

material employed, and consequently a corresponding saving in the cartage of such material.

2. That there is a large saving in mortar, not more than one-fourth of that used in ordinary brick walling being required, giving a corresponding saving in the cartage on this item.

3. As the workman (see Figs. 4 and 6) builds both faces of wall in setting a block, greater rapidity of work is secured, together with a saving of labor.

4. The Z blocks are equally available for the construction of hollow or solid walls, as the spaces may be filled in, if desired, with a rough kind of concrete.

5. By this system the walls are thoroughly bonded throughout.—*Building News*.

THE CHLORIDE OF METHYL ICE MACHINE.

IN SCIENTIFIC AMERICAN SUPPLEMENT, No. 172, page 2739, we gave a description of M. Camille Vincent's process for manufacturing chloride of methyl from the waste liquors (*vinasses*) left after the extraction of the sugar from the beetroot, and also description and figures of an apparatus, by means of which (chloride of methyl being used as the freezing agent) large masses of mercury might be solidified, and the temperature of any liquid reduced to -55° and maintained there for several hours. In that article it was stated that M. Vincent had lately constructed a much larger and more perfect and continuous form of freezing machine, in which, by means of an air pump and a forcing pump, the chloride of methyl is evaporated in the freezing machine, and again condensed in the cylinders; and that this enlarged form of apparatus would probably compete favorably with the ether and sulphurous acid freezing machines now in use. To-day we are able to lay before our readers a figure and description of M. Vincent's larger form of freezing apparatus.

The chloride of methyl freezing machine is composed of three principal parts: (1) a "freezer," where the cold is produced; (2) a pump, which forces the vapor of methyl chloride into the freezer, compresses it, and afterwards

The suction valves of the two pumps are moved mechanically, thus insuring a perfect regularity of action, as well as great precision. The pumps, which are placed upon the same frame, are arranged in such a way as to take up but little space; motion is communicated by a long connecting rod, actuated by a crank-shaft, which, in its turn, is actuated by the engine through an intervening pulley and belt. The operation of the freezing machine is indicated by two pressure-gauges, one connected with the liquefier and the other with the freezer. Normally, the pressure in the liquefier is only from 3 to 4 atmospheres, according to the temperature of the water used in refrigerating; and the degree of vacuum in the freezer varies from 0 to $\frac{1}{2}$ an atmosphere according to the lowness of the temperature that it is desired to obtain. These methyl freezing machines offer a decided advantage over all others, for the following reasons: They need no oiling, since the chloride lubricates the pistons; they are not subject to the entrance of air, the product having a sufficient tension of vapor; the methyl chloride does not act upon the metals, and is in no wise decomposed by the working of the machine; the vapor, which has a sweet smell, does not inconvenience the workmen during repairs; finally, the working parts of the machine are very simple, thus allowing it to be afforded at a very reasonable price. To all this may be added that methyl chloride has now become an industrial product, the value of which is a half or a third that of other freezing agents in use. The new freezing machines will certainly have an important place in the ice-making industry, for they possess features of economy that have not before been attained.

IMPROVED PACKING PAPER.

A NOVEL kind of packing paper is manufactured by Foy Riviere in London.

It consists of a kind of common paper or thin card-board, to one side of which chips or small pieces of cork are fastened by means of glue or some other suitable material. The chips and pieces of cork are the waste from cork-cutting establishments. This improved paper is especially well

had no effect in stopping the destructive action of the sunlight, while with a red solution, allowing eighty per cent. of the heat rays to pass, the cell and its chlorophyll remained quite unaltered.

Besides these experiments on the influences of rays of different refrangibility, Pringsheim tried the effect of surrounding the plant with atmospheres of various composition. The result arrived at was of great interest, namely, that the destructive effect of strong sunlight only takes place when the plant is surrounded with an atmosphere containing oxygen. No effect is produced either in hydrogen or in a mixture of hydrogen and carbonic acid, moreover, the presence of the latter gas is of no importance to the process, which takes place with equal rapidity in an atmosphere from which all the carbonic acid is removed.

