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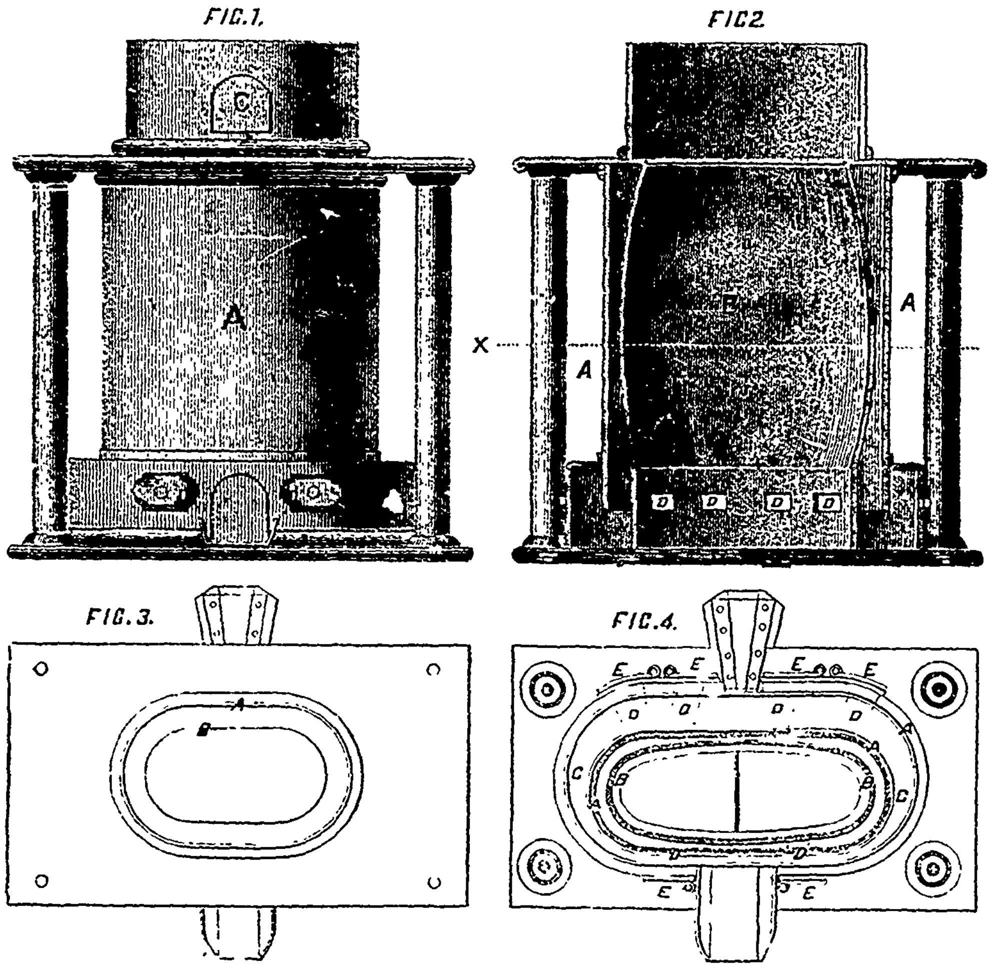


MARSHBANK'S PATENT FOUNDRY CUPOLA (See page 164.)

MARSHBANK'S PATENT FOUNDRY CUPOLA.

We illustrate, on the preceding page, what we consider to be a valuable improvement in Cupolas for melting iron. The improvement consists in a peculiar construction and arrangement of the interior lining. This construction will be understood by reference to the engraving, in which Fig. 1 is a front view of the Cupola, Fig. 2, a longitudinal section; Fig. 3, a plan view, showing the interior lining, and Fig. 4, a horizontal section, taken through the line x, x, of Fig. 2.

A, represents the outer shell of the Cupola, and B, the interior lining, which latter is made in oval oblong form, as shown, which form is carried up or continued to just below the charge-door C. This is done for the purpose of shortening the distance from the discharge of the tuyeres to the centre, requiring less pressure of the blast to carry it to that point than is required in other forms of Cupolas. D, D, represent the tuyeres, which are arranged on opposite sides of the Cupola, so as to alternate, or, in other words, the blast from each tuyere comes directly opposite the space between tuyeres on the other side. By this arrangement of the tuyeres, the blasts from them do not interfere with each other; but a limited pressure will carry them into the centre of the charge on the coal-bed, thereby obtaining an uniform combustion of the fuel, and preventing the formation of a central core, which, in heavy heats, causes the rolling of the charges over on the tuyeres, and clogging of the same. Above the tuyeres, the oval oblong lining B, is thrown back, making it of egg shape, which accomplishes the following important results. First, it increases the area of melting surface at the best melting point over the tuyeres, and where the blast is most efficient, second, by this form of lining it prevents the blast from cutting it away, as is the case where the lining is straight, and, third, it prevents the possibility of the stock lodging or bridging, which is often a source of annoyance and expense, as a general thing, in other Cupolas, where they are worked up to their capacity, the only remedy for this, being, heretofore, to drop the bottom, and do the balance of the melting some other time. The lining B, is contracted at the top, at the charge door C, for the purpose of preventing the escape of the gases, and a too rapid ignition of the coal between the charges before it reaches the real melting point above the tuyeres, thereby economizing fuel. E, E, represent the openings to the tuyeres, and to the inside of the air-chamber G, constructed in such a manner than any obstructions to the tuyeres can be readily removed at any time.

It is claimed that by the use of this Cupola, a given quantity of iron can be melted in a shorter space of time, with less fuel and less pressure of blast, than in any other Cupola; and, at the same time, that a softer iron will be produced.—*American Artisan.*

LIGHT-HOUSES FOR TRINITY SHOALS AND TIMBALIER, GULF OF MEXICO.

On Nov. 15th, 1871, the U. S. Treasury Department issued a circular to iron manufacturers, informing them that sealed proposals would be received at the office of the Light House Board, until the 4th of January, 1872, for furnishing the material, apparatus, tools, and labor, of all kinds necessary to construct first order Iron Light-Houses for Trinity Shoals and Timbalier, Gulf of Mexico, in accordance with specifications and drawings which accompanied the circular. The Light House Board, were, themselves, to furnish the glass for the lantern, the lenses, lamps and furniture. Upon receipt of the sealed proposals, the bidding of the Architectural Iron Works of New York, was accepted. The proprietors at once proceeded to the construction of the light-houses, one of which is now completed, and the other is in process of completion. Both are alike, and the accompanying engraving for which we are indebted to the columns of the *American Artisan*, is an excellent representation of the one the firm has recently built. (Prepared by their special artists.)

The light-house is supported upon nine wrought-iron piles, eight of which are disposed at equal distances around the ninth or central pile, from the axis of which the others measure each twenty feet. The structure has thus an octagonal plan, each side of the octagon measuring a little less than fifteen feet three and eight-tenth inches. The piles penetrate fifteen feet into the shoal, each being furnished at its lower end with a cast-iron screw. The piles are held in position at the ground by adjustable chord links of wrought-iron.

Above the heads of the piles, the superstructure rises in the form of the frustum of an octagonal pyramid, measuring vertically, ninety-three feet from the axes of the pile head ties, to a horizontal plane, three and three-quarter inches below the upper surface of the watch room floor, in which plane the axes of the inclined columns at their extreme upper ends measure four feet six inches, horizontally, from the axis of the tower. At the base of the pyramid, the radius of the circumscribed circle is twenty feet, being the distance from the axis of the tower to the axes of the inclined columns. The inclination of the corner columns, is therefore, twelve inches in six feet, vertical measure. The six sections which comprise the frustum of the pyramid, have their heights as follows: The foundation series is twenty feet from the under side of the lower collars of the piles to the axes of the horizontal ties at the pile heads. The first series above the foundation has a height of fifteen feet from the axes of the pile head ties, to the top of the floor of the dwelling, or base of the second series. The second series has a height of eighteen feet from the surface of the first floor of the dwelling, to the under side of the cornice, frieze and roof girders.

The third series has a height of eighteen feet, measuring from the under side of roof girders, to the axes of the ties at the base of the fourth series. The fourth series has a height of fifteen feet six inches, measuring vertically between the axes of the horizontal ties The fifth series has a height of fourteen feet. The sixth series has a height of twelve feet six inches, from the axes of the horizontal ties at the base of this series, to the top of the frustrum of the pyramid. The columns of the first series, are of wrought-iron, forged tapering. The columns of the other series are of hollow cast-iron, decreasing in diameter as they ascend with the successive series.

SOUTHBY'S ECONOMIC GAS RANGES.

The principle of those economic gas ranges and roaster, as shown in the above illustration, differs from that of all other gas cooking apparatus, in that the gas is burnt in a chimney, the lower end of which is left freely open, while its upper end delivers a highly-heated current of air into the upper part of the vessel in which the articles to be cooked are placed; this vessel having no escape for the heated air except below the level of the articles to be cooked. Many advantages are claimed for this arrangement. 1st. The gas being burnt in a strong current of fresh air, the combustion is perfect. 2nd. The heated air escaping only at the bottom of the vessel instead of, as in other apparatus, at the top, it is that portion which has given out its heat to the articles in process of cooking that escapes instead of the hottest and unused portion, thus producing a much greater economy of gas. 3rd. The meat always being cooler than the air by which it is cooked it is surrounded by a descending current which, the exit being at the bottom, escapes freely; whereas if the exit was at the top it could only eddy round and round. This secures that the great bulk of the air admitted into the apparatus shall pass immediately over the surface of the meat, carrying away with it all the vapours given off as fast as they are produced, thus insuring the same perfect ventilation as before an open fire, and preventing any possibility of the disagreeable flavour of oven-cooked meat. An incidental advantage of the even temperature secured by having only a bottom exit for the air, is that all the space in the apparatus is available for cooking, and also makes it an unrivalled oven for baking pastry.

Much surprise has been expressed at the makers of this gas cooking apparatus chosing illuminating jets in preference to the atmospheric burners, for which greater economy is usually claimed; but they maintain that the former have great advantages; at the same time for cooking purposes they are equally economical when properly used. Atmospheric burners of all kinds are liable to be lighted inside the mixing chamber, producing aeroline smoke and various other noxious products of imperfect combustion. The simple union jet is free from this objection; and, as they contend for the economy, a given amount of gas burnt freely in air must produce exactly the same amount of heat, for as long as the ultimate products are water and carbonic acid, only the same amount of oxygen can have been used, and the same amount of heat developed, the only difference being that in the atmospheric burner the carbon and hydrogen are both oxidised simultaneously, whereas in the illuminating jet the hydrogen burns first, intensely heating the particles of carbon, which thus become luminous, and are then perfectly oxidised as they come in contact with the air at the surface of the flame. The result of this is that the total heat developed is the same in both cases, for the same amount of gas consumed; but whereas the hot gases produced by the air burner will only radiate about one-tenth of their heat, the rest being in the form of highly heated gaseous matter, in the other about one-half the heat is developed in each form. If, therefore, the radiated heat is allowed freely to dissipate itself a larger portion is lost when illuminating jets are used, but if, as in this apparatus, the jets are surrounded by a chimney, so that the radiated heat cannot escape, the results would be the same in both cases in producing the comparatively moderate temperature required for cooking.

The patentee is A. G. Southby, Esq., London, Eng.

THE SOUDAN RAILWAY EXPEDITION.

(Continued from page 135.)

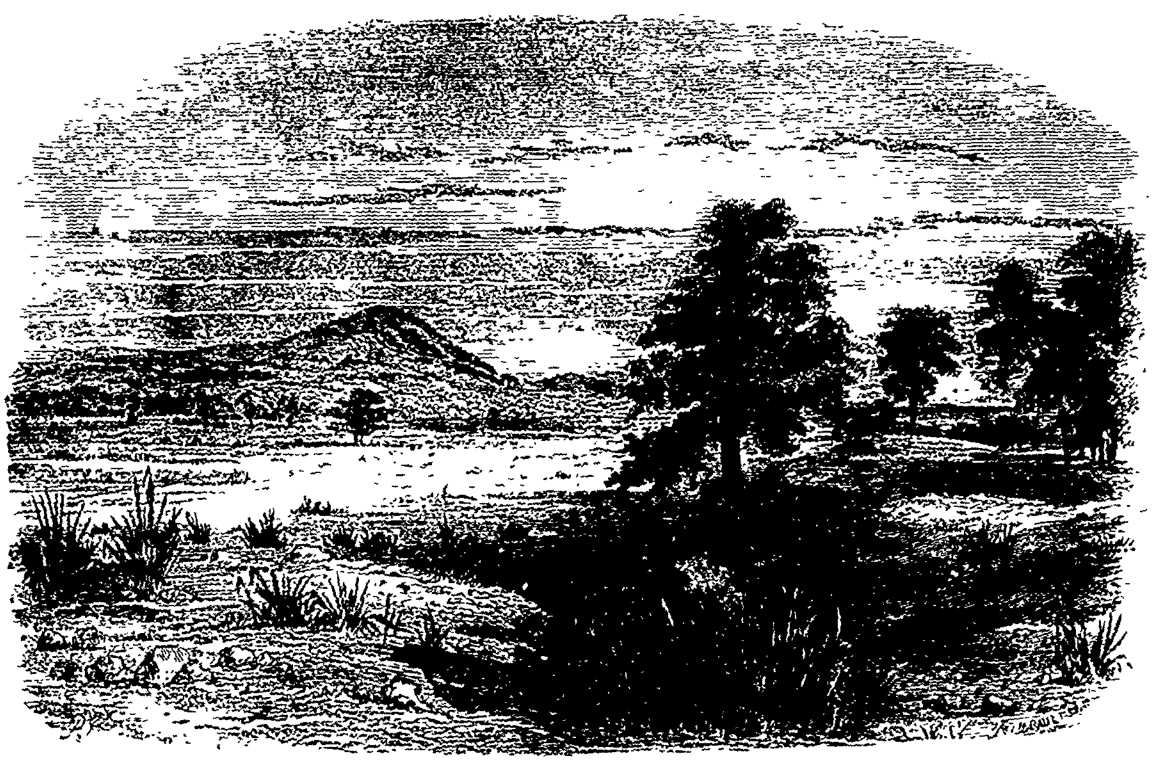
After quitting the Nile at Ambukol, about latitude 18 degrees, and the northern limit of the tropical rains, the Bahiuda desert is reached. This tract of country is very unlike the sterile and rocky districts further north and shows abundant signs of vegetation along the course of the proposed railway. Wadys, pastures of long, coarse grass, and many clusters of trees are seen, whilst during the rainy season the ground is susceptible of profitable cultivation in some parts. Above Halfa, as we have previously remarked, was the point selected as the junction of the third and fourth divisions of the staff, the former working back to Ambukol, and the latter from Shendy the southern terminus, to Abou Halfa. The junction of the railway centre line at this place is across a large river bed, which in rainy seasons receives the drainage of a large watershed from a range of granite, standstone, and porphyry hills lying towards the east. About three miles east of Abou Halfa are the wells of that name, consisting of holes made in the bed of the river, and varying from 5 ft. to 10 ft. in depth, and 3 ft. or 4 ft. in diameter. The sketch on page 166 taken near the wells on the north side of the river, showing the manner in which the banks are scoured away, gives an idea of the velocity with which the water rushes down during the brief, but severe, rainy season. To a breadth of half a mile on each side of the river the mimosa trees abound, and the Sabas grass is also beautiful; this, with the tress grass, forms the principal food of the flocks and herds—goats, camels and cattle—belonging to the Desert Arabs. For about 6 miles after leaving Abou Halfa the line falls, with easy gradients, in a south-easterly direction, passing for about half the distance over a sandy desert with sandstone rocks cropping up all round Then the line rises with grades as easy, and enters a country wooded thickly with the mimosa, and covered with coarse grass. On the western side stand isolated rocks of sandstone, and on the east is seen the extension of the range from Abou Halfa, which vanishes with an abrupt turn eastward. About 3 miles on the east side of the line are the wells of Gakdool, which receive a part of the same watershed that supplies Abou Halfa, whilst in a south-easterly direction, and about 8½ miles from the line, the same range supplies the water for the El Faar wells, where large Wadys and river beds exist, indicating the periodical flow of great bodies of water through these lines of natural drainage, but which is gradually evaporated or absorbed in the arid desert plains.

On the western side of the line, in the valley of Gakdool, a range of sandstone rocks die out, disappearing with isolated fragments about 100 ft. in height, round which the line passes in tending more towards the south. Just at the point when this change of direction takes place, one of the most picturesque portions of the country upon this section of the line is found It is situated at the foot of these rock ranges; the valley, as it gradually narrows up towards the wells of Gakdool being seen, and the range towards the south leading in the direction of the wells of El Faar, the valley being also broken up with isolated rocks whilst around, every species of mimosa is found, and indigenous shrubs, grasses, and plants cover the ground. We shall publish a sketch of this spot in our next number.

Quitting this fertile place the line continues to ascend passing through sandstone rock, quartz boulders and granite with masses of conglomerate, but entirely devoid of vegetation. For about seven miles further the line follows the same southerly direction, rising with easy gradients and passing through sandstone rocks, black ballast and conglomerate boulders, but for the most part the ground is covered with a sandy deposit producing Sabas grass and mimosa During the next eight miles the railway runs through a somewhat similar ground, partly covered with volcanic *débris*, and at first over soil just able to produce vegetation, but which afterwards gives way to hard gravelly sand, sun-baked, and cracked in all directions by the weight of passing camels At the end of this eight miles—the 494th mile from Wady Halfa—the remarkable conical rock of sandstone, called Jebel-el-Noos, is first seen. This hill serves as a prominent and striking landmark, but the railway does not reach it until the 500th mile. Before this the line rises, and enters a tract where much drift-sand prevails, which, often obliterating all traces of the beaten camel tracks, renders Jebel-el-Noos an invaluable landmark. On the western side, sandstone rocks crop up from the surface, forming continuous ridges 100 ft. high, and smaller isolated hills, close to which the line passes, and continues to rise gently until Jebel-el-Noos is left behind about half a mile to the east, and a valley is approached in which drift-sand becomes heavier, but where trees and grass grow abundantly; on either side, however, the aspect of the ground is most forbidding, the rock surrounding the valley, seen from an elevation having the appearance of a troubled, stormy sea. The drift-sand continues in the valley only for a distance of about three miles. Some distance from Jebel-el-Noos, another remarkable desert beacon is seen, and is known to the desert Arabs as Jebel-el-Sergam, or Saddle hill. After deviating somewhat to the east and west through the valley, the line again follows the ruling course of a few degrees east of south, sandstone cropping up all around while a number of black conical hills are seen with coarse grass growing in the lower levels. The summit level of the line is passed during the next 5½ miles, the exact point where it occurs being 507 miles from Wady Halfa, and the height only 79·30 ft. above rail level at that place. The steepest gradients in this division occur at this spot, where, for short distances, 1 in 70 and 1 in 100 are employed. After crossing a grass-grown Wady that partially drains a range of hills on the west, Jebel-el-Sergam, the landmark already mentioned, is passed, the line leaving it about a quarter of a mile to the eastward. The ranges of hills east and west gradually disappear here, affording an opportunity for the adoption of easy falling gradients, which are continued as far as 8½ miles from the summit level.

The valley around Jebel-el-Sergam is fertile, containing much grass and groups of trees; as it affords good pasturage for camels, it is always selected as a resting place when the traveller cannot reach the nearest wells A few miles beyond the summit level another Wady is met, which the line crosses; this Wady drains the southern side of the range of hills just spoken of, and is about a mile in width, being well covered with trees and grass; the drainage runs, as in the one before mentioned, from west to east, but the water is quickly evaporated and absorbed by the sand For the next 12 or 13 miles the line runs through the district of Omit Handll. On first entering this district the railway turns slightly to the west, and passes round the foot of the southern range of hills, which after extending for several miles here die out, leaving beyond them much broken sandstone and loose rock. This is followed by another stretch of sand, over which the line runs in a straight line for 3 or 4 miles, until it enters a more agreeable country, in which grass and trees are plentiful, and reaches a Wady draining some extensive hills running east and west, which is the direction taken by the Wady itself. At this part of the line gazelles are very numerous, the country between Jebel-el-Sergam and the wells of Abou Doleah containing perhaps the greatest number After passing the Wady, the nature of the ground rendered it advisable to try several alternative routes for the line, but it was ultimately found that the camel track, with some few exceptions, offered the greatest advantages, and gradients of 1 in 75 over the rising, and 1 in 70 over the falling ground were

VIEW OF THE NILE FROM MOUNT FOGO.



SKETCH IN THE BAHIUDA DESERT, NEAR THE WELLS OF EL FAAR plateau of sandstone rock covered with large black boulders. On the west lies a Wady, which drains a part of the western side of the hills. This Wady runs in a southerly direction at the foot of the plateau, and is thickly covered with grass, but not many trees. It is crossed by the proposed line in a somewhat easterly direction, and it then runs parallel to it, and within a few hundred yards on the west bank, over a sandy deposit and black shingle. In the Wady bed are situated the wells of Abou Deleah, into the desert of which name the line now enters, near the course of a valley well covered with grass and trees, but following the sidelong ground of some extensive granite and porphyry hills, the lowest ridges of which afford easy rising gradients. Very careful examination at this point showed again that the camel track was the only available route, and this, which goes to El Metemmeh, is followed with but few deviations. At a point about 530 miles from Wady Halfa it was decided to run straight for Shendy, passing for some distance over a plain very similar to those already described, covered with sand and black boulders, and succeeded by a more favourable district, which is, during the heavy rains, capable of cultivation; a little further occur the wells of Shebaet, about two miles to the west of the railway, which finally terminates its course in the west bank of the river Nile, opposite Shendy, 552 miles from the northern terminus of Wady Halfa. El Metemmeh, lying about 3 miles to the south, is the town where the caravan route ends, and standing near the west bank of the Nile, is separated from the desert by a low line of hills. A considerable tract of fertile land, dividing the town from the river, is occasionally inundated during the season of floods. El Metemmeh contains about 3000 inhabitants, and owns a sheikh and dervish; although possessing a bazaar, a market is held here twice a week, where an abundant supply of all native products is to be obtained.

SODA WATER MACHINERY AT THE VIENNA EXHIBITION.

Abounding as it does in objects of interest and usefulness, the Vienna Exhibition does not include many matters of greater interest, with the thermometer at 90o in the shade than the soda water machinery shown. If proof of this assertion be needed, it is to be found in the constantly thronged condition of the pavilions which are met with at various points in the grounds of the Exhibition, where American iced drinks are dispensed, as well as the crowded state of the numerous stands in the Exhibition devoted to the same purpose. These pavilions—one of which is constructed

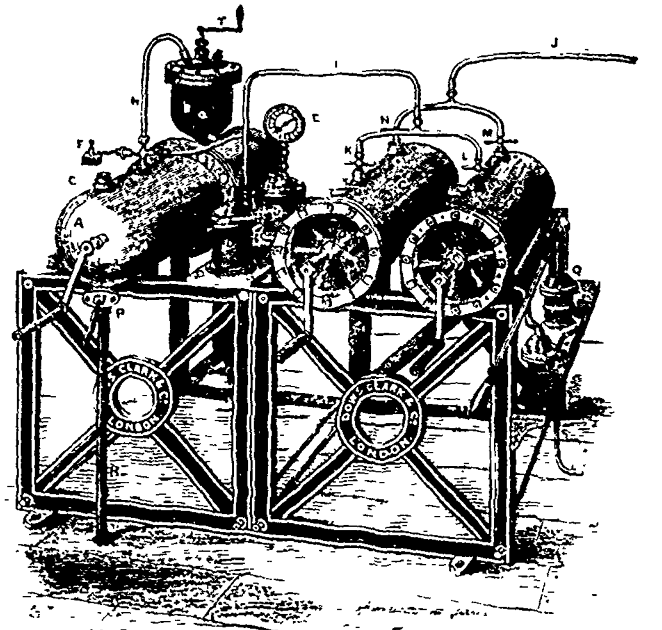


FIG. 1

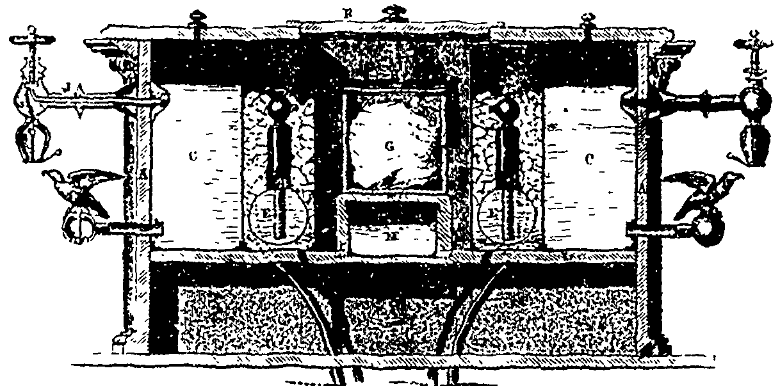


FIG. 2.

