about 1 per cent., without distinction, receive damage of a fatal character by collision during the year. Of the number thus damaged, those on the list remain afloat, while those not on the list are lost. This is deduced from the following figures : Referring to the table given above, he would take only those cases of collision to ships on the list which would have proved fatal but for their compliance with Admiralty requirements. These are 9, or an average of 1½ per year, giving 1½ in 157, or 1 per cent. of prevented fatal cases. Again, the average number of ships sunk by collision per year from the unqualified part of the fleet is 35, and the average annual record of the fleet for the six years is about 3500, also giving 1 per cent. of—in this case—fatal cases. Thus the risk of fatal collision is about 1 to 100, irrespective of the class of ship, and thus ships on the Admiralty List enjoy almost absolute immunity from loss by this cause. It is therefore proper to consider that the vessels on the list have no natural advantage with regard to their safety beyond that due to their bulkheads.

The discussion on this paper was hardly what would have been expected from a great society like that of the Institution of Naval Architects. There was, however, a pretty unanimous opinion that difficulty would be experienced in building ships with many compartments, each one of which was long enough to stow the longest size of steel rails, and yet be sufficiently numerous to make the ship safe in case of accident. One gentleman said that his firm were building ships in such a way as to make the bulkhead divide the hatch and the top of the bulkhead in the wake of the hatch removable. Thus arranged they could stow 40-feet steel rails without difficulty.—*Ex.*

NAMES OF COUNTRIES.—The Phœnicians, who were a great commercial people in the younger days of the world, are thought to have given the present name of most of the countries around the Mediterranean Sea. The Phœnician languages contained the words Europe, Asia, Africa, Italy, Spain, Gaul, Britain, Ætna, Sardinia, and Siberia, as well as many others now used as the names of minor places. Europe, in Phœnician, meant "white complexion," and was applied to the country north of the Mediterranean because the natives were a lighter complexion than those of Asia or Africa. Africa, signified "the land of corn," and Asia meant "the middle land," being so named because it was between Europe and Africa. Italy was the "country of black pitch ;" Spain was "the land of rabbits ;" Gaul, or France, the "land of yellow hair ;" Britain "the country of tin ;" Ætna, "the smoky furnace ;" Sardinia," a man's foot," and Siberia, "thirsty land," because it is so dry.—*Ex.*

FORTY-EIGHT INCH CAR-WHEEL BORING MACHINE.

We illustrate a 48-inch car-wheel boring machine, made by William B. Bement & Son, Philadelphia.

The frame has the general outline used for many years by this firm for machines of this class, and is unusually strong.

The bearing of the revolving table is made in the form of the Schiele curve ; two such parts of one continuous curve being combined as will give the required vertical and lateral support, and at the same time maintain their uniformity of bearing.

The three chuck jaws are concentrically tightened upon the wheel by a single movement of a lever, and are quickly adjustable to wheels of any diameter not exceeding 53 inches on the tread.

The boring spindle is of large diameter, hollow, counterbalanced, and provided with quick and easy hand movement. Its wear is compensated for, and its accurate alignment preserved, by the use of the well-known split conical bushings, which in this case have large surfaces and can be rigidly clamped in any position to which they are adjusted.

The vertical boring feed is thrown into gear by a conical friction, and has six changes which are operated by a sliding clutch-pin ; a device so long in use as not to need explanation. L. R. Faught's patent quadruple cutter is much used as a boring tool in these machines, and is frequently fed through a finishing cut at the rate of half an inch per revolution.

The hub-facing device shown in the cut is also one patented by Mr. Faught. A slide which carries the facing tool receives a surfacing feed from a vertical shaft which passes centrally through the boring spindle and may be actuated either by hand or by power. A gauge screw is provided, by means of which the facing cutter can be brought into the same position for any number of wheels successively.

