paratus is especially adapted. The difference in product obtained by firms using it, as compared with that made by the crude and barbarous methods of open evaporation, is most marked, to say nothing of the economy of production.

In the production of glycerine, the leading manufacturers thoughout the world have adopted the Yaryan system. By its use, an article much nearer anhydrous, viz., 1,264 specific gravity, is produced without loss, than can be obtained by use of the vacuum pan, and at one-half the cost of evaporation.

Among the manufacturers of glycerine using the Yaryan apparatus are Price's Patent Candle Company, of Birkenhead, England; Messrs. Proctor & Gamble, M. Werk & Co., and the American Glycerine Co., of Cincinnati, Ohio.

Other users of the Yaryan evaporator are: Manufacturers of glucose, gelatine, extract of beef, bark and wood extract and caustic soda; as well as slaughtering and rendering establishments, where it is used to concentrate tank water.

The use of fresh water for marine boilers has become a matter of necessity with the progress of engineering and the universal adoption of high pressure. On long voyages the carrying of a supply of fresh water to replenish waste is, of course, not to be thought of. The attention of engineers has, therefore, been urgently directed to processes of distillation of sea water. Nothing that has been found can compare with the Yaryan apparatus for this purpose. Its high evaporative power, its small size and weight, the fact that but a small amount of water is carried in the machine at any one time, its freedom from scaling, its automatic and continuous action, and the ease with which all its parts can be reached for examination and repair, recommend it above all other machines.

For distilled water for domestic purposes, nothing has hitherto been devised which offered a satisfactory solution to the crying need in many of our cities for pure water for drinking purposes. Germs of typhoid and other insidious diseases held in the water, the native element and best of all breeding places for bacteria, cause hundreds upon hundreds of deaths each month. Freezing does not affect them except to make them torpid, so that ice formed on ponds holding the germs of typhoid or typhus may become a deadly poison. For this reason artificial ice made from distilled water is rapidly growing in favor and displacing —even at an increased cost—natural ice, which may bring disease or death into the household.

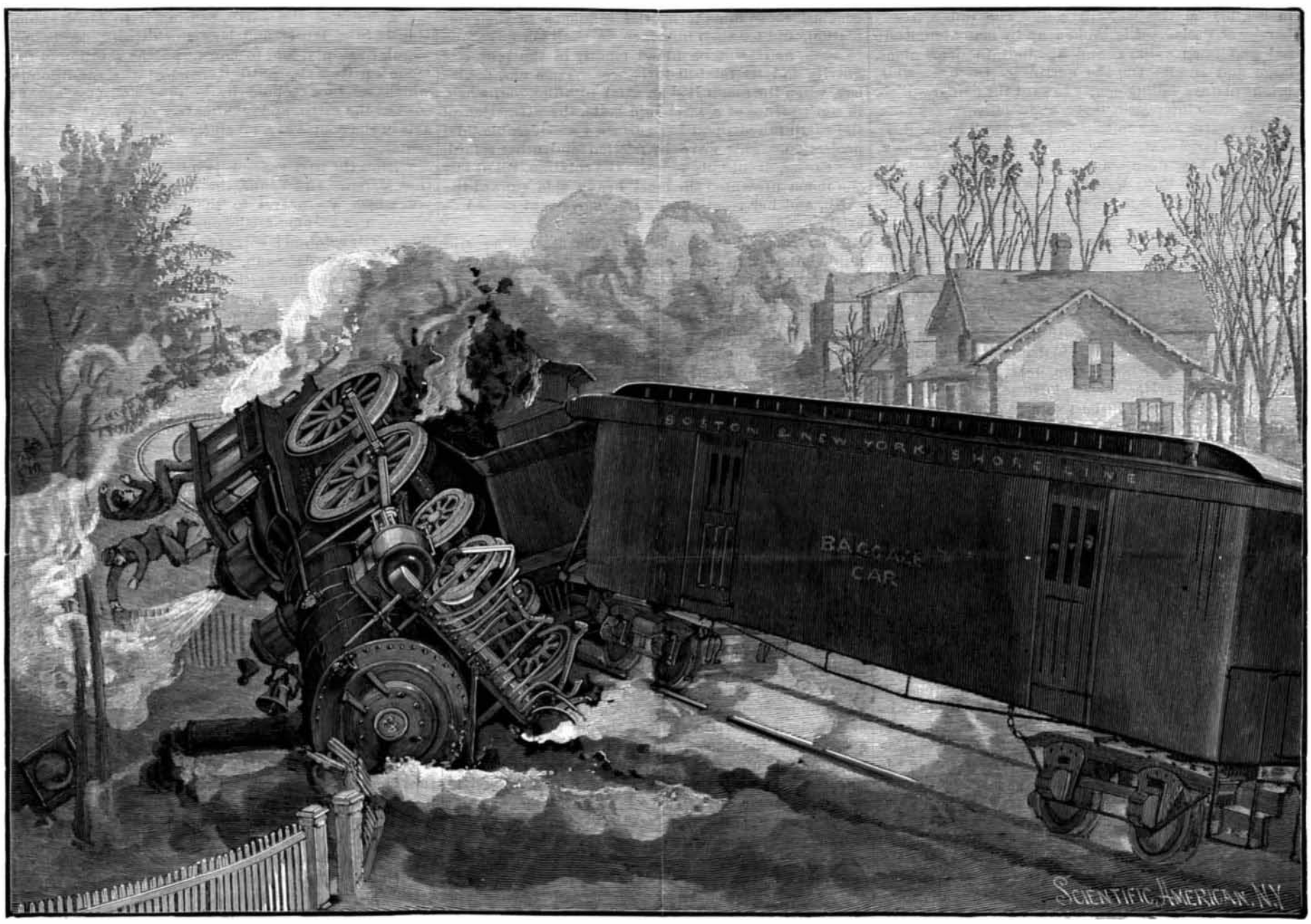
To the manufacturer of artificial ice the Yaryan evaporator, which enables him to obtain distilled water at four times the economy of the old process of distillation, is a *sine qua non*.

