Opaque Engraving of Glass.

In *Dingler's Polytechnic Journal*, Mr. Lainer gives two formulas that permit of preparing solutions for the opaque engraving of glass at a relatively low cost.

I. Two solutions are mixed, one of 10 grammes of soda in 20 grammes of water and the other of 10 grammes of carbonate of potash in 20 of water. To this is added 20 grammes of concentrated hydrofluoric acid, and then a solution of 10 grammes of sulphate of potash in 10 of water. On adding a small quantity of hydrofluoric acid, the appearance of a fine grain is obtained upon glass.

II. The second formula consists of 4 cubic centimeters of water, 1⅓ grammes of carbonate of potash, 0·55 cubic centimeter of dilute hydrofluoric acid, and 0·5 cubic centimeter of sulphate of potash. The desired degree of opacity of the glass is obtained by the alternate addition of hydrofluoric acid and carbonate of potash.

There is a still simpler process, due to Mr. Kampan, of Vienna.

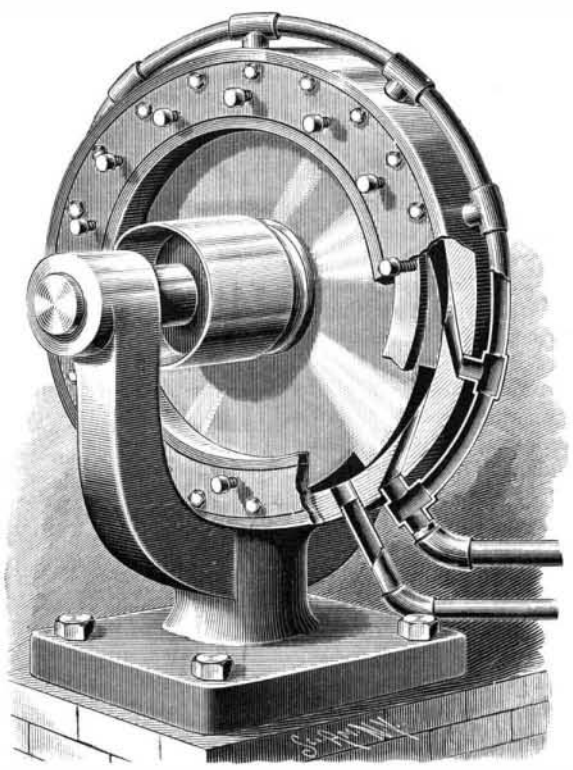
Hydrofluoric acid is neutralized with a few crystals of soda, and the fluoride of soda thus obtained is diluted with five or six times its volume of water. A good proportion is obtained with 240 cubic centimeters of commercial hydrofluoric acid, 600 grammes of powdered crystals of soda, and 100 cubic centimeters of water. The bare surface of the glass is submitted for a few minutes to the action of the ordinary solution employed for engraving (one-tenth of hydrofluoric acid), and then the plate, after being washed, is dried with a sponge. After this the preceding solution is poured upon it for opaque engraving, and allowed to remain for an hour. The liquid is then poured off and the surface is washed with water. The water is left upon the glass until a thin pellicle of silicate forms upon the surface. By varying the duration of the action of the solution, various degrees of opacity may be obtained. If the latter is too great, it may be diminished by a new solution of hydrofluoric acid for engraving.—*Revue Industrielle.*

The Steam Haulage of Canal Boats.

At a meeting of the Railway Union, in Berlin, 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 post 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, running behind and 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 ft. to 12 ft. per second, though a speed of 5 ft. will in general be sufficient. The tension on the tow rope in starting three heavy coal barges was as much as 1,764 lb., but rapidly decreased as the boats gathered way.

AN IMPROVED ROTARY ENGINE.