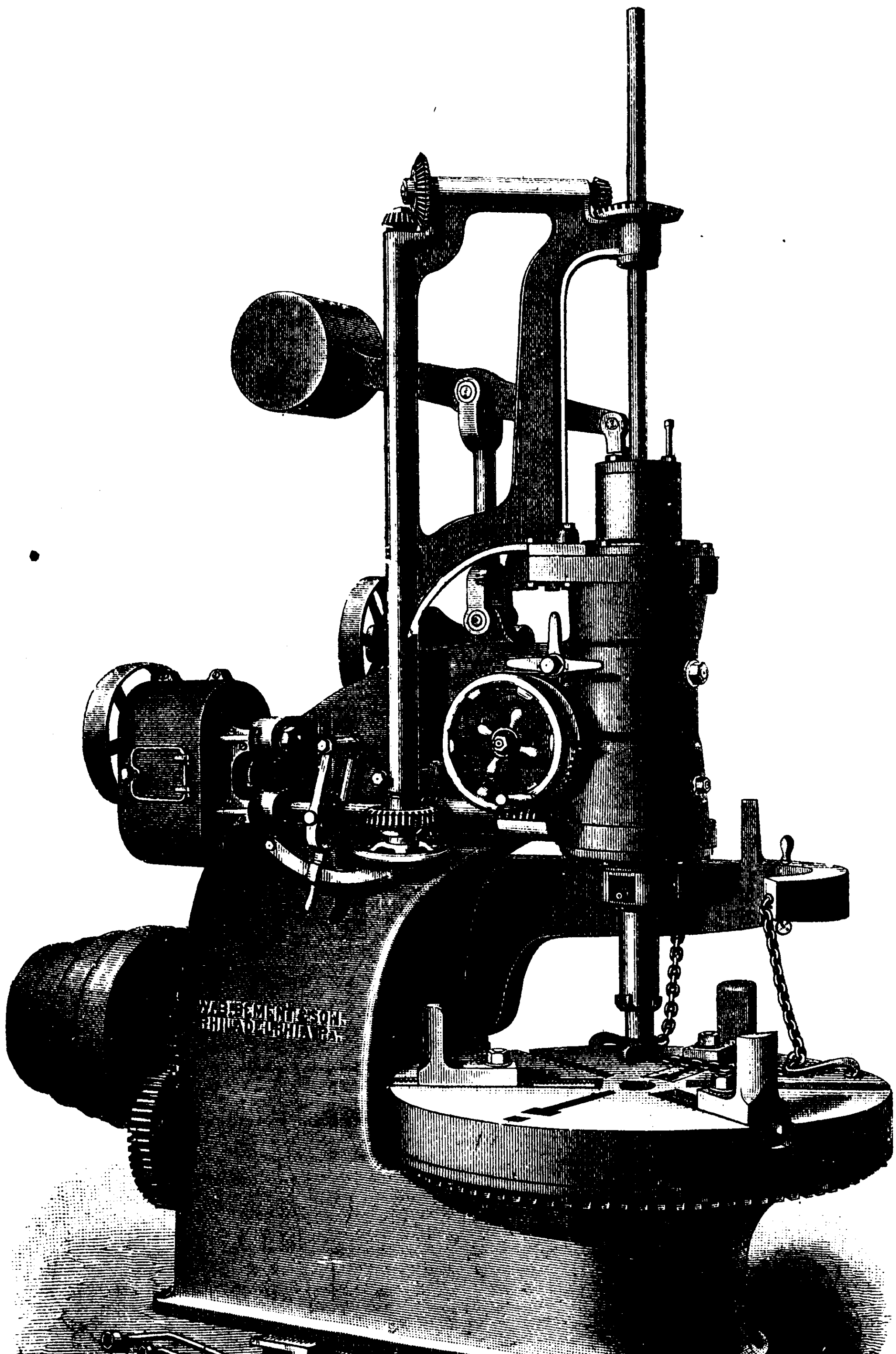
The wheels are raised and lowered by a vertical screw, which is caused to revolve rapidly in either direction by the movement of a lever, and upon which the crane arm is threaded and can be swung to any required position. The wheel is caught by hooks fitting the flange and raised to the proper height. It is then swung inward until the crane arm strikes a stop, when the wheel is centrally over the table, and can be lowered vertically into the chuck, no pushing or sliding being required.

These machines, when managed with a very moderate amount of skill, are capable of producing accurate and uniform work with great rapidity.—*Ex.*