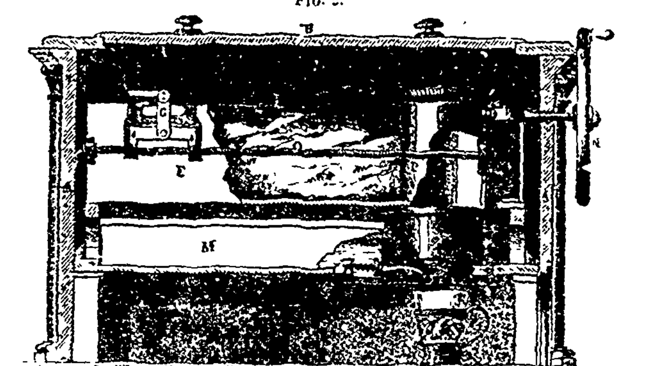


FIG. 3.

SODA WATER MACHINERY AT THE VIENNA EXHIBITION.

CONSTRUCTED BY MESSRS. DOWS, CLARK AND CO., LONDON.

adopted; the sharpest curves (a quarter of a mile radius) upon this division were here introduced in three places, elsewhere upon this length the sharpest being half a mile radius.

After crowning a ridge of black porphyry and sandstone rock, the line takes a somewhat more easterly direction, and alls gently, the ground being favourable, and consisting of a the sole concessionaires for supplying American Soda Drinks in the Exhibition and grounds. For the purpose of meeting the demand, they have in the grounds a neat-looking house of corrugated iron placed near the eastern extremity of the Industrial Hall, and which is their factory. Here the aërated water and syrups are manufactured, and thence conveyed to the pavilions and marble stands before referred to.

From the first manufacture of aerated water at Geneva, by Gosse, towards the close of the last century, and its subsequent introduction into Paris by John Paul, a great amount of inventive talent has been expended upon the various apparatus for preparing and supplying the beverage. In America this has been especially the case, where the enormous consumption has led to the introduction of apparatus for serving soda water on draught, which has to some extent superseded the bottled trade. Amongst the first to conceive and carry out in practice this novel idea was the firm of Dows, Clark, and Co., and their enterprise has not been confined to the United States. At the Paris Exposition they had their stands, and they have established depots in London, where their iced soda creams can be obtained. The apparatus for the manufacture of these beverages, as examined by us in the Exhibition at Vienna, consists first of the machine for making and bottling aërated waters, shown at Fig. 1 of our engraving. It is a machine for generating the carbonic acid gas, and in it can be used either pulverised marble, whiting, or bicarbonate of soda, which is acted upon by sulphuric acid, the flow of which into the generator is regulated by the lever T. A is the body of the generator, B the reservoir for the acid, and D D the washers through which the gas passes, and is purified on its way to the water. E is the pressure gauge for ascertaining the strength of the soda water, and which indicates pressure in pounds per square inch. D is the opening through which the whiting or marble is introduced into the generator. P is the blow-off pipe, just above which is the handle for agitating the contents of the generator. The lower part, R, of the blow-off pipe leads to the waste tank. F is a safety valve, and H a pipe leading from the generator to the acid reservoir to equalise the pressure.

The cylinders for holding the aërated water are shown at C C, the pump, Q, being used to supply the water to either cylinder as desired In the first instance the two cylinders are filled nearly full of pure water, and then charged up to a sufficient pressure, when the cocks, K and L, are closed. The pipe J leads to the bottling machine, and when desired the aerated water is let on by turning either the cock N or M. When either cylinder is empty the cock is closed, and a further supply of water pumped in with the pump, Q. The water is gauged in the cylinders by the small taps, OO. After filling with water, the carbonic acid gas is let on by turning the cock as before, and by agitating with the handles, another charge of aerated water is made in a very few minutes, and with little trouble. The gas in all cases passes through the two washers, D D, and is thoroughly purified. The generator and cylinders are made of thick copper, the former being lined with lead, and the latter thickly tinned with pure metal.

This constitutes the apparatus for manufacturing aërated water for bottling, but for supplying the stands where the iced drinks are dispensed from an apparatus, a modification of this arrangement is employed. In this case the machine for generating the carbonic acid gas is mounted on a frame by itself. A flexible pipe is attached to the washer, D, the other end being connected to a portable copper cylinder which holds about twelve gallons. Two discs are placed across the interior, having apertures in them, and the charging and discharging pipe extends from the top nearly to the bottom of the vessel. Two pins project from the sides of the cylinder by which it is suspended in an iron frame when being charged. When about to be charged the cylinder is first about two-thirds filled with pure water; if desired to have it strictly soda water a little carbonate of soda is dissolved in the water. The cylinder is then placed upon the agitating rack, and connected by the flexible pipe to the gas generator. The gas being let in, and the cylinder oscillated on the pins, the water striking against the discs is broken, and the particles separated, so as to allow the carbonic acid gas to unite very quickly and thoroughly with the water. When sufficiently charged with the gas, which is determined by the pressure gauge, which should stand at 180 lb. after the water and gas have been thoroughly agitated, the tap is closed, and the cylinder tranferred to the place where the water is to be used.

The apparatus for dispensing the iced beverages is shown in section at Fig. 2. In the centre is placed the can, M, which holds the cream, and above which is the ice cutter, destined to reduce the block of ice, G, to the condition of snow. On each side are the copper tanks, in which are placed the syrup cans, C C, and the cylinders, E E, all of which are enclosed in a marble case, A A. Directly above the ice shaver is the cover, B, provided with silver-plated knobs, for convenience of removal to introduce the block of ice, G, and smaller pieces, into the compartments containing the cylinders E E, and the syrup cans, C C, as represented. The draught tubes, J, are connected with the cylinders by a pipe for dispensing the soda water, and below them are the syrup taps connected with the syrup cans. Underneath are the pipes fernishing the soda water, and also for leading off the waste water. Fig. 3 is a central cross section of this apparatus which shows the ice cutter or shaver in position for working. A A is the marble case; B the cover to same; F is the ice-cutter box, which is made of galvanised iron. P is a vertical cylinder, open at the bottom, with knives projecting from its surface and openings in conjunction with the knives in the interior; G is a follower connected by a divided nut with the screw; O, on the opposite side, is another screw with similar connexions; N is a fly-wheel; M represents the cream can, with the valve and a wire, by which it is worked. In operating the apparatus, the fly-wheel is turned and the follower presses the ice against the knives in the cylinder which shave it off like snow. The ice falls into the cup beneath, and cream is added at the same time from the cream can by pulling the handle. To the ice cream thus quickly formed, is added the syrup and soda water, the result being a very refreshing beverage, and one which has quickly become popular wherever introduced. This apparatus is enclosed in an exterior casing of polished Italian Marble, more or less elaborately wrought, according to requirement. At the front are arranged the silver plated syrup taps and soda water taps, as seen in Fig. 2. The draught tap, J, seen in section, is very simple in construction and operation, it dispenses with the bottle or cup and draws the soda water with considerably more gas in it than when drawn in the usual way. After putting the ice cream, and syrup into the tumbler, the valve is opened and the stream, escaping with full force, thoroughly mixes the compound. The edge of the tumbler is then brought against the under side of the projecting lever, the valve is opened still wider, and a larger stream without force, will flow highly unpregnated with gas.

It is satisfactory to know that Messrs. Dows, Clark & Co. have been awarded the Medal of Congress at Vienna for their interesting and useful apparatus.—*Engineering*.

Beet Sugar.—A correspondent of the N. Y. *Tribune*, describing a visit to a great farmer in Bohemia, says: — Herr Horsky had always been a firm advocate of the beet root sugar, and since his acquisition of the farm the number of sugar manufactories in Bohemia has raised from 50 to 160. His entensive establishment in Kolin was erected and fitted up at a cost of $250,000, and it pays annually a large interest, although it must lie idle a good part of the year. The process of making the sugar as practised in this manufactory may be thus briefly described: The roots are washed and elevated to the upper story, where they are finely sliced and are macerated with water until the sugar is dissolved out, and the fibre is afterwards pressed to extract the liquid, to this liquid is added lime, which forms with the sugar saccharate of lime, and all impurities fall to the bottom, and are removed. Carbonic acid is next introduced, which precipitates the lime, and the solution of sugar remaining is subjected to the ordinary method of evaporation and bleaching.

From the statistical report of the United States National Association of Ironmasters, for 1872, we gather that a solution of gum catechu has been most successfully used to prevent incrustations of lime from lime-charged waters in steam boilers.

AN AMERICAN VIEW OF CANADIAN PROGRESS.

(From the Albany Evening Times)

Ill-informed persons ignorant that the divided British provinces of the past and the Dominion of Canada of to-day are very different affairs, are apt to under-estimate the importance of the progress of events north of the St. Lawrence in their bearing on the United States, and more especially on the northern and north-western portion of this country. The act of confederation has been successful in the object for which it was intended. The prospects of the annexation of Canada to the Union are far less than they were five or even three years ago. A new nation has been brought into existence, and a national spirit fostered, which is growing stronger year by year. Its effects are already apparent in the growth of commerce; in the construction and enlargement of canals, in the increase of ocean transportation, and in the projected Canada Pacific railroad. In support of our assertions as to the growth of commerce in Canada, we will cite the city of Montreal as an illustration. The wonderful growth of that old French city and the great improvements made there, force themselves on the attention of all persons who have recently paid it a visit, and know what it was a few years ago. Montreal has increased its population since 1850, and mostly within the era of the Dominion, from 57,000 to 150,000 inhabitants. The city is admirably situated for commercial purposes, on the St. Lawrence, and when the canals are completed will be able to receive the largest vessels from our lake cities, and thus in great measure divert the grain trade from New York. There are now numerous steamers plying between Montreal and Great Britain, and as the railroad system of Canada is directly connected with that of Chicago, Montreal is as near the Pacific as the metropolis of the Hudson, and twenty-four hours nearer Glasgow and Liverpool than New York. Already four miles of stone docks have been built at Montreal, and ten miles additional are in course of construction; a large hydraulic dock is projected, and the river to Montreal has been dredged, so that vessels of twenty-four feet draught can approach the safe, handsome and convenient wharves of that city. New York cannot compare with Montreal in some important respects; and in the next decade the Canadian emporium will inevitably divert much of our western trade unless vigorous means are speedily taken to prevent it.

The opening of Lake Erie to the largest class of lake steamers will immediately draw a large amount of the grain trade from the Erie canal and from the American railways, if things are allowed to remain as at present. We have the advantage in climate—perhaps four or five weeks in the year—shall we not use it? The Chicago *Tribune* says:—

During the last week it has been demonstrated that Chicago could receive 2,100 cars of grain and send back the empty cars to be re-filled in a single day. It is also well understood that a daily arrival of 500 cars of grain exceeds the present handling facilities of New York, and grain has to wait in that city until such time as the slow and round about mode of doing business there, will admit of its being transferred. Philadelphia and Baltimore are, in this particular, in advance of New York; they have provided elevators and warehouses into which grain can be received as fast as it arrives. In New York it has to wait. At Montreal, the arrangements of docks and warehouses are so complete that, whether the grain arrives there by rail, st[illegible] sail vessel, or canal, it can be handled instantly.

[illegible]ntreal, with the lakes, canal and river, has superior facilities for water transportation (which we have previously demonstrated to be more expeditious and economical than land carriage). A lake propeller can hold as much grain as 200 cars, and for exportation purposes, the cheapest route is certain to be favoured by the producers of the North-West. Europe seems to be depending more and more on the western continent for her breadstuffs, and if they are to pass through Canadian instead of American hands it will furnish a very sensible item of loss. It seems to us a very bad time to sneer at Canada and the Canadians, it would be better to be up and doing all that is possible to prevent them from gaining any commercial advantage over us.

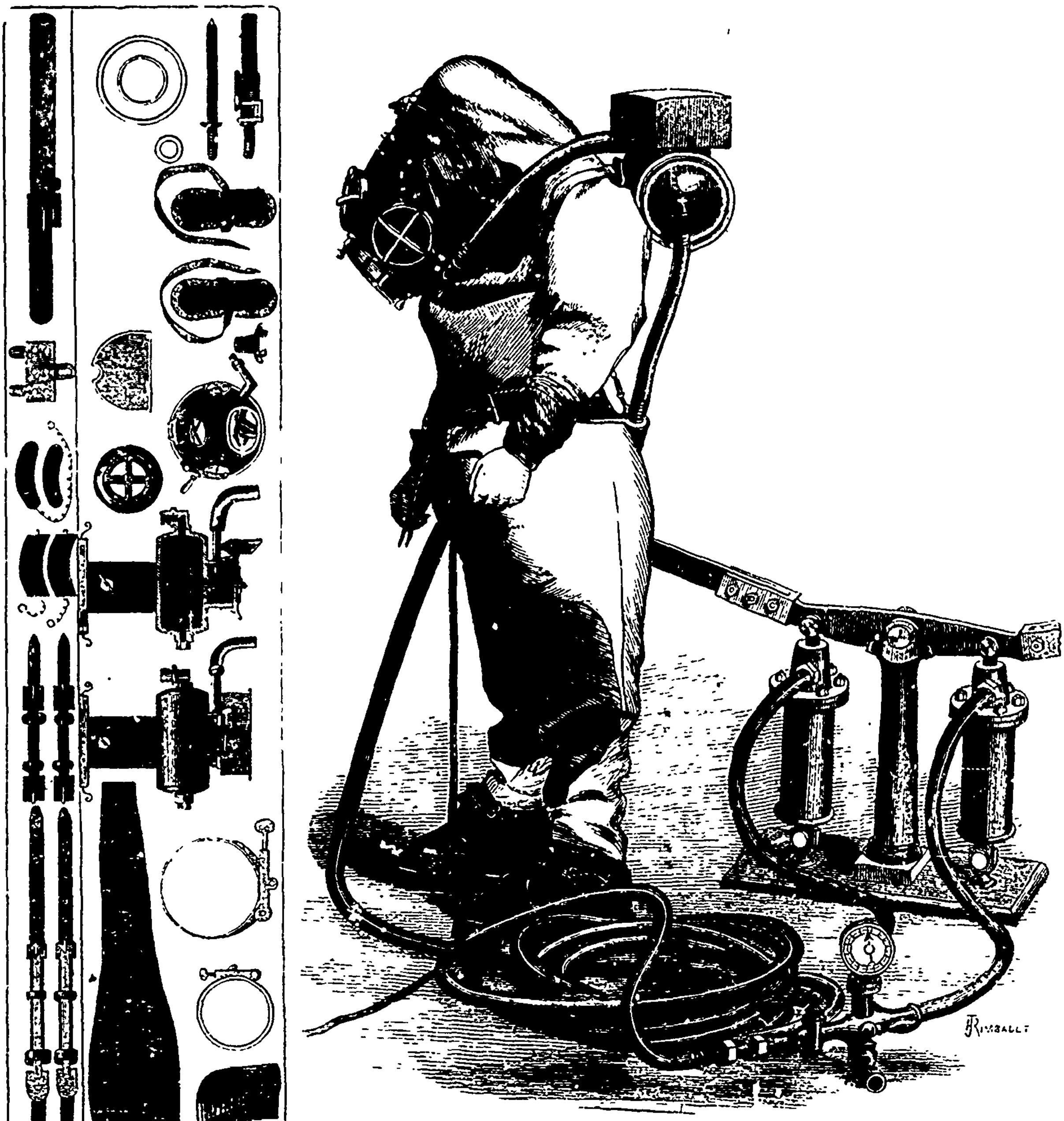
PHILADELPHIA CENTENNIAL EXHIBITION.

The preparations for the Centennial Exhibition at Philadelphia in 1876 are gradually maturing, and the work of arrangement intrusted to the several committees is progressing. The executive commissioner, Prof Blake, is at present at Vienna, making personal observation of the arrangement and conduct of that great display. He had carefully investigated the Paris Exposition of 1867, as shown by his work upon it; and such experience is imperatively demanded, to avoid the blunders and mistakes of previous efforts. The commission is now in daily sittings at their rooms, Walnut-street, near Ninth-street where they have employed two secretaries and three heads of bureaus, each of whom is entrusted with the management of some speciality. The necessity of pushing forward as rapidly as possible the preparations for the exposition buildings is fully recognised. The statement is made that the committee on plans and architecture have decided to make use of four buildings—a central main building, to be devoted to general exhibition purposes, and separate structures to contain the departments of fine arts, of machinery, and of horticulture. It is further stated that the appointment of the architect will be thrown open to public competition, and that all architects will be invited to contribute plans: the authors of the ten most approved designs to each receive a prize of £200. The decision upon the successful plan will be made about July. The plan of classification adopted at the Paris Exibition of 1867 will be carried out, that is to say, each class of exhibits will have a space assigned to it, and each country exhibiting will have a portion of that space, so that the best opportunity will be afforded for comparison. The following are the divisions under which they will be arranged.—(1) Raw materials—mineral, vegetable, and animal. (2) Materials and manufactures used for food or in the arts, the result of extractive or combining processes. (3) Textile and felted fabrics—apparel, costumes, and ornaments for the person. (4) Furniture and manufactures of general use in the construction of dwellings. (5) Tools, implements, machines, and processes. (6) Motors and transportation. (7) Apparatus and methods for the increase and diffusion of knowledge. (8) Engineering, public works, architecture, &c. (9) Plastic and graphic arts. (10) Objects illustrating efforts for the improvement of the physical, intellectual, and moral condition of man, &c. The Centennial Commission for the inauguration and conduct of the great exhibition have already made most commendable progress. Committees from their number, having in charge special departments of this vast scheme, are in constant session, and the general outline of the work seems to have been fully developed. The site for the buildings used for the occasion has already been secured in Philadelphia's beautiful park, and the formal transfer of the ground by the city authorities to the control of the Centennial Commissioners took place, with suitable ceremonies, on July 4th. The decoration of the ground for the purpose, the planting of shade trees, &c., is to be taken in hand at once.

DIVING DRESS USED IN OBTAINING AMBER.

The Konigsberger Maschinenbau Actien-gesellschaft Vulkan of Konigsberg, in Eastern Prussia, exhibits amongst other things in the pavilion for the Prussian Iron and Mining Industry, at the Vienna Exhibition, some interesting diving apparatus as used on the eastern coast of Prussia, for obtaining amber. This apparatus, an illustration of which is given on page 270, and which received a gold medal at the Moscow Exhibition of last year, is constructed on the system of MM Rouxquayrol-Denayroux, some alterations and improvements having however, been introduced so as to give greater safety. The air is transmitted to the diver through long india-rubber tubes by means of an easily transportable air pump with two cylinders. These tubes, which are strengthened by spiral wires, conduct the air to a regulator carried on the diver's back. The completely air and water-tight dress of the diver is connected by an india-rubber ring with a copper helmet, or also with a mask, the helmet and mask being provided with strongly grated windows. The helmet is used for works under water in which the head of the diver has to be kept upright (repairing ships for instance), whilst the mask is adopted for researches and examinations on the sea bottom.

A great advantage of this arrangement is that the diver has always a certain reserve quantity of air in the regulator, so



DIVING DRESS USED IN OBTAINING AMBER.

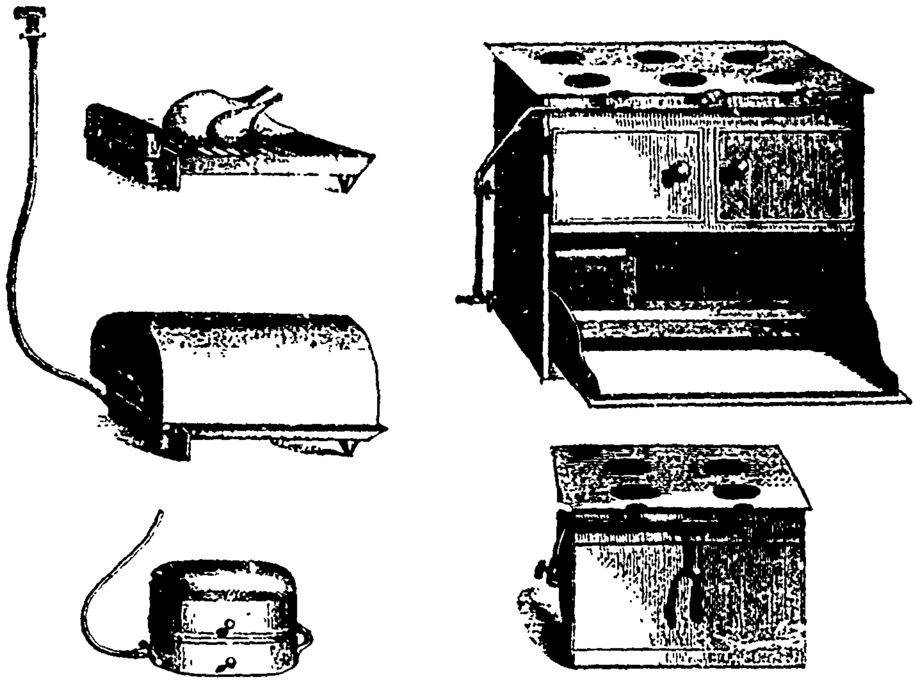
that a fallin, off in the supply of air is not connected with immediate danger or disadvantages for him. The supply of air to the diver is regulated by a peculiarly constructed valve by means of which the pressure under which the air is supplied corresponds always with the depth of the water in which the diver is acting.

The air coming from the diver is not allowed to mix with the fresh supply of air, but escapes to the surface through a side-port closed by an india-rubber valve. The diver is able to increase or diminish his specific weight by simply altering the volume of air between his dress and body, and in this manner it is in his power to ascend or descend as he likes. The right-hand view of our illustration shows a diver equipped with the dress and mask we have described, while on the left is a plan showing the various details of the equipment, as exhibited by the Vulcan Company.

