THE DECOMPOSITION OF WATER AND ABSORPTION OF CARBON DIOXIDE BY CAUSTIC SODA.

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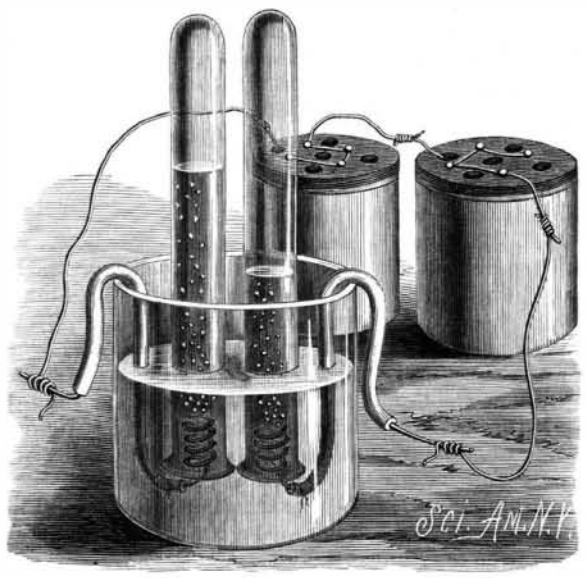
The apparatus generally used to illustrate the decomposition of water by the electric current consists essentially of two plates of platinum immersed in a vessel containing water acidulated with sulphuric acid. The object of the acid is to impart sufficient conductivity to the water, and platinum electrodes are used because they are not attacked by sulphuric acid. There are several objections to the use of this apparatus for general demonstrations. It is somewhat expensive, the platinum plates are extremely fragile, and are not easily connected with the wires from the battery. In the apparatus illustrated iron wire is used in place of platinum electrodes, and a solution of caustic soda is the electrolyte.



DECOMPOSITION OF WATER.

The two pieces of wire, which may be one-sixteenth to one-eighth inch in thickness, have one end bent into a spiral of about one-half inch external diameter. Over the rest of the wire a piece of India-rubber tubing is slipped, of such length as to leave about an inch exposed. At the end nearest the spiral the tube is tightly wrapped with a few turns of fine wire or even string, which is then secured. The electrodes are then bent as shown and hung over the edge of a suitable vessel. A couple of test tubes may be used to catch the gases evolved.

As caustic soda solution is an unpleasant substance when it comes in contact with the hands, the apparatus is best set up in the following manner: The cup is filled with water, and the electrodes are put in place. The test tubes are then filled, one at a time, also with water, and inverted over the electrodes in the usual way, their ends being closed by the experimenter's thumb. Next some of the water is removed by careful pouring, so as to leave the vessel but one-half full. Some strong solution of caustic soda is now poured into the vessel, and stirred or mixed with the water as well as possible. If the terminals of an active battery of sufficient voltage are now attached to the electrodes as shown, the water will be rapidly decomposed, and the hydrogen and oxygen gases evolved will rapidly collect in the tubes. In simplicity and cheapness this apparatus cannot well be surpassed, and on account of the very large surface of the electrodes its resistance is low, and the water is decomposed with very great rapidity. For purposes of demonstration it may be pronounced superior, all things considered, to the usual form with platinum electrodes passing through the glass.

A very interesting experiment illustrating the absorption of carbonic acid gas or carbon dioxide by a caustic alkali, and one that is susceptible of various modifications, is next illustrated. A strong bottle or a round bottom flask fitted with a tight perforated cork is required. A glass tube is arranged to pass tightly through the aperture in the cork, and a common India-rubber balloon is tied to the tube, the lower end of the latter passing within its neck. The tube now is in communication with the interior of the balloon. If one were to blow into the tube, the balloon would become inflated. A strong solution of caustic soda or potash is made, and when perfectly cold is poured into the flask. Some water is now poured very slowly and carefully down the side of the vessel, so as to collect upon and float over the heavy solution of alkali. This it will do in virtue of its lower specific gravity. The separation of the two fluids is evident on inspection. If, however, the experimenter is unwilling to risk this separation, he may use kerosene oil in place of water. The latter will inevitably float on the caustic alkali. The point to be attained is to have the solution covered with a second liquid which is without action upon carbonic acid gas.

Carbonic acid gas is now evolved in the ordinary way from limestone and hydrochloric acid, or by any other method, and is conducted into the flask. Great care must be taken not to disturb the two layers of liquids in the manipulations.

When the flask is full, the conducting tube is lifted out, and the cork with empty balloon attached is placed in the neck as shown. The cork must fit accurately. Now the flask is shaken. The caustic alkali solution at once comes in contact with the carbonic acid gas and absorbs it. In an instant the absorption is complete, and under the influence of atmospheric pressure the balloon inflates and either fills the vessel or bursts.

It is not necessary to use a flask. Any transparent bottle may be used. It is necessary to have the alkaline solution cold before introduction, as otherwise it may crack the flask.

In general terms a chemical vacuum is thus produced, and it may be demonstrated by the height of a mercury column which it can support, or in many other ways.

The particular one described is particularly well adapted for demonstration, as it is very simple and demonstrative. The balloon should be so large that it will not burst, as the effect is better when it inflates and fills the vessel lying closely against its sides.

VIROT'S STEAM CARRIAGE.

