it is technically termed, a "circulation." For manufacturing purposes, and for heating large warehouses, it is usual to have several independent circuits of piping or circulations, either laid side by side, a few inches apart, where high temperatures are required for drying purposes, or, as when used for warming large buildings, different circulations are laid to different rooms or floors, the circuits, however, all returning to the same furnace. Experience has shown that it is not advisable to have a much greater length of piping in one circulation than 500 feet; but although several apartments may be warmed in this circuit, it must not be inferred that they must necessarily be heated, whether desired or not; in fact, it is easy, by the mere turning of a cock handle, to cut off any one or all of the rooms. Each circuit, as already mentioned, is hermetically sealed, and as the steam which fills the expansion pipe increases in pressure, the temperature of the pipe rises proportionately above that of boiling water, so that while the water is just beginning to boil, the temperature of the pipe is 212° Fah.; if by vigorous firing the pressure reaches, say, 185 lbs. to the square inch, the temperature exceeds 380° Fah., and higher for greater pressures By regulating the fire, therefore, the degree of heat is easily under command, and the high temperatures which may thus be obtained will be understood when it is explained that the system has found extended use for heating bakers' ovens, and, although not so widely, for core drying stoves in foundries, for which purpose we can commend it to the notice of our engineering readers, leaving them to recognize the advantages it possesses over the sooty, ill lighted dungeons they now employ, and of which we have painful recollection from the days of our apprenticeship.

We may say that quite recently we inspected an apparatus supplied by Mr. Hearn at work under very trying conditions in the albumen works of Mr. W. H. King, St. Andrew street, Brownlow hill, Liverpool. Albumen, so largely used by calico printers, it should be explained, is obtained from the colorless liquid called serum, which is collected by allowing clotted blood to drain upon perforated trays. Serum consists of water holding in solution about nine to twelve per cent of albumen, and to obtain the latter the water must be removed by evaporation. Now, albumen coagulates at about 150° Fah., and if the evaporation be carried on at this temperature, the coagulated product being insoluble is useless for the printer, while on the other hand, if the concentration be performed at a temperature much below 120° Fah., the albumen tends to decompose, evolving odors more pungent than pleasant, and the inspector of nuisances makes it his business to visit the establishment.

The great nicety of the operation will now be easily understood. The serum is placed to a depth of about half an inch in shallow trays disposed on shelves in the heated chambers, and twenty-four hours suffice to obtain the albumen as a thin scale on the bottom of the tins. Mr. King, having had the apparatus for some time, is perfectly satisfied with its performances. As arranged at his place it consists of four circulations, placed in two chambers; the furnace is a trifling affair, and but little longer than our desk.

En passant, as of interest to calico printers, we may say that Mr. King is placing albumen in the market in a new form, namely, in solution, and of a very convenient degree of concentration—about four pounds to the gallon, or say 20° to 22° Twaddel, and bleached to any degree required. The advantages of this are that it saves the printer the risk of finding solid impurities when he dissolves, and the producer less time for concentration, as it is not evaporated to dryness, but stopped off at the proper point, and also less risk of coagulation.

Artificial Diamonds.

The sons of the late Dr. Gannal, in looking over the documents left by their father, came across the draught of a paper which he had presented to the French Academy of Sciences in 1828, on the subject of the artificial production of the diamond. This paper was referred to MM. Vauquelin and Chevreul, and nothing further was ever heard of it. The MM. Gannal now send the document to the Academy, believing it to be their duty to bring to light the now forgotten researches of their father.

It seems that in making some experiments with carburet of sulphur, the idea occurred to Dr. Gannal that the carbon might be separated from it in crystalline form. He, therefore, took a certain quantity of the carburet, poured a little water on the top of it, and then carefully introduced some stick phosphorus. The latter immediately dissolved, with the formation of three separate layers, phosphorus at the bottom, carburet of sulphur in the middle, and water at the top. After a time he noticed that a sort of film was formed between the two latter layers, and that when exposed to sunlight it was iridescent. After the experiment had been in progress three months, a sudden fall in the temperature froze the water, split the glass, and the contents were thus lost. He again began his experiments, but as each one required six months to carry out, and as the numerous accidents to which they were liable continually interfered with their success, he finally abandoned his efforts. However, in the course of his experiments he had been able to procure some minute crystals, which he submitted to an eminent jeweler, who tested them by the microscope and other means, and decided that they had the true fire, water and hardness of the diamond; moreover, on being subjected to the blowpipe, they left no ash. He concludes his memoir as follows: "I believe that I can now announce that the greatest step is made toward the solution of the problem of making diamonds, in all respects similar to those nature has disseminated in India and Brazil." The complement of this discovery will do great honor to modern chemistry. The MM. Gannal call attention to the fact that there is no analogy whatever between the products obtained by their father and the pretended diamonds of M. Cagniard, of Latour, the latter being nothing more than silicates.

