LIQUID CARBONIC ACID.—ITS INDUSTRIAL PRODUCTION AND USES.

The attention of the scientific world has been directed for a few years past to the curious researches of Messrs. Cailletet and Wroblewski upon the liquefaction of the last permanent gases that have, up till recently, resisted great pressures in the Thilorier apparatus for liquefying and then solidifying carbonic acid.

It would seem at first sight that such experiments could possess nothing more than a purely scientific interest, but the industrial applications of liquid carbonic acid that have just been made in Germany show that an experiment that is considered in the beginning only as a scientific curiosity may nevertheless become the starting point of industrial applications that are as singular as they are remarkable.

Messrs. Raydt and Kunheim, reproducing upon a large scale the apparatus which, during lectures on chemistry, serves to perform a certain number of experiments on liquid and gaseous carbonic acid, have, in fact, just patented an apparatus for the industrial storage of this gas in a liquid state.

This apparatus (Fig. 1) consists of a flask or strong iron tube, *a*, at each extremity of which are adjusted thick disks, *b* and *c*. The copper valve, *d*, is screwed into the upper end, *c*, and is closed by means of a threaded steel rod, *e*. During transportation the cap, *g*, is screwed upon the tube, *f*, and the whole mechanism of the valve is protected by the cover, *h*. In order to use the flask, the cover and cap are removed, and the vessel is then connected with the boiler by means of a coupling or a connecting tube. The apparatus is filled with pure liquid carbonic acid which has been produced and purified by well known processes, and which is compressed into the flask by means of powerful machines. Each flask holds about 8 kilogrammes of liquid carbonic acid, equivalent to 3,500 liters of the gaseous liquid at the ordinary pressure. Before being employed, the flasks are submitted to a pressure of 250 atmospheres, while liquid carbonic acid at 0° exerts a pressure of only 36 atmospheres, which rises to 74 by heating to 30°. As the pressure is constantly calm and regular all danger is averted, and the administration of the German railways has therefore, after a minute examination, concluded that it could authorize the sending of these flasks by all trains.

Up to the present time this liquid carbonic acid has been employed for the raising of beer in breweries, the access of air into the casks being thus prevented, as well as the acid fermentation that atmospheric germs might produce therein. Fig. 2 shows how the apparatus is set up. The liquid carbonic acid is contained in the forged iron cylinder, *a*, which is put in communication, through *i*, with an iron plate reservoir capable of easily supporting a pressure of from 4 to 5 atmospheres, and remaining in place in the brewery. In order to make a connection the lever, *c*, is raised, and this opens at the same time the two cocks, *e* and *d*, the first of which puts the cylinder in communication with the copper. This latter is connected through the second cock with the safety valve, *f*.

After this the cock, *h*, of the cylinder is opened by turning the key, *g*, to the left, the pressure gauge, *k*, being at the same time carefully watched. The acid, under a gaseous form, flows rapidly into the copper through the coupling tube, *i*, and in a few seconds the desired pressure of 1 or 2 atmospheres is reached, as may be easily seen from the pressure gauge. Then the valve, *h*, of the cylinder is closed by turning the key, *g*, to the right, and the two cocks, *d* and *e*, are closed by pushing down the lever, *c*.

Fig. 2 shows different modes of drawing. In cask I. the carbonic acid first traverses a collecting reservoir, *m*, designed for the reception of the small quantity of beer that might choke up the pipe through the differences in pressure between the cask and the reservoir, *b*; then it passes into the siphon, and forces the beer to the draught cock, *n*.

The arrangement of cask II. is more convenient. Here the carbonic acid makes its exit from the copper beneath the pressure gauge, *k*, flows first to the counter, and from thence is directed at will to cask II., through the cock, *o*. The pressure existing in this cask is ascertained from the gauge, *k*, and is regulated by means of the cock, *o*. The beer is drawn through the cock, *q*. In cask III. the carbonic acid passes anew through the beer reservoir, and the draught is effected directly through the siphon without conduit.

Finally, in the arrangement of cask IV. the siphon is likewise dispensed with. Here the carbonic acid reaches the beer through the bung hole, so that the beverage is drawn directly from the cask through the cock, *s*, without any pipe.