The solution of no problem is more sought for than that of the mechanical traction of small vehicles on ordinary roads. Since the first reaction steam carriage, based upon the principle of the eolopyle, and proposed by Isaac Newton, in 1680, and the first steam carriage, constructed in 1769 by Nicolas Joseph Cugnot, and of which a second and improved model, constructed in 1770, still figures in the gallery of the Conservatoire des Arts et Metiers, at Paris, numerous experiments have been made with a view to the application of mechanical traction to ordinary carriages. The solutions proposed or experimented upon may be classed in two distinct groups. One of these includes apparatus in which the energy is produced by thermic generators, in measure as needed, by converting heat into work. This group includes steam apparatus in which the fuel is coal, coke or petroleum, and certain newer apparatus in which the heat of combustion is utilized directly without passing through the intermedium of the steam boiler. In a recent patent, Mr. Debriat even proposes, under the odd name of the "imponderable dynamophore," a powerful and light powder motor in which the explosion is produced by an electric spark!

The second group belongs to the class of reservoirs or accumulators, a system in which a supply of energy, known and prepared in advance, is carried under the form of compressed air, hot water, taut springs, or electric accumulators.

Compressed air, and, *a fortiori*, springs, constitute poor reservoirs of energy, as regards specific power, but the future seems open to electric accumulators, which have not yet had their last say.

Our preferences are for a powerful and light accumulator completed by a pile of great capacity, but of feeble discharge, that will keep the accumulator constantly charged, even during periods of rest. Two qualities, power and duration, which are not met with in combination in any known apparatus, would thus be united.

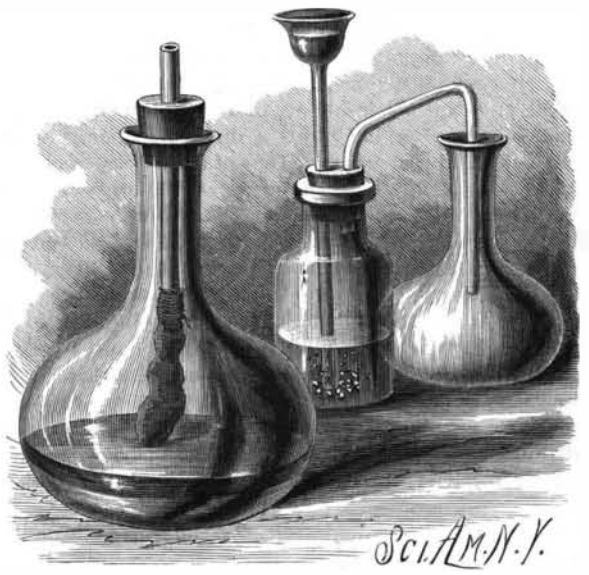
VIROT'S STEAM CARRIAGE.

Whatever be the solutions of the problem in the future, those of the present are oftenest made in view of the utilization of thermic motors, under the form of a furnace that heats a steam boiler which itself supplies the steam cylinder.

The annexed figure represents one of the most recent types of steam carriages. It was constructed by Mr. Virot, head machinist at the Central School of Lyons.

The carriage is actuated by two motors that drive the hind wheels through the intermedium of gearing. In front there is a steering wheel maneuvered through a hand lever. The boiler is of the Seguin type. Twenty minutes suffice to put it under pressure. The speed of the carriage is 9½ miles per hour, and it is capable of ascending gradients of 1 to 13 without difficulty. Behind, there is room for three persons, inclusive of the engineer. It is capable of hauling a load of 2,640 lb. As for the consumption of fuel, that does not exceed four pounds to the mile. With a tender supplied with water and fuel, the carriage is capable of making lengthy trips.

While we do not think that Mr. Virot's apparatus definitely solves the problem of the traction of small vehicles upon roads, it has seemed to us well to present this tentative to our readers, with the object of encouraging researches and of showing the state of the question.—*La Nature.*



ABSORPTION OF CARBON DIOXIDE.

The Colors of Twilight.

Prof. Constantini Rovelli has recently published, in the *Revue Scientifique Industrielle*, a study upon the colors exhibited at twilight, according to the state of the air.

Red and orange tints predominate when the air is dry. On the contrary, yellow, and especially green, characterizes air charged with vesicular vapor.

Prof. Rovelli studies the colorations of the air and their successive modifications in various cases and in the various parts of the crepuscular region, in measure as the sun disappears from the horizon. He likewise studies the same phenomena at the advent of "aurora with rosy fingers," and from them draws conclusions based upon the theory of the colors of the solar spectrum. Observation has already shown that the warmest colors of the spectrum predominate during a period of fine weather, while a yellow tint, followed by a greenish twilight, is the index of great humidity.

On another hand, we may consider the atmosphere as formed of two strata, the lower of which contains clouds and dust and the upper of which is more transparent. These two strata, as regards their refrangibility and absorption, behave differently in the presence of the rays that traverse them. From this Prof. Rovelli concludes that the crepuscular green is the precursor of rain; and, on the contrary, that a rosy twilight announces fine weather, according to the saying: "Rosso di sera; buon tempo spera." Let us compare with this adage the one current in Provence: "Roudgé dé matin, ploou sü lou vesin," *i. e.*, "red in the morning, rain is approaching."

Chemical Misnomers.

An editorial in the *Popular Science News* recites some of the curiosities of names of chemical compounds, which, when their inappropriateness is considered, appear extremely ludicrous. Thus: Oil of vitriol is no oil, neither are oil of turpentine and kerosene. Copperas is an iron compound, and contains no copper. Salts of lemon is the extremely poisonous oxalic acid. Carbolic acid is not an acid, but a phenol. Cobalt contains none of that metal, but arsenic. Soda water has no trace of soda, nor does sulphuric ether contain any sulphur. Sugar of lead has no sugar, cream of tartar has nothing of cream, nor milk of lime any milk. Oxygen means the acid maker, but hydrogen is the essential element of all acids, and many acids contain no oxygen. German silver contains no silver, and black lead no lead. Mosaic gold is simply a sulphide of tin. This list might readily be extended, both in chemistry and other natural sciences, and it is only fair to state that these terms all come from the older writers, and tend to give way to a more scientific nomenclature.