Contribution from the Chemistry Department of Queens College, Flushing, New York

Automatic Microburet with Horizontal Scale

By

Anna-Greta Hybbinette and A. A. Benedetti-Pichler

With 3 figures

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The buret to be described relies solely upon gravitational force and surface tension for its operation. It is known that a liquid rises in a capillary to a height $h_1$, Fig. 1a, which depends upon the diameter of the capillary at the level of the meniscus, the density, and the surface tension of the liquid. It is equally well known that a taller column of the same liquid is supported by the surface force, when the capillary is not in contact with a body of the liquid, Fig. 1b. The additional column of liquid of height $h_2$ is borne by the surface force originating at the meniscus in the tip of the capillary. If the capillary $b$ is lowered into the surface of the liquid, the meniscus in the tip of the capillary is eliminated, and the liquid will flow out of the capillary until the meniscus has dropped from level II to level I. Of course, the flow may be interrupted at any time by raising the capillary $b$ so that the meniscus in the tip is restored. If the capillary is calibrated as a buret, the meniscus in the tip will take the place of an automatically operating stopcock as long as the meniscus in the capillary is on the descent from level II to level I.

If it is desired to have the rate of outflow reasonably fast, the tip of the capillary must not be too fine, and the distance between levels II

1 Research Laboratory of the Boliden Mining Company, Stockholm, Sweden.
and II then becomes rather too short to accommodate the graduated part of a buret in perpendicular position. The distance \( h_p \), however, is sufficient to hold the reservoir of a weight microburet\(^1\) and to permit the use of a calibrated capillary of any desired length in a horizontal position. No liquid will leave the tip of capillary \( c \), Fig. 1, as long as the tip is not touched to the bulk of the liquid below. Contact, however, will empty the horizontal arm completely, no matter how long it is.

It may be mentioned in this connection that burets with perpendicular scale such as those of \(\text{Schwarz}^2, \text{Linderstrøm-Lang}^3 \) and \(\text{Holter}^4\) make use of the surface force originating in the tip of the buret. Means are provided to regulate the gas pressure above the standard solution so as to counterbalance the excess hydrostatic force. Thus, level I of Fig. 1 is continuously held at such distance below the meniscus of the standard solution that the outflow can be started and stopped by making and breaking the contact of the tip with the surface of the titrated solution.

**Construction of Buret**

A buret of 0.6 ml. capacity is made from a 40 cm. length of thermometer capillary of approximately 2 mm. uniform bore. The capillary, which may consist of soft glass or any kind of chemically resistant glass, is bent as shown in Fig. 2. The length of the perpendicular part \( a \) and the tip are adjusted by repeated trials so that, with the graduated portion of the tube in a horizontal position, water will flow out only when the tip of the buret touches a wet surface. At the same time, the rate of flow

\[1 \text{ M. Struszynski, Przemysl chem. 20, 53 (1936).}\]
\[2 \text{ K. Schwarz, Mikrochem. 18, 1 (1933); 18, 309 (1935).}\]
\[4 \text{ N. G. Heatley, Biochemic. J. 29, 626 (1935); Mikrochem. 26, 147 (1939).}\]