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THE PICTET ICE MACHINE.

Ice machines are commonly classed with reference to the mediums they employ for abstraction of heat, hence they are distinctively known as air machines, ether machines, ammonia machines, and so on. A more logical and simpler classification, however, is to refer them to but two general classes, namely, machines which involve the use of a volatile liquid or freezing mixture, and those which do not. Under the first heading would be grouped ammonia, ether, and like machines, under the latter only those wherein air is compressed, then cooled without expansion, and finally expanded, thus causing the abstraction of large quantities of heat. It is not deemed necessary here to enter into the relative advantages and disadvantages of these various different devices, inasmuch as the subject is open to considerable argument on both sides.

The ice machine, or rather the system of artificial refrigeration, invented by M. Raoul Pictet, is based upon the refrigerating properties of anhydrous sulphurous oxide. This substance is a colorless liquid having a specific gravity of 1·6, and remaining fluid under a pressure of from 2 to 3 atmospheres. When allowed to escape in air it vaporizes rapidly, producing a decrease of temperature of 135° Fah., and if a teaspoonful of the liquid be placed in a wine glass of boiling water, the latter instantly freezes solid. It is imported from Europe in copper cylinders each holding about 200 lbs., and the cost of the material delivered in New York is about 65 cents a pound.

The manner in which the system operates will be clearly understood from Fig. 2, which represents the disposition of a small apparatus, such as is illustrated in Fig. 3. At A is the compression pump, the valves of which are so arranged that at one stroke the gaseous oxide is aspirated through the tube, B, and on the return it is compressed through the tube, C. Tube B connects with the refrigerator, D; tube C with the condenser, E. The oxide is introduced at the plug lock, F, and is drawn by the pump in the direction of the arrow into the copper tubular refrigerator, D, the liquid filling the space between the tubes. Here vaporization and consequent production of intense cold takes place, and the temperature of the non-congealable mixture of glycerin and water which surrounds the refrigerator is so far reduced that water placed in the metal boxes, H, immersed in the tank becomes rapidly frozen. The propeller wheel, shown on the right, determines a current of the glycerin solution through the tubes and thus hastens the refrigeration. The vapor of the oxide is drawn out of the refrigerator, as already noted, by the pump, carried through the latter, and forced into the space between the tubes of the condenser, E. Through the tubes a cold stream of water is constantly pumped, which determines the condensation of the vapors, and the re-liquefied oxide passes into the admission pipe and once more enters into circulation as already described.

In the large illustration, Fig. 1, is represented the arrangement of machinery now in operation in this city. Here the freezing tank, which is very large, is separate from the conden-