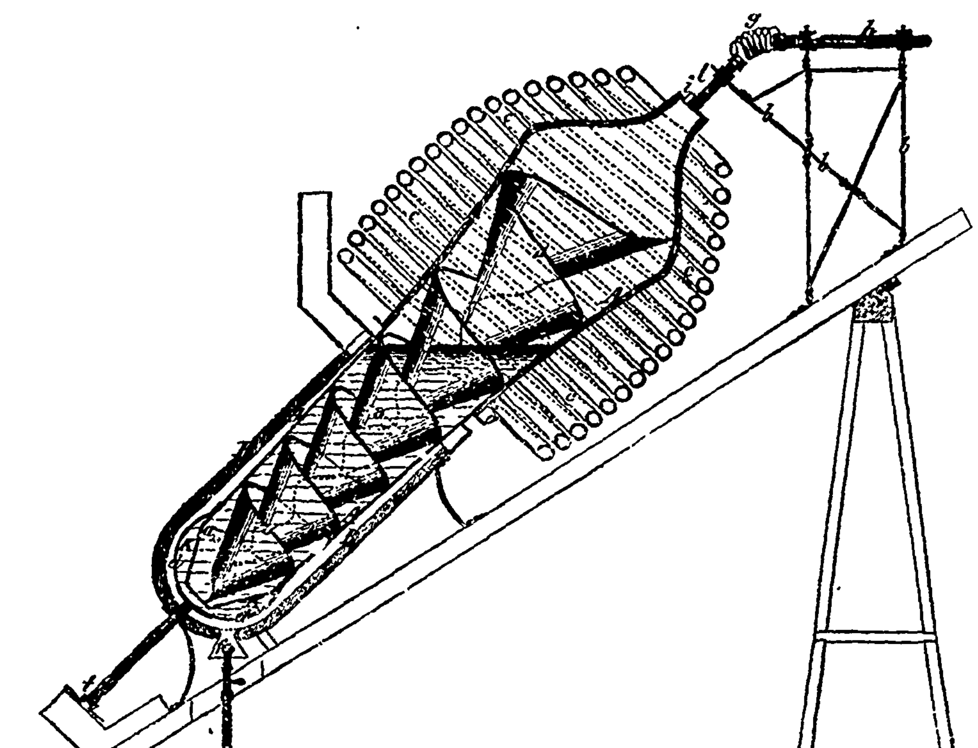
NEW STEAM MOTOR.

Many inventors are working at plans which aim at dispensing with as much as possible of the cumbrous machinery which at present serves to transmit power. Frederick Siemens, of Dresden, exhibits at Vienna a motor of this nature which dispenses entirely with pumps, valves, &c., and operates through the rotation of the steam generator itself. The exertion of power begins instantly with the development of steam, and is continued by the expansion of the steam until close to the vacuum, so that the greatest possible amount of power is developed from the steam pressure and made useful.

Our engraving, from the *Deutsche Industrie Zeitung*, represents such a motor, one-tenth the natural size. The machine consists essentially of a rotating boiler placed in an inclined position. A, is the boiler or shell, inside of which there is a worm or screw, s, made out of plates cut funnel shape, and at-



SOUTHBY'S ECONOMIC GAS RANGES (See page 161.)



NEW STEAM MOTOR.

tached to A. At the lower end the boiler A, is provided with a double bottom *d*, while the upper end is surrounded by a spiral tube *c*, its spiral being in reverse of those of the interior worm or screw *s*. The double bottom of the boiler forms a water space K, which communicates through circular holes *a*, with the inner space of the shell A. The machine is mounted on a sloping axle-tree, which is stepped at *t*, and supported above on the shaft *l*, and bar *b*. The motion of shaft *l*, is transmitted to the horizontal shaft *h*, by means of the flexible connection. The lower part of the shell A, is surrounded by a furnace of clay B, and fire is applied through an opening at *f*. In this example a gas flame is employed. The products of combustion rise from *f*, and surround the shell A, finally escaping through the upright pipe, at the upper end of B. The boiler A, is filled with water at *i*, and here a fusible plug is used, which melts when the temperature of the steam rises above that of a given pressure, and permits the escape of steam into the atmosphere, thus ensuring the safety of the apparatus. When the fire is kindled at *f*, the steam which developes rises through the water and acts on the spirals *s*, causing the turning of the whole machine. The steam continues to rise until it reaches and enters the spiral condensing pipe *c*, which surrounds the upper exterior portion of the shell A. In passing through the pipe *c*, the steam is condensed, and the water of condensation is screwed back by the rotation of the pipe *c*, down below the water level in the boiler A, near *o*, where the water enters the boiler, and is again converted into steam. In starting the machine the steam must first be allowed to escape at *o*, out of the spiral condenser, in order to drive out all the air; then the opening *o*, is closed, and the steam, then rising into the cooling pipes *c*, is condensed as before described.

The machine, if once filled and made completely tight, continues to work without requiring any other attention, except to keep the fire going. No pumps to supply water, or valves or other devices are required, but a constant use of the same water over and over again takes place: the water being first converted into vapor, which is then condensed, then again evaporated, and so on.

In lieu of water other liquids may be employed, and it has been suggested that quicksilver might be advantageously used.

PHOSPHOR-BRONZE.

This new alloy, which has been recently brought before the public for obvious reasons, is likely to be much patronised, especially in manufactures where steel is useless or dangerous. The reasons given by the patentee are that it can be made, according to the wish of the operator, more ductile than copper, as tough as wrought-iron, or as hard as steel; it possesses great fluidity; its homogeneity is complete, and its grain is as fine as that of cast steel. It may be perfectly controlled to suit any particular purpose for which it is intended it can be made either hard or soft, tough or brittle, and its ductility, elasticity, or hardness can be regulated with the most perfect accuracy. Unlike other alloys, it can be re-melted without any material loss or alteration of its quality, while heavy steel castings, when worn out or broken, are comparatively worthless.

A great variety of objects hitherto worked in iron and steel may now be cast in the new alloy, and in many cases they require only a polish to make them ready for use; beside which they do not corrode, as articles of iron or steel do. The great fluidity, compactness, and fine grain, as also the beautiful colour of the metal, especially recommend it for decorative art, and the perfection of the castings greatly reduces the cost of chasing and finishing. This alloy stretches more than copper or any of its ordinary compounds, and plates have been reduced, by a single cold rolling, to one-fifth of their thickness, the edges remaining perfectly sound and without crack. But perhaps the greatest advantage of phosphor-bronze is its incapacity to emit sparks. Tools, knives, scissors, and other articles, such as locks, keys, &c., have therefore already been largely made from it by gunpowder manufacturers. Bearings, pit-ropes, telegraph-wire, tuyères, cannon, cartridge-cases, pistols, bells, &c., have also been made of this metal.

By order of the Prussian Ministry of Commerce, experiments have been made with the various kinds of phosphor alloy, the object of which was to ascertain the resistance of the metal to repeatedly applied strains or pulls, and also to bends of a given force. The first bar fixed on the stretching machine resisted 408,230 pulls of 10 tons per square inch, while a bar of ordinary bronze broke before even the strain of 10 tons per square inch had been attained. Another bar withstood 147,850 pulls of 12½ tons per square inch. Still more favourable results have been obtained on a machine by which the test bar was bent as often as 40,000 times per day. In this instance it resisted 862,980 bends of 10 tons per square inch, while the best gun-metal broke after 102,650 bends of the same force. Another bar which was being tested withstood 1,260,000 bends of 9 tons' force per square inch, without showing any signs of weakness.

The foregoing remarks show the great adaptability of phosphor-bronze for all articles hitherto manufactured of ordinary bronze or gun-metal, and although the primary cost may exceed that of other alloys, the ultimate result will be in its favour, owing to its extra durability, lightness, and capability of reconversion. In fact it may be said that what steel is to cast-iron, phosphor-bronze is to ordinary bronze. The patentees have received diplomas and medals of merit and progress from the Vienna Exhibition.

WATER AS FUEL.

A patent for "An improved method or process and apparatus for securing the combustion of fuel and the utilisation of the gases arising therefrom" has been obtained by Mr J. Ramsden, of Lightcliffe. His apparatus is now in operation, and is thus described by the *Halifax Guardian*:—Mr. Ramsden burns steam, and the means used to effect its combustion are very simple. As the appliances are so far merely for experimental purposes, they are of a miniature description. On a bed, about 5 ft. square, stands a small double-cylinder steam-engine of ordinary construction. The boiler which supplies the motive-power is a mere toy, being about 2 ft 6 in. long, and 15 in. or 16 in. diameter, of the single-flued Cornish pattern, the flue being about 6 in. diameter. Instead of the ordinary furnace-fire bars for burning coal, there is a coil of small iron-piping which takes three turns round the inside of the furnace or flue. In this pipe are drilled eighteen small holes of about one-sixteenth of an inch diameter. These holes are so arranged that when steam is admitted to the coil it rushes out through them, forming a circle of jets which meet in the centre of the furnace. Across the front of the fire-hole or furnace runs another small pipe with two more jets directed into the flue. Immediately in front of these two latter jets are two brass nozzles, the orifices of which are scarcely discernible, connected with a vessel containing petroleum. There are cocks to regulate the supply of petroleum and steam. As the boiler must necessarily be cold to begin with, and as steam is the fuel to be burned, recourse is had to a small auxiliary boiler in which a little steam is generated by ordinary means. This generator is temporarily connected with the coil inside the furnace, a tap is turned, and the steam rushes out of the jets. At the same time another tap is turned, and the petroleum issues from the nozzles. A light is then applied to the petroleum, and instantly the steam is decomposed and ignited, and the furnace is a roaring blast of flame. In a few minutes steam is up in the boiler, and becomes independent of the generator first used. The result is startling and wonderful. The effect of the rush of steam from the jets is to draw the petroleum through the nozzles, and petroleum or any other hydro-carbon having the power to decompose steam, the interior of the flue becomes a furnace of great heat. So intense is this heat that, although steam rushes through the coil, it becomes almost white hot in a very few minutes. A not less important feature of this invention is its adaptability to illuminating purposes. The large quantity of inflammable gas generated would, if not intercepted, escape unconsumed. To utilise this waste Mr. Ramsden brings the steam-engine into operation, geared to a small rotary fan, sending it into a closed vessel containing petroleum. From this receptacle it is conducted to a gasometer, and used exactly in the same manner as ordinary gas. This gas has no smell, and literally no smoke. Its cost, adds our authority, is ridiculously small. Mr. Ramsden contends, and with a show of reason, that it cannot cost more than 9d. a thousand.

ON ENERGY.

By Prof. Robert Stawell Ball, A.M., LL.D.

The science of Energy, which has been developed within the last twenty-five years, appears to have a grand future as intimately connected with astronomy, mechanics, light, heat, magnetism, electricity, even with life itself: it leads us back through periods, compared with which, geological time is nothing, and, looking forward, like a time telescope, points out the ultimate destiny of the universe.

Energy is the capacity of raising weights. The distinction between force and energy is that: Energy is the product of a force and a distance The unit of energy is the energy required to overcome the unit of force through the unit of distance. Energy can be stored in a rapidly moving fly-wheel, as can be demonstrated by experiment. Energy is also stored in any body moving rapidly, as, for example, a cannon ball; energy of this kind is termed "kinetic energy." A steam-engine is a means of turning into mechanical work, a portion of the energy contained in the coal consumed in the furnace. Heat may be turned into mechanical work in other ways: for example, by a thermo-electric battery. The energy stored up in coal, gunpowder, or a compressed spring, is denominated "potential energy." Food and fuel are both forms of potential energy; but the former has to replace the wear and tear of the machine which consumes it, which the latter has not.

Energy can be changed from one form into another. The potential energy of the body may be converted into mechanical work by raising a weight, into kinetic energy, by setting a wheel in motion, heat, by friction into electricity; heat and light, by Wild's electrical machine.

A piece of zinc may be burned in a stream of oxygen The potential energy becomes light and heat; but it might have been more slowly burned in a battery, it would thus develop electricity, which might be turned into kinetic energy by an electro-magnetic engine, or into light, sound, and heat by a Ruhmkorff's coil.

Energy is indestructible. If it disappears in one form, it is only to reappear again. A hammered nail on an anvil becomes hot; the energy which moves the hammer is transformed into heat in the nail; it is not lost. Friction appears to consume energy, but this is not so, for if proper appliances are used, sufficient heat can be collected to boil ether, or even water. Savart's apparatus is another instance; the kinetic energy of a rotating toothed wheel being, by it, transformed into sound.

Perpetual motion is impossible, because some energy is always uselessly expended in friction in every machine, and energy cannot be created. No water-wheel could pump up sufficient water to supply itself.

It has been (fallaciously) proposed to work a magneto-electric machine by a steam-engine, to decompose water with the electricity, and sustain the action of the steam-engine by heat developed by burning the oxygen and hydrogen produced by the decomposition. It would be impossible for the steam-engine to decompose enough water for the purpose.

Since, therefore, energy cannot be destroyed, and cannot be created, the quantity of energy in the universe must remain constant. This is the principle of the conservation of energy.

All the different forms of energy in the earth, whether derived from food, fuel, wind, or water, can be traced to the heat radiated from the sun. The heat is sustained in the sun by the transformation of a potential energy into heat, due to the sun's contraction. If the diameter of the sun diminished 1-10,000th part, heat sufficient to supply the present loss by radiation for 2,000 years would be produced.

The heat of the stars represents the prodigious quantity of energy The earth has a store of potential energy due to its distance from the sun; this energy is equivalent to as much heat as would be produced by the combustion of 6,000 globes of coal, each as large as the earth Beyond this, it has an amount of energy due to its velocity in its orbit equal to that which would be produced by the combustion of fourteen globes of coal of its own size. To this must be added a quantity of energy due to its rotation on its axis.

A period of rest, however, must at length come. The planets, since they are not rigid bodies, must ultimately fall into the sun. Heat diffuses itself, but heat cannot be turned into mechanical energy, except when transferred from a hot body to a cold body. When, therefore, by the diffusion of heat, the temperature is uniform throughout the universe, mechanical work must cease.

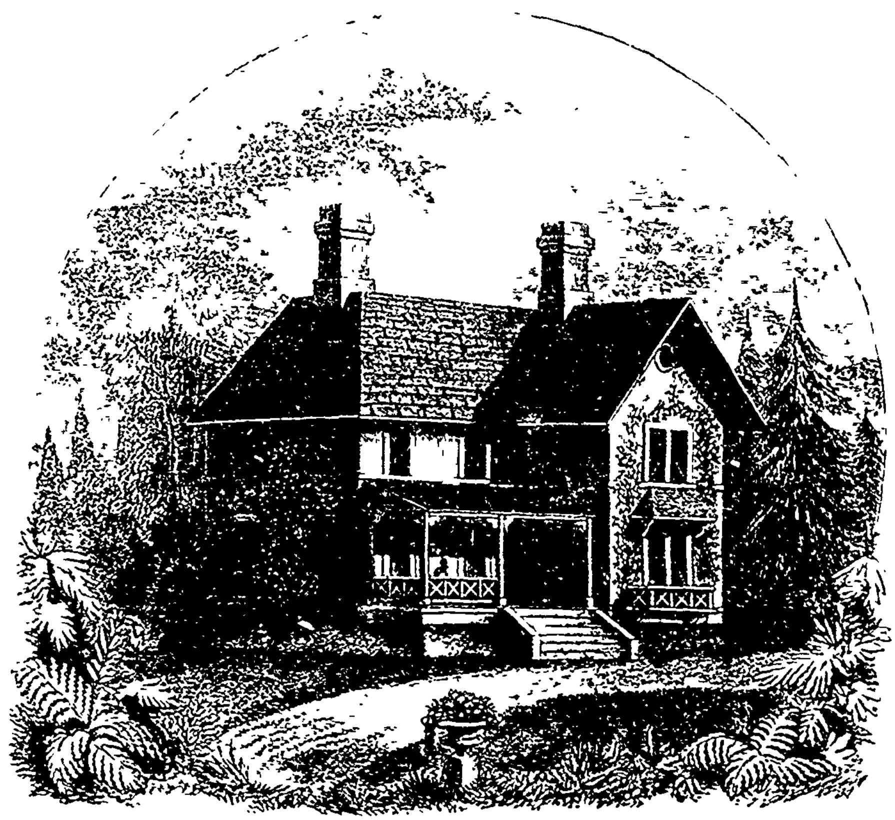
VELOCITY OF LIGHT.

Recently, M. Fizeau has communicated to *Les Mondes* the results of a series of very elaborate experiments, made with a view to the most accurate determination of the velocity of light The distance between the two stations of observation, as found by triangulation, was 33,829 1 feet (about six miles), with a probable error of 0 001. The source of the ray was a jet of oxyhydric gas Six hundred and fifty satisfactory observations were made, the mean of which gave 185,368 miles per second as the required velocity. The experiments of M Foucault to determine this same velocity, give us a result of 185,177 miles.

The formerly accepted determination of the velocity of light was that of Olaf Roemer, a Danish Astronomer, who deduced it from observations on Jupiter's satellites. The earth's orbit being concentric with that of Jupiter, and interior to it, the distance of these bodies is continually varying, the variation extending from the sum to the difference of the radii of the two orbits, making the excess of the greatest over the least distance equal to the diameter of the earth's orbit. A comparison of the eclipses of Jupiter's satellites during many successive years, showed that those which took place about opposition were observed earlier, and those about conjunction later than an average or mean time of occurrence. Connecting the observed acceleration in the one case, and retardation in the other, with the variation of Jupiter's distance below and above its average value, the difference was fully and accurately accounted for by allowing 16m. 26s. 6 for light to traverse the diameter of the earth's orbit. From these data, Roemer found the velocity of light to be about 192,000 miles per second.

It seems at first sight as if the recent and very accurate determination of M. Fizeau had demonstrated a defect in the earlier method, indicating, perhaps, some cause, connected with the acceleration and retardation of the apparent occultations of Jupiter's satellites, other than the time required for light to traverse the earth's orbit. But Captain C. W. Raymond, U. S Engineer, at present Assistant Professor of Physics at West Point, calls attention to the curious fact that by substituting in Roemer's calculation a more modern and more accurate value of the diameter of the earth's orbit, the resultant measure of the velocity of light becomes 185,344 miles per second, which agrees astonishingly with the figures of M. Fizeau. Similar experiments conducted some time ago by M. Foucault, indicated 185,177 miles per second as the velocity. This is one of the questions which will be affected by the thorough observations, to be made by trained astronomers of all nations, of the next transit of Venus. The diameter of the earth's orbit, which may be called our astronomical unit of distance, will be probably finally determined by those observations.—*Engineering and Mining Journal.*

The Rapid Growth of Trout. — "Some years since Prof. Agassiz suggested to George S. Page, Esq., of New York, President of the Oquossoc Angling Association, a means for determining approximatively the age of the famous Rangelys trout which grow to the remarkable weight of seven, eight, and even ten pounds. The mode adopted was to take a small platinum wire, pointed at one end and flattened at the other, and marked on the flat end with the weight and year. Then insert this wire in the dorsal fin, selecting a mark according with weight at the time, and return the fish to the water. In 1870, Mr. Page and others, marked and liberated some fifty trout in this way, and the practice has continued each season since. No marked fish has been captured until this season, when in a lot of trout brought back by the artist Moran, who was one of a large party who visited these waters early this month, one fish was found marked '1870, half pound,' and weighing, when captured, nearly two pounds and a quarter, showing that the trout had grown nearly one and three-quarter pounds in three years."



RURAL COTTAGE.

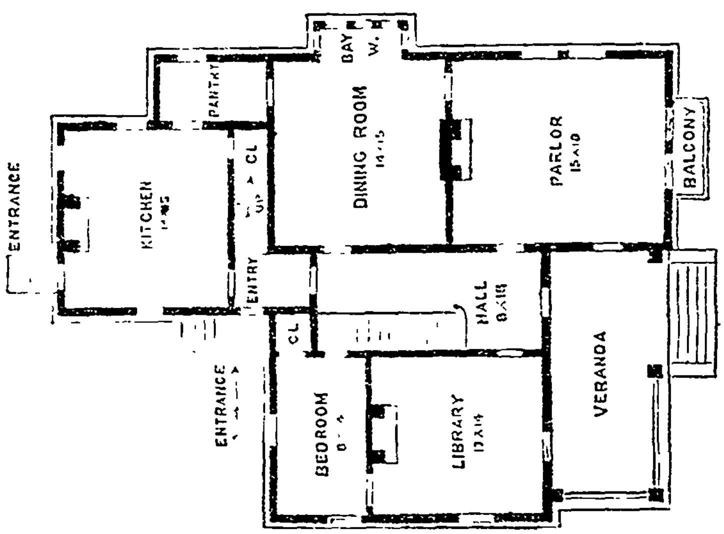


Fig 106.

RURAL COTTAGE

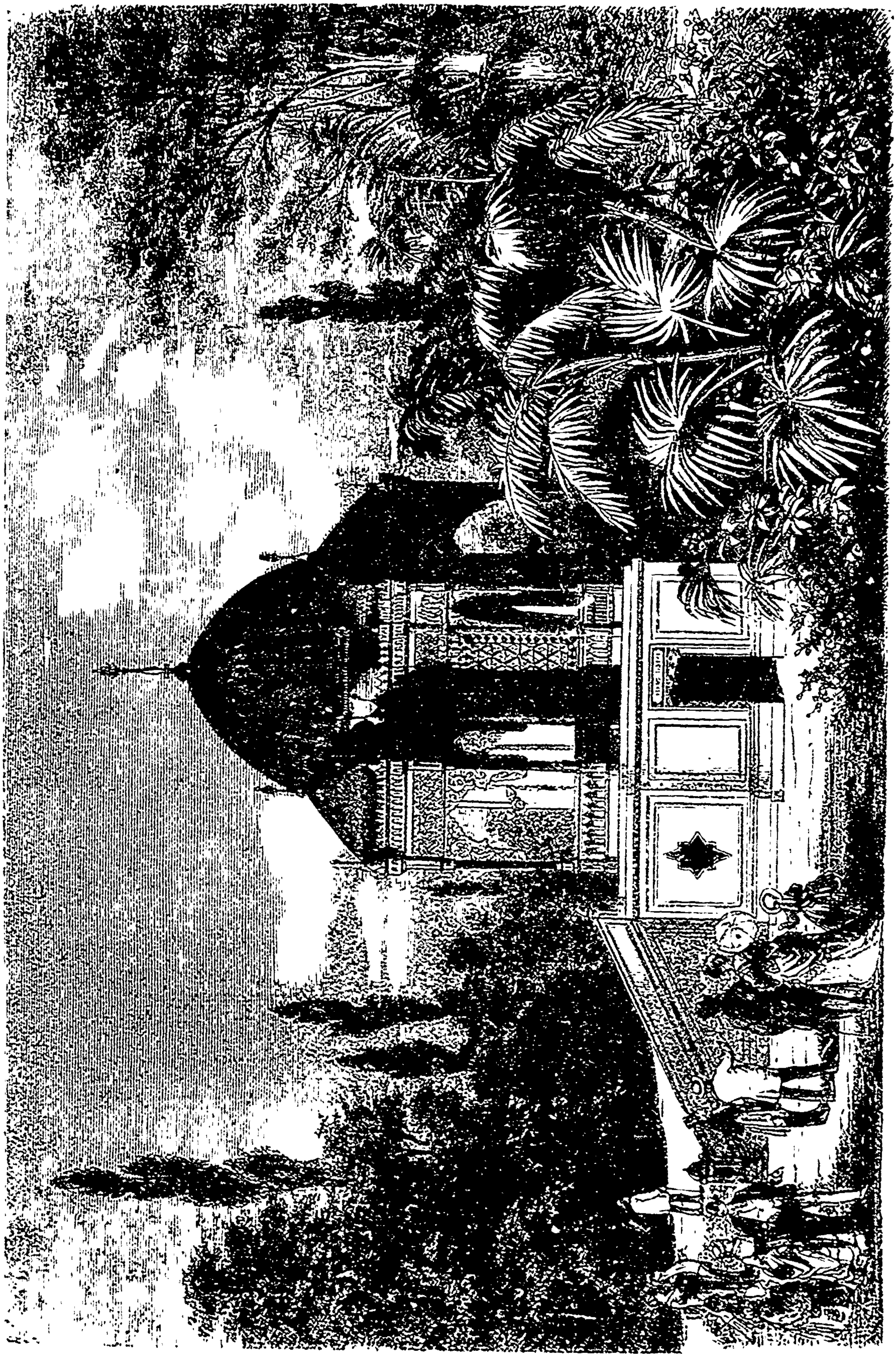
In the accompanying illustration we present a plan for a plain house where abundance of room is more of an object than elaborate ornamentation The decorations are few and simple, and in keeping with the general effect of the structure. The veranda at the entrance is very broad, and the entrance hall large and roomy The dining room has a bay window and is conveniently situated as regards the kitchen The second story contains five chambers, and the attic may be divided off into three large rooms The cellar extends under the whole house A few vines may be trained to climb the walls, and some rustic vases and other ornaments arranged before the front will give a tasteful appearance to the building.