In several cities the distribution of distilled water by pipes is seriously contemplated, using the Yaryan process of distillation. At present a large business is done by several companies who furnish distilled water, either in bulk or in bottles, at a cost of from 10 cents a gallon upward. Already a plant for production of distilled water on a large scale is under construction, by means of which it is confidently claimed that absolutely pure water will be produced at a cost of less than fifty cents a thousand gallons.

It may well be considered whether the Yaryan system of evaporation does not offer the much needed solution of the problem of the disposition of the sewerage of cities. By means of this process, a fertilizer could be produced from sewage water which could be sold as a commercial fertilizer.

A REMARKABLE RAILROAD ACCIDENT.

A noteworthy instance of the very singular manner in which railway accidents sometimes take place, and where the escape from great loss of life seems little less than miraculous, was afforded by the wreck on the Shore Line Railroad, a little east of New Haven, on April 18, which forms the subject of the accompanying illustration.



A RAILWAY ACCIDENT—N. Y., N. H. & H. R.R.

The east bound Boston and New York Express left New Haven at 3:05 P. M. The train consisted of the locomotive, one baggage car, and four passenger cars. It had just passed over the long Quinnipiac River bridge, and was rounding a curve, when the flange of the left hand forward truck wheel of the locomotive broke, and a portion of the wheel nearly eighteen inches long flew off. The train had been going at the rate of only about twelve or fifteen miles an hour over the bridge, and the engineer had just opened the throttle for full speed when the accident happened. With the breaking of the flange, the wheel left the track on the curve, the other truck wheels and the driving wheels also being derailed and bumping along on the ties for some distance, as the locomotive was pushed ahead by the impetus of the train, the locomotive being finally turned completely around and thrown to one side of the track, landing in a partially crosswise position over a shallow ditch or gully. The engineer had been leaning from his cab window, and he was pitched forward into the ditch, the locomotive falling over him, but not upon him, so that he was enabled with a little assistance to crawl out, not having received any serious injuries. The fireman likewise went over in the cab and was thrown out into the mud and water of the ditch. The engineer saw the truck wheel strike the ties, and instantly put on the air brakes and blew the whistle.

Just beside the track, at the place where the accident happened, is a private residence, from which the manner of its occurrence was noted by eyewitnesses. It is said that the momentum of the train appeared to lift the rear end of the locomotive, so that the frame of the cow catcher caught in some heavy planking at the side of the track, when the locomotive was made to turn almost a complete somersault before it landed in the ditch. The tender, which had been drawn from the rails by the engine, was finally swung around and landed in the ditch to the rear of the locomotive, its forward end also pointing in a direction opposite to that in which it had been going. The connecting link between the tender and baggage car was broken, and the latter was pushed into an embankment on the opposite side of the track, when all further progress of the train was stopped, the first passenger coach, which had not left the track, being brought to a standstill immediately opposite the derailed and overturned locomotive, which but a moment before was pulling the train.

