23.76 mm., with Expts. II and III, in which the aqueous pressure was only 0.35 mm.,[1] it is evident that the efficiency of a calcium chloride drying tube does not depend on the quantity of water vapor in the gas that is being dried, but rather on the volume of gas and the rate of flow.

All the samples of granular chloride of calcium that we have examined contain a small amount of surface moisture, so their efficiency lies between that of the anhydrous, granular salt and the fused. The vapor pressures of several samples of Merck's "chemically pure," granular calcium chloride were determined by the method employed above, and were found to be constant for a given sample at a given temperature if no large amount of water were introduced into the tube or removed from it. In every case the vapor pressure of porous chloride of calcium was found to be less than that of the fused salt at the same temperature. For example, at 25° Baxter and Starkweather found the vapor pressure of fused calcium chloride to be 0.35 mm.; one sample of the granular showed, in six determinations, a vapor pressure between 0.23 mm. and 0.25 mm., while another sample was found to have a vapor pressure of 0.14 mm. to 0.16 mm. Thus, the efficiency obtained from granular chloride of calcium as it is ordinarily used is variable and far below that which may be had from the completely anhydrous salt. When calcium chloride is employed where an efficient drying agent is required it should be previously heated, preferably in the tube in which it is to be used, to drive off surface moisture.

F. M. G. Johnson[2] found that aluminium oxide was capable of practically perfect efficiency as a drying agent, and it is very probable that the desiccating action here, since it depends on the physical state of the oxide, is also one of adsorption rather than of hydration, as stated by Johnson.

It is a pleasure to acknowledge that this investigation was undertaken at the suggestion of Prof. J. B. Ford, of Trinity University, under whose direction some preliminary experiments were conducted.

AUSTIN, TEXAS.

NOTES.

Vacuum-Jacketed Pycnometer for Liquids.—The author has used the Davis and Pratt[3] type of pycnometer and found it very satisfactory from the point of view of manipulation. In this type, however, like all others, the proper temperature must be obtained after the instrument is filled by immersion in a constant temperature bath, which results in the troublesome task of drying and polishing before weighing. Believing that this

[1] *Loc. cit.*

[2] THIS JOURNAL, 34, 911 (1912).

[3] *Ibid.*, 37, 1199 (1915).

last factor has been the cause of the inconsistencies noted in a large number of existing density measurements, the Davis and Pratt pycnometer was modified by the addition of a vacuum jacket.

The construction of this instrument is shown in Fig. 1, in which the symbols have the following meaning: A—A reservoir of thin-walled glass tubing, which may be of any desired capacity. B—Tapering tube of thin-walled glass reaching almost to the bottom of A and having a bore at the open end equal to or slightly greater than that of the inlet tube. This tube is of use in drying and filling the instrument. C—Small bore thin-walled tube sealed onto B leading out of the reservoir A through D, a jacketing tube of thin-walled glass which leads from E, the outer jacket of the pycnometer, thus surrounding the entire instrument with an outer jacket. F—An enlargement in D which acts as a stop for a supporting hook of the type used in connection with a weighing pipet as described in a previous number of THIS JOURNAL.[1] G—Slight enlargement in the capillary to accommodate the rise in liquid level when the pycnometer is brought to a vertical position, and which also serves as a safety when the instrument is being filled. H—Fine line etched around the capillary at the lower limit of the taper in the bulb G.

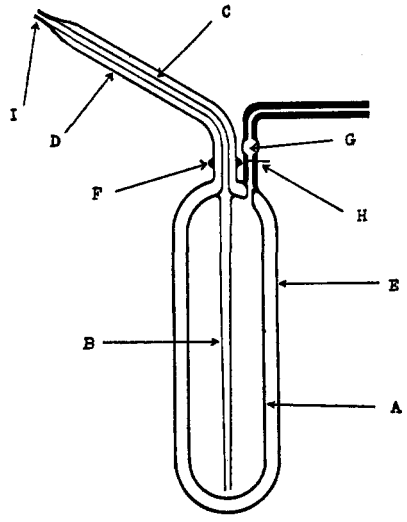


Fig. 1.

The final evacuation and sealing of the jacket is done at the tip of the inlet tube, marked I in the figure, the outer tube being allowed to collapse on the inner one. In the construction of this instrument the thinness of all the glass used should be emphasized in order to cut down the weight to a minimum. In spite of its apparent bulk, the one constructed and used, which was of about 20 cc. capacity, weighed only 35 g. Following the above suggestion, this weight could be made much less.

The operation of this instrument does not differ materially from others of similar form, except, that preliminary to filling it is washed out two or three times with the liquid, which has previously been brought to the desired temperature. Thus having brought the inner body of the pycnometer to the temperature at which the liquid is to be measured, it can be filled and the level adjusted without any appreciable change in temperature. The liquid is now drawn in through C, having the body of the pycnometer

[1] 37, 2062 (1915).

tilted, until the level rises in G. The excess of the liquid is removed and the level very accurately adjusted by touching a filter paper to the tip of the inlet tube at I, while the instrument is inclined sufficiently to bring the liquid to the tip.

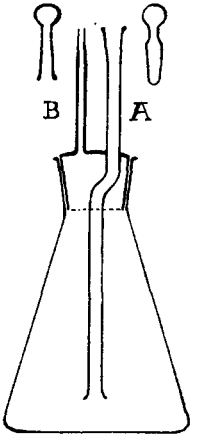
The advantages of this instrument over the Davis and Pratt type are as follows:

(1) There is no loss in time in waiting for the pycnometer and contents to come to the desired temperature.

(2) The troublesome drying and polishing normally necessary before weighing is eliminated, since it does not have to be immersed in a constant temperature bath. FRANK HALL.

A Titration Flask.—The use of the following titrating flask in place of the familiar type of the weight buret has been found to possess some advantages in volumetric analyses in which great accuracy and speed of manipulation are requisites:

It consists, as shown, of a flask fitted with a ground-glass stopper, through which passes a relatively large tube, A, extending nearly to the bottom of the flask, and a capillary tube, B. A is ground to fit the exit of a stock bottle, and is provided with a ground-glass cap. In use the flask is weighed empty. The sample is then introduced, either through A, or by removal of the stopper, and a second weighing is taken. It is then brought into connection with the stock bottle, and solution is run in until the end point is reached, whereupon the final weighing is made. From these data, the weight of the sample, and solution are obtained. If necessary, back titrations are made with a dilute solution from an ordinary buret. In all cases, the tube A is rinsed by blowing into B, and allowing the solution thus raised to flow back. The connection with the stock bottle is preferably made through a flexible glass grid, permitting the flask to be shaken during the introduction of the solution.



An entire analysis requires only three weighings, whereas with the weight buret, four are necessary. This form of titration flask decreases the loss by spattering or evaporation; although, of course, it would not prevent the escape of a volatile product such as carbon dioxide. This method is particularly adapted to the analysis of solutions containing a highly volatile constituent. It was used in a series of determinations of the bromine content of solutions saturated with bromine, and the error was found to be consistently less than 0.03%. F. K. BEZZENBERGER.