THE TURKISH TREASURE PAVILION AT VIENNA

Among the one hundred and forty special buildings, in addition to the main exhibition edifice, pertaining to the Vienna World's Fair is the Treasure Pavilion of the Sultan of Turkey, or King of the Ottomans. The pavilion, which we illustrate on page 175, is in the form of an oriental kiosk The domed within ceiling is painted in arabesques, and pendant from it are five large golden walls. Here may be read the history of the Sublime Portè from the days of the conqueror of Byzantium, Mahoud II, to the present Padishah Abd-ul-Aziz. The golden throne of Nadr-Shah is here, which was renowned in the east before the peacock throne of the Great Mogul at Delhi was dreamed of. It is marvelous in its workmanship large enough for a coach, and weighs four and a half hundred weight. It is enameled in celadon, green and crimson, and its patterns of arabesquerie are in rubies, emeralds and pearls. Above it hang the turban and armor of Sultan Murad, heavy with gold and gleaming with jewels. Near it are the horse caparisons of Selim III, with the heavy Mameluke stirrups and Arab bit of solid gold, encrusted with diamonds. Scabbards, where nothing but diamonds can be seen; cinctures of diamonds, bowls of China porcelain, their patterns marked out in gold and reset with rubies; clocks encased in diamonds and glistening with crescent moons and stars; hookahs with golden bowls, and chibouques whose amber mouth-pieces are encircled with rings of diamonds, gleam and glisten everywhere.

The value of the Turkish treasures contained in the pavilion is estimated at $27,500,000.

Daniel M. Lamb, of Strathroy, Canada, is the author of a method of producing gum from the milkweed plant, or other plants of the asclepia family, and flax and other seeds, which consists in macerating and fermenting the substances, and then by evaporation reducing the resulting liquid to a thick gummy mass. The gum thus obtained may be cheaply produced, and is alleged to have many of the valuable qualities of rubber. It is insoluble in water, may be vulcanised with sulphur, &c. The price of pure rubber is now very high, and the discovery of an economical substitute is a matter of the greatest importance in the arts.



THE TURKISH TREASURE PAVILION AT THE VIENNA EXHIBITION

MECHANICS' MAGAZINE.

MONTREAL, SEPTEMBER, 1873.

ILLUSTRATIONS:

CONTENTS:

THE NORTH SHORE.

Just in rear of the valley of the St. Lawrence there stretches away the vast tract of country occupied by the Laurentian hills. This extent embraces every description of land, fertile valley, lake and river shore, rocky hill and undulating pasture land. There is much land that is not rich, but there is but little that is not quite as fertile as the average land in the Eastern Townships This territory has gained slowly but steadily during the past ten years. One drawback has been a wrong system of farming. Most of the settlers went thither from the rich grain lands of the valley of the St. Lawrence and continue among the hills the same system of grain culture their fathers followed on the flat rich land. This the land is not adapted to, but its green valleys with numerous springs and extensive natural meadows offer splendid facilities for dairy farming; and when once the farmers have changed their system the effect must be at once apparent in increased prosperity and new and enlarged settlements. The other drawback has been the long distance to market. The latter hindrance is about to be withdrawn by the construction of a line of railway from Montreal north-easterly through part of this section of the country. A meeting was recently held in this city, and stock subscribed to a large amount for the purpose Mr. Legge, C E, was instructed to proceed immediately with the preliminary surveys from St. Jerome via New Glasgow, to St. Lin, and report at as early a date as possible, to the permanent Board of Directors, to be appointed by the stockholders within a month. The traffic from this railway will come into Montreal over the Northern Colonization Railway from St. Jerome, and thus avoid the expense of constructing additional bridges over the two branches of the Ottawa The country to be traversed by the proposed line is stated to be a fine agricultural one—and already a movement is on foot to carry the line from St. Lin to Industry, a place of some importance, but, at present, during the winter season, completely isolated. A considerable amount of local aid has been promised, as well as Government assistance. The friends of the enterprise are sanguine of being able to let the contracts during the present year, for the first section to St. Lin.

This section of country besides dairy produce, grain, &c, will also be able to export vast quantities of wood, hard wood for fuel, and lumber ready worked up by its abundant water power into doors, sashes and numberless other articles which must command a steady and constantly increasing market.

We have to chronicle, with much pleasure the opening of another railway in this province. We allude to the Montreal, Chambly and Sorel RR., which was formally opened for traffic on the 25th instant. The present terminus of the road is at St. Lambert's. The road is completed to Chambly and will soon be available for traffic to Sorel. This will open up a section of country which is in a thriving condition but which has hitherto, in winter, been entirely dependent on the common roads for traffic. The road, passing through the level valley of the St. Lawrence, is singularly favoured as to ease of construction, there being but one bridge of importance between St Lambert's and Chambly. This bridge which crosses the Little Montreal River, is constructed on the Anderson patent truss principle. The span is one hundred feet. So far as the road is concerned commercially there is ample prospect of success. Chambly possesses an abundant supply of water power and has already established several manufacturing establishments in the shape of woollen and cotton mills, a shovel factory, &c. The farming community through which the road passes is also in a most prosperous condition.

PROVINCIAL EXHIBITIONS.

The annual Exhibitions of this Province and of Ontario have just taken place successfully and almost simultaneously. The industrial departments with which we are more specially concerned were at least as full of entries as usual. The nature of these was in the main satisfactory and the interest taken in them by visitors was very marked, indeed the industrial department at Montreal was always thronged. The show of machinery at Montreal was not as satisfactory as it might have been. The agent for the Baxter Steam Engine exhibited one of those useful little engines at work. We noticed a tyre-setting machine, somewhat similar in principle to West's tyre-setter which we described in our number for July last. Judging from specimens of its work shewn this must be a very useful tool. Strong's excelsior gate, invented and patented by J. C. Strong, of Newtonbrook, Ontario, attracted a good deal of attention. It is opened readily from the waggon and does not seem likely to get out of order. Edson Fitch & Co., shew some very well made splints and friction matches from their factory near Quebec. another firm, also of Quebec, shewed a very fine assortment of steel and other springs. The display of agricultural implements was good. Mr. William Evans, of Montreal, was the largest exhibitor in this department. Messrs. Vanvliet, of Lacolle, shewed some very fine wooden ploughs. One of the most interesting exhibits in this department was Vessot's combined sower, harrow and roller. This seems to be a very useful implement, it attracted a good deal of attention from practical farmers on the ground. We saw many other exhibits in this department we should like to particularize, such as the castings, carriages, &c., but must refrain now from want of space. We will endeavour to describe some of them separately in a future issue.

The exhibition at London, Ontario, was also very successful The President of the Association in a very interesting address stated that it is believed that no Exhibition on this continent precedes in importance that of Ontario, except that at St. Louis. In the course of his remarks the President observed that there was needed in Ontario an institution in which teaching the science and practice of agriculture should be the leading feature. To secure this end the Government of that Province have engaged the valuable services of Prof. McCandless, late of Cornell University. Under his direction it is proposed to conduct an Agricultural College and Model Farm which shall be of such a nature as to claim the confidence and patronage of the farmers of Ontario. The next exhibition will be held in Toronto.

LAKE SUPERIOR DISTRICT.

A tourist, who has lately returned from the North Shore of Lake Superior, describes in glowing colours the mineral resources on that side, and also states that when the navigation at Sault Ste. Marie is improved, mineral ores of great value, and vast quantities of lumber in that country, will find their way to the markets on the St. Lawrence, for shipment abroad. There is a fair proportion of arable land near the coast, ample to sustain the population engaged in mining and lumbering, and our informant is of opinion that ere many months elapse considerable settlements will be established on the Canadian coast of the Lake, and to some extent inland. The Dominion Government has recently caused to be erected a first-class lighthouse at Batchewana Bay, on the north shore of the lake. It has been placed on Carbay Point and lights up the coast, and the bay, which is a well protected and safe harbour. Being a first-class light it can be seen for more than twenty miles distant on the Lake. The coast in the immediate vicinity, but for this light, would be extremely dangerous, numerous vessels having been wrecked here in past years and many lives lost. The light-house is of wood, ballasted, however, with some sixty tons of stone. It is 80 feet high, of octagonal form, some 20 or 30 feet in diameter at the base, and 10 or 11 feet at the top, and is supplied with an excellent white light, obtained from Canadian oil furnished by the London, Ontario, Refining Company. The tower projects from the keeper's house, which is twenty-five feet in height. The first storeys of the tower are substantially braced, and the entire structure is of the first class. It will cost between $12,000 and $13,000. Carbay Point is about fifty miles above Sault Ste. Marie. There is an Indian village on the Bay of about 200 souls all semi-civilized, Catholic aborigines who are visited once a year, and sometimes oftener by Missionary priests. They are civil, well disposed and industrious, and subsist chiefly by trapping and fishing. That enterprising Scotch Canadian, J. A. (Cariboo) Cameron, has erected a saw mill on the Bay, and employs profitably some sixty labourers, chiefly French Canadians. The tourist predicts that the time is not far distant when a thriving town will grow up on the Bay. The much talked of Canada Pacific Railway must, it is said, eventually pass near to such town, and will, probably, be connected with it by a short branch. The United States authorities are constructing, on the south side of Sault Ste. Marie an additional canal to the old one made by them some years ago, which is found to be insufficient for the commerce between Lake Superior and the lower lakes, two millions of dollars and more have already been expended on these canals; when finished large vessels can ply for seven months in the year between Lake Superior and Montreal, and other Lakes and St. Lawrence Ports. The trade, in small vessels, to and from Duluth, is already very valuable. During the past summer often 25 and 30 vessels (either propellers or schooners with steam tugs) have been waiting in one day to get through the Sault. Many cargoes of valuable ores, lumber from both shores of Lake Superior and grain for ports on the Lake in the States of Michigan, Wisconsin and Minnesota, and return supplies and merchandise go by this route. The proposed improvements at these straits are also highly important to the United States as well as the Dominion unless the canal from Lake Michigan to Lake Erie, heretofore spoken of, is constructed; and even if the latter is made, the former should not be abandoned.

THE MARMORA GOLD MINES.

(From the Belleville Ontario.)

Prof. Bell, who has just returned from a visit to the Marmora mining region, informs us that apparances have much improved since his last visit a year ago. In the Cook mine they have worked down to the level of the shaft bottom, and will have to deepen that to enable the miners to work the present slope. The ore is abundant, and is becoming richer as the depth increases, visible gold being much more frequently met with than formerly, while the body of the ore yields better in the pan. The great want in these mines has hitherto been a good furnace which will drive off the arsenic and sulphur rapidly, effectually, and cheaply, and this at last seems to be upon the verge of completion. The revolving furnace put up under Mr. Dunstan's directions has been modified so as much to improve its efficiency, and further improvements have been suggested, and are about to be made upon it, which will both increase its effect and diminish the expense of working it. Experimental workings are now being made upon the tailings thrown out from former crushings with satisfactory results, showing beyond a doubt that a larger amount is still obtainable than that taken from them at first.

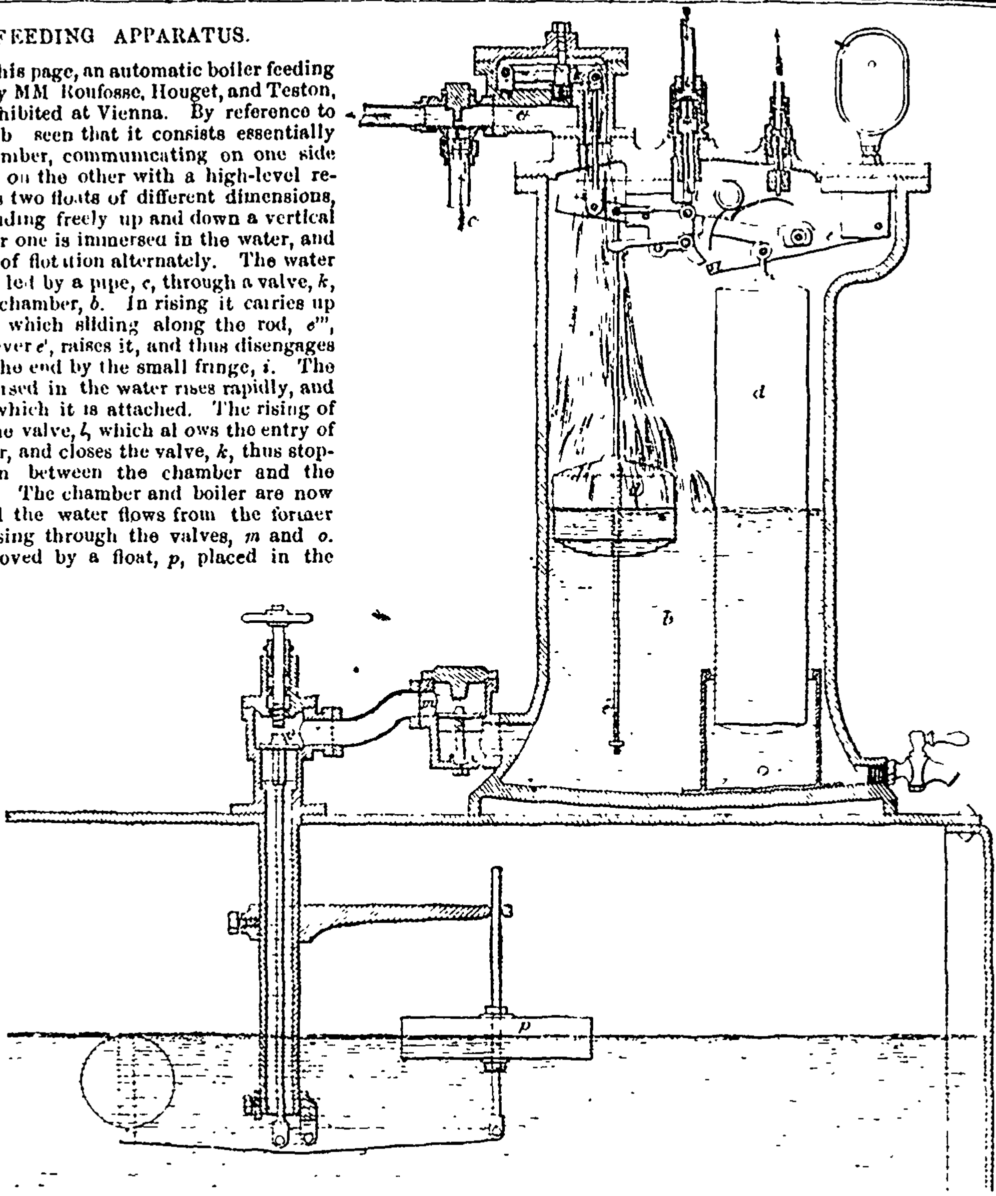
On the Gatling property but little additional work has been done. In the mining department two shafts have been put down, and a few openings made, from one of which a few barrels of ore have been sent to Swansea, the returns from which are stated as very satisfactory. This property has been fully and very favourably reported on by Prof. Chapman, of Toronto. In addition to the handsome and spacious dwelling house and boarding house erected last year, Mr. Gatling has put up what may fairly be termed a magnificent mill building, consisting of a deep and spacious stone basement surmounted by a well-finished superstructure, lined with felt paper. Within are placed two very fine upright engines of about 40 horse power, capable of being worked either together or independently, and a large boiler capable of running them both when necessary. Four batteries of five stamps each, making twenty in all, are also in their places ready to start work, and the hangers are up for the shafting. The flue for the roasting furnace is also more than half finished; but the furnace, pans, sluice boxes, &c., are not put in yet. We understand that the original plan comprehends the introduction of the chlorine process, which is perhaps the best adapted of any for the treatment of the Marmora ores after roasting, as the gold is mostly in such a fine state of division as to be readily reduced by the chlorine gas. Taken altogether, the prospect is healthy and encouraging, and we trust that ere long a monthly gold mining report will be a regular item in our commercial department.

At the Patent Office, Washington, every examiner is now favoured with the help of a lady clerk, who takes charge of the official correspondence and looks after the odds and ends of the examiner's business. There is one exception, however. The examiner of medical inventions is debarred from feminine assistance, and is compelled to keep a clerk of the masculine gender.

BOILER FEEDING APPARATUS.

We illustrate, on this page, an automatic boiler feeding apparatus devised by MM Roufosse, Houget, and Teston, of Verviers, and exhibited at Vienna. By reference to the drawing, it will be seen that it consists essentially of a cylindrical chamber, communicating on one side with the boiler, and on the other with a high-level reservoir. It contains two floats of different dimensions, the smaller one sliding freely up and down a vertical rod, while the larger one is immersed in the water, and kept above its line of flotation alternately. The water from the reservoir is led by a pipe, *c*, through a valve, *k*, and falls into the chamber, *b*. In rising it carries up the small float, *d'* which sliding along the rod, *e'''*, strikes against the lever *e'*, raises it, and thus disengages the lever *e'*, held at the end by the small fringe, *i*. The large float *d*, immersed in the water rises rapidly, and lifts the lever, *e*, to which it is attached. The rising of the lever, *e*, opens the valve, *l*, which allows the entry of steam from the boiler, and closes the valve, *k*, thus stopping communication between the chamber and the high-level reservoir. The chamber and boiler are now in equilibrium, and the water flows from the former into the latter, passing through the valves, *m* and *o*. This valve, *o*, is moved by a float, *p*, placed in the boiler, and which, acccording to the variation of water level, closes or opens the valve, so as to permit only the admission of the proper quantity of water.

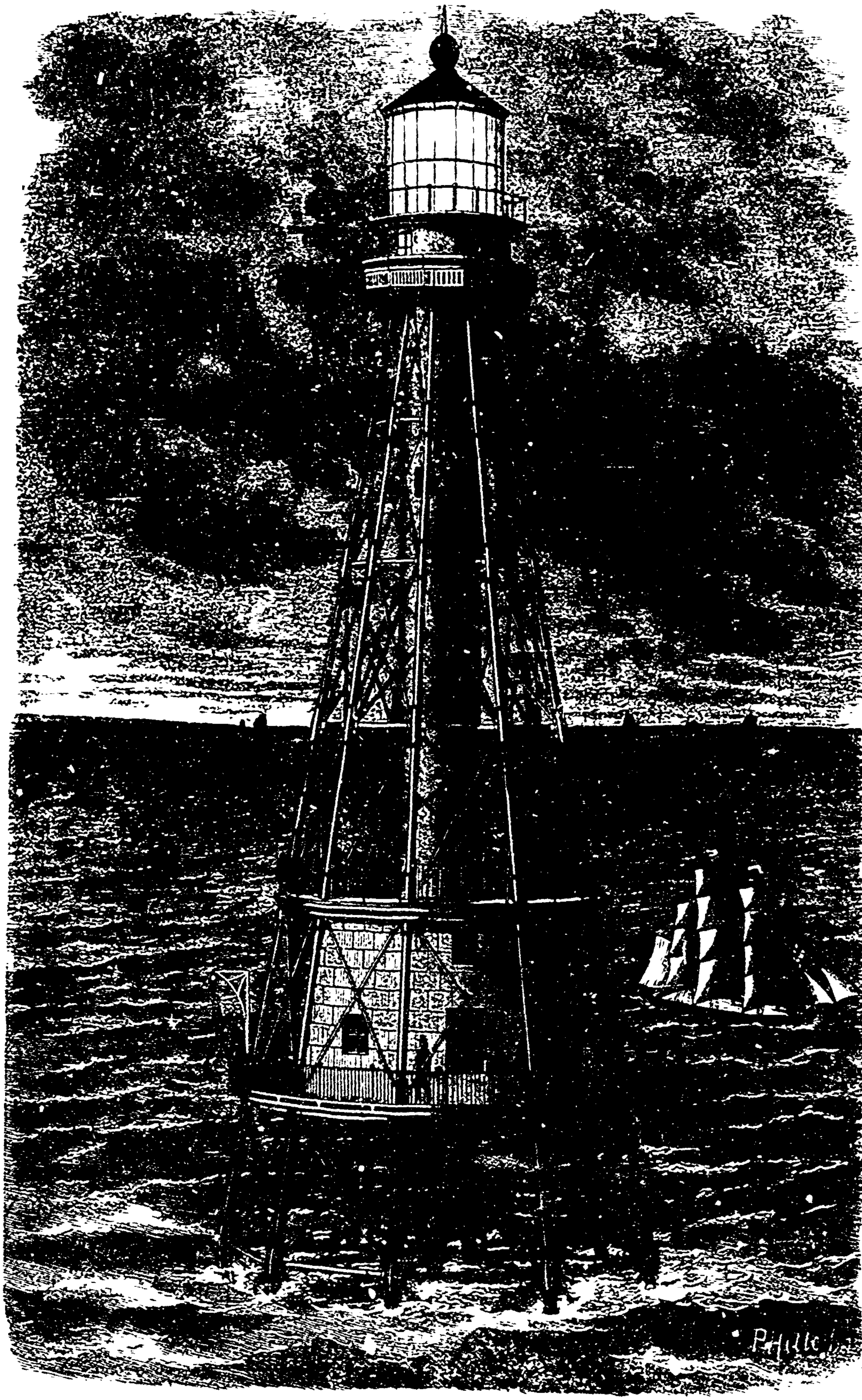
The small float, *d'*, follows the water as it descends, until it strikes on a stud fixed at the extremity of the guide rod, *e'''*. By its weight it detaches the large float, *d*, which in falling again closes the valve *l*, and reopens the valve *k*. The steam in the receiver then escapes in the reservoir, where it becomes condensed and more water flows into the apparatus. The process just described then recommences. In connexion with the apparatus there is also a counter which indicates the number of times the operation has been repeated, and this affords a means of knowing the exact quantity of water fed into the boiler. We believe that this apparatus has been tested largely, and has given good results. It will be seen from the drawing that the working parts are easily accessible.



BOILER FEEDING APPARATUS.

The St. Gothard Railway.—The seventh report of the progress of the St. Gothard Tunnel has just been published by the Federal Council. From this it appears that the length of gallery driven up to 30th of June, was 427·40 metres; length of tunnel completely excavated, 296 20; length of arch, 145 00, length of side-walls (east), 101·90; do. west, 141 60; length of drain built, 99 50 metres. The average number of workmen employed during the month of June was 1,036; the greatest number employed in one day was 1,205. At Goeschenen, 10 metres of the tunnel in curve have been driven, and 13 80 of arch built. Towards the end of the month trial will be made of two new boring machines (Mackeau). At Airolo the tunnelling by machinery was commenced on the 21st of June with the machines of Dubois and François.