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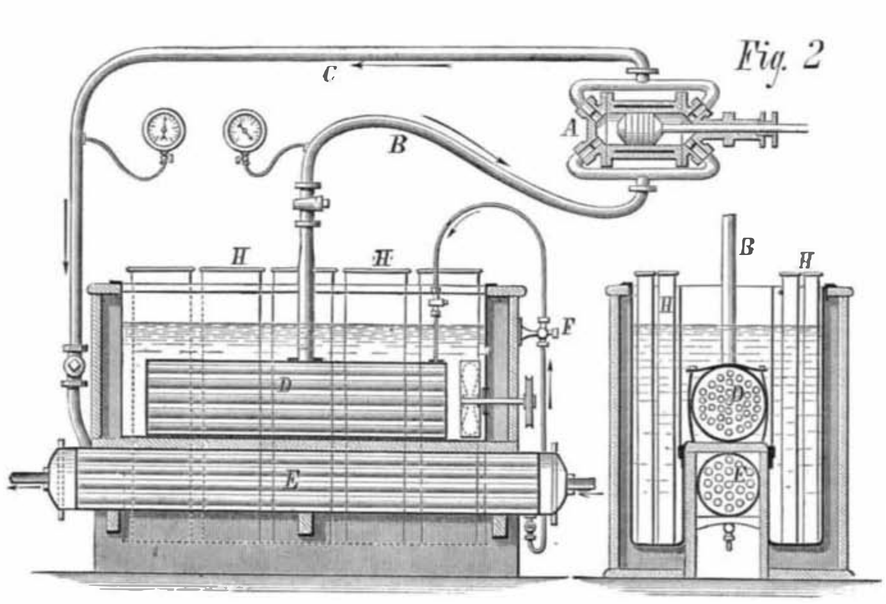
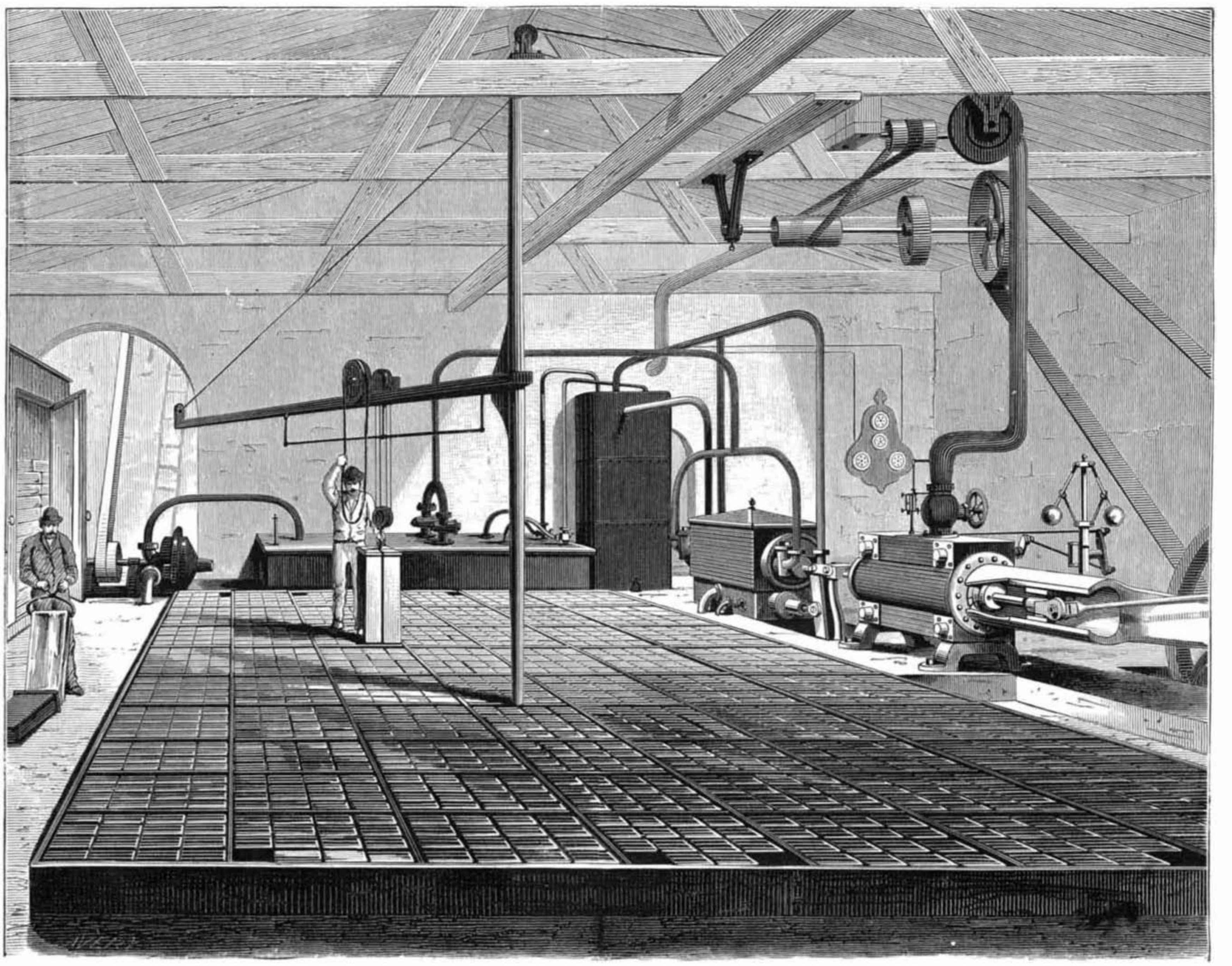


THE PICTET ICE MACHINE.



THE PICTET ICE MACHINE.—Fig. 1.

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ser, and its refrigerator holds about 1,700 lbs. of oxide. The non-congealable liquid is a saturated solution of chloride of magnesium, which has given better results than the glycerin and water mixture. The tension of the oxide vapor varies from 14·7 to 13 lbs. about, and on the return stroke the gas is compressed to $\frac{1}{4}$ or $\frac{1}{5}$ its original volume, having its temperature raised to 200° Fah. The cold water current reduces this temperature to about 61° at the outlet, and then, under the pressure of from 3 to $3\frac{1}{2}$ atmospheres, the gas returns to liquid state. When the ice in the freezing boxes is formed, the workmen, by means of the crane shown in Fig. 1, which moves around an axis in the center of the large tank, lifts out the boxes one by one, and dips them in hot water, so that the block of ice within may become detached. The block is then removed and the box, replenished with fresh water, is replaced. The pressure in the condenser, we are informed, does not exceed 35 to 37 lbs. per square inch above atmospheric pressure—the average absolute steam pressure in the engine cylinder is 30 lbs. maximum. No difficulty is experienced in keeping tight joints, and the loss of oxide per week does not exceed $\frac{1}{2}$ lb. The magnesium chloride or glycerin solution rarely needs renewal and is always cheap.

