SIMPLIFIED APPARATUS FOR THE DETERMINATION OF THE VOLUMETRIC COMPOSITION OF AMMONIA.

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This experiment can be performed with such simple apparatus that the most meagerly equipped laboratory can furnish it. Any kind of a tube can be used. One with an internal diameter of about 9 cm. and from 40 to 60 cm. long will give splendid results.

Suppose the tube is a plain burette (B). Fit the large end with a rubber stopper (A) and the other end with a short piece of rubber tubing (C) and a pinch clamp (D). Close the clamp (D) and fill the burette with chlorine by displacement of water. Be sure that the tube is filled with *chlorine*. When the tube is full, lower it in the trough and pinch the clamp for an instant to let the increased pressure drive the water out of the small part of the tube.

Allow the apparatus to stand (5 minutes) till the water in the burette runs down. If the tube is not now full, add chlorine.

Insert the stopper (A) and push it in firmly. (Be careful not to warm the gas by handling the tube.) Pinch the clamp an instant to equalize the pressure. The burette is now full of chlorine at room temperature and pressure.

Clamp the tube in a vertical position and insert a short-stemmed thistle tube (E) in the rubber tube at the top. Pour 10 cm.³ of strong ammonia water into the thistle tube. Work a glass rod up and down in the stem of the thistle tube to

remove air bubbles. Let the ammonia drop slowly into the chlorine (by pinching the clamp) till nearly all is used. Remove the thistle tube and tilt the burette to completely use the chlorine.

Connect the burette with a small beaker (H) of diluted sulphuric acid (1:4) by a bent tube (F) filled with water. Be sure there are no air bubbles in any of the connections. (The clamp (G) holds the water in the arms of the tube while the connection is made.) Remove the clamp (G) of the tube and pinch the clamp (D) of the burette and allow the acid of the beaker (H) to flow in. Close the clamp and allow the apparatus to cool to room temperature. Again pinch the clamp. Disconnect the tube (F).

Measure the length of the liquid column. Invert the tube and measure the length of the gas column. The sum of these lengths is the length of a chlorine column of uniform diameter whose volume is the original volume. Examine the gas.

As the volume of chlorine used up is equal to the volume of hydrogen furnished by the ammonia, and the nitrogen originally with this hydrogen is the remaining gas, the ratio is easily seen.

Students easily determine the ratio correct to 5 mm. of nitrogen, using a burette, and often much more accurately.

NOTE ON FILLING A BAROMETER TUBE.

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The problem of successfully filling a barometer tube with mercury is one which has caused difficulty to many teachers, and the following method, which has been successfully used many times, may be found helpful.

The tube, about eighty centimeters long and at least six millimeters in diameter, is sealed at one end and then placed in a vertical gas pipe an inch or more in diameter provided with a cap or plug at the lower end. The gas pipe is then filled with sand, leav-