From these experiments the important result is arrived at, that the destruction of chlorophyll by concentrated sunlight is a true process of combustion, and has no relation whatever to the decomposition of carbonic acid by the plant. And from the circumstance that the green coloring matter, once discharged from the chlorophyll-grain, cannot be restored, it is inferred that the process is not a normal but a pathological one.

The disintegration of the general cell-contents is evidently of the same nature. That it is independent of the destruction of the chlorophyll is evident, for it takes place in colorless cells, such as nettle-hairs. But as long as the chlorophyll remained unaltered, the protoplasm is also unaffected, so that the chlorophyll may be said to act as a protective covering to the protoplasm against the hurtful action of light, or, in other words, to diminish the intensity of the respiratory process. The absorptive property of chlorophyll on light, especially on the chemical rays, confers upon it, therefore, the power of regulating the respiration of the plant.

In connection with the disintegration of the cell-contents, the interesting observation was made that the colorless granules contained in the protoplasm diminished in number and disappeared during the earlier stages of the action of light, so that probably these bodies, the exact nature of which is unknown, are the most combustible parts of the cell-contents, and as such are used up in ordinary respiration.

But the constituent of the cell which shows the greatest degree of sensitiveness to light is a substance discovered by Pringsheim in the course of this inquiry, and named by him *hypochlorin* or *hypochromyl*. It is an oleaginous substance, occurring in the chlorophyll-grains, and may be extracted by placing portions of plants in weak hydrochloric acid for from twelve to twenty-four hours. It is then found to be in the form of minute semi-fluid drops, which gradually assume the form of indistinct crystalline scales, and, finally, of reddish-brown needles of a resinous nature. These crystals are, in all probability, formed by oxidation from the hypochlorin, as it occurs in the ground substance of the chlorophyll-grains.

Pringsheim considers that this remarkable substance is "the true primary assimilation-product of green plants," and that from it the starch and oil occurring in chlorophyll-grains are formed.—*Nineteenth Century*.

A NEW METHOD OF PREPARING SULPHURETED HYDROGEN.

By J. FLETCHER, F.C.S.

ANY mode by which the preparation of this useful gas can be rendered easier, and the unpleasantness of its manipulation diminished, will no doubt be welcomed by analysts: I therefore make no apology for submitting the results of some experiments made after reading a suggestion in some of the scientific journals, perhaps your own, but the name does not at the moment occur to me.

The plan is simply to fuse in a small glass flask sulphur and solid paraffin, leading the resulting gas by means of a perforated cork, India-rubber, and glass tube directly into the solution to be tested. The first gases are not sulphureted, but when the mixture has been thoroughly fused and mixed, the sulphureted hydrogen passes over abundantly.

The advantage of the process is that the moment the flame of the lamp is removed the evolution of gas ceases, and the little apparatus can be laid aside without fear of creating offensive smells. When used again, the gas passes at once when sufficiently heated.

A washing bottle seems unnecessary. I passed the gas for an hour through such a bottle, and the water, although most strongly impregnated with the gas, was fairly clear and limpid, showing only the usual appearances.

There are a few precautions to be taken. The mixture is inclined to bump when strongly heated, but a few pieces of broken tobacco-pipe shank prevent that. Care must be taken that when the lamp is removed, and the gas ceases to pass, none of the solution is sucked back into the bulb; it is very easily prevented. A very strong heat should not be applied, as then distillations would commence and the product condense in the tube.

I believe the process to be a simple, cleanly, and elegant substitute for the old methods, and particularly well suited for small and private laboratories. How it would work in large ones I would like to hear from those who are in a position to try it.—*Chemical News*.

DIGESTIVE FERMENT OF CARICA PAPAYA.