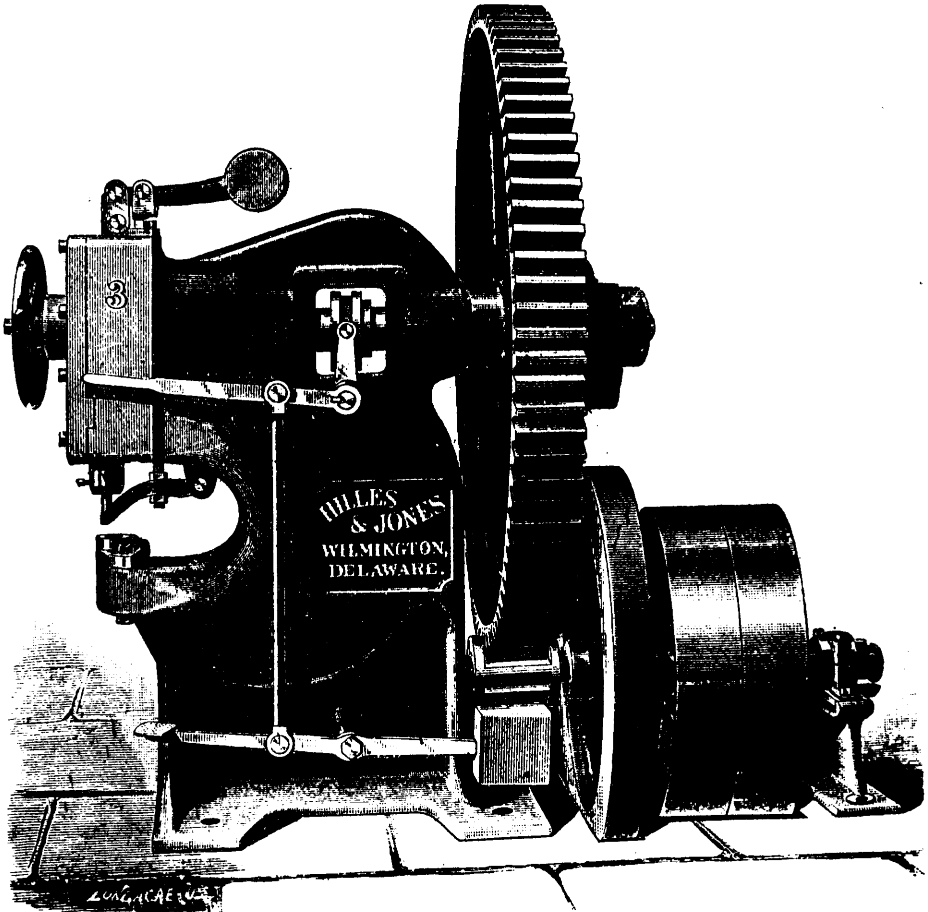
KILLED BY ELECTRICITY.

Another death by ignorant or careless interference with a high tension electric circuit has been recorded. An engine driver at Messrs. Bolckow, Vaughan and Company's steel works, at Eston, imagining that an arc light had "gone out," touched the lamp with the apparent purpose of adjusting the carbons. In the absence of expert evidence it is difficult to assign a cause for this mishap, but it probably arose from simultaneous contact with the positive ann negative sides of the lamp while the arc was broken or from defective insulation eleewhere en the circuit, enabling a derived earth current to be made through the body of the unfortunate man. In either case the system is at fault, and if it is found impracticable to effectively insulate every part of a high tension circuit, steps should be taken to prohibit the use of series lighting with all its advantages. This would be a serions attempt and as an alternative it might be well to put the person or persons in future responsible for such installations on their trial for manslaughter, for there can be no moral doubt that if by their ignorance or neglect a fatal accident arises, they are guilty of constructive homicide. The experiments made by Goulard aud Gibbs, on the Metropolitan railway showed beyond question that the most dangerous alternating high tension currents could be safely dealt with. and these experiments have been confirmed by others.

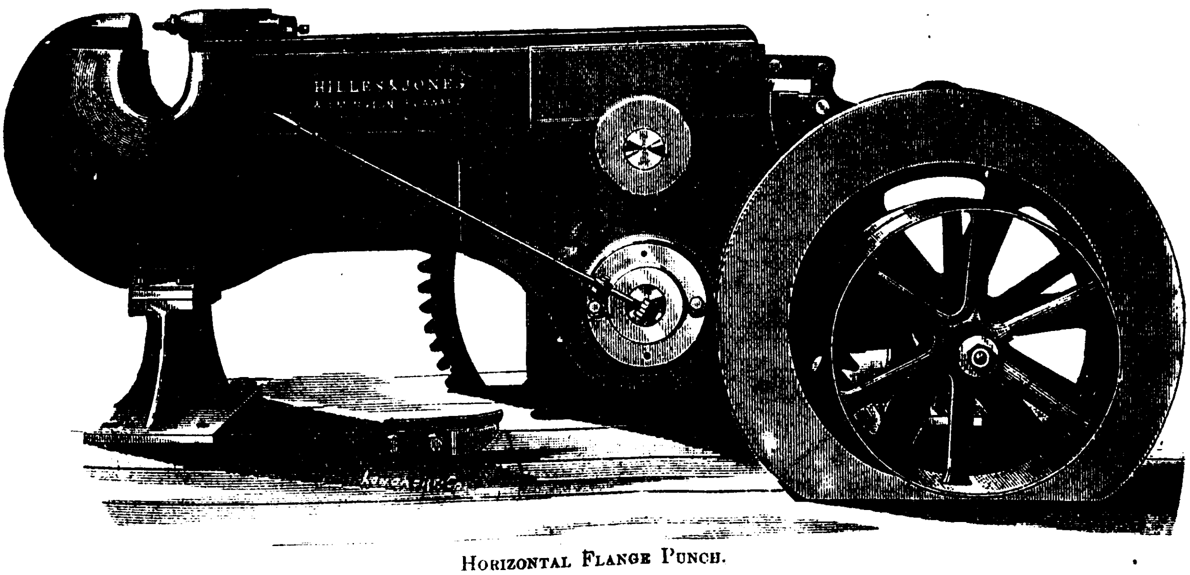
It is a pity that electric installations are so often carried out by untrained men ; too often it is thought that any one who has handled a telegraphic instrument or run a telephone wire can put down an electric lighting plant, and many accidents have arisen from this cause. As electric lighting grows in importance this will doubtless be remedied, but meantime the incompetence of many of the persons employed in the industry is a prolific source of danger.—*Mechanical World.*