REYNIER'S NEW ELECTRIC LAMP.

The chief difficulty to be overcome in an electric lamp is a means of supplying the wasting away of the luminous conductors—a wasting which takes place very rapidly, even when inclosed, in consequence of the volatilization and disintegration of the carbon pencils, and which is greatly accelerated in free air, through the quick combustion of the incandescent carbon.

Fig. 1.

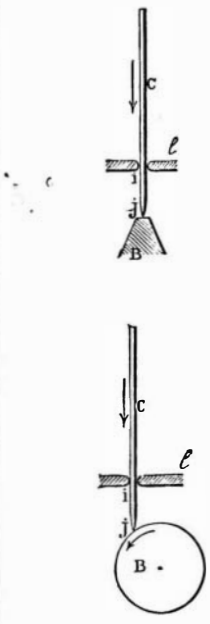


Fig. 2.

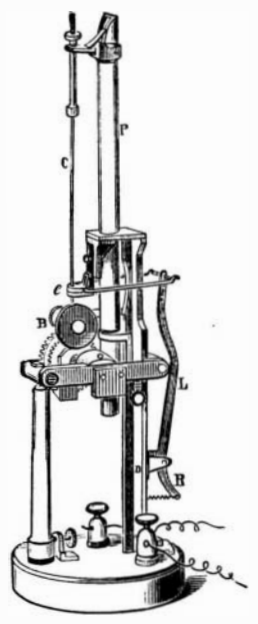
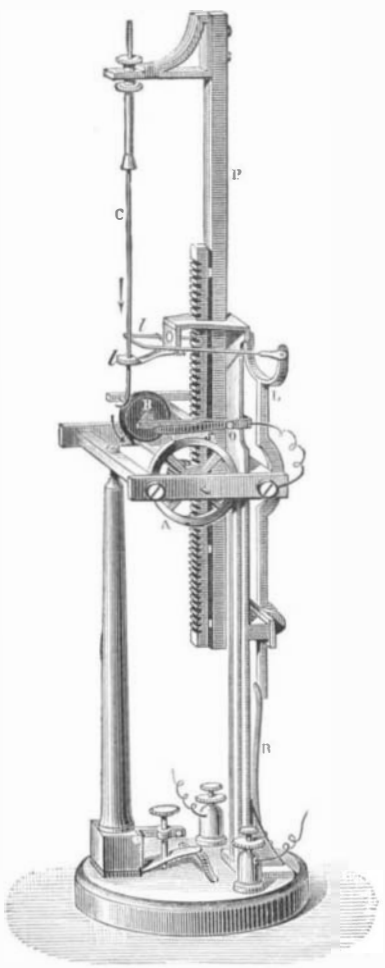


Fig. 3.

In the various systems of electric lamps hitherto proposed, the renewal of the carbons takes place as follows: The incandescent pencil, fixed in its support, remains in place until broken by being worn out, then the light is extinguished; the electric current now passes suddenly from this carbon to another, which wears out and breaks in its turn, and so on. This method presents many inconveniences; there is an interruption of the current with an extinction of the light at every break of the carbon; the luminous intensity varies continually with the gradual thinning of the carbon pencil; the conductor furnishes its maximum of light only at the moment when it is about to break; and, finally, the devices proposed can scarcely operate well except when inclosed. In the new system, described in this article, the renewal of the carbon is progressive. The pencil, incandescent at one part of its length, proceeds almost continuously, until every portion that can be utilized is completely used up. This system will operate in free air. This is the principle involved.

Fig. 4.



A cylindrical or prismatic pencil of carbon, C (Fig. 1), is traversed between *i* and *j* by an electric current (continuous or alternate) sufficiently intense to render it incandescent in this portion. The current enters or passes out through the contact, *l*, it passes out or enters through the contact, B. The contact, *l* (which is elastic), presses against the carbon laterally; the contact, B, touches it at the extremity. Under these conditions, the carbon wears away at its extremity faster than at any other point, and tends to shorten. Consequently if the carbon, C, is urged forward continuously in the direction of the arrow, it will advance gradually, in proportion as it wastes away, sliding through the lateral contact, *l*, in such a way as to continually touch the terminal contact, B. The heat developed by the passage of the current through the pencil is greatly increased by the combustion of the carbon.