The engine shown in the illustration, and which has been patented by Mr. Laban J. Everest, is very simple in construction, and designed to be durable and effective in operation, utilizing the motive power to the greatest advantage. The frame supports a cylinder made in the shape of a ring having an annular recess, closed at one side by a ring-shaped head, while the outer edge of a piston extends centrally into this recess on the inner side of the cylinder, the piston being made in the shape of a wheel on a shaft turning in suitable bearings of the frame. The wheel-shaped piston has recesses or buckets in its periphery, against



EVEREST'S ROTARY ENGINE.

which the steam is tangentially directed through angularly arranged inlet ports in the cylinder. The outer ends of these ports are connected by short branch pipes with a pipe extending almost entirely around the cylinder, the latter pipe being connected at one end with the steam supply source and closed at its other end. The series of inlet ports follow each other at equal distances around the cylinder, and following them is an exhaust port connecting with a pipe leading to the outside. By this arrangement all but one of the buckets in the periphery of the piston are kept constantly filled with live steam, each discharging as it reaches the exhaust port. To insure the steam-tight rotation of the piston in the annular recess of the cylinder, packing rings are provided, to be pressed against the sides of the piston by set screws placed at suitable distances apart in each outer side of the cylinder.

For further information relative to this invention address Messrs. Everest & Betterman, No. 1437 North 24th Street, Omaha, Neb.

THE JAMAICA EXHIBITION.

This "isle of springs," as its native name signifies, has had a somewhat checkered career. Discovered by Columbus on his second voyage, in 1494, it remained in possession of the Spaniards for upward of a century and a half, during which period the native Indians were—as was usual in the early days of colonization—almost exterminated, and the importation of African blacks was commenced—a sowing the seeds of slavery of which the British empire had to rid itself at a fearfully large cost. The negro population in the West Indies is happily now the only memento of what has been well called "a kind of incubus upon the empire throughout the eighteenth century."

In 1655 Admiral Penn and General Venables captured the island, as an attempt to compensate for the lack of success which had attended their expedition against Hayti. Thus Jamaica became a British possession at a time when England was beginning to feel her supremacy at sea, and to supersede Spain and Portugal as a colonizing power. It became one of the foundation stones of the Greater Britain of to-day.

Six years after its conquest regular government was established in Jamaica under Colonel d'Oyley; but the later prosperity of the island is due in great measure to the wise and energetic policy of Sir Thomas Modyford, who was sent out as governor during the reign of Charles II. During the following years it was the resort of numerous buccaneers, who there found a coign of vantage from which to conduct their marauding expeditions. In 1782 it was saved from a threatened invasion of the combined fleets of France and Spain by the memorable victory of Rodney over the Compte de Grasse, for which he was raised to the peerage. A marble statue by Bacon was erected to him in the then capital, Spanish Town, but it has recently been removed to Kingston, and now overlooks the bay, the finest of Jamaica's thirty harbors, all capable of affording shelter to large vessels. Other important features in the history of the island have been invasions by the Picaroons of Cuba, occasional rebellions on the part of the blacks, political differences with the home government, hurricanes, earthquakes, the largest of which almost totally destroyed Port Royal in 1692, and the Gordon rising in 1865.