FORTY-EIGHT INCH CAR WHEEL BORING MACHINE.



SINGLE PUNCH FOR HEAVY WORK.



HORIZONTAL FLANGE PUNCH.

HOMES OF ARTISANS.

There are few, if any, reasons for the average artisan, at the pay he can command for his work, living in hired apartments. In some localities we find neat little villages owned and governed by the factories and their men; others where all the homes are rented and governed by individuals who work for the salary of their office instead of the village's good. In the one case inducements are offered the young mechanic to save his earnings, select his mate and establish a home. There is a premium on his hard earnings; the man becomes a man, wins his title to distinction as a worthy man and recognition for his worth as an artisan. On the other hand, there is a discount on saving wages and establishing a home. The young man can spend on Saturday night the results of a week's tiresome toil, and sleep off his debauch on Sunday, ready for work at the whistle's blowing on Monday. He pays his money and takes his choice; but let him choose the path all good people would recommend—save his money and health, establish a home. The first thing he pays for is subjected to taxation, and by the time the house is built, furnished, and the owner out of debt, taxes require about as much paying as rent. This is the premium for economy. The riotous liver may spend his all in the saloon or other gilded palaces of sin, and the town in which he lives is cursed rather than blessed by his living there. But he pays nothing for the privilege of tearing down society. But let a man help to build up and improve society by becoming a member—an honorable member—the head of a family and home, and we at once make him pay for doing it. Hence we allow persons to pull out the dearest and sweetest tendrils of life for naught; but when he improves by adding to them, we tax him for the good he does. There is something wrong here somewhere.

But inasmuch as we can not help it, we must all make the best of it. At the same time the entire system is wrong. Nevertheless let us build houses and furnish them; for you nor I, dear reader, would not trade with the single Saturday-night reveller, even though the town imposes a tax upon our industry. While we are building houses, let us neither build palaces in which to display our vanity or foolishness, nor prisons in which to pass an unhappy existence; but rather let us construct for ourselves homes wherein shall always dwell peace, love and contentment. It has long since been practically demonstrated that one of the elements most vital to the success of our mechanics lies in the need of more convenient and home-like abodes, and a more perfect culture socially among the workers.

Rest and change are very rigid requirements to a prolonged, happy life. In nearly every occupation the hardest laborer finds relief from his work, and all suggestions of it, within the precincts of his home. There is no need of good mechanics being isolated from all influences of society and social intercourse, nor of all domestic enjoym-nt and recreation. If they do, the entire family becomes prematurely old, and cheerfulness and mutual gayety soon fades gradually from their lives. It is a fact worthy of remark in this connection, that among no people of other professions or occupations, possessing even greater incomes than the ordinary mechanic, none, in the aggregate, can show as much contentment and solid home comforts as the workers in the mills or shops. But whether it is from interest in their work or from a mistaken idea of necessity, hard labor, long days, and plain food, are soon forgotten if the surroundings are cheerful and the home clean and pleasant.

The rude methods of living as seen a few years ago are rapidly being reformed, especially in our manufacturing villages. Still there is wide room for improvement. We need more mechanics who can see beauty in the sunset and glory in sunrise; we need more who can distinguish the beautiful in nature from the gilded daub of pretenders in art. In a word (and we speak from experience in our own life as employer and employe) we need more mechanics who love the beautiful as well as practical; we want to see more mechanics at the lecture hall and art galleries, and fewer at the horse-race, ball play, or hanging around the saloon; more mechanics who are happy are needed. A man who whistles will do more work than he who sighs, and one who laughs merrily will be done his job long before he who groans has begun. Mechanics, think, act, laugh and go home for real pleasure.—*Ex.*

A MAGISTRATE lately suggested that it would not do to go on drowning stray dogs in the river, as so many sunken barks might obstruct navigation.