Aside from this special application, Mr. Raydt proposes the use of liquid carbonic acid for the manufacture of seltzer and other artificial mineral waters, etc., and, in a word, of all gaseous beverages. It is only necessary to introduce into the liquids that it is desired to convert into aerated beverages the carbonic acid coming from the reservoir of liquid acid that we have described above. The inventors have likewise applied their apparatus to various kinds of extinguishers and fire pumps, which, in practice, have given most excellent results. Fig. 3 gives a general idea of a fire pump to which the system under consideration is applied, and Fig. 4 shows the details of the introduction of the carbonic acid into the receptacle filled with water, or a saline solution (phosphate of ammonia, boracic acid, etc.) more efficient than pure water. The acid passes from B to A through the intermedium of the tube, C, which is punctured with holes through which the gaseous acid escapes. At *b* there is a small hand wheel, *r*, which serves to regulate the pressure, and which is provided with a pressure gauge, *m*. When the acidulated water reaches the pressure determined by the regulator, *b*, it escapes through the cock, *e*, and may be directed horizontally or vertically in order to extinguish a fire. The gas may also be introduced directly into the boiler of a steam pump, so as to actuate the latter while the water is heating. Liquid carbonic acid has likewise received an interesting application in the production of compact castings. In this process, which is now in current use in the works of Mr. F. A. Krupp, at Essen, the mould is closed hermetically immediately after the metal is poured into it, and gas at a high pressure is made to enter it at the upper part by opening the valve of a liquid carbonic acid reservoir. In order to increase the pressure and make it regular, the carbonic acid reservoir is heated by means of a water bath. The pressure is exerted until no further tendency to form bubbles is shown in the molten metal. The experiments of Mr. Krupp have shown that in receptacles that are entirely full a heat of 200° produces the immense pressure of 1,200 atmospheres. The same process has likewise been applied with the greatest success at Bemdorff, near Vienna, in the production of compact castings of white metal.

Finally, the last application of liquid carbonic acid that has been proposed by Raydt is the use of it for raising sunken vessels. An application of air has for a long time been used for obtaining the same result, but carbonic acid has the advantage over the latter in that it requires the use of no costly apparatus, difficult to actuate. In some experiments made in the port of Kiel a stone weighing 300 quintals, and sunk to a depth of 10 meters, was raised to the surface in eight minutes by means of a bag inflated with carbonic acid.—*La Nature.*

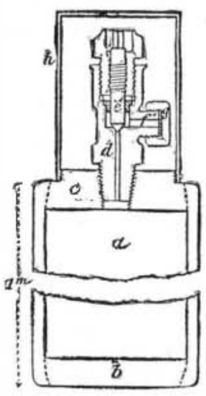

Fig. 1.—FLASK FOR LIQUID CARBONIC ACID.

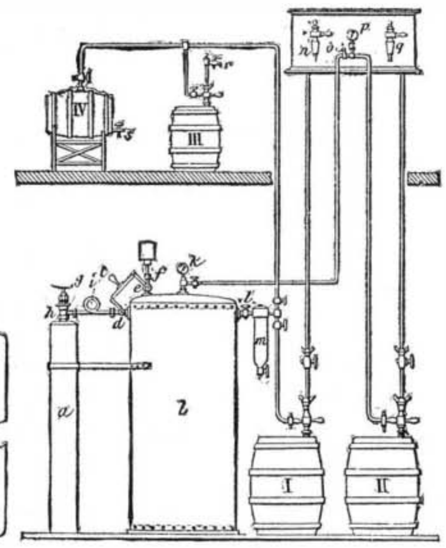

Fig. 2.—ARRANGEMENTS FOR RAISING BEER IN BREWERIES.

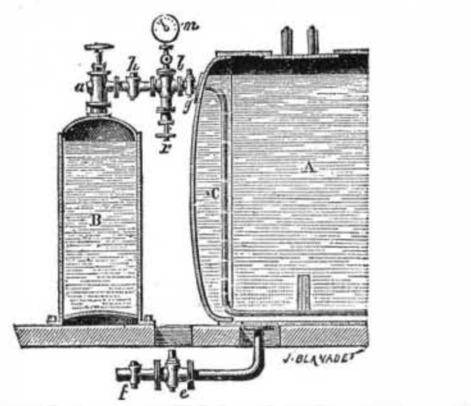

Fig. 4.—DETAILS OF MECHANISM FOR INTRODUCING THE CARBONIC ACID INTO A RESERVOIR OF WATER.