New Process for making Steel Dies.—A new process for making steel dies is spoken of, viz., by heating the metal to a white heat in a close chamber to exclude the air, and then pressing it upon the material to be copied. It is claimed that by means of this process the hardest steel may be stamped by any soft metal—even lead—so as to make a perfect die of the objects impressed. A carved ring, for instance, might be used to stamp its own image on the hardest and most finely tempered steel, reproducing all its delicate tracing and outline with absolute precision and perfection without injury to the stone. It is said that the secret of thus being able to bring together friable and easily melted substances, such as lead or precious stones, with semi-fused steel, consists in the process of heating the steel disc, which must be of a certain degree of temperature. Admitting the possibility of such a thing, we might remark that it would enable every counterfeiter to get perfectly accurate dies of all kinds of coins, and may be used for the cheap reproduction in steel of any kinds of engraving in wood, copper, or type metal. The most elegant chasings, heretofore made at great expense, might thus be cheaply stamped, and the small castings of copper, brass, and bronze might be imitated in the hardest steel. Stereotype plates that will defy the wear of years may be made in the same manner.



NEW LIGHT HOUSE FOR TIMBALIER SHOALS, GULF OF MEXICO (See page 164.)

PRIZES FOR ELECTRICAL INVENTIONS.

Among the general subjects for which prizes of gold and silver medals are offered by the Society of Arts, London, are the following:

A galvanic element which shall combine the constancy for the Daniell's cell with the low resistance and high electromotive force of a Grove's cell.

An electric condenser which shall combine high capacity with small bulk and small residual charge.

A sensitive pocket galvanometer. The size should not exceed that of a watch.

To which may be added, as of use in telegraphy:

A varnish or coating which can be applied to iron wires so as to protect them against rust, and which shall not be liable to chip off when the wire is bent or rubbed.

Electric weaving. To the manufacturer who first practically applies electricity to the production commercially of figured fabrics in the loom.

Telegraphs. For an economic and permanent means of telegraphing through uninsulated wires, between places not less than 1,000 miles apart.

All communications and articles intended for competition must be delivered addressed to the Secretary, at the Society's House, free of expense, either on or before the 31st December, 1873 or 1874, except where otherwise stated. In the first case they will be considered during the session 1873-74; in the second case during the session 1874-75. Any communication rewarded by the Society, or any paper read at an ordinary meeting, will be considered as the property of the Society.

QUALITATIVE ANALYSIS FOR AMATEURS.—IV.

By E. J. Hallock, A.M., in the *Boston Journal of Chemistry*, continued from p. 136.

GROUP SECOND. (Continued.)

Tin forms two distinct series of salts, whose reactions are quite dissimilar. Unlike all the other metals except gold and platinum, it is insoluble in nitric acid, but is converted by it into a white oxide. Metallic tin can be recognised in this way, and also separated from other metals with which it may be alloyed. When tin is dissolved in muriatic acid, tin being in excess, stannous chloride ($SnCl_2$) is formed. This substance is used by dyers and known as "tinsalt." With H_2S this salt gives a dark brown or black precipitate, soluble in yellow ammonic sulphide, from which solution it is precipitated yellow by hydrochloric acid; with corrosive sublimate ($HgCl_2$) it gives a white precipitate of Hg_2Cl_2 (calomel) if the former is in the excess, but if the $SnCl_2$ is in excess, a grey precipitate of metallic mercury is formed. With $SnCl_4$ and chloride of gold a beautiful purple colour is produced, known as the purple of Cassius. Stannic chloride, $SnCl_4$, is formed by the direct action of chloride on tin, and was known to the alchemists as "Liquor fumans Libavii." This gives with excess of H_2S a yellow precipitate (white if the $SnCl_4$ is in excess). The precipitate is soluble in ammonic sulphide. It gives no precipitate with $HgCl_2$ or $AuCl_3$. The separation of tin from other metals of this group, in the wet way, being rather tedious, we may be allowed to mention a few of its blow-pipe tests. When fused with carbonate of sodium and cyanide of potassium on charcoal, the compounds of tin give malleable globules of metallic tin. . . in gives a white coating on charcoal with the oxidising flame. If this coating is moistened with nitrate of cobalt and treated with the oxidising flame, a bluish-green colour is produced. Zinc oxide takes a fine yellowish-green colour. These reactions are very characteristic. A simple blow-pipe for this experiment is formed by drawing out a piece of glass tubing two inches long, and passing it through a cork, which fits into the bowl of a clay pipe.

Gold is insoluble in any single acid. Aqua regia converts it into the chloride, which yields a black precipitate with H_2S, soluble in yellow ammonic sulphide. With $SnCl_2$ and $SnCl_4$ dilute gold solutions give a purple precipitate, so that gold and tin are each tests for the presence of the other. (See tests for tin above.) Sulphate of iron precipitates metallic gold as a fine brown powder. As gold is usually met with in a metallic state, its colour and insolubility in any single acid usually suffice to identify it.

Platinum dissolves only in aqua regia. In solutions of the chloride H_2S yields a *black precipitate after some time*, immediately if heated. Sal ammoniac (NH_4Cl) produces a yellow crystalline precipitate, but this is not formed in dilute solutions until the fluid is evaporated to dryness and the *residue treated with a little water or dilute spirits*. The same effect is produced by potassic chloride (KCl).

SEPARATION OF METALS OF GROUP SECOND.
SECOND DIVISION.

Into a solution containing the five metals of this group pass a current of H_2S. When the metals have all been precipitated, filter carefully (sometimes the sulphide of tin passes through the filter, so that the operation needs repeating), and dissolve in yellow ammonic sulphide. If any residue remains filter again. The sulphides are reprecipitated from this solution by hydrochloric acid, washed, and dissolved in the least possible quantity of aqua regia. They are then introduced into a Marsh apparatus, as described last month. A sufficient quantity of zinc is placed in the generating flask to furnish hydrogen enough to carry away all the arsenic and antimony. Dilute sulphuric acid is added until all the zinc is dissolved. During this operation the tin, gold, and platinum are reduced to the metallic state, and are *filtered out of the* zinc sulphate solution in the flask, and tested as follows: the tin is first dissolved out with HCl and tested with corrosive sublimate; the other metals are dissolved in hydrochloric and *nitric* acid and *tested for separately in different* portions of the solution.

EXAMPLES FOR PRACTICE.

Precipitated with H_2S.

Arsenic; yellow.	Antimony; orange.	Tin; yellow or black.	Gold; black.	Platinum; black
		Digest with $(NH_4)_2S$. Solution.		

Arsenic.	Antimony.	Tin.	Gold.	Platinum.
		Excess of HCl. *Precipitate.*		

Arsenic.	Antimony.	Tin.	Gold.	Platinum
		Dissolve in $HCl - HNO_3$ and place in flask with H_2SO_4 and Zn.		
Given off as Gas.				*Residue.*

AsH_3	SbH_3	Tin.	Gold.	Platinum.
Pass into $AgNO_3$			Boil with HCl.	
Solution.	Precipitate.		Solution.	Residue.

$H_3AsO_3 - HNO_3$ and $AgNO_3$ Boil with sodic acetate.	$SbAg_2$ and Ag. Boil with tartaric acid, and add H_2S.	$SnCl_2$ Add $HgCl_2$	Gold. Dissolve in aqua regia, and divide into two portions	Platinum.
Prec. Ag_3AsO_4	Prec. Sb_2S_3	Prec. Hg.	$AuCl_3$ with	$PtCl_4$ with KCl.
yellow.	orange.	grey	$SnCl_2$ } $SnCl_4$ }	Prec. PtK_2Cl
			Purple of Cassius	yellow.

The student has become, by this time, acquainted with the reactions of eleven metals, and is able to recognise them when separate, and to separate them when mixed. He may now vary the exercise, by putting his knowledge to the test. If he has a friend who will give him a solution of $HgCl_2$, or $SnCl_2$ or $CuSO_4$, *without telling him which it is, he will soon* learn to rely on himself, and will enjoy the pleasure of finding out what was, to him, the unknown.

Analysis of Type-metal.—The composition used by various type-founders varies enough to furnish an interesting example for practice. The type is cleaned and dissolved in nitric acid. If a white residue remain, it is probably tin. To the solution, after filtering, add just enough hydrochloric acid to precipitate the lead. Filter cold, and test the filtrate with a drop of HCl for lead. To the filtrate add H_2S as long as a precipitate is formed. Filter and wash thoroughly then digest with ammonic sulphide. Filter again, and label the filtrate, "Group II., 2d. Div." The insoluble residue probably contains traces of lead, and perhaps bismuth; it is dissolved in nitric acid, and the lead precipitated with sulphuric acid. After filtering, the bismuth is precipitated by ammonia (see p. 165). Antimony will probably be found in the portion dissolved by $(NH_4)_2S$, and is recognised by the bright orange colour on reprecipitating it with HCl. Its presence is confirmed by the Marsh test.

The analysis of bronze is made in a similar manner, tin remaining as an oxide insoluble in nitric acid. The solution has a blue colour, which is intensified by the addition of ammonia, or gives a brown precipitate with H_2S.

THIRD GROUP.

This group embraces the metals precipitated from neutral or alkaline solutions by ammonic sulphide. Cobalt, nickel, iron, manganese, and zinc are precipitated as sulphides; aluminum, chromium, and uranium as oxides.

If the end of a piece of platinum wire be bent into an eye, then dipped in borax, and heated in a lamp or blow-pipe flame, the borax will fuse to a colourless bead. On moistening this bead with any solution of cobalt and heating again, it becomes a beautiful blue. This is very characteristic and delicate test for cobalt. Cobalt solutions give with ammonic sulphide a black precipitate, insoluble in dilute hydrochloric acid, but easily soluble in aqua regia. Potassic nitrite (KNO_2), followed by acetic acid, produces a yellow crystalline precipitate. Potassic cyanide precipitates the cyanide of cobalt, which dissolves in excess of the precipitant. If this solution is boiled with more potassic cyanide for half an hour, a drop of hydrochloric acid being added, the cobalticyanide of potassium is formed (K_3CyCo). This solution is not precipitated by acids, nor by boiling with sodic hypochlorite or Labarraque's solution.

Nickel so closely resembles cobalt as to be separated with difficulty from it. Ammonic sulphide produces a black precipitate, insoluble in dilute hydrochloric acid, soluble in aqua regia. Potassic nitrite with acetic acid gives no precipitate. Potassic cyanide precipitates the cyanide of nickel, which is soluble in excess of precipitant. If hydrochloric acid is added to this solution, the cyanide is precipitated. It is not altered by boiling with HCy. When boiled with sodic hypochlorite, it gives a black precipitate. This enables us to separate cobalt and nickel. Great care must be taken, when performing these tests, to avoid inhaling any of the prussic acid so abundantly liberated. On this account, potassic nitrite is to be preferred, if it can be obtained, for detecting nickel in the presence of cobalt.

SAYS the *Journal of the Franklin Institute*:—A project no less gigantic than the piercing of the Rocky Mountains is announced as about to be commenced. The projected tunnel will, if completed, be carried through the Rocky Mountains from a point near Black Hawk, and will come out in the Middle Park. It is said that the project is fully inaugurated, and that its projector is on the ground with ample means and labour at disposal to prosecute the work to completion. The tunnel will be about twelve miles long. Its greatest depth will be 6000ft., at James Park. It will make the Middle Park readily accessible from the eastern part of the territory, will indicate the mineral and geological character of the region, and will not fail to attract attention to the place, as the scene of an engineering enterprise nearly twice as difficult of accomplishment as the famous Mont Cenis Tunnel. It is stated that early next year work will be commenced from Middle Park. Already considerable work has been done. The mountain has been graded down for the face of the tunnel; a flume, 1300ft. long, has been built from the creek, by which a fall of 25ft. is obtained for the purpose of driving an overshot wheel, by means of which the tunnel is to be supplied with air; a strong levee has been built, to prevent the waters in the creek from overflowing and embarrassing the operations in the tunnel. The main advantages to be derived from its construction are stated to be that it will be open up new lodes, and afford a thorough knowledge of the course of mineral veins; that it will afford a means of working the discovered mines cheaply and rapidly and that it will develop the resources of the region by the increased facilities for transportation which its construction will afford.

PRESERVING GRASSES, FERNS AND FLOWERS.

The following details in the art of preserving flowers, &c., are given by a lady correspondent of the *Farmer*:—Grasses should be gathered early in July, if we desire them to retain their bright hues without the aid of art. Gathered then, tied up in large bunches, and hung away in a dark closet, they come forth at our bidding, fresh and green as when plucked. Now, by brook-side or in shady places, we can find graceful grasses, which will prove additions to our winter bouquets, but they will loose their colouring, and require a dip into "Judson's Green Dye." Dry them again, and they will last for years. Wild oats, feather-grass, and all their various species are very ornamental in winter, and mingled with the everlasting flowers—Acroclinium, Xeranthemum, and the white, yellow, and crimson Helichrysums—they vie with their more perishable sisters, whose glories are on the wane. We have just arranged two small vases for the coming winter. The brilliant pink and white Acrocliniums add much to their beauty. The white Helichrysums can be dyed a brilliant purple or scarlet with "Judson's Dyes," and exquisite bouquets can easily be manufactured. These "everlasting" flowers should be gathered as soon as the outer leaves open. Tie them up in bundles as you pick them, and hang up, flowers downwards, to dry. Treated in this way, the stems are straight and more easily used. They can be hung to dry in one's chamber, not requiring a darkened place. Most of these flowers are allowed to remain too long upon the bushes, and their beauty is spoiled. As they become dusty under the frequent sweepings of carpets, we dip them in cold water; their petals close entirely. We dip the grasses also. The running fern is a lovely decoration for walls and pictures. Its flowers add much to its grace and beauty, but it fades quickly, and by Christmas but a faint green remains. Dip them in "Judson's Dye" (following the directions given on the bottle for dyeing ribbons), and you will keep their lovely colour. After they have been thoroughly pressed in heavy books, then dye them, spread on paper to dry in the shade and then press again. Thus treated, they will last for years. Maidenhair, the most graceful of our ferns, soon loses its colour; but dyed, it is an addition to every collection of grasses or ferns.

Parsley fern is very beautiful; its soft, feathery leaves are always sought after. These, if gathered late in the autumn, will retain their colour much better. The male fern, with its stiff stems, if well pressed, looks beautiful. We mingle it with the many-coloured leaves of autumn, or we pin it to the wall-paper, around pictures, or over lace or muslin curtains, and its effects are charming.

The branches of the Sumach, gathered soon after the frost has appeared, or even before, press perfectly, and keep their colours finely. If varnished with map-varnish they never fade. Branches of this tree, interspersed with the ferns, are very ornamental. We have made exceedingly pretty crosses from its leaves, sewing each one separately over the other on a pasteboard cross. Anchors and stars can also be made of its lance-shaped leaves. Thus suspended over engravings or curtains, they are very ornamental, and are easily dusted—an essential in the eyes of a good housewife.

Bunches of dyed mosses are to be purchased of all seedsmen in the cities; we dwellers in villages cannot avail ourselves of them if we would; but we can make them even prettier than those exposed for sale. Gather the mosses, pick out all the *débris*, cleanse from dirt, and dry in the sun; then dip into "Judson's Dye," spread on papers to dry by fire or sunlight. We gathered last year a very finely-fibred moss, dyed it a lovely green, and saved some of the original colour to mingle its brown hues with it. Then we took the "hoops" from an old skirt, tied them together, and on the circlet tied wreaths, which city friends said "surpassed those displayed at the shops."

ALLUDING to the railways of the Maritime Provinces, the St. John, N. B., *News* says 702 miles are in operation. 838 miles are building, and 470 miles are chartered and mainly provided for. Total, 2,010 miles. The Eastern & Maine Central line forms the exclusive outlet of the system to the west. As soon as the St. John bridge is built and the gauge of the European road reduced, a very great increase of traffic will be realized.

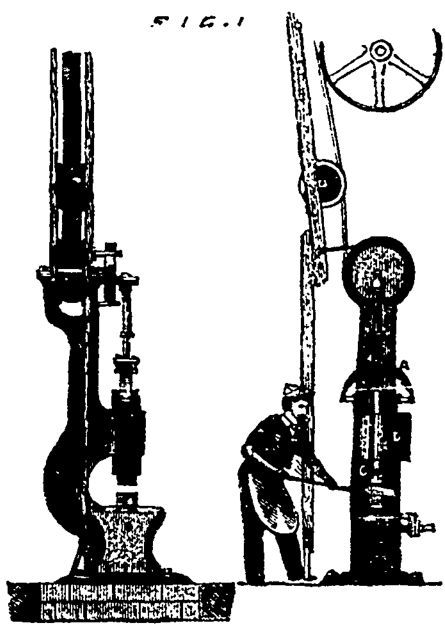
FACTS AND FIGURES CONNECTED WITH BELTING.

By Mr. J. H. Cooper, in the *Journal of the Franklin Institute.*

IMPARTING AND ARRESTING MOTION.

The dead stroke power hammer of Mr. T. Shaw, (Fig. 1) illustrates the application of the belt for giving to and taking motion from a shaft at the pleasure of the operator. The same devices can, however, by an easy transition, be applied to other machines. In this the driving pulley, carrying a loose belt, is on a line shaft over the driven flanged pulley, which latter is on a shaft at the top of the hammer frame. This shaft carries a crank wheel actuating the hammer, as shown, and is partly invested by a leather band for arresting its motion. One end of this band is secured to a pin in the hammer frame under the crank wheel; the other end is fastened to the swinging lever to which also the tightener pulley of the driving belt is applied The action of these belts is produced by opposite motions of the lever; thus, when the operator pushes it, the arresting band releases the crank wheel, and the tightener pulley presses upon the driving belt, which, being constantly in motion, applies its adhesion to the pulley on the crank shaft and propels the hammer, and it does this with a varying velocity,

FIG. 1



according to the pressure upon the tightener. Withdrawing the lever relaxes the driving belt and tightens the arresting band. These motions are under the easy control of the operator, and such is the nature and action of the belt, in this application, that these motions can be repeated rapidly and effectively without destructive wear to any part of the machine.

TRANSMITTING MOTION.

To transmit motion from one shaft to another at right angles thereto, by a belt, when the shafts are not in the same plane.—Let E (Fig. 2) be the driving shaft with tight pulley A, and loose pulley B, and F the driven shaft with tight pulley D, and loose pulley C; all the pulleys of the same size and with rounded face in the usual way.

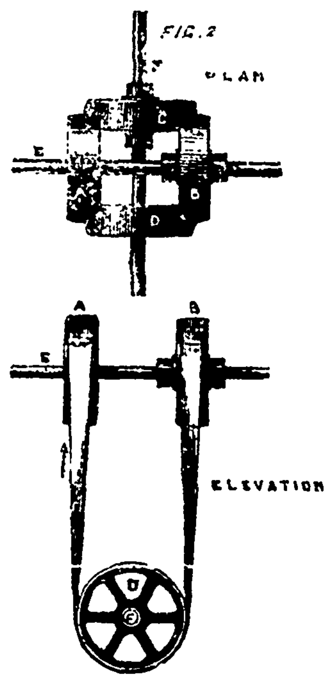
Let the pulleys be arranged in a square on the plan, whose side is the diameter of pulleys at centre of face, and let an endless belt be put on as shown and run in the direction of the arrow. It will be noticed the loose pulleys C and B run in opposite directions from that of the shafts on which they turn, but since they carry the slack fold of the belt, they are relieved of heavy strain on the shafts. This is a good plan for wide belts when the shafts are a proper distance apart, say ten times the breadth of the belt, and solves that sometimes difficult problem of carrying considerable power around a corner by a belt. There is no loss of contact of the belt on any of the pulleys of this system, and no lateral straining and tearing of the fibres of the belt as in the usual quarter twist arrangement in which only two pulleys are used. The lower shaft may drive the upper one, as well, by changing the direction of motion, or changing the relative positions of the tight and loose pulleys.

WEAVER'S BELTING.

The object of this arrangement (Fig. 3) is to obtain high speed in a shaft directly from a driving pulley without the aid of intermediate counter pulleys or gears, and with reduced lateral stress on the bearings of the driven shaft.

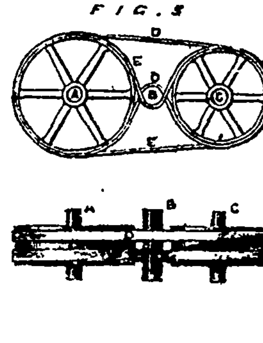
A, B, and C show three shafts parallel to one another. A and C carry straight-faced pulleys, upon which run two belts

FIG. 2



of equal length and width, separated to prevent contact with each other while running. The lower fold of belt D is carried over shaft B, and the upper fold of belt E is carried under B, and each, in running, imparts motion to the driven shaft in the same direction, and at the same time balancing the lateral pressure on its journals. A is the driven shaft with large pulley; B the driven shaft of comparatively small diameter, and C, a counter shaft, with its pulley of any convenient diameter, is placed in position to carry and return the belts, and may be moved and secured to and from B by screw adjustment or otherwise, to secure proper tension of belts.

FIG. 3



COMBINED FAST AND LOOSE PULLEY FOR ROUND BELTS.

In the combined fast and loose pulley for round belts, by John Shinn, of Philadelphia, the round belt, *f* (Figs. 4 and 5), fits in a groove formed between two half-pulleys, of which A'

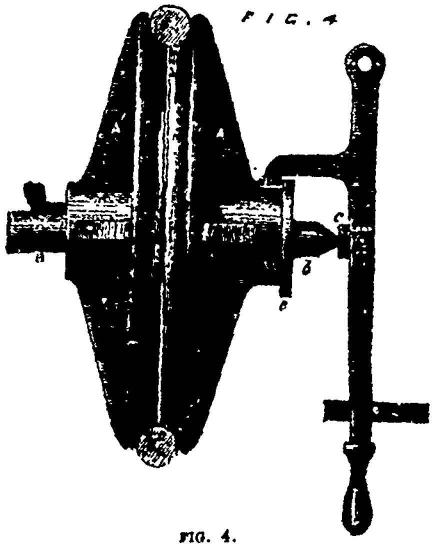
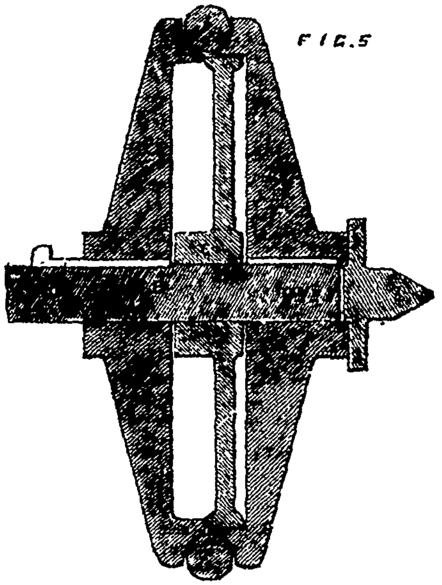


FIG. 4.

is fixed and A slides upon a fixed key on the shaft B ; between A' and A, and running loosely on the shaft, is a flat-faced pulley C ; when A is separated from A' a short distance, the belt *f* will cease to turn them, and will run on and turn C instead. The belt drives the shaft B only when pinched between the half grooves of A' and A. The lever D when moved in the direction indicated by the arrow, withdraws the half-sheave A, and permits the belt to run on the loose pulley. Simple and efficient means for holding the parts together and drawing one half from the other, are shown in the cuts.