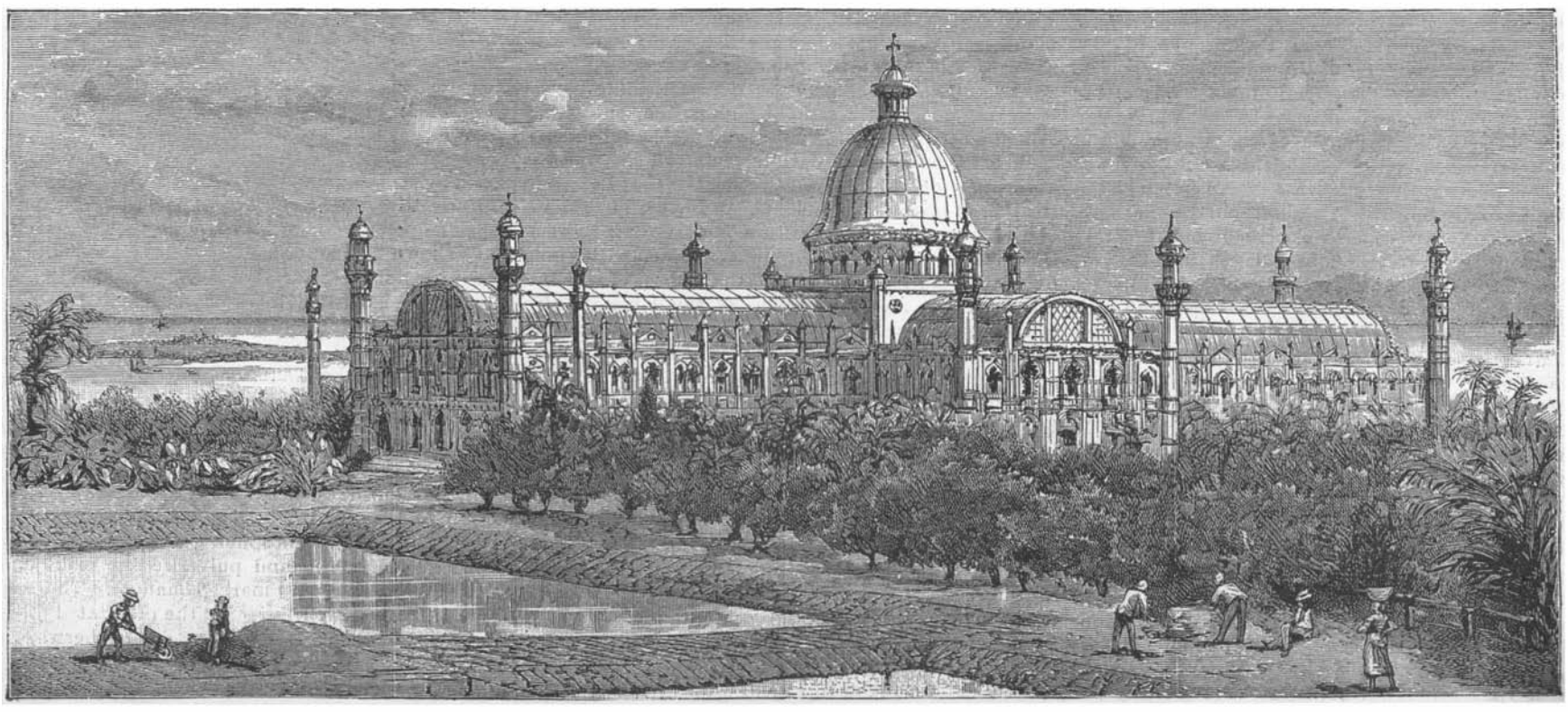
The climate of Jamaica, which is equable, has been compared to that of the Riviera; it is also varied, as the high lands offer a pleasing relief to the heat sometimes felt on the seaboard. The vegetation is in parts typical of tropical luxuriance, and in parts mountainous rocks rise bare and rugged; the river scenery, too, with its numerous waterfalls, is very picturesque. The sea teems with fish, song birds abound, and the island is a veritable happy hunting ground for the naturalist and botanist, as Gosse and Kingsley have testified. To the hospitality of its inhabitants Mr. Froude has lately borne witness.

Situated as it is on the highroad to the South American continent, its importance would have been greatly increased had the Panama canal become a reality.

The existing railroads in the island are being extended, and Kingston will shortly be connected by a short line with Montego Bay and Port Antonio on the north coast. Road making is being rapidly pushed on, and must materially increase the chances of successful transport of fruit and other produce to European markets.

That there is plenty of scope for the further development of the natural resources of the island is evident when we read that three-fourths of the arable land is at present lying fallow.

Those who inaugurated the Jamaica exhibition had two objects in view—the demonstration to the world at large of the natural resources of their island, which



THE EXHIBITION BUILDING, JAMAICA.