The damage to the locomotive was by no means as great as might have been expected, although the cab was broken to pieces, the cow catcher broken and its rods twisted out of shape, and the iron sheathing punctured and ripped in many places. The locomotive was built in 1873, and was to have been taken to the repair shops the next week. The engineer testifies to having tried the wheel with a hammer before the train left New Haven, but a few minutes previous to the accident, and that he found it good and sound. It would have been a little remarkable for the truck wheel to have left the track in such a manner had it not been that the engine was on a curve, and the comparatively slow rate at which the train was moving tended to minimize the danger. As it was, there were not a few of the passengers who felt profoundly thankful that the accident had not happened some four hundred feet further back, when the entire train might have been precipitated from the high bridge into the Quinnipiac River.

To get a good polish on mahogany easily: Mix one part of boiled linseed oil with two parts of alcoholic shellac varnish. Shake well before using. Apply in small quantities, with a cloth, and rub the work vigorously until the desired polish is secured.

The Moon.

At a recent meeting of the British Astronomical Association, London, Mr. T. Gwyn Elger read a paper on "The Lunar Walled-Plain Ptolemaus," which was illustrated by lantern slides prepared by Mr. A. Wheeler and exhibited by Mr. Maw. After describing the telescopic aspect of this magnificent circumvallation under a low sun, and the more prominent details which may be seen under these conditions, even in a small achromatic of 2¾ in. or 3 in. aperture, he said that it is an hexagonal shaped inclosure some 115 miles in diameter, the area of the floor being about 9,000 square miles, or approximately equal to the combined areas of the counties of York, Lancashire, and Westmoreland. Its dimensions are so great that, were it possible for any one to be stationed on the floor near the center of the ring, he might easily imagine that he was standing on a boundless plain, so long as he looked only to the north, east, or south, as not a peak or any indications of the existence of the complex and massive border would be visible.

Even on turning westward, one object only would break the monotony of the horizon, and this the upper one thousand feet of the great peak η (nearly 8,700 ft. in height) on the western wall. The rough, rocky barrier of Ptolemaus is broken up by many longitudinal and cross valleys, and abounds in depressions, large and small. On the northwest there is a wide, bright plateau falling gently toward the border, which, among other interesting features, includes a very noteworthy crater row running from the wall to the S. E. side of a large crateriform depression, Hipparchus *r*, which has two deep contiguous craters on its S. W. side. The late Rev. Prebendary Webb found that the direction of this crater row was continued down the eastern slope of *r*, by a delicate cleft, now called "Webb's Furrow." Hipparchus *r* has a central mountain, easily visible under a moderately high sun. The shadow of the mountain η is very conspicuous and beautiful at sunrise, when the three peaks which surmount it may be well observed in very "common telescopes," and the crater near its highest point is very clearly visible on the wall in instruments of moderate aperture. The north and northeast border, and the neighborhood of Herschel and Herschel *d*, include a vast amount of detail hitherto unrecorded, but which will be mapped and catalogued in the monograph of the formation which is being prepared under the auspices of the association.

The floor, in addition to the many craterlets and saucer-shaped depressions and low ridges visible thereon, is traversed by a system of light markings and associated light spots, even more remarkable than those discovered in Plato, Fracastorius, and Archimedes. Between January, 1881, and August, 1883, Mr. A. Williams recorded at least 85 of these faint, light streaks, which objects will, of course, receive the close attention of the section, with a view to confirm his observations. The hexagonal shape of the border of Ptolemaus is far from being a solitary instance of the tendency to a six-sided figure among the larger class of walled and ring plains. The same peculiarity may be noted in the case of Copernicus, and in many other of the so-called rings, large and small. The explanation of this, and also of the fact that arrangement of the mountains and highlands of which it is made up have in many places no apparent relation whatever to the contour of the floor (a structural condition also not confined by any means to Ptolemaus), may be left to the ingenuity of the framers of hypotheses. In describing the eastern wall, Mr. Elger referred to a remarkable gap in it, where for a distance of three or four miles there is no barrier at all between the floor and the outside country. In conclusion, he contended for the importance of the observer acquiring a correct appreciation of the actual size of the formation he studies so as not to underrate the true significance of details. He also urged the members of the section not to attempt to draw more of Ptolemaus, or any other formation, than they can reasonably hope to finish during the course of three or four hours' observation, and to devote themselves to a limited area, or their work would not possess any great selenographical value.