In practice, the fixed contact is replaced by a revolving contact, B (Fig. 2), which carries off the ashes of the carbon. The rotation of the terminal contact is made to depend on the progressive movement of the carbon; so that the latter acts as a check on the motive mechanism of the lamp.

The principle of this new system of lamps having been established, it became an easy matter, of course, to devise a simple apparatus to put it into execution.

A mere inspection of the model (Fig. 3), which was exhibited by the inventor, M. Emile Reynier, before the Société de Physique, will serve to show how it operates. The progression of the carbon, C (Fig. 3), and the rotation of the terminal contact, B, are obtained by the descent of the heavy rod, P. To wind up the lamp it is only necessary to raise this column. The carbon pencil is put in place without any adjustment.

The luminous point remains fixed in one place, a very important matter, and especially so in optical experiments. This apparatus gives a clear white light with four Bunsen elements. With more powerful electric sources, several lamps may be illuminated by this system, and thus a subdivision of the electric light may be obtained. With a battery of 36 elements the inventor has operated four lamps, in tension, on a single circuit; these he extinguished and relighted at pleasure, several times; each of the four lamps he extinguished and relighted separately, the other three continuing to shine. Light has been obtained in one of these lamps by the current from a small laboratory Gramme machine. Finally, a beautiful light has been obtained with a Plante battery of 3 elements (secondary). These experiments may be considered as a step toward the application of the electric light to domestic uses.

Fig. 4 shows a newer mechanical arrangement of one of these lamps, which has not been hitherto published. In this device the rotation of the revolving contact is obtained by the pressure of the carbon on the circumference of the disk. By this means the end of the incandescent pencil never leaves the revolving contact, thus avoiding any cause for inequality in the light. The check, which is indispensable, is obtained as follows:

The wheel, B, is borne at the extremity of a lever which articulates at O. The pressure exercised by the carbon on the wheel, B, causes the shoe, S, to rub on the felly of a smooth wheel, A, which is turned by the descent of the heavy rod, P, through the medium of its rack and pinion, *a*. According as the point of the luminous conductor presses more or less on the wheel, B, the check prevents to a greater or less degree the descent of the column, P, the advance of which is imperceptible.

New Mechanical Inventions.

Mr. Lyman B. Howland, of Lakeville, Mass., has patented an improved Picking Motion for Looms, which consists in a peculiar arrangement of cams, levers, springs, and yielding connecting rods, whereby the shuttle is driven at a uniform speed, irrespective of the speed of the loom.

Mr. Joseph Taylor, of New Orleans, La., has patented an improved Machine for Sandpapering or Polishing the surface of blind slats or other articles. The inventor employs a polishing wheel or drum rotated by competent power, and having its inner surface lined with sand or emery paper or other polishing substance. The articles to be polished are placed against a guide or rest next to the polishing surface, and moved back and forth by hand to polish them. An exhaust blower is connected with the polishing wheel to draw away the dust and particles removed by the wheel from the surface under operation.

Mr. Francis J. Ribble, of Campbellsport, Wis., has patented an improved Ratchet Wheel and Pawl Mechanism for rotating shafts by treadle power. This consists in a ratchet wheel and pawl carrier upon the driving shaft, operated by connections from a treadle to cause the pawl to turn the ratchet wheel and driving shaft, and then return the pawl to the starting point. A cord is unwound from a spool to move the pawl and ratchet wheel by winding the cord upon a wheel propelled by the treadle, and the ratchet is returned by the reaction of a spring acting through a cord on a second spool to return the parts to their normal position.

An improvement in Steam Gauges has been patented by Mr. Charles R. Vaillant, of Mobile, Ala. This relates to certain improvements the object of which is to enable the pressure of steam in a boiler to be indicated so as to be seen simultaneously by two or more persons located at different points.

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Exhibition of the Massachusetts Charitable Mechanic Association, Boston, Mass.

It is four years since the Massachusetts Charitable Mechanic Association held their last industrial exhibition. The former triennial expositions were held at Faneuil Hall, Boston, but for the present exhibit, now open, special buildings have been erected that cover an area of two and a half acres, in close proximity to the depot of the Boston and Providence Railroad. The main building is constructed of wood, but the art building is of corrugated iron.