A RATIONAL VIEW OF BOILER EXPLOSIONS.

When the cork of a soda-water bottle is set free it escapes with considerable violence and noise. It behaves in a manner like a projectile shot from a gun. There is this great difference, however, between the projectile and the cork—that the whole of the projecting work must be done on the latter after it has left the neck of the bottle. In the case of a gun, the work is done on the shot while it is moving up the barrel and acquiring volocity. The motion of the cork is extremely slow until it escapes from the bottle. The motion of the projectile from the gun is most rapid at the moment it leaves the muzzle. We have a strict analogy between the flight of a soda-water bottle cork and that of a bit of boiler plate. The cast iron top of the dome of a locomotive was a few years ago blown through the roof of a station. All the bolts securing the dome top gave away, and it sailed through the air some hundreds of feet.

Now, it is very easy to say that the flight of this mass of cast iron is readily explained. "It was blown into the air," "It was violently forced off by the steam," "The steam shot it off," and a dozen similar explanations may be given. But engineers do not rest content with vague statements of this kind. They see that the cast iron must have been put into very rapid motion indeed in a very minute fraction of time, and they want to know how the motion was actively impressed on it. As soon as we begin to use figures, we discover that vague generalities really convey no adequate idea at all of what takes place.

Let us suppose, for the sake of illustration, that the cast iron dome was 18 inches in diameter, 24 inches area, and that it weighed 100 pounds. Also, we shall assume that it was projected to a height of 100 feet. In order that it should attain to this altitude, it must have an initial velocity at least as great as that which it would acquire if it fell 100 ft. Allowing a little for the retarding influence of the air, the initial velocity must have been 82 feet per second. The boiler pressure being 120 pounds on the square inch the total effort lifting the dome would be 30,480 pounds. We have therefore a force of 30,480 pounds, a velocity of 82 feet, and a weight of 100 pounds. Through what space must this force operate on the weight? A very simple calculation suffices to shew that the force of 30,480 pounds must act through a space of about .32 of a foot. It will be seen from this that the steam must have exerted its full pressure of 120 pounds on the square inch until the lip of the dome had been parted from it by a distance of about 4 inches.

In boiler explosions the same thing happens. The pressure follows, so as to speak, the flying fragments for a certain distance after disruption takes place. In the same way, the column of escaping carbonic acid gas rising from the neck of a soda-water bottle imparts a high velocity to the cork after this last is quite free of the bottle. It is in this way that the projection of fragments to a great distance is brought about, and we do not think it necessary that water should be called into play, for the mere projection of portions of the plates. As we should state the case, the phenomenon of a boiler explosion would be somewhat as follows: First, rending takes place through a weak joint or corroded plate; secondly, there is a violent outburst of steam; thirdly, there is a fall in pressure; fourthly, portions of the water are propelled with great violence against the boiler shell, which is shattered thereby; fifthly, the steam generated from the liberated water imparts, in the way we have tried to explain, high initial velocities to the fragments, converts them into so many projectiles, and spreads ruin around.

The point worth special notice about all this is that the steam keeps together, so to speak, and does not escape by fissures or cracks. It might be thought that the moment the steam dome cover, which we have already used for the purpose of illustration, was raised at all, the steam would all rush out sideways, and that the cover would be projected but a few feet. This is not the case; the steam does not diverge to the right or left; its molecules advance, each in a straight line, behaving like a minute projectile; and this columnar advance of a gas, free to diverge right or left, but going straight on, is the main cause of the violence of boiler explosions as manifested by the flight of fragments to great distances—*London Engineer.*

A camel will work seven or eight days without drinking. In this he differs from some men, who drink seven or eight days without working.

THE LIVING ORGANISMS OF THE ATMOSPHERE.

As well known, the depths of the ocean were for centuries regarded as abysses inaccessible to the sight, and its was taught that no living being could exist in the darkness that reigned therein. Yet it was only necessary to cast the lead and trawl into the submarine valleys to discover therein an entire flora of wonderful richness and beauty, and an entire fauna of singular beings regarding whose form and nature there could heve been no suspicion. On another hand, the microscope has revealed the existence of innumerable animalcules in the least drop of water taken from any spot whatever ou the surface of the ocean. and, in the very place where it was believed that there could be nothing but inert matter, the presence of life has been discovered in its completest development.