are undoubtedly most varied, and which place Jamaica at the head of the British West Indian Islands, and the introduction into the island of the latest improvements in machinery for the further development of these products. The glories of the sugar plantations have been dimmed by a series of circumstances over which the Jamaicans had but little control, *e. g.*, the bountiesgranted by France and Germany for beet root sugar and the increase in the cost of labor (a result of the emancipation of the slaves), etc. The loss to the island on this score is not so great as has been stated, for it is said that not more than five per cent of the total population are interested in the production of the sugar cane. There are, moreover, other products in the island besides sugar, such as rum, tea, coffee, cocoa, tobacco, annatto, pimento, beeswax, lime juice, and fruits of all kinds, including oranges, bananas, mangoes, pineapples, and many of which the names are almost unknown in England—"sweet sop," "cherimoyer," "star apple," and the "alligator pear," all of which are said to be of excellent flavor. In addition to the fruits, turtle, both prepared and dried, and tortoise shell, are all capable of yielding fair profits. Already the fruit trade with America is progressing, and when the transport to the coast is rendered easier by the completion of the new roads under construction, and the art of packing is better understood, it is hoped that large cargoes of fruit will be successfully shipped to England and the Continent, and these native products of the island become one of its most staple supports.

Time was when oranges were obtainable in England only during the winter months; now, thanks to powerful steamships, this acceptable fruit is to be had almost all the year through, and there is no reason why a large number of them should not come from Jamaica, where the orange tree grows luxuriantly without cultivation.

The exhibition is held under all the favorable auspices that official sanction and guidance can give. The president, and in fact originator, is Sir Henry Blake, the governor. Its commission was appointed by law and approved by the Secretary of State, and it was opened on the 27th of January last by his Royal Highness Prince George of Wales.

For the above and our illustration we are indebted to the *Graphic*.

The following is from a letter in the *N. Y. Times:*

The exhibition building of the Jamaica Industrial Exhibition, which was formally opened January 27, in the form of an immense cross, occupies the central point of the plain of Liguanea, and the grounds cover twenty-three acres, which are broken up by walks and drives. The grounds are about a mile and a half from the harbor and about 200 feet above the sea level. The long arms of the building point east and west, and at the intersection rises a great dome 100 feet high. The cupola is gilded and finished to the ground in decorations of the Moorish order. The nave has a circular roof 54 feet high, supported by long lines of pillars. The building is lighted throughout by electricity, and from the top of the dome at night a great electric search light throws its glare far out over the harbor.

In the main hall of the exhibition, Jamaica reserves the central spaces for herself. Canada has the largest area, having two of the central compartments and three on each side of the main hall. England, France, Germany, Austria, and the United States come next, in the order mentioned. The display in the United States court is anything but creditable to the country, and owes whatever credit it deserves to the enterprise of private individuals. It occupies one of the central and one of the side compartments, with a small space in the gallery. The firm of G. J. De Cordova, of New York, represents a number of United States firms, who have some exhibits, and Mr. De Cordova is one of the exhibition commissioners.

Among the business houses of the United States which are represented by exhibits are Schwarlzer & Co., who make a display of desks of American manufacture elegantly finished in walnut, cherry, and oak. They also show a handsome suit of bedroom furniture in oak, which is a revelation to some of the other exhibitors of goods of the same character. A toilet set of oxidized silver, consisting of ewer, basin, and soap cups, beautifully chased, is exhibited by Simpson, Hall, Miller & Co.

The Singer Manufacturing Company exhibits a sample of its machine with a vibrating shuttle that interests the ladies as something not seen here before. It has a table cover leaf, three drawers, and automatic bobbin winder, with a full not of all attachments. Its new drop cabinet machine is the first of its kind seen in Jamaica. The company also exhibits a machine for manufacturing purposes which takes 2,000 stitches a minute, and is adapted to work on heavy cloth and leather fabrics.

Burroughs, Wellcome & Co., New York and London, exhibit the Stanley medicine chest, a facsimile of that used by the explorer in Africa. Lascelles, De Mercade & Co. have erected a pavilion opposite machinery hall for the exhibition of their New York and London firms. The building is in the shape of a T and was built by the Harvey Lumber Company of Chicago. It was sent to Kingston in sections all ready for the carpenters, and is a model structure. The roof is of corrugated tiles and is surmounted by three flagstaffs, from which float the stars and stripes, the Jamaica and the English flags. The interior is finished in Georgia pine, with a very fine effect.