It is not proposed, of course, to drive very large and heavy machinery with round belts, such as are required for this description of shifting pulleys ; but, as far as a round belt will go with advantage, these pulleys will be found of the greatest service. Thus, the round belt cuts off less light, occupies less room, makes smaller holes in the floors, requires lighter driving

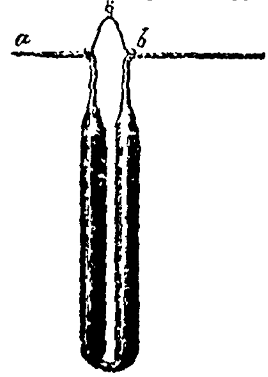


pulleys to carry it, and thus saves power.; while, as regards the driving power of round belts, we have seen one, of an inch diameter doing for years work which proved too much for a 7-inch flat belt.

A SPECIFIC GRAVITY INDICATOR.

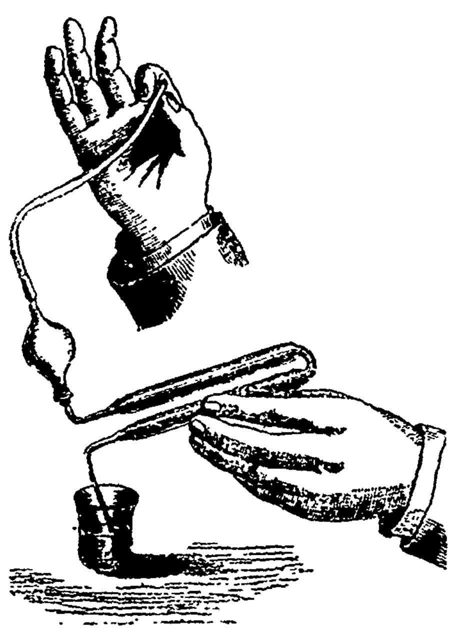
The following description of a simple apparatus for ascertaining specific gravities was recently read before the Chemical Society by Dr. H. Sprengel :—

"I have, for a number of years, availed myself of pipette shaped vessels in preference to the usual specific gravity bottle, the following being a short description of my method : —The form of my instrument, Fig. 1, is that of an elongated U tube, the open ends of which terminate in two capillary tubes, which are bent at right angles in opposite directions.



The size and weight of this instrument should be adapted to the size and capability of the balance in which it is to be weighed. The instrument which served for my determinations had a length of 7 inches, and was made of a glass tube, the outer diameter of which was 7-16th of an inch. It hardly need be mentioned that the U shape is adopted for the sake of presenting a large surface, and so rendering the instrument sensitive to changes of temperature. The point, however, which I wish to notice more particularly (for reasons explained below) is the different calibres of the two capillary tubes. The shorter one is a good deal narrower (at least towards the end) than the longer one, the inner diameter of which is about ·02 of an inch. The horizontal part of this wide tube is marked near the bend with a delicate line, *b*. This line and the extremity of the opposite capillary tube, *a*, are the marks which limit the volume of the liquid to be weighed.

"The filling of the instrument is easily effected by suction, provided that the little bulb apparatus (Fig. 2) has previously been attached to the narrow capillary tube by means of a per-



forated stopper, that is, a bit of india rubber tube, tightly fitting the conical tubulus of bulb. On dipping the wider and longer capillary tube into a liquid, suction applied to the open end of the india rubber tube will produce a partial vacuum in the apparatus, causing the liquid to enter the U tube. As this partial vacuum maintains itself for some time (on account of the bulb, which acts as an air chamber), it is not necessary to continue the suction, if the end of the india rubber tube be timely closed by compression between the fingers. When the bulb and U tube have about equal capacity, it is hardly necessary, during the filling, to repeat the exhaustion more than once. Without such a bulb, the filling of the U tube through these fine capillary tubes is found somewhat tiresome. The emptying of the U tube is effected by reversing the action and so compressing the air.

"After the U tube has been filled, it is detached from the bulb, placed in water of the standard temperature almost up to the bends in the capillary tubes, left there until it has assumed this temperature, and after a careful adjustment of the volume, it is taken out, dried, and weighed. Particular care must be taken to insure the correctness of the standard temperature, for a mistake of 0 1° causes an error in the fifth decimal, making 100,000 parts 100,001 4 parts. A peculiar feature of my instrument is the ease and precision with which the measurement of the liquid can be adjusted at the moment it has taken the standard temperature, for it will be found that the liquid expands and contracts only in the wider capillary tube, namely, in the direction of the least resistance. The narrow capillary tube remains always completely filled. Supposing the liquid reaches beyond the mark *b*, it may be reduced through capillary force by touching the point *a* with a little roll of filter paper. Supposing, however, that in so doing too much liquid is abstracted, capillary force will redress the fault, if point *a* be touched with a drop of the liquid under examination, for this gentle force acts instantly through the whole mass of the liquid, causing it to move forward again to or beyond the mark.

As the instrument itself possesses the properties of a delicate thermometer, the time when it has reached the standard temparature of the bath may be learned from the stability of the thread of liquid inside the wider capillary tube. The length of this thread remains constant after the lapse of about five minutes. In wiping the instrument (after its removal from the bath), care should be taken not to touch point, *a*, as capillarity might extract some of the liquid; otherwise the handling of the instrument requires no especial precaution. The nicety attainable by this method is very satisfactory."

SMOKING AND THINKING.

Dr. Richardson has so clearly explained the influence of smoking upon the blood, that it will be best to quote his graphic account. His scientific eminence entitles his evidence to respect, and lovers of the weed must recollect that it is a smoker to whom they are listening :—"On the blood the prolonged inhalation of tobacco produces changes which are very marked in character. The fluid is thinner than is natural, and in extreme cases paler. In such instances the deficient color of the blood is communicated to the body altogether, rendering the external surface yellowish, white, and puffy. The blood being thin, also exudes freely, and a cut surface bleeds for a long time, and may continue to bleed inconveniently, even in opposition to remedies. But the most important change is exerted on those little bodies which float in myriads in the blood, and are known as the red globules. These globules have naturally a double concave surface, and at their edges a perfectly smooth outline. They are very soluble in alkalies, and are subject to change of shape and character, when the quality of the fluid in which they float is modified in respect to density. The absorption, therefore, of the fumes of tobacco necessarily leads to rapid changes in them, they lose their round shape, they become oval and irregular at their edges, and instead of having a mutual attraction for each other, and running together, a good sign of their physical health, they lie loosely scattered before the eye and indicate to the learned observer, as clearly as though they spoke to him, and said the words, that the man from whom they were taken is physically depressed and deplorably deficient both in muscular and mental power."

Tobacco modifies the circulation in the brain, as in other portions of the body. Hence, it would be remarkable indeed if it did not exercise some influence upon the mechanism of thought. "A sincere, self-observing smoker cannot fail," says M. Meunier, "to recognise that tobacco creates a new nature, more disposed to dreaming than action." Although a great smoker himself, he considered the habit was inimical to the national mind. His frequent diatribes against this *mort aux peuples* excited much raillery ; but the habit of twenty years was long too strong for him. So close was the connection between work and smoke with M. Meunier, that the amount of intellectual labor he had performed was chronicled by the extent of his consumption of tobacco. When, at last, after many fruitless attempts, he put his conduct in harmony with his opinions, it required several weeks of undivided attention to break the chains of habit which bound him. The mode by which nicotine acts upon the blood-vessels explains the apparent contradiction that it should be able to excite into momentary activity an organ which it has enfeebled and stupified. The excitement and over-activity, which it causes in the contractile apparatus of the walls of the blood-vessels, are quickly followed by a general fatigue which is only a modified paralysis. Thinking, as we have seen, is closely related with the cerebral circulation. When, by continual usage, the muscular tissue of the blood-vessels has become gradually benumbed, the blood, in place of its natural rapid flow circulates slowly, and sluggishly, and the functional energy of the brain is diminished. But with a new exhibition of the stimulant, the muscular contractility is again stimulated, the circulation becomes quicker, the brain, abundantly and regularly bathed by the life-blood, takes up again its functions, the brain-power increases, ideas flow with greater rapidity ; but the activity thus produced cannot last. With this stimulation disappear the brilliant results which it had produced, and the organ falls into a relaxed condition, from which only increased doses can temporarily rescue it.

One of the results upon the brain is the loss of memory. Many authors have noticed this fact.

The case of l'Abbé Moigno, the celebrated editor of *Les Mondes*, is curious. He had often been in the habit of taking snuff, which had always led to prejudicial results. After various temporary renunciations, he had returned to its use. In 1861, whilst engaged in some mathematical labors, he took from twenty to twenty-five grammes daily, and found himself continually having recourse to the snuff-box. The effect was a rapid extinction of the faculty of memory. He had learned several languages by their root words, of which he knew from 1,200 to 1,500 of each tongue, but he found that his power of recalling these words was gradually diminishing, and recourse to the dictionary became each day more necessary. Struck with this fact, he resolved to abandon the *tabatière* and cigar. Writing after six years' experience as a non-smoker, he says—"It has been for us the commencement of a veritable resurrection of health, mind, and memory ; our ideas have become more lucid, our imagination more vivid, our work easier, our pen quicker, and we have seen gradually return that army of words which had run away. Our memory, in a word, has recovered all its riches, all its sensibility. . . . . That tobacco, especially in the form of snuff, is a personal enemy of memory, which it has destroyed little by little, and sometimes very promptly, cannot be doubted. Many persons with whom we are acquainted—M. Dubrunfaut, the celebrated chemist, for example—have run the same dangers, and escaped them in the same fashion, by renouncing tobacco, which we do not hesitate to say harms the greatest part of those who employ it, since for one smoker or snuffer who uses it there are ninety-nine who abuse it."

Memory depends upon the vigor and health of the nervous system ; it is likely to be impaired by whatever causes unhealthy excitement and nervous waste. Hence, if the smoker's memory fail, it may be considered as one symptom of general injury of the nervous centers, from which arise other ills. The perceptive faculties become coarser, and this leads to hallucinations. Blatin quotes from Ehrhart some curious cases of this nature. M. X., forty-six years old, nervo-sanguine temperament, and in apparent good-health, had often experienced embarrassment in speech and motion after indulgence in tobacco. One fine day in the country, when the air was calm, and the sun was shining brightly, he was astonished to see a heavy rain-shower which appeared to be driven towards him by a violent wind He extended his hand. No drops were falling, his clothes were quite dry, but at the same moment he was struck with violent palpitation. He threw away his cigar, the violent beatings of his heart ceased, and the vision disappeared. Many times this phenomenon recurred. He abandoned tobacco, and the accidents quickly disappeared. Thinking himself perfectly cured, he commenced again to smoke, but the palpitations and visions reappeared. Complete abstinence was his only safety.

The step from temporary hallucination to chronic lunacy is not very great, and we find on record the case of a man who became insane, and whose recovery was due to a lucky accident, which barred him from access to his usual indulgence Druhen narrates another note-worthy case. A middle-aged man, in good health and of steady habits, was sent by his employer to Paris, charged with papers of considerable value. The importance of the trust preyed very much upon his imagination, and led to an attack of melancholy mania. He was under medical treatment about three weeks, during which time his usual desire for tobacco disappeared. On his recovery he again commenced smoking moderately. A few months after another attack commenced, and he began to talk once more of the (imaginary) risks and dangers he had encountered in his journey to Paris. Druhen saw that he was upon the brink of insanity, and his first prescription was "No tobacco!" Under this *régime* the man has since enjoyed the best health.*

These facts, although curious, are not entirely decisive, for, in judging by individual cases, there is always a risk of mistaking the exception for the rule. There are, however, data of a more absolutely convincing nature which we commend to the careful consideration of young smokers and their parents.

In 1855, M. Bertillon divided the 160 pupils of the Paris Ecole Polytechnique into smokers and non-smokers, with a view of testing this question. The results in the examinations of the twenty who stood highest, and those next to them, have been thus stated:

Smokers.	Non-smokers.
6	14
10	10
11	9
14	6
13	7
15	5
16	4
17	3
102	58

An examination of this table will show that whilst the non-smoking pupils exhibit a steady upward tendency, the contrary is the case with the smokers. Although the majority in numbers, they were the minority in intellectual attainments The contrast is most instructive, and demonstrates conclusively the deadening influence of this popular narcotic upon the functional activity of the brain. If tobacco were, as its apologists sometimes claim, the handmaid of thought, a very different result must have ensued. Dr. Murray, of Newcastle, who is not an opponent, but a defender of smoking, says: "My own personal experience and observation among medical students, is supported by the results of examinations for law and divinity, smokers having been found behind non-smokers in mental calibre. So long ago as 1606, a medical writer sa[ys] tobacco is not safe for the young, and should be called youths bane." Sir Benjamin Brodie, from the result of experiments upon animals, affirms that the oil of tobacco acts by destroying the function of the brain. This, of course, refers to its administration as a poison; but who can think with coolness upon our youth, voluntarily sapping the vigor of their brains —the only organ in which we excel (?) the brute creation— and thus wearing out their nervous systems ere they have fairly entered upon the important duties of life?

It will be seen that medical science and statistics confirm, by *a posteriori* evidence, that which physiology would lead us to expect on *a priori* grounds. It would be folly to suppose that the brain, with all its minutely wonderful mechanism, should not be injured by continual contact with blood weakened and deteriorated—poisoned—by contact with deadly principles evolved in smoking tobacco.

Smoking is now so common amongst persons of unformed constitutions, that the facts here detailed acquire a grave importance. If juvenile smoking continues and extends, we may look for generations endowed with weaker brains and duller intellects in a continued series of degradation Let those who would not have our brave, bright, English lads degenerate into a race of dyspeptic dullards, warn them, as they wish for the full exercise of that power to think, which is their greatest privilege and glory, as they hope for clear heads and unclouded brains, to resist the dreamy seductions of tobacco.—*The Builder.*

* Druhen, du Tabac," 1867, p. 56

THE CENTRAL RAIL RAILWAY.

We have no sooner concluded that human invention has attained its limit in this, or that, special direction, than all at once we are startled by some announcement which shows that what we supposed to be its ultimate form was only a stage in development. Who would have thought till a few months since, notwithstanding the "pannier" railway proposed last year, that trains would ever run upon other than two rails? And now such a project is before the world, which, its promoters assert, will probably revolutionize the present system. In this project, the inventor utilises the principle by which the bicycle rider travels balanced and steady above two narrow wheels. In the proposed single line of rail system the carriages and engine will have a single row of central and double-flanged wheels striding or saddling the single central rail.

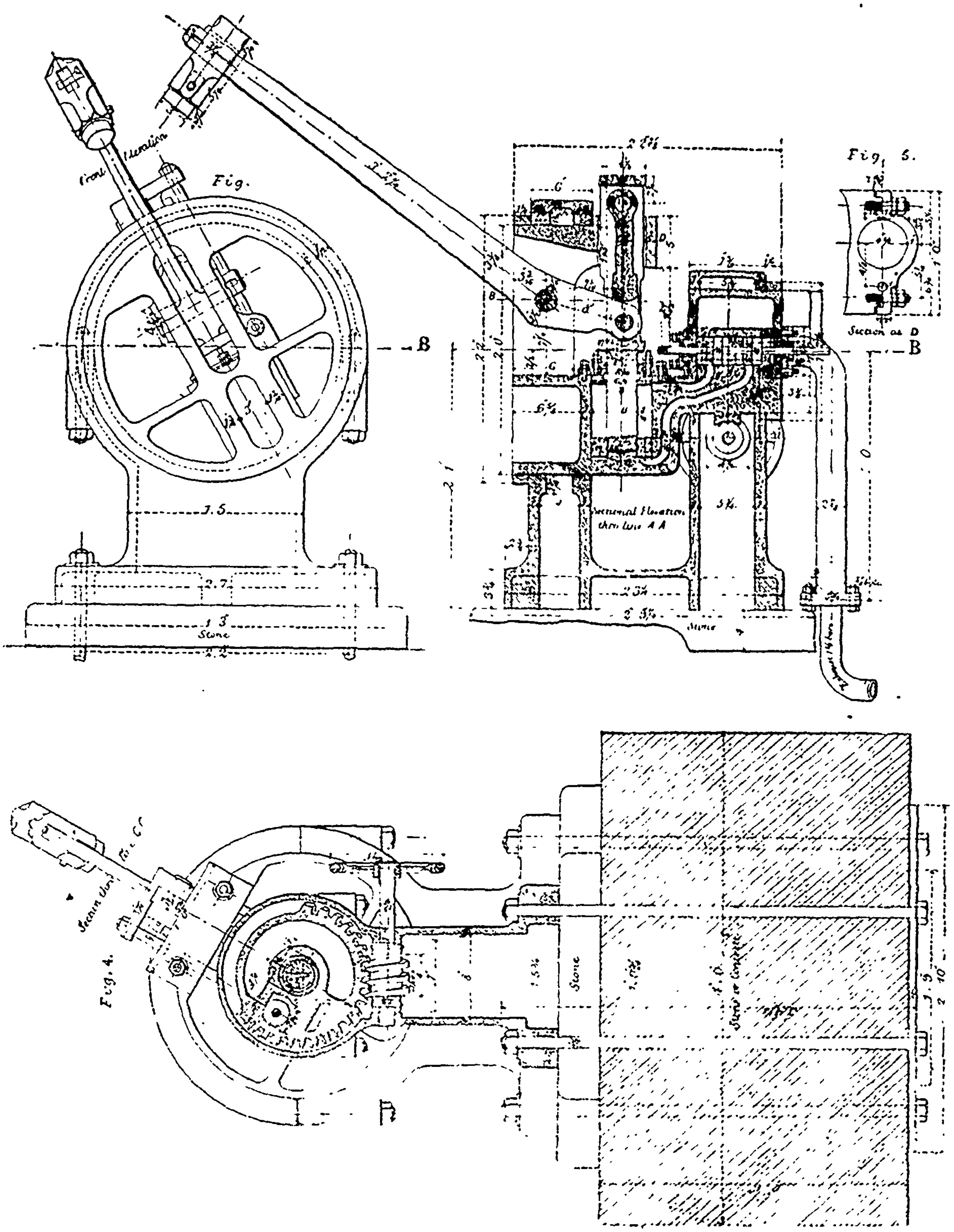
The recollection of mishaps and upsets to bicycle riders in starting will probably excite the reader's smile as soon as the project is proposed to him. But the inventor does not intend that his engines and carriages shall struggle into steadiness like the bicycle rider: he provides balance-rails and wheels. The balance-rails are provided for some distance in and out of stations. The carriages and engines will be brought very much nearer the ground, and many other sources of danger in our present railway system will be mitigated,—at least so says the inventor, who proposes lighter trains and engines, and that trains shall run more frequently. Existing lines would be able to accommodate three or four "ways" of the new style within the compass of the usual "up" and "down" lines.

The inventor suggests several forms in which, under different circumstances, the system may be worked.

DAVIS' "STEAM STRIKER"

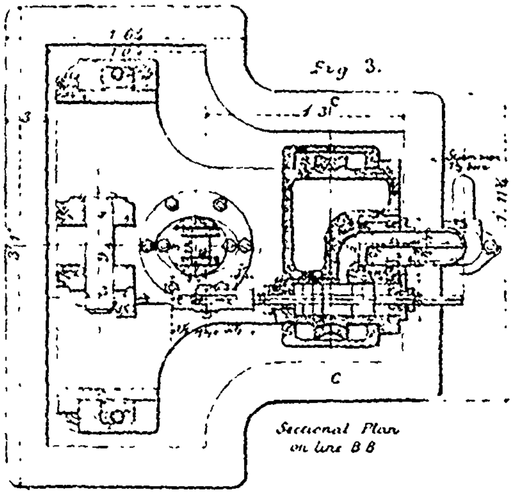
The machinery represented in the engravings on pages 186, and 187, which is exhibited at Vienna by the patentee, Mr D Davies, of Viaducts Works, Crumlin, Newport, Monmouthshire, is unique of its kind, and has deservedly attracted a good deal of attention in the Exhibition. It is intended for all kinds of small forging work about a smithy, for which the steam hammer is scarcely suitable, but an examination of our engravings will show better than any lengthened statement of ours the kind of work for which it is most adapted The machine may be described shortly as a tilt hammer worked direct by a steam cylinder (the blows being controlled by a foot lever), and capable of being turned round by a simple apparatus so as to deliver the blows at any angle to the anvil.

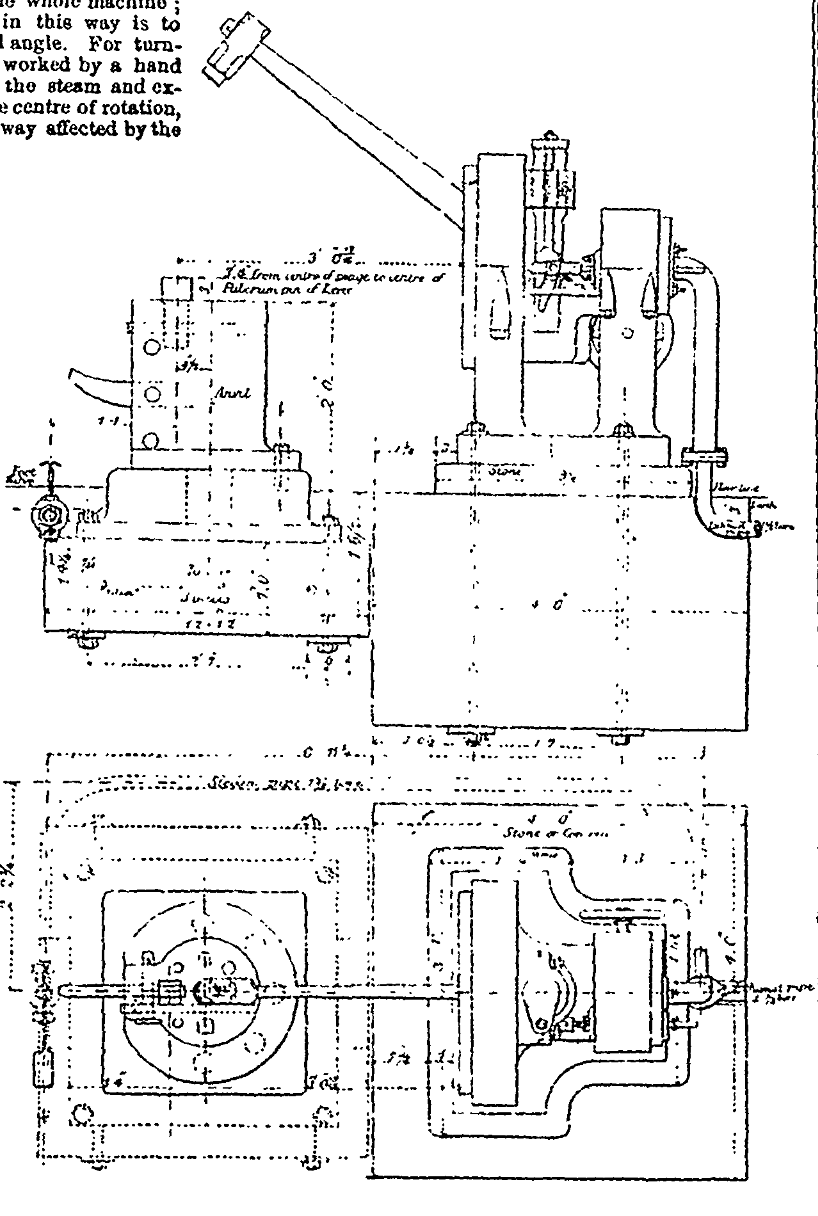
In our engravings Fig 1, is a front elevation of the machine; Fig. 2, is a vertical section through the line A, A, in Fig. 3; Fig. 3, is a sectional plan on the line B, B, in Fig. 2, Fig. 4, is a vertical section through the valve-chest and turning gear and Fig. 5. is a section at D, in Fig. 2. The rest of the figures show a side elevation and outside plan of the machine The arrangement of the striking gear is as follows: The hammer shaft itself, which works on a fixed pin, 2½ inches in diameter, is connected at its hinder end with a pin in the lower end of a short connecting rod. This rod is free to vibrate in a large slot made in what may be called the piston



rod head, and is compelled by a pin at its upper end always *to follow the movements of the pist n rod,* which moves up and down in t' e guide shown in plan in Fig. 5. The steam cylinder itself (the part of the rod in which 3 inches diameter) in 6 in. diameter, and has a maximum stroke of 5 inches, corresponding to a movement of the hammer head five times as great. A lug at the top of the piston-rod head carries a spindle (seen in Figs. 1 and 4), and compels it always to follow the motions of the piston. Lower down this spindle becomes a frame, in which is a curved slot, and this slotted frame works up and down as the piston rod moves across the spindle of the little double-piston steam distribution valve seen in longitudinal section in Figs. 2 and 3. From Fig. 3, it will be seen that the valve spindle has attached to it a slottled head, through which the above-mentioned frame can work. Through this slotted head a pin is fastened, passing through the slot in the moving frame, and the curved sides of this slot, pressing upon the pin in one or the other direction, give the required motion to the valve. The construction of the valve, and the arrangement of the parts, are clearly shown on the drawing, from which also it will be seen that one pipe, divided into two by a partition, and placed like a trunnion in the centre of rotation, serves for both steam and exhaust. The steam is always pressing on the two internal surfaces of the pistons, so that the valve is in equilibrium, and is admitted to the two ends of the cylinder alternately, the hammer being double-acting, while the exhaust passes out past the outside sides of the pistons, and through the other half of the trunnion pipe.