Mr. Green then gave a paper on "The Lunar Seas," which was also illustrated by means of the lantern. He said: On examining a map or photograph of the moon, it will be evident that these seas follow a definite order of arrangement, the smaller being near the limb and the larger nearer the center of the disk. There is not a single instance of these dark areas extending to the limb, and although large craters may be found there, and larger still are revealed by libration, they are not filled with dark matter like the seas. It should also be observed that even when the dark formations come very near the limb, as on the northeast, there is still an unbroken line of bright surface beyond them, so that we have no reason to expect that similar blotches exist on the side turned from the earth. The brighter portions of the lunar surface are separated most definitely from the seas, by being higher, more detailed, and to a great extent covered with crater-like forms. The seas, on the contrary, are lower, comparatively smooth, and craters few and far between. The question then arises, which of these two so widely diversified surfaces is the older? It has been supposed by some that the seas represent the more ancient state of our satellite and that the crater-covered surface has encroached on them; yet this cannot be the case, for the shapes of the seas would then have been that of the spaces left between invading circular forms; but this is not the case; the seas tend greatly to circles, and press forward into the crater-covered surface with a fairly even line, broken occasionally by the remains of partly destroyed craters. Mr. Green illustrated this point by drawings of Fracastorius, the ruins of the north wall of which he pointed out could be seen under favorable circumstances, and of Doppelmeyer, Gassendi, and the Sinus Iridium.

He also showed how the base of the Apennines appeared to be fringed by great masses of debris which seemed to have fallen from their summits. He then resumed: Thus far we have found that the lunar seas are comparatively a recent formation, that they increase in size from the limb toward the center, and that in all probability they exist only on the side which is turned toward the earth: These circumstances point conclusively to some terrestrial influence in their formation, and for such influence we shall not have long to seek, as it will be found readily in the power of gravity and its tidal disturbances. Time was, doubtless, when the moon had an axial rotation, and when, in consequence of a semi-fluid state, the attraction of the earth raised upon her surface a considerable tidal projection. This wave, by friction and other retarding causes, eventually reduced the rotation, till at last the moon presented the most heavy side toward the earth, and her rotation as a free movement ceased to exist.

Then came the formation of the seas. The still liquid interior, in obedience to the powerful attraction of the earth, welled up through every crack and opening, choosing, of course, the weakest places, and, spreading on the surface, reduced it again to the semi-fluid condition, where now it is to be seen in the various forms of these lunar seas. It need not be supposed that these irruptions rose to a higher level than the older crater-covered surface; but that the heated mass cut its way into the general surface which it undermined, and gradually reduced the fallen portions. An example of this may be seen on the eastern edge of the Apennines, near Archimedes. The possibility of this remelting process is evident from the frequent cutting of one crater form into another, portions of the older crater being thoroughly destroyed by the contact.

Mr. Alex. J. G. Adams said: The idea that, owing to tidal action by the earth, lunar seas exist upon the side facing us only, was not quite clear to him. Were we to assume a single tide alone? The effect of gravitation was the production of two tides in a line with the disturbing body, and he thought this state would apply to the moon. Moreover, while in no way detracting from the general hypothesis, and while fully allowing for cleanness at the disk edge, the probability of double tide carried with it the idea of seas upon either side the moon. The point of tidal lag had been touched upon and deserved further remark. Our tidal effects were always in rear of causation, and in some cases there appeared to be a harmonic give and take, as exampled by the fact that whereas the spring tides lagged more and more each spring lunation, the neaps gained, insomuch as to produce occasional overlapping. In the case of the moon, however, it was probable, owing to coincidence in her periods of orbital and rotative motions, that her tidal lag would be comparatively fixed, and seemingly just such as to produce decrease of sea upon her western limb.

Consumption Germs.