It is the same with the atmosphere. In that transparent, invisible, ungraspable air in which for centuries nothing has been seen but winged birds and insects, the microscope shows us to-day a whole world suspended, unbeknown to us, amid the dust that is continuously floating about. The air is no less peopled than the ocean, and just as we see sediment, infusoria, and algæ in a drop of ocean water, just so we find in the least volume of air collected near the earth dust, vegetable debris, living organisms, and infinitely small animalcules, which live, feed, develop, and reproduce themselves, and germs of fermentation and putrefaction—those noxious organisms in which Mr. Pastear has found the cause of so many maladies that afflict humanity.

In recent years the question of atmospheric dust has been stupied by the aid of new methods, by a learned investigator, Dr. P. Miquel, chief of the micrographic service of the Montsouris Observatory. This gentleman has collected together a description of his processes and analyses, and the results that he has obtained, in a remarkable work which we shall now known to our readers by extracting therefrom a few interesting and little known facts.

We shall not speak of the methods by means of which we may collect atmospheric dust and aerial sediments; it will suffice to say that they are usually based upon the filtration of a certain volume of air, and upon the condensation of the aqueous vapor which it contains and which carries along the dust in suspension, or else upon an examination of the sedimentfrom rain or snow water that has been collected in special ve-sels.

We shall give at present a few specimens of the productions that Dr. Miquel has found in atmospheric dust during the course of his long and patient researches. Cadavers and debris of animal and vegetable nature are very frequently met with in the corpuscles of the atmosphere. Herein we find butterfly scales, down from the bodies of birds, parts of insects' bodies, and sometimes even the entire carcases of acarians (Fig. 1). The nature of the organized corpuscles of the atmosphere is exceedingly varied, and starch grains, spores of cryptogams, and complete unicellular plants are very abundant therein. Fig. 2 shows under a magnification of 400 diameters, two spores of *Alternaria*, near a blackish mass, which is nothing else than a lichen spore that did not come within the focus. Fig. 3 represents a very few common types of aerial spores. At *b* is seen a large number of young and tender cryptogams that are very abundant after rains. Fig. 4 shows a few other speciments which Dr. Miquel collected from the air of the Montsouris Park.

Since Mr. Pasteur's great labors in this field, the study of the animalcules of the atmosphere, and of the bacteria, bacilli, and vibrios that are found in suspension therein, has offered great interest, and Dr. Miquel has succeeded in throwing much light upon it. In order to collect atmospheric bacteria, it is necessary to have recourse to delicate methods, and notably to examine under strong magnifications the liquid formed through the artificial condensation of the aqueous vapor of the atmosphere—that which, for example, stands upon the surface of an internally cooled glass vessel. For our part, we have also often met mith bacteria in drops of dew that we had gathered in the country upon herbs at daybreak.

Fig. 5 shows, according to Dr. Miquel, four specimens of atmospheric bacteria. "The first," says the learned observer, "approaches the *Micrococci* in appearance and the *Bacteria* in mobility. The second might serve as a type to the species; its adult articulations, four one-thousandths to five one-thousandths of a millimeter in length, are about one-thousandth of a millimeter in thickness; it appears to be the same thing as the *Bacterium lineolum* of Cohn. I have met with it quite frequently in the dust of hospitals. The third has the appearance of the *Bacterium catenulum* of Dujardin. The air shows several varieties of this, and one of them, which I have cultivated, has the singular property of converting one gramme of sulphur into hodrosulphuric acid in forty-eight hours in 4 liters of boiled waser, to which has been added tartrate of ammonia and an excess of sulphur. The bacterium marked No. 4 is a microbe of exceedingly small size, and it is necessary to accustom the eye for a long time to the light of the microscope in order to see it detach itself as a shining or black object upon the field rendered luminous or dark. It is found quite frequently in the course of development in the matter secreted by several micrococci."

Such are the living organisms that belong to the class of microbes whose existence and role has been revealed by Mr. Pasteur. When we consider these infinitely small objects—true dots in motion—under the microscopic objective, we cannot rid ourselves of that singular impression that Michelet, in his poetic language, has so well called "the vertigo of infinity." What would not one give so have at his disposal a still more powerful microscope, that would permit of seeing better, and of distinguishing the details of these beings' organization ?

Dut *cui bono ?* One would then doubtless discover still smaller ones yet which would defy science anew.—*La Nature.*

VETTER'S FRUIT DRIER.

Mr. C. W. Vetter, of San Francisco, Cal., is the patentee of an excellent fruit drier. It consists of a stove having a heating chamber to receive the fruit drawers, which consist of a frame holding a perforated metal plate and having two hinged covers of wire netting, by which fruits can be held between both surfaces of the perforated plate and the hinged covers.