The machine consists of two principal castings, of which one, which carries the hammer, and contains the cylinder and the whole of the working parts, rests in two bearings in the other, which is the frame. These bearings are respectively 2 feet and 1 feet diameter, a size which is necessary as well to admit the proper play of the hammer, and room for the valve, as to secure steadiness to the whole machine; and the object of arranging the machine in this way is to allow the hammer to strike at any desired angle. For turning the hammer round, worm gear Fig. 3, worked by a hand wheel, is provided, and in consequence of the steam and exhaust pipes being both admitted through the centre of rotation, the distribution of the steam is not in any way affected by the position of the valve, which must of course turn round along with the rest of the casting above referred to. The hammer is set in motion or stopped by a foot lever Fig. 3, which works a stop-valve (shown in dotted lines) placed below ground in a convenient position for the man working at the anvil. The striker can be worked with a pressure of 35 lb. steam, but 60 lb. or 70 lb. is more advantageous; it can also be arranged to work either with water or compressed air in situations where these agents are preferable to steam. It can deliver from 300 to 400 blows per minute.





Mr. Richardson, of the Canadian Geological Survey, says that the Taxada iron ore turns out to be of the richest quality, and the quantity is unlimited. He is making further researches for ore. He also came upon a marble vein. It is approached through a grotto, the entrance to which is 2,000 feet long, and 100 feet wide; the ceiling is covered throughout with stalactites. Mr. Richardson was at Nanaimo when the steamer left.

Mr. J. H. Devereux, General Manager of the *Atlantic and Great Western* Railroad, has given the following instruction to *employés* of the road: "Treat people as if you appreciated and were willing to acknowlged their custom. Try to accommodate and please. In short, act as any good business man would toward his customers. Don't treat people as if you were conferring a favour on them by letting them ride. Rather seek to make the like popular, because its business is dependent on the good will of the people. You need not be ashame to let people understand that you acknowledge this. If a passenger refuses to pay, or is rough and abusive, treat him with courtesy but firmness."

STORING EGGS.

For storing eggs a very good plan is to have a large board pierced with holes in regular rows. Many breeders keep them in bran; and this latter method is, perhaps, best for those meant only to be eaten, but for setting hens the pierced board has many obvious conveniences. They should be always kept with the large end downwards. This direction being exactly contrary to that usually given, we (*Farmer*) should state that our attention was first called specially to the subject by a most intelligent lady, who advocated this plan, alleging as the probable reason of its superiority, "Keeping eggs on the small end appears to me to cause the air-bubble to spread, detaching it from the shell, or rather from its membranous lining; and after being so kept for a fortnight the air-bubble will be found to be much spread, and the eggs to have lost much vitality, though still very good for eating" She then described her success the other way, adding, "Owing to this method of storing, such a thing as a stale egg has never been known in my house; and as regards success in hatching, for several seasons when I was able to attend to my poultry myself, of many broods set every egg produced a chick." We were by no means hasty in adopting or recommending this plan, but after careful observation and comparison for two seasons, have proved indisputably that both for eating or setting, eggs do keep much better the large end down. There is after a week a marked difference in eggs kept in the two positions as regards the spreading of the air-bubble—which is well known to affect both the freshness for eating and vitality for setting of stored eggs—and after three weeks the difference can be discerned even by the taste alone It will, of course, matter little which mode is adopted, provided the eggs are used for either purpose within a short time; but the longer kept, the more the difference from the two positions increases, and while eggs stored with the small end down cannot be depended upon after a fortnight to produce more than a proportion of chickens, those kept in the way we now advocate will keep perfectly good for hatching a month, or even more. We have sent thirty dark Brahma eggs to Ohio, U. S., which were twenty-two days on the road; yet they produced eighteen strong, lively chickens, or sixty per cent., though the eggs must have been nearly a month old. We ought, however, to add that, as already observed, we base our change of plan not on any single instance, however striking, but on systematic trial for two seasons. During each of these seasons we sent out about forty sittings (of ten each) dark Brahma eggs, and we satisfied ourselves most fully that, with the ordinary age of eggs thus sold by English fanciers —say from three to thirteen days—the difference in favour of eggs stored the large end down amounted to nearly 5 per cent. This may not be much; but, as already remarked with age it increases, and we have proved as conclusively, by actual trial, that eggs may be set and successfully hatched with remarkable uniformity, at ages which, kept in the usual method, would be nearly hopeless. We have known eggs kept a month hatch fairly, even on the old system; but we are now speaking of usual and average results, and so simply place at the service of fanciers in general the results patient trial, which have abundantly satisfied ourselves that there is a real difference in the product of the two positions. With regard to packing, so far as actual injury is concerned, we believe there is no difference whatever in the two ways; but if the journey occupy any time, the same position should be maintained for similar reasons.

Asphalte Paper.—Asphalte paper is likely to become of great use in many ways. In thin sheets it is useful for wrapping silks or other fabrics that need protection from moisture, for lining cases, or packing boxes for pianos, &c., or rolled up into pipes for conveying water. Asphalte tubes are only one-fifth the weight of iron, will not rust, and are quite tough and strong The tubes are simply sheets of paper, of a peculiar quality, dipped in melted asphalte, and then rolled upon a cylinder A machine for preparing the asphalte wrapping paper consists of a hollow cylinder, heated by steam, and a wedge-shaped box, containing the hot asphalte. The box has a narrow slit, the width of the paper, and as the paper passes, a thin layer of asphalte is distributed on the paper just before it passes the cylinder.

CORRESPONDENCE.

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

To the Editor of the Mechanics' Magazine.

Sir,—A great deal has been said by geologists about the geological formation of North America, the many formations, their different ages and how formed. Most of these scientific men say that the quartz rocks was formed by infiltration—silica held in solution and filtered into the chasms of rock when the beds were under water, as I understand it. But I should like to ask those gentlemen how these veins of quartz could be formed by infiltration, when we find so many of them only very narrow at the top or surface and very wide as you go down, all the formation veins and all showing that this quartz came up from below at some time.

Another question.

How is it we never or rarely find a horizontal bed of quartz, and how is it we never find them without their showing some communication from below? If they were formed by filtration would they always have signs of communication from below? If quartz was formed by filtration, how is it we do not find veins of quartz forming now?

I believe they are formed by quite a different agency altogether; and were formed in sections of country at one time. These are all the queries I will ask space for this time. Hoping some scientific man will answer me,

I remain,

AN INQUIRER.

DOMINION.

The Paris nut and bolt factory has commenced operations.

About six hundred tons of iron ore is shipped daily from Cobourg.

No Pullman cars are to be placed on the Intercolonial Railway this year.

The breakwater for the protection of the light-house at Goderich is completed.

Berlin has at length decided upon purchasing a steam fire engine at a cost of $5,600.

Some agitation is reported from Five Islands on the subject of a railway from Parrsboro' to connect with the Parrsboro' and Spring Hill road, for the purpose of carrying coal to the proposed iron works at the first mentioned place.—*Oxford Sentinel.*

Three waggon loads of iron arrived recently at Bobcaygeon, from the mine just opened on the Monk-road. The ore is being sent to Pittsburg by Toronto parties. The ore is said to be the best yet discovered in Canada.

A manufacturer in Saxony claims to have discovered a method by which certain alloys of aluminium may be advantageously used in the manufacture of hair springs for clocks and watches. Hitherto the main difficulty in effecting this was that the rolling and drawing of the metal destroyed its elasticity, and it is in overcoming this obstacle that the novelty of the discovery consists. To effect this the wire or band, after having been drawn or rolled to a proper size, is submitted to the action of a plane of peculiar construction, and afterwards trimmed to the proper size by grinding. The superiority of these springs over those of steel consists in their being less likely to oxidise, free from the action of magnetism, and less brittle.

SCIENTIFIC MATTERS.

The use of peat as a fuel is mentioned by Pliny.

The reverberatory furnace for baking porcelain is said to have been introduced from China.

The liability of safety valves to stick, in consequence of corrosion, is obviated by nickel plating both the valve and the seat.

At the recent General Assembly of French papermakers, MM. Jourdeuil, Parizot and Gresse, the well-known French firm of paper manufacturers, submitted some samples of a new textile fabric, namely—the sheath of the hop-stalk. By removing the outer skin, and subjecting it to a certain chemical process, a textile substance possessing the qualities which make rags so valuable in papermaking—namely, length, suppleness, and delicacy of texture, has been produced. The invention has been patented.

The Abbé Plessis gives, in *Les Mondes*, some curious facts relative to the muscular strength of insects. He placed a stag-beetle, weighing 3gr. 20, on a piece of wood, and balanced on its back a case, in which he put weights, gradually increasing to 1 kilogramme. On being incited somewhat, the animal moved forward with this enormous load, about 315 times its own weight. An ordinary man is certainly 100 times less strong. An elephant, proportionally endowed, might carry the obelisk of Tongsor, 230,000 kilogrammes in weight. The common flea can leap more than 500 times its height, while man can rarely leap even once his.

The seeds of beets, when germination takes place very slowly, often become the prey of a species of small subterraneous myriopoda. M. Pagnoul has recently made experiments on the effects of immersing the seeds for a short time in various solutions previous to sowing. He finds that a solution of sulphate of magnesia gives the best result, and among other beneficial substances are (in order), phenic acid, arseniate of potassium, chlorhydric acid, and sulphate of zinc.

Power of Explosives.—Some experiments have been made recently in a German iron mine at Hamm, to ascertain the relative efficiency of powder and some of the nitro-glycerine compounds for blasting purposes. The following were the results obtained:—Ordinary saltpetre gunpowder, one unit of force; extra best powder, with excess of saltpetre and cherry tree charcoal, made by L. Ritter at Hamm, tree units; dualin, obtained from Herr Dittmar, lieutenant of artillery, Charlottenburg, five units, lithofracteur, from Krebs, Co, Deutz five units, colonia powder (a sort of powder saturated with thirty to thirty-five per cent nitro-glycerine), five to six units; dynamite, six to seven units. It will be seen that dynamite far exceeds the others in power, and its use is displacing theirs in German mines.

An interesting paper was communicated, at the recent meeting of the French Academy, by Gen. Morin, on the cubic space and the volume of air necessary to insure healthiness in inhabited places. He constructs a mathematical formula expressing the amount of air necessary to be renewed hourly, so that the noxious gases (CO_2, &c.) emitted may not accumulate beyond a certain proportion not far from that in normal pure air, which contains about 0·0005 CO_2. The following numbers are obtained:—

	cub. m.	cm.	cm.	cm.	cm.	cm.	cm.	cm.
E (Cubic space per individual.)	10	12	16	20	30	40	50	60
x (amount of air to be renewed hourly for each.)	90	88	84	80	70	60	60	40

The formula and results are of much practical value. Thus, a bedroom 60 cubic metres capacity is generally thought sufficient for one person; but there should be an hourly circulation of 40 cubic metres in it, so that the CO_2 may not exceed 0 0008. The ventilation of an amphitheatre at the Sorbonne, and other public buildings, is shown by the author to be enormously defective. In hospitals an allowance of 50 cm. to each bed, with an hourly renewal of 60 cm. gives good results.

MISCELLANEA.

Polishing Wood in the Lathe.—After sand papering a very little preparation is required. Fill up the grain with oil and plaster of Paris, wipe off clean, polish with French polish, and finish off with alcohol.—*Samuel Smither, London.*

An Indelible Red Ink.—Dr. Elsner states that an indelible red ink can be prepared as follows: Equal parts, by weight, of copperas and cinnabar, both in fine powder and sifted, are rubbed up with linseed oil with a muller, and finally squeezed through cloth. The thick paste can be employed for writing, or stamping woolen or cotton goods, and the color remains fast after the goods have been bleached. The reds usually employed are not fast colors, and do not resist the action of bleaching agents.

Shaping Soft Rubber with a File.—President Morton, of the Steven's Institute, states that he finds the ordinary thick sheet rubber, used in making up lantern tanks, and for many similar purposes, may be readily dressed into exact shape with a file, if only it is supported by being clamped between plates of wood or metal in the vise. The file is used dry, and in all respects as in working on wood or metal.

A Good Cement.—A very adhesive cement, and one particularly useful for fastening the brass mountings on glass lamps, as it is unaffected by petroleum, may be prepared by boiling three parts of rosin with one part of caustic soda, and five parts of water, thus making a kind of soap, which is mixed with one-half its weight of plaster of Paris. Zinc white, white lead, or precipitated chalk may be used instead of the plaster, but when they are used the cement will be longer in hardening.

To Cut and Bore India Rubber Stoppers.—Dip the knife, or cork-borer, in solution of caustic potash or soda. The strength is of very little consequence, but it should not be weaker than the ordinary re-agent solution. Alcohol is generally recommended, and it works well until it evaporates, which is generally long before the cork is cut or bored through, and more has to be applied; water acts just as well as alcohol, and lasts longer. When, however, a tolerably sharp knife is moistened with soda lye, it goes through the india rubber quite as easily as through common cork; and the same may be said of a cork-borer of whatever size. We have frequently bored inch holes in large caoutchouc stoppers, perfectly smooth and cylindrical, by this method. In order to finish the hole without the usual contraction of its diameter, the stopper should be held firmly against a flat surface of common cork till the borer passes into the latter.

Waterproof Glue.—Red chromate of potash has the attribute of rendering certain organic matters insoluble, such as gum, glycerine, and gelatine, especially with the aid of light. If a sheet of paper, coated with gum mixed with the red chromate is exposed to the light, the coating becomes perfectly insoluble, even in boiling water. This property is applied in photography in the so-called carbon process. Strong glue becomes insoluble more rapidly than gum, the action going on slowly even in the dark. A concentrated solution of the red chromate is prepared and kept in a dark place. When required, a little of it is added to some dissolved glue. Articles glued with this preparation may, after the lapse of some time, be washed without inconvenience either in cold or boiling water. Paper prepared with this glue becomes a kind of parchment, and serves for the covers of the pea-sausages (Erbswurst) used in the Germany army.

Ammoniacal Preserves.—A German technological paper makes the following frightful suggestion:—"Very satisfactory experiments have been made in using ammonia to lessen the amount of sugar required in preserving acid fruits. In the course of the operation a small quantity of sugar is to be stirred in and its effects carefully noted. The alkali of the ammonia, combining with the acid of the fruit, produces a neutral action, which permits the sugar to have its full effect. An excess of ammonia can be remedied by the introduction of a little vinegar." The ammoniacal salts which would be formed by this process, especially the acetate, have, in addition to certain undesirable medicinal qualities, a taste which can best be described as strongly urinous!

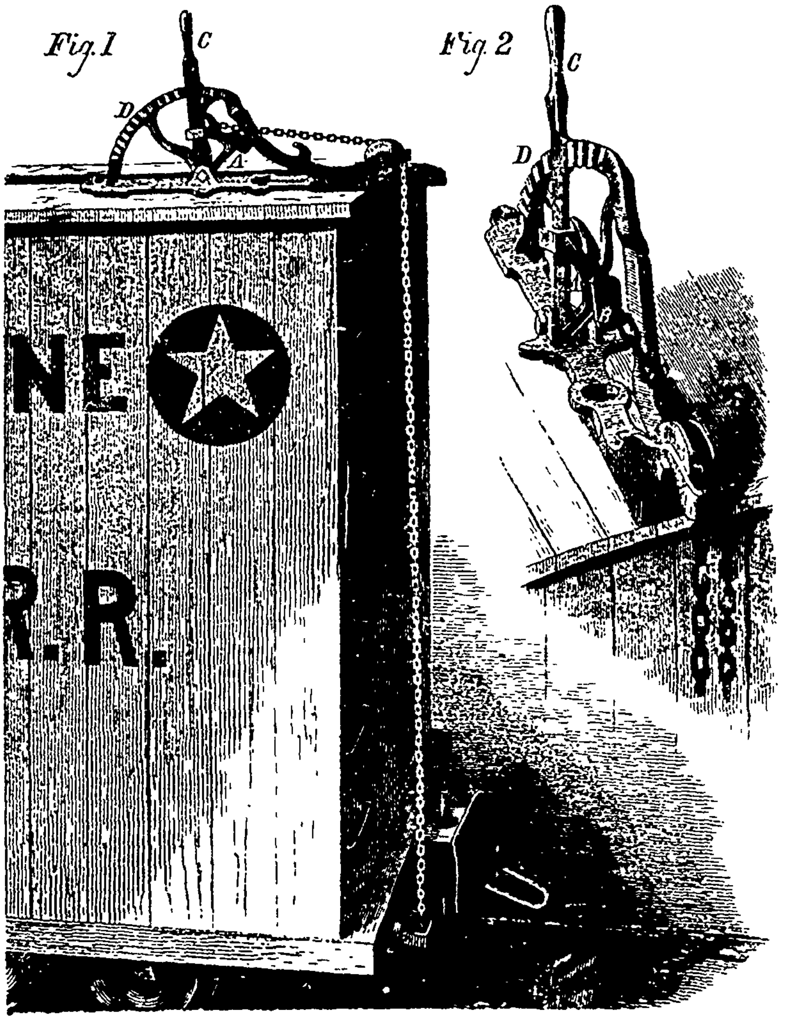
IMPROVED RAILROAD HAND BRAKE.

We illustrate herewith an improved form of railway hand brake, which, it is claimed, saves fully two thirds in distance run and time occupied while setting brakes. It is also stated to be much safer in use than the ordinary "twist up" arrangement, as it is placed from three and a half to four feet from the end of the car roof, so that, in case of accident, there is less danger of the brakeman being thrown between the train.

The device is quite simple, and consists of a bed plate, to which is pivoted in lugs, a segment, A. On the latter is formed a hook, to which the brake chain is attached, and also a fork, B, for guiding the same. C is a wrought iron lever, connected with the segment and provided with a steel lip to engage in the teeth of the rack, D. The brake chain passes from the hook on the segment over a pulley, journaled in suitable bearings cast with the bed plate, and thence down under another pulley, secured as shown under the car, and so to the brakes. The arrangement on the roof of the car is secured by but two bolts, and having merely a single motion, can necessarily be quickly operated.

The inventor informs us that on the occasion of a competitive trial between his device and the ordinary brake, which took place on the Little Miami railroad, while the latter stopped four cars and an engine in 1,130 feet, actual measurement, his invention performed the same operation within 425 feet, thus gaining 705 feet; and this although the cars in both cases were of the same weight and running as nearly as possible at the same speed.

From our engraving, giving two perspective views of the apparatus, and also showing how it is applied, a clear idea of its construction will be obtained. It appears strong and durable, and, according to the inventor, it is not expensive.—*Scientific American.*



FOSTER'S RAILROAD HAND BRAKE.

THERE have arrived in New York 20,000 tons of iron ore, direct from Bona, in Algeria. 10,000 tons go to the works at Bethlehem, and 10,000 tons to the Trenton Steel Works. This ore is warranted to yield 60 per cent. of manganese. It is especially adapted to the Bessemer steel process. A year ago this ore was offered to be delivered in Pittsburg, at $16 per ton. The cost in New York is about $12. There is much interest manifested among American iron manufacturers as to how this ore will work.

A NEW motor has recently been patented in the U States, the operation of which is as follows:—Oil is sprayed into the cylinder behind the piston, and being mixed with air, is ignited at the proper time by an electric attachment. The consequent expansion drives the piston forward, the momentum of the fly wheel returning it to its former position. An ejector supplies the oil from the tank to the sprayer, the injector being connected to a piston blower driven by a crank attached to the main shaft. Street patented much the same thing in England many years ago, using turpentine instead of oil.

IT is estimated that it will take two years and a half to complete the long tunnel under the Lehigh mountains, on the Perkiomen Railroad. Operations are to be commenced in a few days.

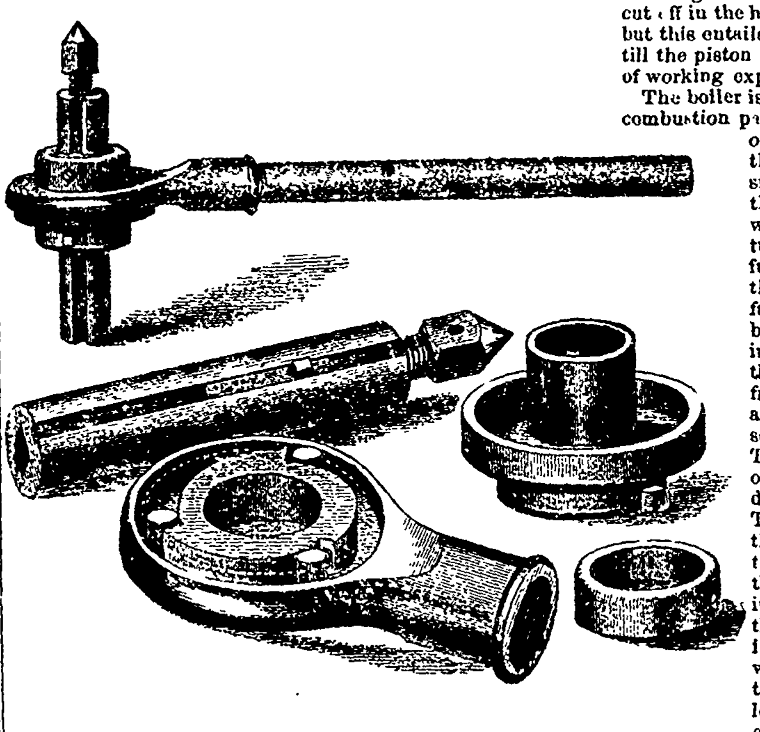
IMPROVED PLOW ATTACHMENT.

(From the *Scientific American.*)

The invention herewith illustrated is an attachment to the ordinary plow, and is designed to open furrows or channels in the soil of suitable depth to receive potatoes, and afterwards to cover the latter with earth. The device consists simply in a plate C, pivoted and secured by a screw and nut to an elbowed arm. The vertical position of the support drops into a socket, as shown on the rear of the mold board when in use, or, when not employed, is carried by the staple represented on the plow beam. It will be understood that the furrow left by the plow is too deep for potato planting, and hence the primary object of the attachment is to partially fill the channel with the loose earth thrown up by the share. A bed of friable soil is thus prepared, excellently suitable for the germination of the seed. To cover the latter, it is simply necessary to use the plow without the attachment the ground being thrown up and over the potatoes by the moldboard in the ordinary way.