Speaking at the Sanitary Convention in Vicksburg, Miss., of December, 1889, Dr. A. Arnold Clark, of Lansing, Mich., as reported in *Popular Science Monthly*, accepted the germ as the chief source of the disease, and referred to experiments in which the germs had been found on the walls of rooms where consumptives had been. They are derived from the dried sputa of the patients. Animals, according to Dr. Cagny, feeding on the sputa die of consumption, and the disease has been produced by inoculating with the sputa, by swallowing it, and by breathing it. "When we think of the ten thousand consumptives in Michigan who every hour in the day are expectorating along our streets, and even on the floors of public buildings, post offices, churches, hotels, railroad cars, and street cars, when we think how these germs are being dried and carried into the air by every passing breeze, by every sweeping, and how they are capable of producing the disease six months after drying, when we think of the miscellaneous crowd sleeping in hotel bedrooms, when we think of the close, unventilated sleeping car with hangings and curtains so well calculated to catch the germs, and where, as some one has said, the air is as dangerous as in those boxes filled with pulverized sputa where dogs are placed for experiment, then when we remember that man's lungs are a regular hot house for the multiplication and growth of these seeds of consumption—is it any wonder that one citizen in every seven dies of this disease?" As the lesson from these facts, the author advises that no consumptive should be allowed to expectorate on the floor or street, and all sputa (from consumptives) should be disinfected and burned.

The Tides and the Stars.

One of the most interesting steps in the wonderful advance of astronomy during the last forty years is that taken a few years ago by Prof. George H. Darwin in his investigation of the effects of tidal action in the evolution of the solar system. According to Prof. Darwin's conclusions, the moon was born directly from the earth in the molten stage of our planet's history, and at the beginning of its career revolved rapidly around the earth at very close quarters. At that time tremendous tides were raised upon each of these plastic masses through the attraction of the other. By means of reactions, which can be demonstrated readily with simple geometrical figures, although their full analytical investigation is an intense mathematical process, the effect of the tides is both to drive the moon gradually away from the earth, causing it to revolve constantly in a larger and larger orbit with decreasing angular velocity, and to slow down the rotation of the moon on its axis, until it reached the condition in which we now behold it, keeping one face always toward the earth, and making but one rotation on its axis in the course of a revolution around its terrestrial center.

Within the past year or two it has been discovered that Mercury and Venus, the only planets of our system which are nearer to the sun than the earth is, behave in a manner analogous to that of the moon, so far as their rotation is concerned. They always keep the same side toward the sun, ust as the moon always keeps one face toward the earth. It is not improbable that these planets may have been brought into their peculiar condition by the effects of tidal friction, although the problem presents great difficulties.

Quite recently an attempt has been made to apply the principle of tidal evolution to those wonderful solar systems known as the double or binary stars. Mr. T. J. J. See, of Berlin, has made a mathematical investigation along this line which leads him to some exceedingly interesting conclusions concerning the constitution of the universe. In a binary system there are two suns, often far exceeding our sun in magnitude, which, held in comradeship by their mutual attraction, revolve around their common center of gravity, carrying their families of planets, if such they have, round and round in ceaseless gyrations. One remarkable feature of such systems is that the orbits of the revolving suns are exceedingly elongated ellipses, differing in this respect very widely from the nearly circular orbits of the planets in our system. Another feature is that, while one of the members of the combination is almost always noticeably smaller than the other, yet in no case is the disproportion of magnitude anything like so great as that which exists between even the largest of our planets and the sun.

Both of these peculiar features of the binary stars are explained by Mr. See's hypothesis. He concludes that the fact that the two stars are always comparable in size indicates that they owe their origin to the splitting up, through the effects of rapid rotation, of a condensing nebulous mass which was nearly homogeneous throughout its volume. He shows, mathematically, that the greater the departure from absolute homogeneity in the parent nebula, the wider the difference in magnitude of the two masses after the separation would be. His investigations lead also to an explanation of the highly eccentric orbits of the binary systems, by showing that the effect of tidal reaction between the two masses after separation had taken place would be not only to drive them gradually apart, but to increase the eccentricity of their orbits.

Perhaps the most interesting thing that Mr. See points out as a deduction from his investigations is that we cannot take our solar system as a type of solar systems in general. The smallness of our planets in proportion to the sun, and the near approach to circularity of their orbits, indicate that our system resulted from exceptional conditions, which, perhaps, have not been precisely duplicated. This conclusion will undoubtedly be welcomed by those who hold with Dr. Whewell that ours is the only inhabited world, and yet, surely, proof of the infinite diversity and variety of the universe cannot militate against the belief that nature is as perfect in binary systems and in sun clusters as in our little corner of space.—*N. Y. Sun.*

PROF. ELIHU THOMSON finds in his experiments on the physiological effects of alternate currents that the danger of the current diminishes as the number of alternations per second is increased. Thus it took twenty times as strong a current to kill a dog when the alternations were 4,500 per second than when they were 120 per second. When the alternations were 300 per second, the current was only half as dangerous to life as when the alternations were 120.