It is claimed that 1 lb. of acid by volatilization produces nearly 1 lb. of ice. From the apparatus illustrated in Fig. 1 the following data have been obtained: Average horse power of engine, 73 to 75, of which 23 horse power is used for the condensing pump, circulating pump, boiler feed pump, air pump, and acid pump. The quantity of ice produced was 18 to 20 tons in twenty-four hours; coal burned, $2\frac{1}{8}$ tons per day; the average production of ice is claimed to be from 9 to 10 tons per ton of coal. The cakes of ice measure 12 inches by 6 inches by 36 inches, and weigh 83 lbs. each.

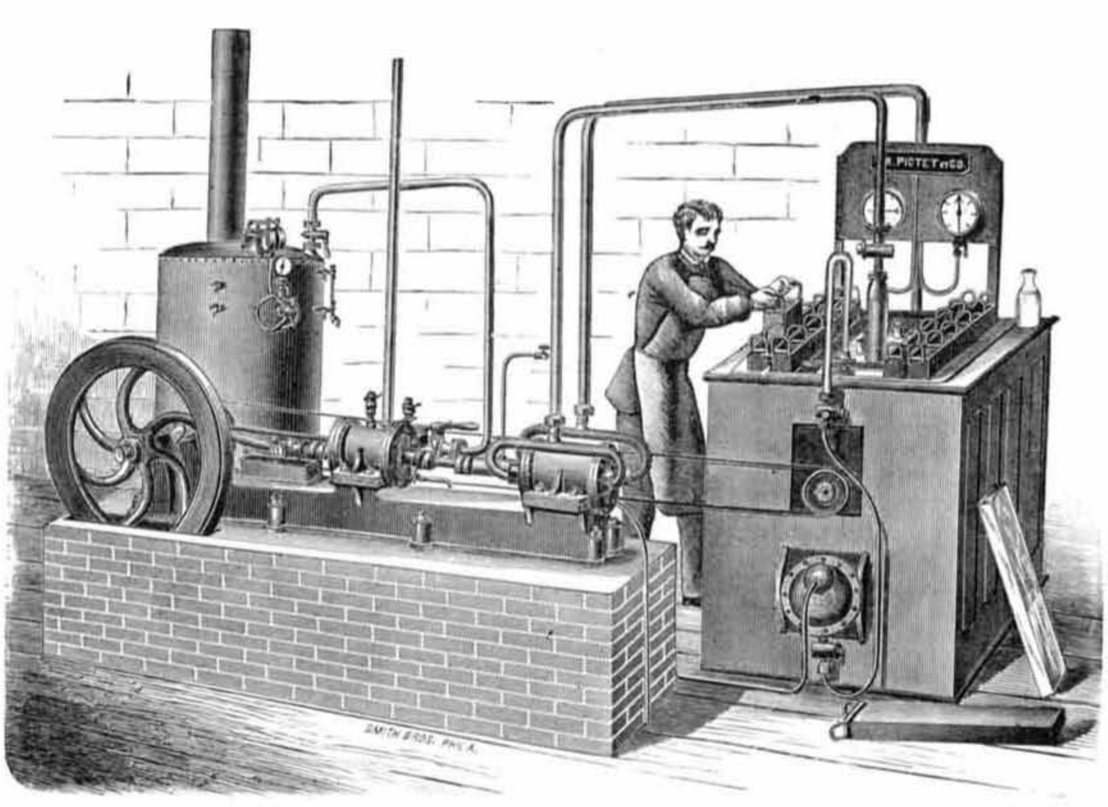


Fig. 3.—THE PICTET ARTIFICIAL ICE MACHINE.

The following data show the inflammability and explosibility of various substances used in ice-making.