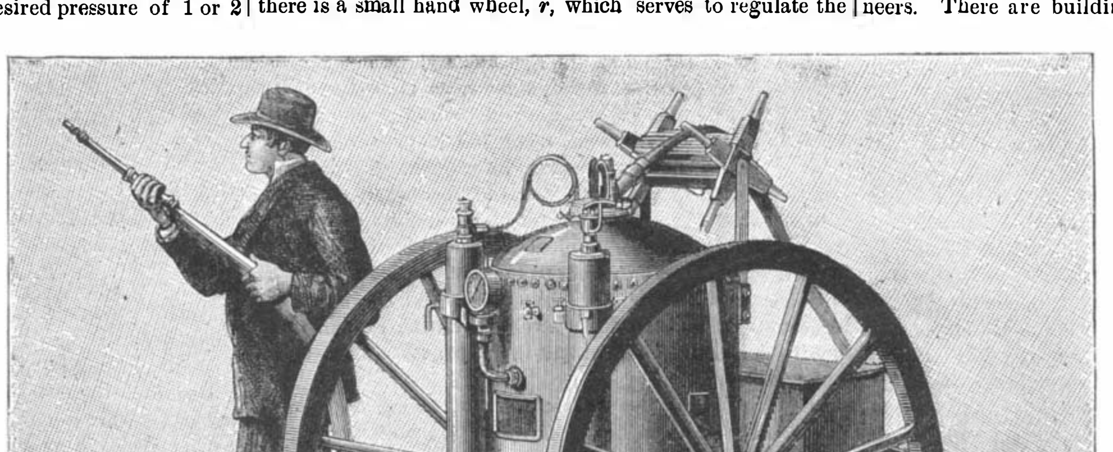

Fig. 3.—A FIRE PUMP OPERATED BY LIQUID CARBONIC ACID.

The Value of Exhaust Steam for Heating Purposes.

When standing on a tall building in New York city, in the winter time, one cannot help noticing the number of exhaust pipes from steam engines which puff their heat and vapor into our atmosphere.

How few of the many who thus view the great city from on high, and are driven into a reverie over the thousands of busy people who are beneath, and the industries that these little white puffs are a waste product from, have any idea of the thermal value represented in these apparently useless clouds!

This steam, when it leaves the top of the exhaust pipe and before it is condensed or dissipated in the atmosphere, represents, we can safely say, three-quarters of the actual value of the coal that was used in the furnace to produce it. Less than one-tenth of the energy of the fluid has been realized in the engine, yet it is all that can be so utilized. What has been used in the engine we may call the static energy of the steam, and what is going to waste in the atmosphere is the potential energy. The static energy is about 1,980,000 foot-pounds per horse power per hour, but the potential energy, according to the steam used for average engines, is about 30,000,000 foot-pounds for the same time.

It may appear incredible to the business man that a residuum so valuable should be let run to waste if it is possible to utilize it, but nevertheless such is the rule in New York at the present time.

To scientific engineers its value has been long known, and the utilization of exhaust steam for warming air, etc., has long and successfully been practiced in some industries, and in warming workshops and factories, but its use in large buildings in New York is of comparatively recent date, and very few are as yet using it, or can be induced to try the experiment, because of the prejudice of some of their engineers. There are buildings where its use has not been a practical success, but that was because the arrangements were not planned by a competent person.

In summer time this heat must be wasted, but in winter it should be used for warming and cooking. Many of our buildings as they are now piped cannot use exhaust steam successfully, but successful methods can be devised by any competent steam heating engineer, and we hope in a few years to see architects and owners fully educated and alive to the importance of preventing the waste that takes place from the top of our exhaust pipes. —*Sanitary Engineer.*

Layering a Rose Bush.

A writer in one of our agricultural newspapers says that a rose bush may be layered with little trouble, and then tells how to do it. Make a narrow trench, three or four inches deep, where a good well grown shoot can be bent into it. After blooming, in June, cut a slit in the shoot selected at the point where it will touch the soil, press some soil into the cut, bend the cane down to the bottom of the trench, and fasten it there with some pegs, and cover it well with soil. By fall it will be a rooted plant, and can be cut away and transplanted