The Origin of Petroleum.

In a late number of the Austrian *Zeitschrift fur Berg- und Huttenwesen,* Professor Hoefer sums up the discussion of this subject, and claims a substantial victory for the theory of the animal origin of petroleum, which he has steadfastly maintained since 1877.

The arguments in favor of this theory were at first chiefly drawn from the observed geological conditions of the occurrence of petroleum; and the principal argument against it has always been a chemical one. It has been urged that the absence of nitrogen in petroleum must be fatal to the theory of its animal origin, because an oil produced from animal substances could not fail to be nitrogenous. One answer to this argument was furnished when Dr. Engler actually produced from blubber and other animal fats an artificial petroleum, free from nitrogen, as might have been expected, since the fats are non-nitrogenous. And Engler declares that the absence of nitrogen in natural petroleum is a necessary result of its production from animal remains, because the nitrogenous flesh decays rapidly and assumes soluble forms, so that it would be removed before the fat, which is peculiarly stable, began to be transformed by the slower process of dry distillation. This proposition was confirmed by Dr. M. Albrecht, who treated several thousand mussels and fishes in this way, and found that the ammonia and nitrogenous organic bases incidentally produced were easily removed by reason of their extreme solubility in water.

But Peckham's examinations of the petroleum of California, Texas, West Virginia, and Ohio showed the presence of nitrogen, and led to the general acceptance for these oils of the theory of an animal origin, which was still denied by many for the non-nitrogenous Pennsylvania oil. Prof. Hoefer, however, still held to his former view, declaring the geological conditions of the Pennsylvania and New York oil fields to be such as could not be reconciled satisfactorily with the hypothesis of vegetable origin.

In his latest paper he repeats and enlarges an argument based on the presence in natural gas of more nitrogen than can be accounted for by an admixture of air. If natural gas be admitted to have resulted from the decomposition or distillation of animal remains, the probability of a similar origin for petroleum is greatly strengthened.

The large percentage of nitrogen in the natural gas of Pennsylvania—amounting to something more than 25 per cent—is well known. The gases in Baku have been shown to be nitrogenous likewise. Certain earth gases in Alsatia have yielded by analysis up to 17 per cent of nitrogen. And in all these cases the amount of oxygen, free or combined, revealed by the analysis is too little to account for the nitrogen as derived from an admixture of air.

To these evidences, Professor Hoefer now adds the analyses of the natural gas of Ohio and Indiana, as given by Orton in the *Economic Geology of Ohio* and by Howard in the *Mineral Resources of the United States* for 1888. All three of Professor Howard's analyses and two of the four given by Orton show an excess of nitrogen over the amount necessary to form air with the total oxygen.

Moreover, the gases from the mud volcanoes of northeastern Italy have been repeatedly analyzed; and Professor Hoefer cites 13 analyses, the provinces of Bologna, Florence and Ravenna, in which the amount of nitrogen clearly bears no relation to that of oxygen (here present as CO_2).

A further proof is drawn from the interesting report, published last summer by Gumbel, on the mineral and geological character of the samples taken from the sea bottom during the scientific exploring voyage of the Gazelle. In samples taken from depths of 500 meters and over, fine globules of fat were found—similar in character to the *adipocere* sometimes found in ancient graves, or the fat still remaining in some fossil bones. Director Gumbel recognizes the possible significance of this discovery in connection with the origin of petroleum. It is clear that, to some extent, the *adipocere* of small marine organisms is at the present time accumulating in the ooze of the deep sea bottom. The frequent presence of petroleum in nummulitic Eocene strata is at once suggested as a related phenomenon; and I may add that the petroleum found in the Niagara limestone, and particularly in the pores of *Favosites niagarensis*, seems to be another corroborative occurrence.

The contention of Professor Hoefer may be considered, perhaps, as still lacking complete demonstration—that is to say, it may be said that he has not proved the animal origin of *all* petroleum or absolutely disproved the vegetable origin of that of the Pennsylvania field. But it seems to me that he has made out a strong case, and that the chemical argument once relied upon in opposition to his theory has been much reduced in force, if not entirely destroyed.—*R. W. R., in Engineering and Mining Journal.*

NEW LANTERN EFFECT.