The exhibition as a whole is one of interest. The most prominent feature is the department of fine arts, where there is a good exhibition of oil and water color paintings, crayons, engravings, ceramics, statuary, architectural drawings, chromos, etc.; in the disposition of these good judgment has been shown. In the machinery department, though somewhat limited, there are some machines and mechanical contrivances in operation that for beauty of design and practical utility attract more than ordinary attention. Among these are the boilers and elevators by the Whittier Machine Company; a horizontal engine that drives the machinery in the main building, by C. H. Brown & Co., of Fitchburg, Mass.; looms by L. J. Knowles & Brother, Worcester, Mass.; and cotton spinning machinery by Davis & Furber, North Andover, Mass.

The boilers referred to are two in number, and furnish steam for the building. They are 54 inches in diameter, 16 feet long. Each boiler has 42 tubes, 4 ins. diameter and 15 feet long. The shell is 5-16 inch thick, heads 7-16 inch thick. They are made of homogeneous steel plate from the Cleveland Rolling Mill Co., Cleveland, Ohio. These boilers are set with the Jarvis Furnace setting, and attract much attention, on account of the remarkable economy of fuel attained. After careful examination for three hours we found that steam at 60 lbs. pressure was maintained with fuel 80 per cent. of which was screenings and 20 per cent. of soft coal. At another stage of firing, pomace and screenings were used. There was no artificial draught, beyond the ordinary smokestack, which in this case is 55 feet high, and yet a bright, intensely hot fire was the result. The peculiar construction of the Jarvis Patent Gas-Consuming Furnace has already been fully described in this journal, and to this description we refer all who are interested.

The horizontal engine driving the machinery is one of the finest ever made by the manufacturers, and is admirable in workmanship, efficiency, and high finish. It is rated at 80 horse power. Cylinder is 16 inches diameter, stroke 42 inches. Band driving pulley is 12 feet diameter, with a face of 25 inches. The engine has Brown's variable cut-off, and makes 60 revolutions per minute.

The elevators, by the Whittier Machine Co., of Boston, Mass., are three in number, consisting of one steam and one hydraulic passenger elevator and one steam freight elevator. These are all in constant operation. The steam elevators are technically termed "double screw hoisting machines," and are operated by double upright reversing engines without links. The double upright hydraulic elevator is capable of lifting 3,000 lbs. at a time by the large cylinder, and 1,500 lbs. at a time by the small cylinder. These cylinders are made from the best loam castings, and fitted with the necessary piston, crosshead, guides for the crosshead, sheaves, and the inlet and outlet valves for the entrance and discharge of the water. The sheaves are grooved and bored in a lathe to insure accuracy of form. The piston, crosshead, and the sheaves, etc., attached to them, are counter-balanced by iron weights to render the consumption of water as small as possible, and to prevent the ropes from leaving their places on the sheaves, should the car in its descent meet an obstacle carelessly left in its path. There are two hoisting ropes, a shipping rope, and two counter-weight ropes, all of iron wire. The frame of the car or platform is of ash, well ironed. Its crosshead is ash lined with plate iron, and fitted with Whittier's Patent Equalizing Sheave. The safety apparatus is so arranged that the breakage of either hoisting rope will operate it. The finish of the car is paneled and of good design. The car has an electric annunciator and a gas bracket with rubber tubing to convey the gas to it. The size of the car is about 6 feet square. The machine has a register to record the amount of water used. It has also an automatic stop, independent of the shipping rope, to stop it when the car reaches the upper landing, and specially designed to operate when the shipping rope may get deranged or broken, and to protect the machine and load from the injury which would without it be likely to happen. The machine also has the shipping rope arranged to stop it automatically when the car reaches the upper or lower landings.

The Economy of Good Workmanship and Material.

Five years ago a steam engine, six boilers and some elevating machinery were put into operation at the Boston Post Office. The engine, having the Rider cut off and a Norton ejector, a cylinder 14 inches in diameter, a stroke of 28 inches, a driving band pulley 8 feet in diameter and 18 inches face, working at low pressure of 25 lbs. per square inch, and making 50 revolutions per minute, has not needed any repairs. Keys and screws have been adjusted, but for repairs there has not been an expenditure of one dollar. So with the boilers—48 inches in diameter, with shells of steel $\frac{5}{16}$ inch thick, each having 48 tubes, 3 inches diameter, and 15 feet in length—beyond careful cleaning, there have been no repairs. And yet this machinery for five years has been in operation, on an average, twenty-one hours out of the twenty-four, working efficiently and noiselessly, the admiration of engineers and all visitors. The engine and pumps are elaborately finished in the highest style of mechanical art. The engine, boilers, and elevator were constructed by the Whittier Machine Company, of Boston, Mass., and have been under the charge of Chief Engineer M. G. Wood. The same company have recently erected some fine machinery in the Orient Building, Wall street, New York.