The device can be placed in the socket with the end of the vertical part of the arm either up or down, it being suitably secured while in the latter position, so that the downward reach of the plate can be adjusted to plow in grain, etc., to any desired depth. Properly arranged, it is stated, the implement is well adapted for putting in manure or plowing grass ground.

The seed potatoes are of course deposited by a suitable dropper or other convenient means. It is also claimed that a result of using the invention is that the digging of the hills, when the vegetables are ripe, is attended with much less labor than ordinarily. The apparatus is simple, very quickly attached or removed, and readily adapted to the plow. The patentee is a practical farmer, and informs us that he has found it in operation a useful and valuable tool.



IMPROVED CLUTCH DRILL.

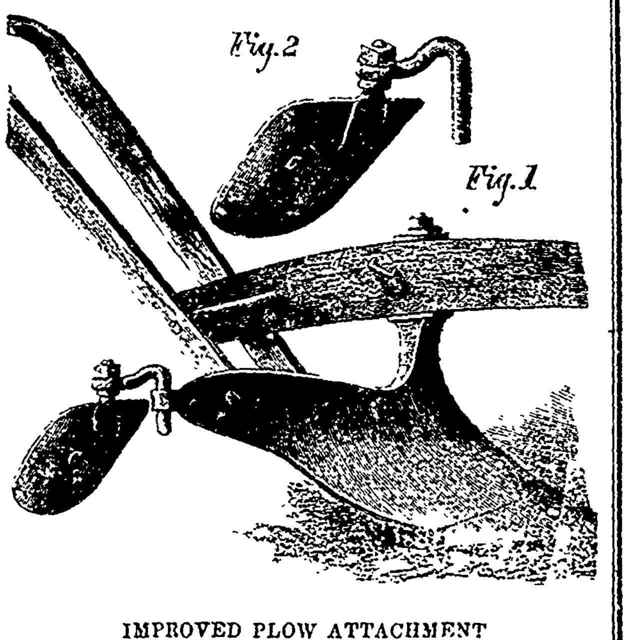
Little explanation, in addition to our illustration for which we are indebted to the *Scientific American*, is needed to show the action of this invention. By communicating the motion of the lever to the drill spindle by means of a friction clutch, the strain is distributed all around the spindle, and the liability of the drill, when acted upon on one side only, to swerve from the perpendicular is prevented. The merest possible motion of the lever moves the drill; and it will be seen that the clutch can be slid lengthwise on the spindle, allowing the latter and the lever to work clear of obstructions. The inventor, Mr. Geo. W. Gill, of Philadelphia, claims that, by using cast steel as a material, he has produced the best and cheapest drill stock now in market, and the only one which uses friction as a means of communicating the motion, and which has, consequently, the advantages above mentioned.

MORELL'S PATENT HIGH PRESSURE ENGINE AND BOILER

We illustrate on page 194, a little engine — which has at least the merit of novelty — of which the patentee, Mr. B. Morell, exhibits a drawing at the Vienna Exhibition. The inventor claims that the engine itself is the simplest that can be made, and will be, in consumption of fuel, the most economical form of engine for running at high speeds, and that in the boiler he has obviated two great objections to vertical boilers, namely the liability to prime, and the likelihood of leakage at the bottom of the tubes and the cracking of the tube plate. The engine is compound, with cylinders 3 in. and 6 in. in diameter respectively, and 9 in. stroke. The boiler is 3 ft. in diameter (3 ft. 6 in. over the steam casing), and 5 ft. high, and contains 28 tubes 3¼ in. in diameter, besides one centre tube 8¾ in. in diameter. The total heating surface, not including the feed heaters, is 200 square feet, and the grate surface is 8 square feet. The boiler pressure is 90 lb. per square inch, and the engine is intended to work at 10 effective horse power with 350 revolutions per minute.

The two cylinders are cast together; they have no slide valves, but the distribution of steam is effected by the ports passing openings in the top of a semi-circular box on which the cylinder oscillates. It is expected that the face of this box and that of the cylinder will be kept steam-tight by screwing down the two levers which encircle the latter. The cut off in the high pressure cylinder takes place at ¾ in. stroke, but this entails the disadvantage that the port is not opened till the piston is nearly at quarter stroke, rather a rough way of working expansively.

The boiler is set on a large brick furnace, the products of combustion passing through an opening in its roof, the bricks of which will be of course red-hot, before touching the boiler. This is an old method of preventing smoke, but we think it doubtful whether by it the gases can be freed from all materials which will exercise a deleterious influence in the bottom tube plate, as the patentee seems to expect. The furnace door has a hopper cast on it through which the fuel can be introduced and pushed into the furnace by a cross which can be turned round by hand. As this cross does nothing whatever in the way of distributing the fuel on the grate, the door would have to be opened every time fresh fuel was put on, in order that it might be arranged by a poker or shove in the usual way, so that the use of the cross i not very obvious. There is no means of admitting air above the level of the grate bars without opening the furnace door, a defect that ought certainly to be remedied. The boiler is a simple vertical cylinder traversed throughout its length by the tubes before mentioned. The centre tube is made larger so that the draught may be regulated by a damper over its upper end. The other tubes are ferruled at the top, the size of the holes in the ferrules depending on the nature of the fuel used. The way in which priming is prevented is by rivetting round the whole upper half of the boiler an outer shell, leaving between it and the boiler proper a space of about 2½ in. A number of small holes round the top of the shell communicate with this annular steam chest, and any water that passes through



IMPROVED PLOW ATTACHMENT

them will, it is expected, be evaporated before it reaches the steam pipe. The whole boiler is enclosed in a cast-iron casing or smoke box, and the products of combustion pass down this casing — enveloping the boiler — on their way to the chimney. In the flues just behind the furnace, through which the gases pass after leaving by an inclined pipe Both of them communicate direct by vertical pipes with the boiler. The feed water is introduced into the bottom of one of them, and a circulation is expected to be kept up through the inclined tube, up into the boiler, and down again, so vigorously that all deposit is to be brought down into one of the boxes, from which it can be easily blown off. It is easy to see how the feed water will rise but how a downward current is to be induced from the hottest part of the boiler into these comparatively cool vessels (from which at the same time the feed must continually ascend), is not so comprehensible.

In spite of the ingenuity of this engine, and of some good points about the boiler, it has several obvious objections which will — we are afraid — be sufficient to prevent it coming into general use One advantage of a vertical boiler of the usual kind is that it is self-contained, and requires very little setting, while this one requires a large firebrick furnace and flues. The exhaust steam will not make a very efficient blast if it is only admitted into the base of the chimney at a considerable distance from the boiler, and there does not seem any way of using it sooner. It will, therefore, be necessary to have a higher and more expensive chimney than is generally the case with vertical boilers. In addition to this the defective distribution of the steam in the cylinders will make itself felt unless the engine runs at a higher speed than 525 ft. per minute, which although high, has been reached even by engines of the ordinary construction, and much exceeded by some constructed like this one, specially for driving fans, &c., direct. With 8 ft. of grate and 200 ft. of heating surface no doubt much more than the 10 effective horse power named by Mr. Morell would be obtained, and there is no reason why the boiler should not rather work at ten or twelve atmospheres than at six. We are indebted to *Engineering* for the above description and drawings.

According to the calculations of Professor Rogers, each acre a coal seam 4ft. in thickness, and yielding one yard net of pure coal, is equivalent to about 5000 tons, and possesses, therefore, a reserve of mechanical strength in its fuel equal to the life-labour of more than 1600 men. Each square mile of one such single coal bed contains 3,000,000 tons of fuel, equivalent to 1,000,000 men labouring through twenty years of their ripe strength. Assuming, for calculation, that 10,-000,000 of tons out of the annual produce of British coal mines are applied to the production of mechanical power, then England annually summons to her aid the equivalent of 3,300,000 fresh men pledged to exert their fullest strength through twenty years. Reducing this to one year, we find that England's actual expenditure of power generated by coal is represented by that of 66,000,000 able-bodied labourers. This is a representation of what really exists in another form; but if we proceed so far as to convert the entire latent strength resident in the whole annual produce of our coal mines into its equivalent in human labour, then, by the same process of calculation, we shall find it to be more than the labour of 400,000,000 strong men, or more than double the number of adult males now upon the globe. In alluding to these facts Mr. Leifchild, in his excellent little work on *Coal at Home and Abroad*, observes that there is a most humiliating element in the calculation. Thus, if we estimate a lifetime of hard human work at twenty years, giving to each year 300 working days, then we have for a man's total dynamic efforts 6000 days In coal this is represented by three tons; so that a man may stand at his own door, while an ordinary quantity of coals is being delivered, and say to himself, "There, in that waggon, lies the mineral representative of my whole working life's strength."

An exchange says: "Why cannot our railroad cars be made of paper, instead of iron, as proposed, so as to prevent the danger of splintering and burning, in case of accident?" A pertinent inquiry.

It is commonly assumed that accidents on American railroads are far more common and more fatal than on those of Great Britain The following comparative statements do not appear to justify this opinion. Let us take Great Britain and Ireland first. The parliamentary return for 1872 has just been issued, from it we learn that the total number of passengers, servants of companies, or of contractors and other, killed by railway accidents in 1872, was 930 in England and Wales, 168 in Scotland, and 47 in Ireland; while the number injured was in England and Wales, 2617; in Scotland, 383, and in Ireland, 38. Total killed, 1145, injured, 3038. Of the passengers the number of killed throughout the year in the United Kingdom was 127; the number of injured, 1462; while the number of companies' and contractors' servants killed was 632; the number injured 1395. The third class included in the report consists of trespassers, suicides, persons passing over railways at level crossing, &c. Of these the number killed was 268; the number injured 181; 19 persons were killed, and 1233 injured from accidents to trains, &c, as collisions, trains leaving rails, &c., 48 persons killed and 53 injured from falling between carriages and platforms, 10 killed and 117 injured from falling on to the platform when getting into or out of trains; 39 killed and 16 injured while crossing the line at stations; and 6 killed and 20 injured from falling out of carriages during the travelling of trains. Among railway servants and workmen on the line 117 were killed and 378 injured during shunting operations; 100 were killed and 52 injured whilst working on the permanent way or in sidings, 118 were killed and 95 injured whilst crossing or standing on the lines; 54 were killed and 106 were injured whilst getting on or off trains, engines, &c.; 42 were killed and 214 injured from accidents to trains, collisions, &c.; 44 were killed and 84 injured from falling off engines, vans, wagons, &c.; 27 were killed and the same number injured whilst passing between vehicles; and 18 were killed and 33 injured from falling or being caught between vehicles and platforms. 132 railway accidents, involving the death of nine and the injury of 462 persons, arose from collisions between passenger trains and goods or mineral trains; 124 accidents from broken rails; 99 accidents for trains running over cattle or other obstructions on the line; 77 accidents from the giving way of axles; 75 accidents from passenger trains, or part of them, leaving the rails; 51 accidents from the giving way of tires; 47 accidents from collisions between passenger trains; 25 accidents from trains running through gates at level crossings; 24 accidents from slips in cuttings and embankments and 29 accidents from trains or engines travelling in the wrong direction through points being set improperly. The report on American accidents is not made up with the same elaborate care. The world is mainly indebted for it, indeed, to our able contemporary, the American *Railroad Gazette*—an enterprising and well managed journal, in which a record is kept of all railway accidents from year to year. From this we learn that in the year ending July 1st, 1873, the casualties were as follows:—In July 1872, there were 31 accidents, 35 persons were killed, and 66 injured; in August, 63 accidents, 15 killed, 49 injured; in September, 71 accidents, 24 killed, 104 injured; in October, 90 accidents, 29 killed, 102 injured; in November, 103 accidents, 37 killed, 114 injured; in December, 112 accidents, 42 killed, 133 injured; in January, 1873, 178 accidents, 40 killed, 199 injured; in February, 133 accidents, 25 killed, 126 injured; in March, 112 accidents, 18 killed, 92 injured; in April, 101 accidents, 23 killed, 88 injured; in May, 79 accidents, 10 killed, 113 injured; in June, 90 accidents, 12 killed, 104 injured. Total, 1163 accidents, 310 persons killed, and 1290 injured.

A Pacific Cable.—The United States war steamer "Tuscarora," which has been detailed to make surveys and soundings preparatory to the laying of a telegraph cable from San Francisco to Japan and the Asiatic Continent, has made an experimental trip for the purpose of testing different apparatus for the purpose of taking ocean soundings. The result was the adoption of some machinery invented by Lieutenant Brooks, with a recent improvement by Captain Belsnap Eleven attempts at sounding were made in all, two only being failures. The greatest depth reached was 1949 fathoms, in latitude 37 degrees, 24 minutes and 50 seconds north; longitude 123 degrees, 33 minutes and 25 seconds west. The "Tuscarora" is now awaiting orders to proceed in sounding the line of the cable to the coast of Japan.

GOLD MINING IN THE EASTERN TOWNSHIPS.

A correspondent to the Sherbrooke *Gazette*, describes a visit paid to the gold mines at Ditton in the Eastern Townships. He says:—We reached the mines at noon, the mine proper covers nearly fifty acres of land, which has been thrown into mounds and otherwise disfigured by the miners, in the haste to secure the precious metal, and to-day scarcely one acre of its former even surface can be found. Sluices nearly half a mile in length are kept constantly running during the summer months, emptying the tons of earth and broken slate on some place already worked, or on a neighbouring group of standing trees, and when the mound has reached a height considered dangerous, the stream is aimed at some vacant lots and another mountain not on the map of Ditton appears. In many places groups of standing trees have been covered, leaving only the tops alone visible, and it is with the greatest difficulty that the stranger makes his way over the different mounds and through excavations, water courses, &c. In and around the mine we were astonished to find gold in the different sluices in abundance, gold in the sands and for nearly two miles higher up the river, the bed rock seems to be covered with gold, and enough to furnish constant and profitable employment to many hundreds of Canadians for centuries. An active man can with pick, pan and shovel earn $3.00 per day's work of ten hours. Skilled labor, together with the necessary mining appliances, have produced results sufficiently encouraging to induce the proprietor to contrive and extend his business, and now at the end of ten years he finds his boarding houses, barns, &c., too small, and insufficient for the wants of this rapidly increasing colony, and new and larger buildings are in course of construction.

The connecting tubes of the first arch of the St. Louis Bridge have been successfully placed in position. The *St. Louis Republican*, of September 17th, says: —"At present the weight of the superstructure is supported by the cables, and while that is the case the expansion and contraction of the tubes by heat and cold is of no consequence, but when it comes to putting in the last tubes, expansion and contraction cut a pretty big figure. When the connection is once made and the supports removed, so that the arch is self-sustaining, a new element comes into care—the contraction from pressure When the cables are slackened, the arch at the centre will from this cause settle about 3 in. Provision has been made for this by increased length in the tubes, all the calculations being based on a temperature of sixty degrees. At that temperature it is known to the sixtieth of an inch what would be the intervening space between the approaching tubes, and the last joints have been dimensioned accordingly. Only once, since the workmen have been ready to put in these last tubes, has the temperature been favourable On Sunday morning at 5 o'clock, the conditions were all right, but owing to some unexpected tardiness the workmen did not get there till eight One tube was put in and it fitted to a nicety. In the meantime the sun shone on the bridge, and when they came to put in the other tube it would not go entirely to its place, being about a thirtieth of an inch too long on account of the expansion of the tubes in place An attempt was made to drive it in place with sledges, but without effect. In consequence of not being able to put in the second tube, the first one had to be taken out again and a more favourable opportunity waited for On Monday morning, the expansion was still greater, being ⅝ in, and on Tuesday morning 2⅝ in., owing to the warmth of the day before. The prospect being that a delay of several days would occur before the exact temperature required would be obtained, it was determined to try a little strategy in the case by reducing the temperature artificially. About two o'clock yesterday morning forty-five tons of ice were applied to the tubes, and bound on by many yards of gunny bagging, which formed perhaps the most extensive ice poultice ever used. At three o'clock yesterday afternoon the expansion had been reduced about 2 in., and it was calculated that at five o'clock in the morning it would be sufficiently so to admit of the tubes being put in place." The application of the ice proved entirely successful, and on the following day the connecting tubes were put in and the first arch completed.

HABITS OF THE BALTIMORE OYSTER.

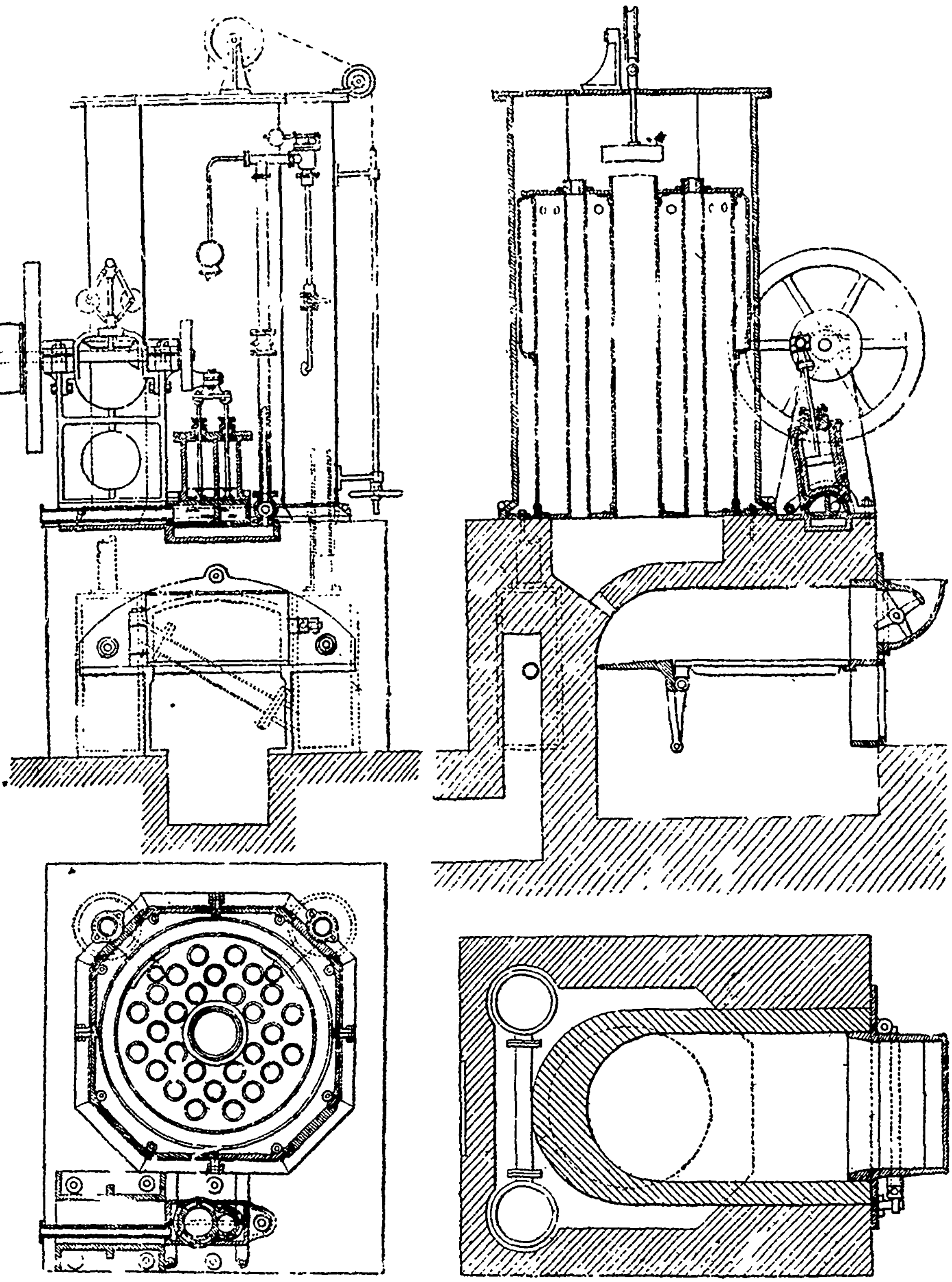
In a conversation with a prominent oyster packer, says the *Baltimore American*, some curious and interesting features of the oyster trade were related. As is well known, the habits of this bivalve are an entire mystery, what it eats and how it lives are questions not yet understood. The spawn of the oyster floats around with the action of the waves and tide, and adheres to whatever it may come into contact with. Oysters taken from a rocky bed are of superior quality; those taken from a soft bottom are comparatively poor in quality. Thousands of "poor innocent" oysters die annually from resting on a soft bottom, a fact which should arouse the sympathies of all tender hearted people.

The weight of the oyster, as it gradually matures, sinks it beneath the surface; and as soon as it is covered with sediment or mud, it dies. Many people suppose that the oyster really eats, and kind hearted people, buying oysters in the shell sometimes throw corn meal over them thinking to feed them. The peculiar noise emanating from them has been supposed to be produced by feeding. All shellfish at times have their shells open, and when touched will instantly close them. The noise thus produced has been mistaken for mastication, when, in reality, it is from fright.

Most of the Baltimore dealers in raw oysters during the summer months transact their business at Fair Haven, Conn., whither large beds of Baltimore oysters have been transplanted. The bed are so arranged that, on the receding of the salt water tide, fresh water from a small stream covers the oysters; it is said that this fattens oysters better than any other method. Order are received for the article in question during the summer months, and they are taken from the beds and shipped with the greatest possible dispatch, and many eat them with apparent relish, notwithstanding the warmth of the season. Altogether the oyster packing trade of Baltimore is an enormous one, and, in connection with fruit and vegetable packing business, employs a capital of about $25,000,000, a fact which sufficiently expresses the great importance of this interest to Baltimore.

Common Scientific Language.—The *Athenæum* notices, as worthy of remark, that Prof. T. Thorell, of Upsala, has lately advocated the introduction of a common scientific language; and, as in these days a return to Latin is neither to be expected nor desired, he considers it not improbable that English may at some time succeed to this position. This he believes, not only because English is far more widely diffused than any other tongue, but also because it can by most Europeans, be more easily acquired than any other language Prof. Thorell has given us an earnest of his belief by writing his recent work, "Remarks on Synonyms of European Spiders," entirely in English—in such English, too, that (says the same authority) none of our countrymen need be ashamed to own it.

A New Covering for Steam Pipes.—A new method of covering steam pipes is being applied in different mines of the Saarbrucken district, which has proved very efficient. A coat of thin loam wash is first given to the pipes, which serves to increase the adhesion of the mass with which they are to be covered. The composition consists of equal parts of loam or clay, free from sand and brick dust, with an addition of cow hair. This is well mixed up and put round the pipes in a hot state. For better securing this coating, wood splints, 0.26 metre long, 13 m. broad, and 22 m. thick, are laid along the the whole length of the pipes and fastened by thin iron wire After applying the loam-wash again to the dried mass till all the cracks have disappeared, the pipes receive another coating of the mass, until they feel quite cool, which will be attained after the mass has been laid on to the thickness of from 124 m. to 140 m. A coat of linseed oil and cement is finally given. This method answers at present all requirements, the covering being perfectly air-tight and free from cracks. The mass is not hygroscopic, a property making it all the more suitable for pipes in the open air. The cost of the covering per foot of 8-inch pipe is 6d., while the expense of the old proceeding amounted to nearly 8d. The inventor, Herr Wiess, has take nout a patent for his method.



MORELL'S PATENT HIGH-PRESSURE ENGINE AND BOILER.