Not every one can go to Europe, but, possessed of a lively imagination, one may go there in spirit, provided only that the scenes are presented pictorially in a truthful and artistic way. Thanks first to the skill of the optician, and secondly to the modern photographic art, any one may be instructed and entertained by the modern lanternist, who will produce storm or sunshine, winter or summer, or the soft effects of moonlight at will upon the screen by the skillful manipulation of the optical lantern with a truly wonderful effect, but there are many effects which seem to be difficult of execution by means of the optical lantern. The saying is, "See Naples and then die;" but what is seeing Naples without seeing Vesuvius in active eruption? Comparatively few European travelers have the good fortune to witness this phenomenon, and until now, so far as we are aware, no one has been able to faithfully represent this awe-inspiring spectacle.

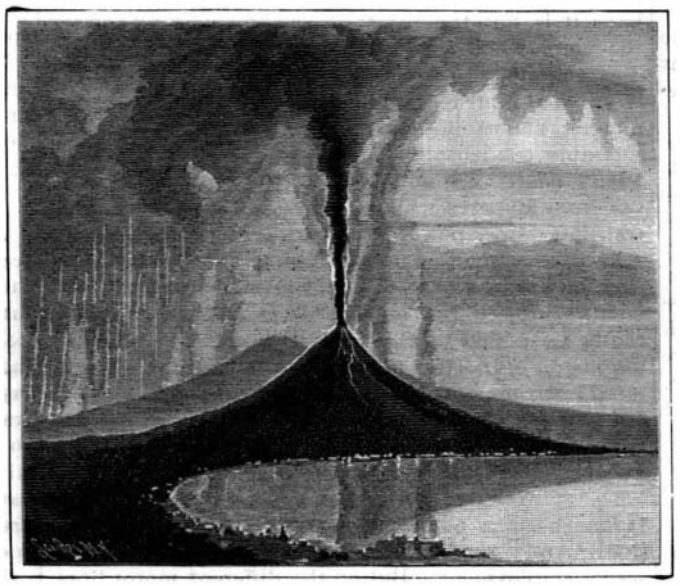


Fig. 1.—ERUPTION OF VESUVIUS.

Mr. H. C. Ogden, of Middletown, N. Y., has come to the aid of the lanternist and the non-traveler, by producing a very simple apparatus by means of which Vesuvius, in full eruption, may be projected on the screen in a very vivid and realistic manner.

Fig. 1 of the engravings shows the scene as it appears on the screen, and Fig. 2 shows the apparatus by which the effect is produced. The main idea of Mr. Ogden is illustrated in this apparatus, but our artist has added an improvement which is designed to represent the flowing lava as well as the upwardly projected flame and smoke.

In a glass tank attached to the lantern are inserted two curved drop tubes, with their extremities placed side by side, and on the rear of the tank is painted a picture of the volcano, which is represented mainly in profile by black varnish applied to the glass. The tips of the drop tubes coincide with the crater of the volcano, and from the crater down the sides there are transparent streaks representing lava. To the side of one of the clamps holding the tank together is attached a spring carrying a strip of metal which extends along behind the opaque portion of the picture, and is provided with teeth, as shown in dotted lines, which are designed to irregularly eclipse the transparent streaks.

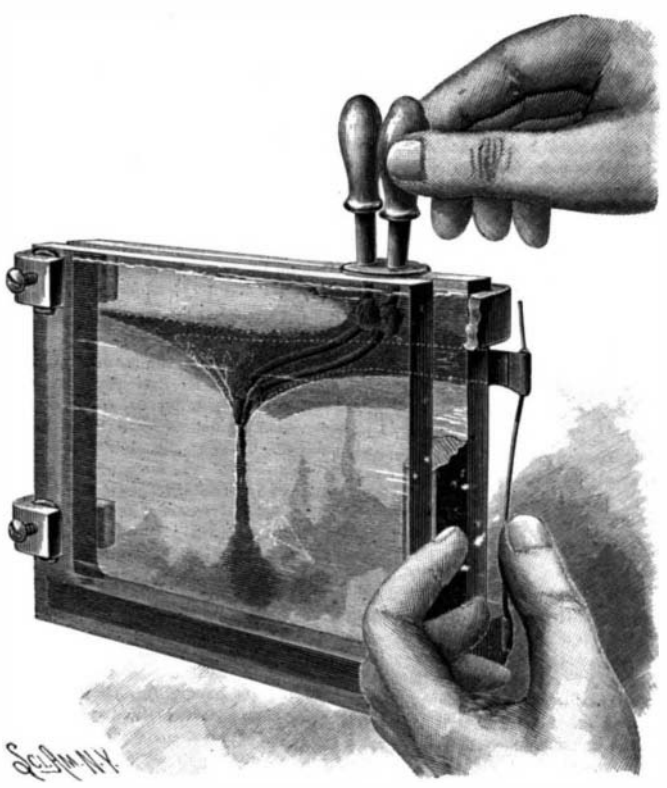


Fig. 2.—APPARATUS FOR PRODUCING THE VOLCANIC EFFECT.