Electric Lighting.

The advancement made of late in lighting by electricity is so full of promise, of such general interest and importance to the public, that we give, in order to call attention to some of its advantages, which are not generally understood, a brief extract from a report from M. Delahaye to the Industrial Society at Rouen, referring to the lighting by electricity at the works of M. Manchon, an extensive cloth manufacturer.

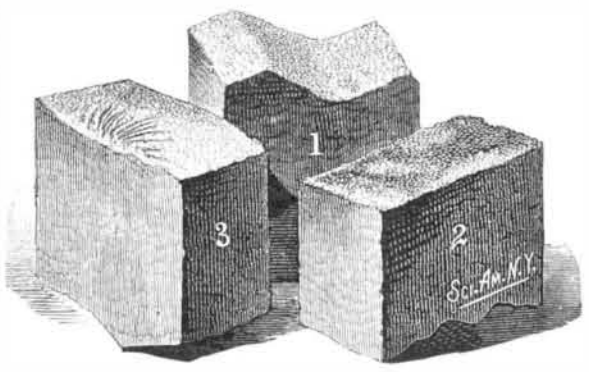
"On entering M. Manchon's factory one is favorably impressed by a striking sense of intense brightness, excited more by the nearly entire suppression of shadows than by the brightness even of the light which pervades the shed. The workmen are very well pleased with the light obtained. The foremen, who, no doubt, are best able to form a comparison between the two lights, since they never quit the building, do not hesitate to declare that the electric light is much superior to the gas light, and that the women, like themselves, are much less fatigued after the long hours by reason of the absence of the heat radiated from the gas-reflectors which were immediately over their heads. M. Manchon has also pointed out to me a considerable advantage in the new light, due to the well-known property of the electric light of not altering even the most delicate shades of color; the errors formerly fallen into by the workmen in renewing broken threads, or in refilling the shuttles, being thus prevented; the quality of the product is, in consequence, sensibly improved."

Comparative estimates of the cost for lighting on various systems might be given, from which the great advantage of the electric light over all other systems of lighting for equal powers would be shown.

Should electric lighting eventually supersede all other methods, as now seems very probable, it will, of course, seriously interfere with the consumption of coal and probably cause considerable reduction in its price, and will, happily, relieve the public from the too common oppressive monopolies of gas companies.

BAUER'S STEEL RESTORING AND REFINING COMPOUND.

Every one who has used steel tools sufficiently to become experienced as to their cutting capacity has discovered the



serious deterioration consequent to the least overheating in forging them, or the least defect in the quality of the steel. The use of burnt or inferior steel involves a serious loss of time and material.

Mechanics generally can form a fair estimate of the quality of steel from the appearance of its fracture, and readily detect the coarse granular appearance accompanying burned steel as well as the fine granular appearance common to inferior steel.

In Figs. 1, 2, and 3 are shown adjoining pieces of steel from the end of the same bar. Fig. 1 is a piece broken from the new bar. The bar was then burned, and the pieces, Fig. 2 and Fig. 3, broken off. Fig. 3 (one of the burned pieces) was then heated and quenched in a compound manufactured by the Steel Restorative Works, of 119 Greenwich avenue, New York city. The grain of the latter is, it will be seen, considerably finer than the original steel. Of this compound Joshua Rose, M. E., says: "I have used it on a tool previously burned, and cut cast iron at 38 feet per minute, taking a heavy cut and coarse feed. I have tried it on burned steel of which a thin spring was subsequently forged, and the results were equally satisfactory."

This compound is also used for annealing purposes, to remove the liability to warping or cracking, the steel being heated and then cooled in the compound, and then reheated and placed in sawdust.

A Queer Boat.

The Portland (Me.) *Argus* says that Captain R. H. Tucker, of Wiscasset, has lately launched a curious boat called "Air Propeller." It is a diamond shape, 90 feet long and 15 feet wide in center; has flat bottom, five masts, covered with very odd-shaped sails, which are three-sided, and every alternate one is placed point down instead of up; the rudder, and in fact every part of the boat, is different from those in use. Captain Tucker is experimenting on some new principles which he thinks may be better than those in use. He will also put a steam boiler in this boat, for the purpose of forcing air underneath, which will be the power used in calms.