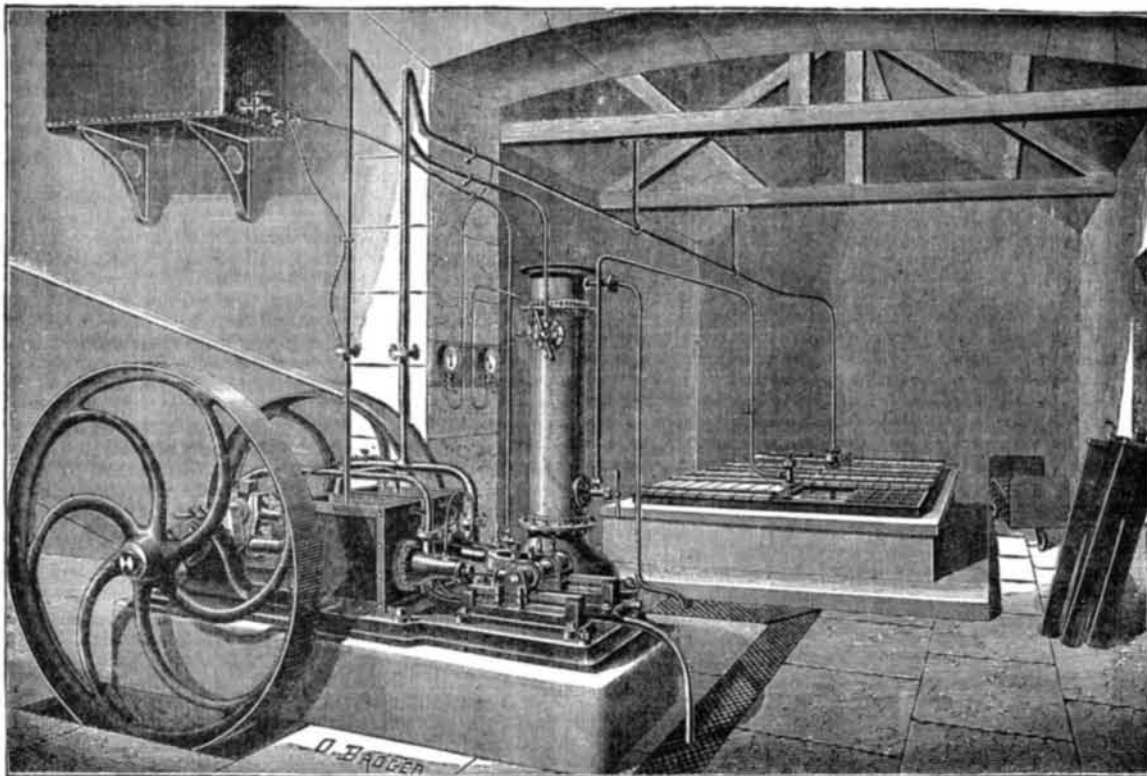
By A. WURTZ and E. BOUCHUT.

FROM the undecomposed juice of this tree the authors have obtained, by precipitation with alcohol, the ferment, in the form of an amorphous white powder, entirely soluble in water, and containing 10 per cent. of nitrogen. To this substance they have provisionally given the name of papain. It is distinguished from pepsin by the circumstance that it is capable of dissolving large quantities of fibrin not merely in presence of a small quantity of acid, but even in a neutral or slightly alkaline medium. It is doubtless analogous to the ferments secreted by carnivorous plants such as *Nepenthes*, *Drosera*, etc.

COMPRESSIBILITY OF GASES AT HIGH PRESSURES.

By E. H. AMAGAT.

It appears very probable that when a gas submitted to increasing pressures, whether or not it has shown at first an augmentation in its compressibility, presents afterwards a decrease, it is always placed in conditions where it may, by pressure alone, pass gradually through all the intermediate conditions between the gaseous and the liquid state without liquefaction properly so-called. The decrease in the compressibility indicates then in general that the gas has reached a temperature higher than that of the critical point.



