An apparatus for the measurement of small quantities of fluid / by J.W. Trevan.

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AN APPARATUS FOR THE MEASUREMENT OF SMALL QUANTITIES OF FLUID.[1]

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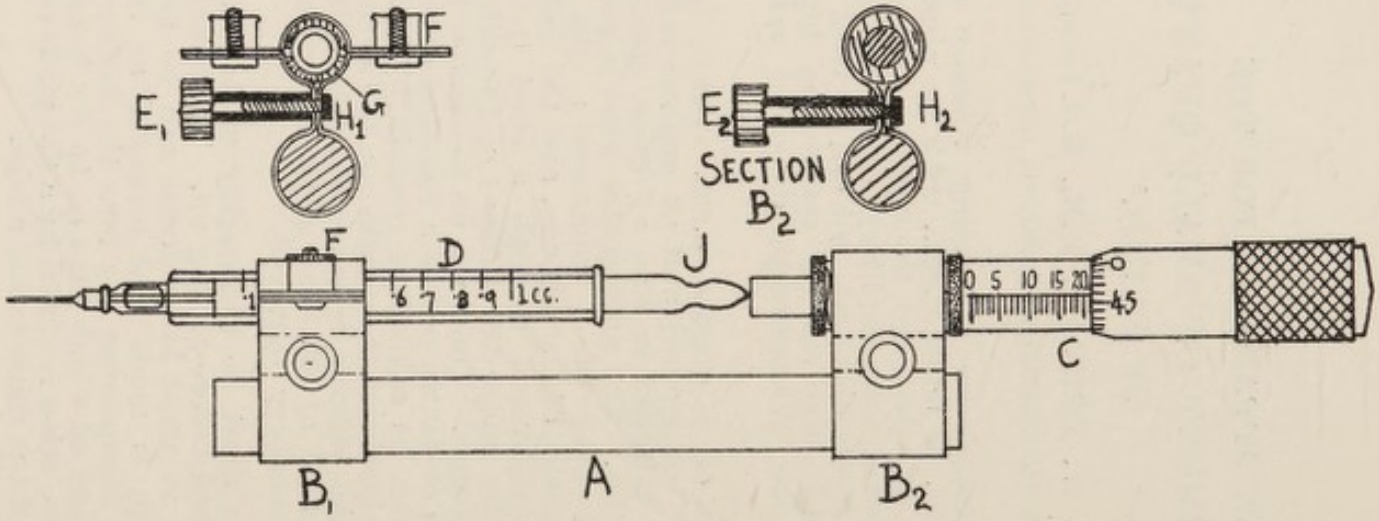
THIS apparatus for measuring volumes of fluid from 0·5 c.cm. to 0·005 c.cm., with an accuracy of 1 per cent., was designed to measure 0·02 c.cm. of diphtheria toxin into capillary tubes for the performance of the Schick test, but can be used for any titration which involves the making of high dilutions—e.g., the Wassermann or other serological reactions.

It consists of a good 1 c.cm. syringe (all-glass "tuberculin" or record) and an engineering micrometer head, clamped in line by brass clamps to a ½ inch steel rod. The micrometer head is graduated in one-hundredths of a millimetre; its motion pushes the piston of the syringe, and the fluid to be measured is delivered through a steel (preferably rustless) needle under the surface of the diluent (to avoid drop errors). The knob on the piston is either ground plane or drawn out to a rounded point. The instrument can be calibrated roughly by measuring the distance between the marks on the syringe and calculating the volume corresponding to 1/100 mm. (=1/50 of a turn of the head of the micrometer), or by weighing mercury delivered.

The piston must be thoroughly wetted with the fluid to be used before setting up. The usual micrometer found in most laboratories can be used if a copper trough is made and arranged so that the anvil of the micrometer fits into the hollow of the trough, one end of which clips on to the knob of the piston, and the other is closed by a flat plate on which the plunger of the micrometer works.

[1] Shown at the Pathological Section of the Royal Society of Medicine, Feb. 21st, 1922.

The Apparatus for Measuring Small Quantities of Fluid



Micrometer syringe made with detachable micrometer head. A, ½ in. steel rod. B1, B2, brass clips (see section above). C, micrometer head, which can be obtained at any tool shop, 25 mm. in 1/100 mm. D, 1 c.cm. " tuberculin " syringe. E1, E2, milled heads with screw in shank, for tightening clips ; the male screw, H, fits into these and is soldered to the clip. F, electrical binding screws for fixing syringe in clip. G, chamois leather lining. J, head of piston drawn out to a point and rounded off ; this is devised to prevent errors due to the irregularity of the usual surface of the piston head. The same result could be obtained by grinding the head of the piston to a flat surface.

Calibration of successive turns gave the following results :—

1. By weighing mercury : 34 readings, 1 turn of the head of the micrometer = 0·1276 ± 0·0094 g. mercury = less than 1 per cent. Corresponds to 0·0190 c.cm. per mm. Direct measurement gave 0·0192 c.cm. per mm.

2. By ejecting 50 per cent. calcium chloride under the surface of water in a beaker and titrating with N/50 $AgNO_3$ and chromate : (*a*) All-glass 1 c.cm. syringe. 4 turns, 8 readings gave 10·91 c.cm. $AgNO_3$ average, extreme error 0·05 c.cm. $AgNO_3$ = less than 1 per cent. (*b*) Record 0·3 c.cm. syringe gave 6·317 c.cm. $AgNO_3$ for 4 turns (about 0·02 c.cm.) extreme error 0·055 c.cm. $AgNO_3$ = less than 1 per cent.

3. By measuring the number of turns to eject a standard drop of fluid : (*a*) All-glass syringe, 34 readings : 1 drop = 1·0263 mm., extreme error = 0·0075 mm. = 0·76 per cent. on a volume of 0·0190 c.cm. (*b*) Record syringe : using mercury as a dropping fluid, volume of 1 drop 0·0001 c.cm., 10 drops of mercury (0·001 c.cm.) = 0·099 to 0·109 mm. movement of the micrometer head ; error less than 5 per cent. The chance of the mercury drop varying in volume is so great owing to the ease with which it becomes contaminated that the error of the method of calibration is probably greater than the error of the measurement by the syringe.

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