Remarkable Earth Convulsions.

A correspondent of the *San Francisco Chronicle*, writing from Apia, Samoan Islands, under date of July 17, says that the most extraordinary convulsions of nature are taking place throughout the island groups of Southern Polynesia, and never in the history of those regions have these convulsions been so frequent as during the present year. There can be no doubt that raging fires of great vastness are now constantly active in the bowels of the earth all through these tropical latitudes, for daily new islands have been formed or old ones blotted out of sight, absorbed into the unknown by tremendous earthquakes. Scarcely a vessel arrives at Apia that does not bring the news of some such gigantic action of nature.

Captain Hassenberg, master of the brigantine Matutu, lately arrived at San Francisco from the Ellis group, and reported that the earth had been acting in a very strange and mysterious manner. The sea encircling the group was constantly agitated, and vast quantities of pumice stone were being thrown to the surface. At the Island of Vaitupu it lay two feet thick upon the reef. When first upheaved it was hot, and occasionally mixed with lava. This phenomenon was believed to be the advance guard of a mighty eruption, and the natives were looking for such an occurrence daily. The group is of volcanic origin.

Reports of a remarkable convulsion of nature came from Tanna Island, and were vouched for by Captain Kilgour, master of the schooner Stanley. The phenomenon occurred on the 10th of January last. At that date a very severe shock of earthquake was experienced, and immediately afterward a body of land, estimated at 40 acres, situated at the north entrance of the harbor, slid into the sea, and was absorbed out of sight, as if it were a pebble.

A New Zealand captain who reached Apia a few days before, brought the intelligence that a disastrous volcano eruption occurred at Blanche Bay, New Britain, in the early part of last February. An old crater that had been inactive during many years broke out with awful and alarming fury, destroying two villages, the natives of which fortunately escaped with their lives. The eruption was preceded by frequent shocks of earthquake, which alarmed the inhabitants, and taking a warning therefrom they fled just in time to save themselves. The shocks were very severe in New Britain, but were not felt on the Duke of York Island, only 20 miles distant. After the eruption it was discovered that great quantities of pumice stone had been thrown up from the sea, the extent being several miles in length and averaging half a mile in breadth. The pumice was spread in a crust of from three to five feet in depth. The old crater is still active and throwing up immense clouds of thick black smoke, accompanied by red hot stones and ashes. A loud roaring is distinctly audible for a distance of 20 miles from the crater. On the 3d of February a terrific shock rent portions of the coast of New Britain, and on the 4th two tidal waves swept with irresistible power along the shore, carrying with them fabulous bodies of earth. The whole face of nature has been changed by these convulsions.

The British war vessel Sapphire, says the *San Francisco Chronicle*, touched at the island of Tongatabu, one of the Tonga group, in April, and leaving there on the 15th of the month steamed for the island of Vavau, a volcanic island which first made its appearance above the water in 1854 and has been constantly growing ever since, but as imperceptibly as a human being grows. The object of the officers of the warship was to note the changes of this growth in the years past. The captain of the ship John Wesley touched at the island in 1862, when it had reached a height of about 12 feet above the level of the sea. A few years later a Dutch captain estimated its elevation at 30 feet, and now it has attained an elevation of 111 feet as correctly measured by the Sapphire. Its summit was covered with sulphur, and large jets of steam and smoke issue slowly from the countless crevices. Except that no volcano is in sight, the ground is precisely like that adjacent to the great crater of Kilauea, on the Sandwich Islands, from which myriads of jets of steam are constantly ejected.

On the 11th of May, 1877, the waters of Apia harbor rose and fell with surprising rapidity. After a little while we had news of earthquakes and tidal waves on the American continent on May 10 of the same year. These waves must have traveled at a tremendous rate of speed. Since the 11th of May last the tides of Apia harbor have been remarkably low. Opposite Matafele the bank, or shoal, has grown considerably; in fact, all round the beach the land seems to have risen.

How to Kill a Tapeworm in an Hour.

Dr. Karl Bettelheim, of Vienna, narrates, in the *Deutsches Archiv*, a heroic method and nearly sure cure in the short space of time of three quarters of an hour to two hours. It is this: He inserts a tube in the œsophagus, to the stomach, and pours down from 200 to 400 grammes of a very concentrated decoction of pomegranate root, having previously had his patient fast for 24 hours. The worm is stupefied, and passed, head and all, to a certainty; the patient has no sickness of the stomach, and no naseous swallowing to do; and the drug is cheap.—*Med. and Surg. Reporter.*

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