Names of substances used in ice-making.	Boiling point at atmospheric pressure in degrees Fahrenheit.	Pressure of vapor in lbs. per square inch at 65° Fahrenheit.	Specific gravity of liquid at 40° Fah. water =1.	Specific gravity of vapor at 40° Fah. Air = 1.	Latent heat of vapor by equal weight.	Relative latent heat of vapor by equal volume.
Chymogene, gasolene, and other derivatives of petroleum*...	30 to 50	12 to 17	0·6	3·9	170	663
Methylic ether*.....	—6	90		1·617	240	384
Ammonia†...	—30	120	0·76	0·59	900	511
Anhydrous sulphurous oxide‡...	14	52	1·49	2·25	170	392

*Inflammable and explosible. †Explosible. ‡Extinguishes combustion, not explosible.

The manufacturers furnish us the following estimate of maximum cost to produce 250 tons per day of 24 hours. Employees, \$51.00; oxide, at 4 lbs. per week, 37 cents; oil, \$2; coal, $22\frac{1}{2}$ tons at \$4.25 per ton, \$105.63. Equivalent to $63\frac{3}{5}$ cents per ton actual cost of manufacture.

Estimating capital at \$250,000, and adding taxes, office expenses, wear and tear, insurance, etc., the total cost comes to \$1.05 per ton of ice.

Attention is called to the advantage of the low boiling point of sulphurous oxide, which is 14 Fah. as compared with chymogene, which is 30° to 50°. Also the advantage of the pressure of vapor of the oxide at 65° Fah., namely, 52 lbs., instead of the very low pressure of chymogene, 12 to 17 lbs., which results constantly in the pumps using the latter working almost in a vacuum. The disadvantage on the other hand of the high pressure of ammonia is obvious.

For further information address the Pictet Artificial Ice Company, room 51 Coal and Iron Exchange Building, corner Courtlandt and Church streets, New York city.

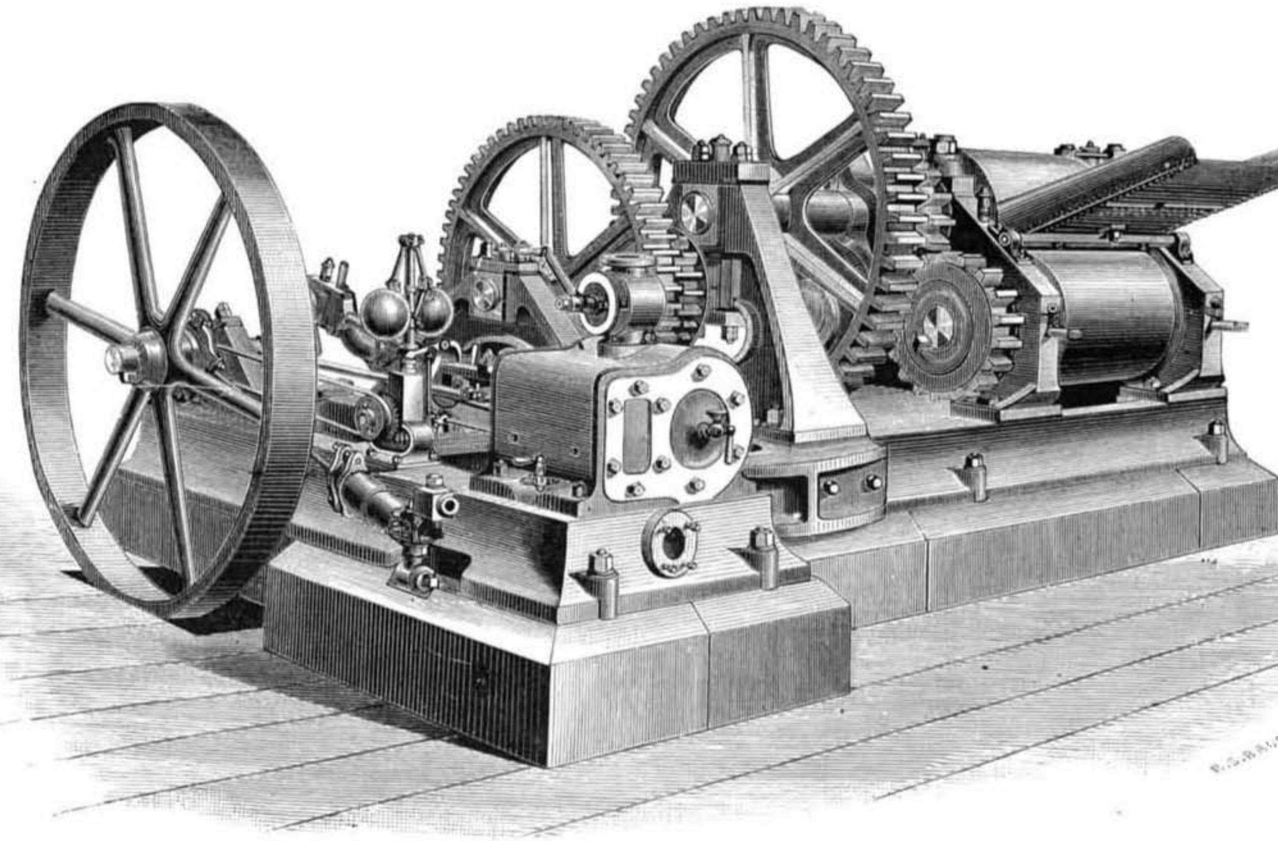
Keeping Fruit Fresh.