In one of the drop tubes is placed a dark liquid, such as diluted ink, and in the other is placed a bright red liquid, as red aniline ink. The tank is filled with a solution of glycerine and water and inserted in the lantern. Dexterous manipulation of the flexible bulbs of the drop tubes produces red and dark streaks representing fire and heavy smoke, which are forced down in the tank and have the effect of rising in the image on the screen. At the same time the manipulation of the spring at the side of the tank alternately displays and covers the streaks representing the lava.

Electric Cars Run by Waterfalls.

The advance in all electrical matters is really marvelous. Last week we noticed the fact of a village in the Alps being lighted by electricity, the power being derived from a water wheel. And now comes this week's *Engineer* and tells us that in the town of Dover, on the Salmon Falls River, on the division line of Maine and New Hampshire, the water power furnishes not only light and heat to that town but to several distant towns also. Power is also furnished to a street railway seven miles in length. The water wheel has a capacity of 500 horse power.

Greenwood Springs, Col., is in a blaze of electric light; mills, pumps, hoists, and tramways are successfully run miles away from the power station at the falls. During the winter months the Pelton wheels, though incased in ice for weeks together, keep spinning away without cessation.

In the north of Ireland, the Giant's Causeway electric railway, eight miles in length, derives its power from two Alcott turbines, that drive dynamos which deliver electric power to the motors of the railway.

At Burgenstock, near Lucerne, Switzerland, there is an electric mountain railway, which, with its appurtenances, is a triumph of engineering. The Burgenstock is almost perpendicular; from the shore of Lake Lucerne it is 1,330 feet, and it is 2,800 feet above sea level. The total length of the road is nearly a mile, and it is operated by two dynamos of 25 horse power, worked by a water wheel of 125 horse power. Between Pazzala and Lugano, in Italy, there is a large waterfall, which supplies the water conducted through iron pipes to the dynamo room, where two Girard turbines, of 300 horse power each, run two dynamos, one for continuous and one for alternating currents, the former working the tramway motors, the latter supplying nearly 2,000 16 candle power lamps at the hotel and in private buildings.

Haulage of Canal Boats by Locomotives.

At a meeting of the Railway Union in Berlin, says *Iron*, Herr Wiebe described some experiments recently made on two lengths of the Oder and Spree canal, 3½ miles long in all, with a view to ascertain the best method of towing large boats. The submerged chain system is, he states, unsatisfactory, nor has the endless rope system of traction given entirely satisfactory results when practically tested during the course of the experiments, though a great many types of supporting posts and pulleys were tried. The difficulty encountered arose from the rotation of the rope as it moved onward, which tended to twist the boat painter about the rope, and the form of connection between the rope and the painter could not be depended on to stop this action. Further experiments were then made by attaching the rope to the center of gravity of a heavy towing car drawn by a light locomotive, such as is commonly used in mines. If the rope is attached directly to the locomotive, trouble may arise from the side pull of the rope tending to overturn the engine. It is for this reason that the towing car was adopted in the experiments in question. This plan is stated to have proved satisfactory, and boats have been towed by it at the rate of from 10 to 12 feet per second (7 to 8 miles per hour), though a speed of 5 feet (3½ miles per hour) will, in general, be sufficient. The tension on the tow rope in starting three heavy coal barges was as much as 1,764 pounds, but rapidly decreased as the boats gathered way.

Improvement in Microscopic Lenses.

It is stated that an immense improvement has recently been effected in the manufacture of glass for optical instruments by means of the addition to the ordinary materials of phosphorus and chlorine, which in some as yet unexplained way cause the glass to be very much more transparent, and enable it to receive a much higher degree of polish than any optical glass hitherto manufactured. Thus microscopes can be made which will render objects of the diameter of only the one eight-millionth of a millimeter visible, whereas with the best instruments now in use the diameter of the smallest object that can be seen is one sixteen-thousandth of a millimeter. This news, we fear, is too good to be true.