M. VINCENT'S CHLORIDE OF METHYL ICE MACHINE.

forces it into a condenser, where it liquefies; (3) a condenser, or liquefier, serving to cool the vapor of the compressed methyl chloride and to cause its liquefaction, the liquefied product afterwards returning gradually into the freezer. The accompanying illustration gives a general view of one of these freezing machines, which is capable of producing from 225 to 1,100 pounds of ice per hour. The freezer, which in the engraving is to the right in the back part of the room and under the collection of cells holding the water to be frozen, is a horizontal tubular boiler containing the liquid chloride of methyl. An unchangeable solution of calcium chloride passes into the tubes of this apparatus, becomes cooled, and is afterward driven by the action of a helix around the cells which contain the water that is soon to be frozen. The vapor of methyl chloride produced in the freezer is aspirated through a long pipe, by means of a pump (seen to the left of the engraving), and is then compressed and directed through another pipe into the liquefier (seen between the two preceding apparatus), where the liquefaction is effected. The liquefier is composed essentially of a vertical tubular apparatus, within the tubes of which circulates the water which is to cool the compressed chloride of methyl forced around the tubes by the pump. The liquefied chloride returns to the freezer through a pipe provided at its lower part with a screw cock, which serves to regulate the outflow according to the speed of the machine. The compression of the vapor of the frigorific product is effected in these new machines with a degree of perfection that has never been hitherto reached in any of the ordinary ammonia, sulphurous acid, ether, or methyl ice machines, and the result is a greater yield of ice, and a saving of coal.

The compression pump has two cylinders of unequal diameters (as shown in the figure), and works after the fashion of "compound" machines, thus allowing all the known advantages of this system to be realized. The first piston, and the larger of the two, aspirates the methyl vapor and compresses it to just half the final quantity; the second cylinder then receives the compressed vapor, and its piston, after having doubled the pressure, forces it into the liquefier. The two compressing cylinders are arranged in a reservoir in which circulates a current of cold water; and, by this means, too great an elevation of temperature is avoided.

adapted for packing glass and china ware, the cork side of the paper lying against the article and protecting it from sudden shocks and jars.—*Ackermann's Gewerbe Zeitung*.

PROPERTIES AND FUNCTIONS OF CHLOROPHYLL.

A VERY important inquiry into the properties and functions of chlorophyll has just been made by Pringsheim,* whose results necessitate a great change in the current opinions on the nutrition and general physiology of plants. The main subject of the research is the influence upon chlorophyll, and upon the plant-cell generally, of concentrated sunlight.

Pringsheim's method is to place the plant under examination upon the stage of a microscope in the usual manner, and then to concentrate the sun's rays upon it by means of a heliostat and a lens of 60 mm. diameter. By this means an intense light can be brought to bear upon a very limited area of a plant, upon a single cell, or even upon a particular part of a cell, and the effect watched continuously and easily. This method of "microscopical photo-chemistry" has already, as we can see, yielded results of the highest importance.

The first effect on the living cell of the intense light is the complete destruction of the green coloring matter. This takes place in a few minutes, and by proper arrangement can be made so local as to affect only a single chlorophyll-grain, or a single patch in the diffused chlorophyll of an alga, all the rest remaining as green as before. This change is followed by the gradual dissolution of the remaining constituents of the cell; cyclosis ceases; protoplasmic filaments are broken up; the arrangement of the cell-contents is destroyed and their properties altered; the final result being the entire death and destruction of the cell, with the exception of its formed constituents, the cell-wall, starch grains, etc.

That these effects were in no way due to the heat of the sun's rays was shown by interposing in the path of the beam various colored media, when it was found that a blue solution, which shut off nearly the whole of the heat rays,

* "Ueber Lichtwirkung und Chlorophyll-Funktion in der Pflanze." Monats. d. k. Akad. d. Wiss. zu Berlin, July, 1878.