Among the more notable American exhibits here are these: Edmund C. Cole, of New Haven, Conn., has a splendid assortment of buggies and carriages; Aspinwall & Co., a fine display of enamels; the Ansonia Clock Company makes a creditable exhibit of its clocks and bronzes; Simpson, McIntyre & Co., an exhibit of butter; the Binghamton Oil Refining Company shows a variety of the manufactured products of petroleum; Mackellar, Smith & Jordan, the Philadelphia type founders, send a display of American type tastefully arranged in the large show cases, and a number of books, pamphlets, and newspapers that speak in the highest terms for the progress of the typographical art in the United States. The Edison Mimeograph Company exhibits its wonderful copying machines, and the National Typewriter Company has a corps of operators working their machines. The Domestic Sewing Machine Company's exhibit is the wonder of the women folk, and the Sheperd Hardware Company send for inspection a great variety of ice cream freezers, just the thing for this climate.

The Cannon Hollowware Company displays kitchenware, and the Sidney School Manufacturing Company has a well arranged exhibit of school furniture of all kinds. The Archer Company shows an American barber chair that suggests peace and comfort, and the Amberg File and Index Company's display of letter files and cabinets is a notable collection.

Concerts are to be given in the pavilion on the Wilcox & White organs and on the instruments of the Chicago Cottage Organ Company, both of which make fine displays. Carr & Co., of New York, make an exhibit of agricultural machinery that is specially interesting, as it is adapted for the preparation of the products of this island. Marburg Brothers, of Baltimore, have a tasteful exhibition of various brands of their tobaccos, and the stoves shown by L. Bennett & Sons should tempt the natives to discard the use of oil stoves, which are now in general use.

Natural History Notes.

How the Muskrat Breathes under Ice.—Animals that breathe by means of lungs can prolong their stay under water only through special anatomical arrangements, or by having recourse to some extraneous means. Mr. W. Spoon, of the Elisha Mitchell Society, who has hunted the muskrat in winter, asserts that the animal, when obliged to traverse, under ice, a pond so wide that it cannot keep up its breathing, stops from time to time and exhales the air from its lungs. This air, being confined by the ice, becomes oxygenated in contact with the water, and the animal, taking a fresh inspiration, dives in order to begin its swimming again a little further along. It appears that other observers have found that if this air is dispersed through the ice being struck, the animal is killed through asphyxia.

Absorption of Organic Matter by Plants.—In a communication from Prof. Calderon, of the Institute of Las Palmas, Canary Isles, he contests the ordinary view that the nitrogen of the tissues of plants is derived entirely from the nitrates and ammoniacal salts absorbed through the roots. He does not, however, adopt the old theory that the source is the free nitrogen of the atmosphere, but rather the nitrogenous organic matter which is always floating in the air. The nutrition of plants he divides into three classes: *necrophagous*, the absorption of dead organic matter in various stages of decomposition; *plasmophagous*, the assimilation of living organic matter without elimination, or distinction of any kind between useful and useless substances, such as the nutrition of parasites; and *biophagous*, the absorption of living organisms, such as that known in the case of insectivorous plants. A further illustration of the latter kind of nutrition is, according to Prof. Calderon, furnished by all plants provided with viscid hairs or a glutinous excretion, the object of which is the detention and destruction of small insects. To prove the importance of the nitrogenous substances floating in the air to the life of plants, he deprived air of all organic matter in the mode described by Professor Tyndall, and subjected lichens to the access only of this filtered air and distilled water, when he found all their physiological functions to be suddenly suspended. —*Nature.*

Life of Lichens during Winter.—Of all plants, lichens are the ones that most easily endure the lowest temperatures. They are met with in profusion in the polar regions and at the highest altitudes, where no other plant can subsist. The causes of this peculiar resistance being unknown, Mr. H. Jumelle decided to ascertain how, from the standpoint of gaseous exchanges with the atmosphere, the lichens of our country behave during the winter. The study of this point was evidently capable of throwing light upon the question of the resistance of these plants. The results obtained by Mr. Jumelle, and recently communicated to the Society of Biology, are as follows:

In our country, when the temperature descends below zero, lichens enter upon a retarded course of life due less to the lowering of the temperature than to a loss of water. In lichens that grow under shelter and on the ground, the loss of water being less, the gaseous exchanges will be merely decreased, and remain sensible. On the contrary, in lichens living upon trees and exposed to the air, desiccation occurs to a considerable extent, and life is then so retarded that, in darkness as well as in light, the gaseous exchange no longer becomes appreciable. If, by chance, the lichen contains a notable proportion of water, the freezing of the latter produces an effect analogous to that of desiccation, and the gaseous exchanges are again of the feeblest character.—*Revue Scientifique.*

How the World Appears to the Lower Animals.—In addition to the organs of hearing, touch, and smell, Sir John Lubbock has found upon the antennæ of insects certain organs that seem to be connected with senses that we know nothing about.

Experiments made upon certain fresh water crustaceans show that they are sensible to sounds corresponding to more than 40,000 vibrations per second (sounds that we cannot hear), and to ultra-violet rays that we cannot perceive. Now all the rays that we can perceive appear to us with definite colors, and it should be the same with these animals; so that it is probable that they see colors that are unknown to us and that are as different from those that we are familiar with as red is different from yellow or green from violet. It would result from this that natural light, which seems white to us, would appear colored to them, and that the aspect of nature would be entirely different to them from what it is to us. It is possible, therefore, that to certain animals nature is full of sounds, colors, and sensations that we have no idea of.

The Longevity of Animals.—What is the maximum longevity of animals? It has been found that the herbivores, especially those that are compelled to work, are generally longer-lived than the carnivores. Thus, an ass died a few years ago at Cromarty at the age of 106 years. It had belonged to the same family since 1779. We have a record of several horses that reached the age of 40, 50, or more years. A tow horse died at Washington at the age of 62 years. Another horse died at New York aged 38 years, and had worked up to nearly its last moment. At Philadelphia there was a mule that reached the respectable age of 42 years. Another mule, aged between 40 and 45 years, is still working at a place near San Francisco. A ewe, born at Kalinowitz in 1829, remained fertile for twenty years, and died in 1850. As for carnivores, a Spanish slut recently died in America at the age of 28 years, and the case is cited of a cat that died at the age of 22 years and 2 months.—*La Nature.*

The Color of Batrachians.—According to the researches of Mr. Ponchet, the green and golden coloration of the batrachians is produced by yellow chromoblasts and blue iridocysts, the mixture of which gives an impression of green upon the retina. Black chromatophores contained in the derma and epidermis are, by extending in a network, capable of covering the other chromoblasts, to a greater or less extent, and of giving all the shades between dark brown and yellowish green or light blue.

In a note presented by Mr. Chauveau, in the name of Mr. Abel Dutartre, the latter describes the principal conditions that govern the motions of these black chromatophores. He first studies the action of the different rays of the spectrum, and demonstrates that white light and yellow cause a contraction of the black chromatophores and render the color of the animal lighter, while blue light and violet leave the animal more or less dark. Then, examining the influence of the bottom, he finds a curious case of mimicry, viz., that the coloration of the animal remains light when it is placed upon a light bottom, while it remains brown when it is placed upon a dark bottom. Finally, Mr. Dutartre's researches on the influence of the nervous system upon the changes of color in the batrachians have shown him that an excitation of the bulb gives rise to a lighter coloration, even though such excitation takes place after the spinal marrow has been cleft in the center. Hence it follows that it is not the nerves of animal life that act upon the coloration of batrachians, but rather the sympathetic nerve.

Effects of Heat and Pressure on Rocks.

The author has continued his researches on the effects produced upon rocks in contact with gases suddenly developed by means of such explosives as gun-cotton and dynamite. Temperatures of 2,500°, and pressures of 1,100 atmospheres, thus obtained, have been sufficient to fuse and pulverize the rocks experimented upon in a very marked manner. The results lead M. Daubree to believe that the perforated pipes or *diatremes*, diamantiferous, volcanic, or otherwise, and much of the subaerial dust and oceanic deposits are formed by such actions as he has obtained in the laboratory. He also shows that rocks may acquire an apparent plasticity under the influence of pressure.