The stove is mounted with fire brick and has a door on each side and at the ends, which inclose the heating chamber into which the drawers are passed. A fire box is arranged in the bottom of the stove, and two pipes extend to the top for carrying upward the smoke and conducting it above the heating chamber, from whence it passes off through a flue. The chamber has an aperture in one side for the admission of air to the chamber, in which it becomes heated. The heat then passes up into the heating chamber, by which the fruit in the drawers is exposed to the drying action of the hot air, the moisture or vapor passing off through the apertures in the top of the heating chamber. The fruits are placed in drawers, composed of a frame having a central partition and two hinged covers, one at the top and another at the bottom, which are made of wire netting or perforated metal plates, and are locked on the frame by ring bolts. On the outer surface of the ends of the frame are cleats, which are adapted to pass in suitable grooves in the sides of the heating chamber, by which the fruit drawers are held in place.

The fruit is placed on one surface of the perforated partition in the frame and the cover is closed and locked, when the drawer is inverted and fruit is placed on the other side of the partition and the other cover closed and locked, the fruit being held between the perforated partition and the covers. The drawer is then placed in the heating chamber and exposed to the heat until the fruit is perfectly dry, the heat passing through the wire netting covers and through the apertures in the central partition.

PLATE glass was discovered in an accidental way, in 1688, by a man named Thevart. It is attributed to the breaking of a vessel containing melted glass, a portion of which found its way under a large flag stone, which, when subsequently removed, was found to cover a plate of glass. This suggested the idea of casting glass in plates.

THE Japanese are seriously considering the utilization of the hot springs near Tokio as a means of producing heat and power. The subject has been discussed in the Japanese Seismologic Society. In a country where the presence of hot springs and the frequency of earthquakes indicate a rapid increase of subterranean temperature the thing may be quite practicable.—*Ex.*

PROF. MOSELEY, of the famous *Challenger* expedition around the world, has discovered eyes in the shells of chitonidæ, no less than 11,000 being contained in the shell of a single animal. As the shell grows larger new eyes are formed. No other molluskas have any sense organs in their shells, but the chitonidæ, in addition to eyes, have elaborate organs of touch permeating their shells.

AMERICAN SOCIETY OF CIVIL ENGINEERS.—A paper by Edmund B. Weston, M. Am. Soc. C.E. was read giving the description and result of experiments on the flow of water through a 2½ inch hose and through nozzles of various forms and sizes; also giving the results of experiments as to the height of jets of water. The experiments were made at Providence, R. I. The water was taken from a hydrant to the head of which was attached couplings holding two pressure gauges and from the couplings the hose extended to a tank holding 2100 gallons, so arranged as to measure accurately the time and amount of delivery of water by the hose. Different length of hose were used. The experiments resulted in the following formula for flow from coupling.

1. For hose between 90 and 100 feet in length and where great accuracy is required.

$$V = Y \frac{2gh}{1. - .0256\, d4 + \left\{ .0087 + \frac{.0504}{V\ v} \right\} \cdot 12288\, d4\, l}$$

For full lengths of hose a reliable general formula

$$y = V \frac{h}{.0155463 - .000398\, d\, 4 + .0000362962\, d4\, l}$$

giving velocity of efflux in feet per second h, head in feet located by gauge.

d diameter of coupling in inches.

l, length of hose in feet from gauge.

v, velocity in 2½ inch hose.

Forty-five experiments were made on ring nozzles resulting in the following formula:

$$f = .001135\ v2$$

f, being loss of head in feet owing to resistance of nozzle, and v, the velocity of the contracted vein in feet per second.

Thirty-five experiments were made with smooth nozzles resulting in the following formula:

$$f = .0009639\ v2$$

f being the loss of head in feet owing to resistance and v, the velocity of efflux in feet per second.

Experiments show that a prevailing opinion is incorrect that jets will rise higher from ring nozzles than from smooth nozzles.

Box's formula for height of jets of water compares very favorably with experimental results.

A HIGH TOWER PROJECTED AT PARIS.

The Washington monument may not long enjoy its pre-eminence as the highest structure in the world. An iron tower of the height of 1,000 feet is to be erected in the grounds of the French Exhibition in 1889. An elevator, the safety of which is guaranteed, will communicate with the summit, and visitors to the exhibition will be taken to the top for a small fee. Those who have the courage to make the ascent will enjoy an almost uninterrupted view for nearly 100 miles all around. The tower will also be utilized for astronomical and meteorological observations, for experiments in optic signalling, for the investigation of certain problems in experimental physics, and for various other scientific purposes. It will, perhaps, be remembered that a tower of the same elevation was spoken of in connection with the Centennial Exhibition at Philedelphia, but the necessary financial backing could not be had for the enterprise and the project was dropped.—*Ex.*

IMPROVED PUNCHES.