The following is said to be a good process for keeping fresh fruit through the winter: Mix rosin 2 lbs., tallow 2 ozs., beeswax 2 ozs., slowly over a fire in an iron pot, but do not boil. Rub each fruit separately with pulverized chalk and dip it in the mixture. Hold it up for a moment to permit the coating to set, and pack away carefully in a cool place.

COMBINED ENGINE AND SUGAR CANE GRINDING MILL.

We select from *Iron* the accompanying cut of a combined engine and sugar cane grinding mill, manufactured by Messrs. Robey & Co., of Lincoln, England.

The mill is especially designed for small plantations. The rollers are three in number and are placed horizontally, one over the other two. These rollers are 20 inches in diameter and 30 inches long, and are keyed on to their respective shafts. On one end of these shafts are pinions, which are driven by a train of strong gearing actuated by the horizontal engine, which is of 8 horse power nominal, but capable of working more than that power. The whole is fixed on strong foundation plates, by which arrangement the fitting up is much facilitated. For the sake of greater ease in transit, these plates are made in two parts. The cane is conveyed to the rolls by a carrier worked from the mill, consisting of chains on a series of wooden rollers.



COMBINED ENGINE AND SUGAR CANE GRINDING MILL.

Vitality of Ants.

Several interesting observations have been made by the Rev. H. C. McCook on the endurance of extremes of heat and cold by ants. This year a formicary of *F. pennsylvanica* was cut from an oak bough and exposed out of doors to the rigor of a mountain winter, and survived. A number were dropped separately upon ice, and were found alive after forty-eight hours, each in a little depression. *F. rufa* was found active in its formicary at 34° F., sluggish at 30°. The extreme of heat seemed also to be endured by *F. pennsylvanica*; they did not suffer at all from the heat of stones walling in a camp fire, having been driven into this position out of a burning stump. A community of agricultural ants (*M. molefaciens*) lived in a mound upon which some smiths in Texas made their fires for heating wagon tires. Numbers of ants were seen at work by Dr. Lincecum, cleaning out the entrance to their city, before the entire extinction of the fire just used for heating tires. They had learnt all about the fire, and knew how to work in and around the dying embers without injury. A quantity of mason ants (variety of *F. rufa*) observed by Mr. McCook were accidentally flooded under five inches of water, and they appeared to be quite dead, and floated about in this condition for many hours. But subsequently most of them recovered full activity. In Texas Mr. Lincecum found that the agricultural ants are seen in great numbers in wells, forming a sort of floating mass as large as an orange, clinging together. In this condition they get drawn up in the bucket, and though they may have been in the water a day or two, they are all found alive. Yet individuals cannot survive under water more than six minutes; and life in these balls can only be preserved by the mass revolving, either by the continued struggles of the individual insects, or by an instinctive and orderly movement of the outer tier of ants.—*Proc. Acad. Nat. Sci., Philadelphia.*

Boring Power of Magilus.

We have received from Mr. Charlesworth a preliminary note giving briefly a result of his study of the genus magilus, the remarkable testaceous gasteropod that is found immersed in the large hemispherical corals of the genus meandrina. The current belief, as set forth by Sowerby, Owen, Woodward, and other authorities in molluscan biology who have treated of this coral-inhabiting mollusc, is that magilus in its young state effects a lodgment in a crevice of a meandrina, and that as the coral enlarges the magilus extends the margins of the mouth of its shell in the form of a cylindrical corrugated tube, the growth of this tube and of the coral proceeding together *pari passu*, and consequently that there is no penetration of the coral by the magilus at all. Mr. Charlesworth, however, finds that magilus not only drives through solid masses of coral in any direction with apparently the same facility that the bivalve teredo tunnels masses of wood, but he finds that it even surpasses teredo in its power of suddenly reflecting its shell and returning to the point from which it commenced its advance; and this bending back of the shell upon itself is not accomplished in such natural cavities as frequently prevail in large corals, but in the solid coral.—*Nature.*

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