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Pipetting Machine with Rapid Preset. (23115)

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Several immunochemical procedures require the addition of less than cc volumes of reagents to large series of tubes. In studies on production of hemolysin by mice or other laboratory animals following the method described by Taliaferro(1) large series of serum dilutions must be made. Pipetting machines are available* for repetitive delivery of fluid volumes but resetting for some new volume requires careful recalibration and adjustment. Ordinarily, there is not enough time for these manipulations during the course of a given test. The machine described here was constructed to reduce the time required for adding quantities such as 0.02, 0.04, 0.06 cc, etc. to sets of 20 to 30 tubes in the serial dilutions of serums for estimation of their hemolysin content.

Methods. Fig. 1 is a general view of the assembly and shows presetting button (white), toggle switch (black) for operating the machine and other features described in detail in Fig. 2. Details of construction of the plunger and associated parts of the machine are illustrated in Fig. 2, I. The stainless steel plunger, A, Fig. 2, I, was made 0.874 cm in diameter and displaces a 3 cc volume when inserted a distance of 5 cm in the fluid reservoir, B. Fluid volume displaced is directly proportional to movement of the plunger. Control of the forward movement and hence of the fluid displaced is provided in the preset counter by means of the micro-switch, C. Counting rate is determined by the 4-sided cam, D, and with the gear ratio and plunger shown here the preset counter records one count for each 0.01 cc delivered. Tapped holes in various positions around the cam allow one to obtain a larger or smaller number of counts per unit quantity of fluid delivered. Worm gears, E, with a 60 to 1 ratio and the pinion gear, F, advances the rack at the rate of 4.0 cm per revolution. By revolving the slotted ram, G, in a counterclockwise direction the rack and pinion become disengaged allowing the plunger assembly to be withdrawn for reloading.

An exploded view of the preset counter indicating the relationships between its 4 principal parts is shown from left to right in Fig. 2, II. Number of counts and thus volume to be delivered is determined by the setting of the dial, 1, which positions the stop block, 2. Immediately to the right of the stop in Fig. 2, II, is shown a single unit combining the following 4 structures: the cam, 3, that actuates the microswitch controlling the motor-drive; the positioning stop, 3S; the indexing tongue, 3L; and the axle of the instrument. The controlling element, shown at far right in Fig. 2, II, during normal operation lies in the position indicated by x - - - x. This structure is shown in place in Fig. 2, III. The ratchet wheel 4R and the toothed wheel 4S are machined as a single unit and are actuated by the relay armature, 5. The wheel, 4S, has 70-1/32 inch slots spaced about its periphery and the ratchet, 4R, has 70 teeth which correspond with the divisions

* Brewer automatic pipetting machine, Baltimore Biol. Lab., Baltimore, Md., and Sterling Automatic Pipette, Ivan Sorvall, N. Y. are 2 of the available mechanical pipettors in use in our laboratory.

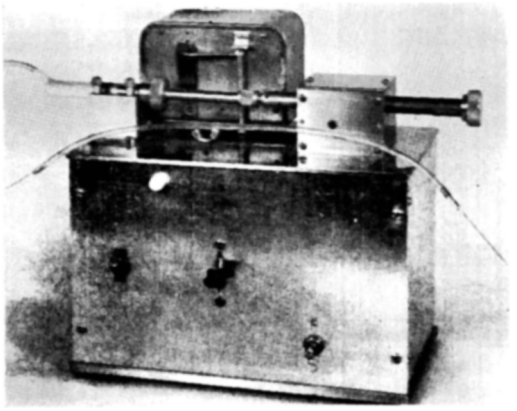

FIG. 1. Front view of pipetting machine showing preset button (white) and operating toggle switch.

on the dial, 1.

When the current which operates the relay is interrupted by the microswitch, C, the indexing tongue, 3L, engages the wheel 4S to rotate the cam. A thrust spring holds the parts of the controlling assembly together and a spiral spring, 6, loads the cam shaft to return it to the stop. This action is triggered by the operator as the reset lever, 7, is depressed thus disengaging the tongue, 3L. Resetting for repeated delivery of a given volume is done by pressing the reset lever while selecting a new volume for repetitive delivery is done simply by turning the dial to a new position.

Time required to deliver less than cc volumes of fluids to large series of tubes has been reduced and fatigue associated with frequent pipette refillings has been essentially eliminated by the use of the pipetting machine just described. Since the volume delivered is directly proportional to the linear movement of the plunger, the accuracy of the instrument is related to the accuracy of machining the plunger. Aside from its reliability the great advantage of the machine just described lies in the rapidity with which a new volume setting can be made.

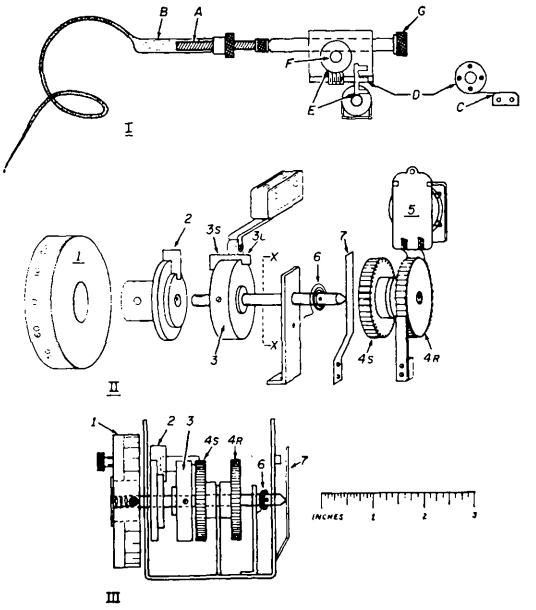

FIG. 2. Details of construction of pipetting machine; part I is shown half scale, parts II and III are shown full scale.

Summary. A pipetting machine designed for the repetitive delivery of fluid volumes in the range of 0.01 cc to 0.60 cc has been described. A counter and its associated parts drives an accurately made stainless steel plunger forward displacing the fluid in a glass cylinder at such a rate that one count represents a delivered volume of 0.01 cc. Any given number of counts up to 60 may be selected allowing the operator to deliver that volume repeatedly to a large series of tubes. Accuracy of delivery is ensured since the linear movement of the plunger is directly proportional to the volume delivered; time is saved in pipetting operations involving large series of tubes and the fatigue of frequent pipette refillings is reduced.

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