We present engravings of two improved punches, made by Hilles & Jones, Wilmington, Del.

The horizontal flange punch for boiler makers or bridge builder's use, possess advantages that will be readily seen. The gearing and driving mechanism being all below the punch, leaves the top of the machine free for handling work of ane shape, so that flanges of all forms, or bent angle iron, may by punched from either the outside or inside, as may be desired.

A counterweight is provided, which draws the punch back when the clutch is thrown out.

The single vertical punch is designed for heavy work. The large spur wheel runs close to the bearing, the clutch being outside. This reduces the effect of "overhang" on the bearing to a minimum.

When desired, this machine can be furnished to serve as a shear as well as a punch, by the substitution of knife block.

Both these machines are massive, with metal well distributed, and are capable of doing heavy work without risk of breakage. They are made with any depth of jaw or throat required, up to 48 inches.—*Ex.*

THE SELECTION OF APPRENTICES.

Messrs. Denny & Brothers, of the Leven Shipyard, Dumbarton, are abandoning the practice of taking premium apprentices, and in place of these they are recruiting the lower branches of their staff by means of competitive examinations, the vacancies being award to the most successful candidates. Two apprentices are wanted just now, and the terms on which they are to be accepted are as follow: The applicants must not be under fourteen years of age, must belong to the town of Dumbarton, or be at present apprentices in Leven Shipyard, and must be able to show good certificates of health and character. The subjects of examination will embrace: (1), Mathematics, including arithmetic, geometry, as far as the first two books of Euclid; algebra, as far as and including simple equations and logarithms; (2), theoretical mechanics, as required for the elementary stage of the Science and Art Department; (3), practical plane and solid geometry, also as required in the elementary stage of the department's examinations; (4). freehand drawing; (5), mechanical drawing. For the first subject a maximum of 200 marks will be given, and for each of the other four subjects a maximum of 100 marks, making in all 600 marks as a maximum for the five subjects. No candidate will be admitted who does not obtain 40 per cent. of the maximum number of marks. Successful candidates, in the event of their conduct and diligence being satisfactory, will be retained in the drawing office for an apprenticeship of five years, the rate of payment for which will be, respectively, £20, £30, £40, £50 and £60 per annum. In the interest alike of scientific shipbuilding and of Messrs. Denny & Brothers, we cannot but wish well to this new method of recruiting the profession from the most intelligent of the candidates who present themselves, but we scarcely understands why the selection should be limited to youths at present residing in the immediate neighbourhood of the works.—*Eng.*

JOHN FINK WANTED IN CANADA.

The following extract is from a recent issue of the *Montreal Gazette*:

"A *capias* was issued on Saturday at the instance of Mr. John Turnbull, managing director of the Cornwall Manufacturing Company, for the arrest of Mr. John Fink, doing business in Baltimore, Md., under the style of Henry Fink & Son, for the alleged fraudulent sale of the right to use Fink's patent oil mixture. The *capias* was at once placed in the hands of a bailiff, with instructions to look out for him. Mr. Turnbull states that in 1879 the Cornwall Manufacturing Company purchased the receipt for the manufacture of this patent oil mixture, which was guaranteed to effect a saving in the oil used in the establishment of 40 per cent. The purchase of this receipt gave the company the sole right to manufacture this mixture in Canada. A few days ago Mr. John Fink came to this city, and going to Mr. Turnbull's office in this city, sold the sole right to use the patent in Canada over again for $100, together with the saving which it would effect during the first three months of its use. On sending the receipt to the company at Cornwall, however, it was returned to him, with the information that they had already purchased it in 1879, and had discarded it as useless some time ago. Hence the issuing of the *capias*."

A person answering the description of John Fink was in New York City the day after Christmas, trying to sell the Fink mixture recipe to a gentleman in the slate trade. He gave his name as O'Donovan, and was in a hurry to catch a train to Chicago. He exhibited a certificate of a recent sale to the proprietor of a slate quarry in the vicinity of Bangor, Me.

The *Baltimore American* of December 30 publishes the facts noted in above extract from the *Montreal Gazette*, and says:

"The Fink family reside in an elegant residence in Baltimore County, built by the late Henry Fink about ten months ago. The business is carried on by the family, and all the transactions and correspondence is conducted from their home which is also the office. Mr. Fink acquired a considerable fortune by the sale of his patent."—*Ex.*

"Bob, what's steam?" "Boiling water." "That's right; compare it." "Positive boil, comparative boiler, superlative burst."