A MECHANICAL PIPETTE

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An automatic pipette is a very useful equipment for any laboratory carrying out Kahn tests on a large number of sera. A number of devices were tried in a field laboratory which was functioning as a serological laboratory for the Ceylon Army Command during the years 1945 and 1946. A mechanical pipette which can easily be prepared with materials salvaged from a small workshop is described below. The writer does not claim any originality in describing this pipette, as it was made after one reported by Smith (1944). It was, however, found necessary completely to alter the design of the mechanical parts of the apparatus described by him, as it did not prove to be satisfactory in the writer's hand. The valve system used in this improved apparatus was similar to that described by Smith.

Description of the Apparatus

(FIGURES 1 AND 2)

A small table fan motor of 1,350 r.p.m. is mounted on a suitable stand. It is connected with a train of gears (gear ratio 1 : 64) to give 21 r.p.m.

Crank housing A connected with the gearing described above has a screw (40 threads per inch) which acts as a crank. A nut which can be screwed up and down this screw by means of a knurled knob provides a crank pin which fixes the required eccentricity of the crank. Every turn of the knurled knob on the screw gives a variation of 0·050 in. in the eccentricity of the crank. The housing is set into a rotary motion by the motor.

Connecting link B connects the crank pin with the crank bell. The rotary motion of the crank pin sets the link moving which sets the crank bell oscillating.

Crank bell C is an angular piece having arms at right angles to each other and its pivot at the point of the intersection of the centre lines of the arms. Both the arms have slots for the necessary variation in the movement of the plunger rod D. The small arm is connected with the connecting link B, which gives it an oscillatory movement. This sets the long arm in an upward and downward motion, and this in its turn imparts a reciprocating motion to the plunger rod.

The syringe frame E is mounted on the vertical part of the stand on which the crank bell C and the housing A are also mounted.

The locking cap F of a 2-ml. record syringe is soldered to the lower end of the syringe frame. The syringe barrel G with its plunger in it is fitted on to the locking cap and is fixed in its proper position by means of a bracket H.

The plunger rod D specially designed for the purpose is then slipped through the ferrule (soldered at the lower end) of the syringe frame and the locking cap and its upper end is screwed to the plunger. The lower end of the rod has several holes by which the position of the plunger can be adjusted.

Eleven inches of a glass tube (*a b*) with 6 to 7 mm. bore is narrowed to a bore of 2 mm. at the end *b* to provide a valve seat. A solid glass rod ($1\frac{1}{4}$ in. × 3 mm.) well ground at its lower end is inserted through the end *a* so that it acts as a valve seat at *b*. The tube is then constricted to a bore of nearly 3 mm. at a point 5 in. from the end *a* to provide the valve seat *c*, and a second glass rod ($2\frac{1}{2}$ in. × 3 mm.) with its lower end similarly ground is inserted into the tube at the constriction *c*. A right-angled piece, with its two arms *d e* and *e g*, 2 in. and $1\frac{1}{2}$ in. respectively in length, is then fused at a point *d* which is $1\frac{1}{2}$ in. from the constriction *c*. The arm *e g* is slightly constricted at a point *f*, which is $\frac{1}{2}$ in. from the end *g* of the T piece, and lastly the end *g* is also constricted to a bore of 2 mm. The T tube is fixed to the stand by means of wooden clamps.

A glass tube *h i* of suitable length with its upper end bent in U shape is fixed on the right side of the T tube with the same wooden clamps.

The end *g* of the valve system is connected to the nozzle of the syringe with rubber pressure tubing. Similarly the end *a* is connected with the curved end *h* of the glass tube *h i* and the end *i* of the tube *h i* to a capillary pipette *j k* which serves as an outlet for fluid.

The Working of the Apparatus

When the motor is switched on, the plunger is moved up and down through the medium of the crank bell C connecting link B and the crank housing A. Valve *b* opens and *a* closes on the down strokes of the plunger, and this process is reversed during its up strokes. This gives an intermittent flow of a required volume of fluid (twenty-one times in a minute) from the outlet *k* of the capillary pipette J K.

The adjustment of the plunger rod to obtain

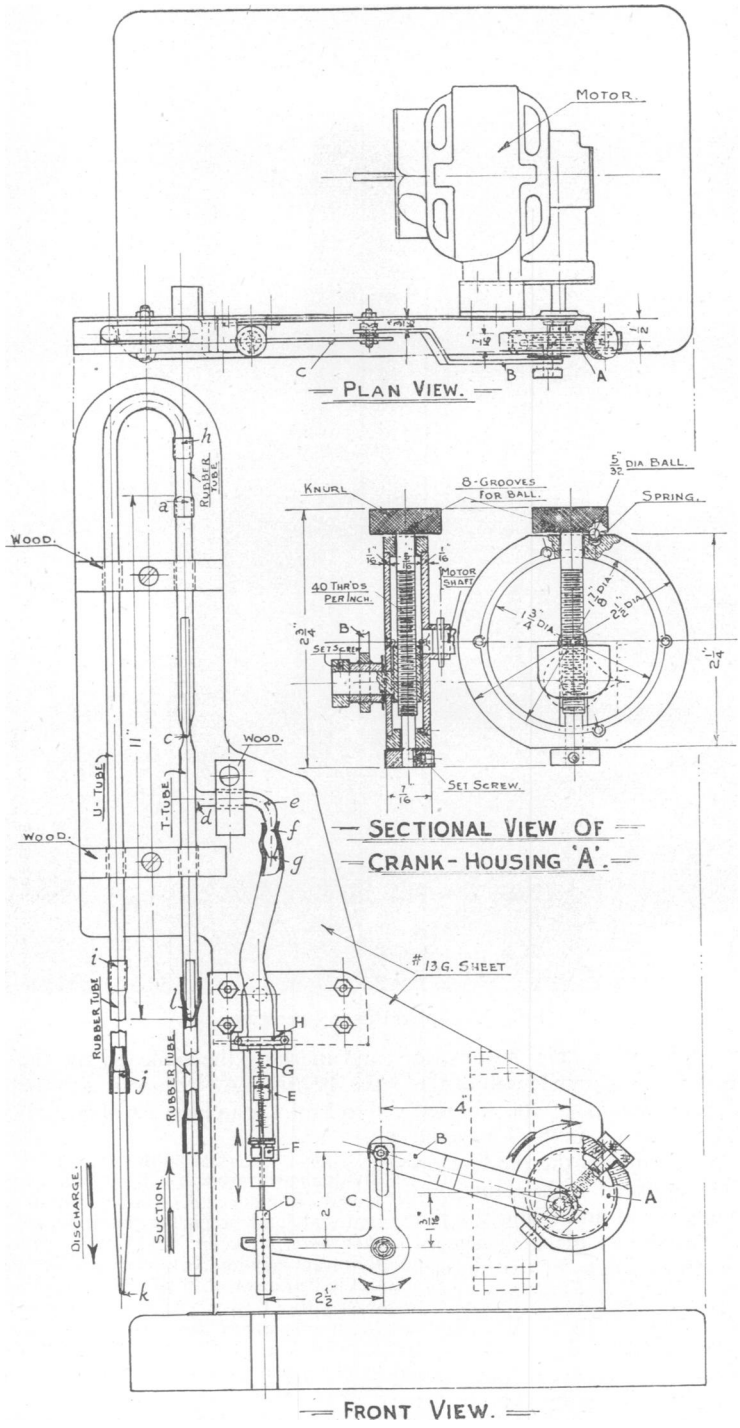

FIG. 1.—Plan of apparatus.

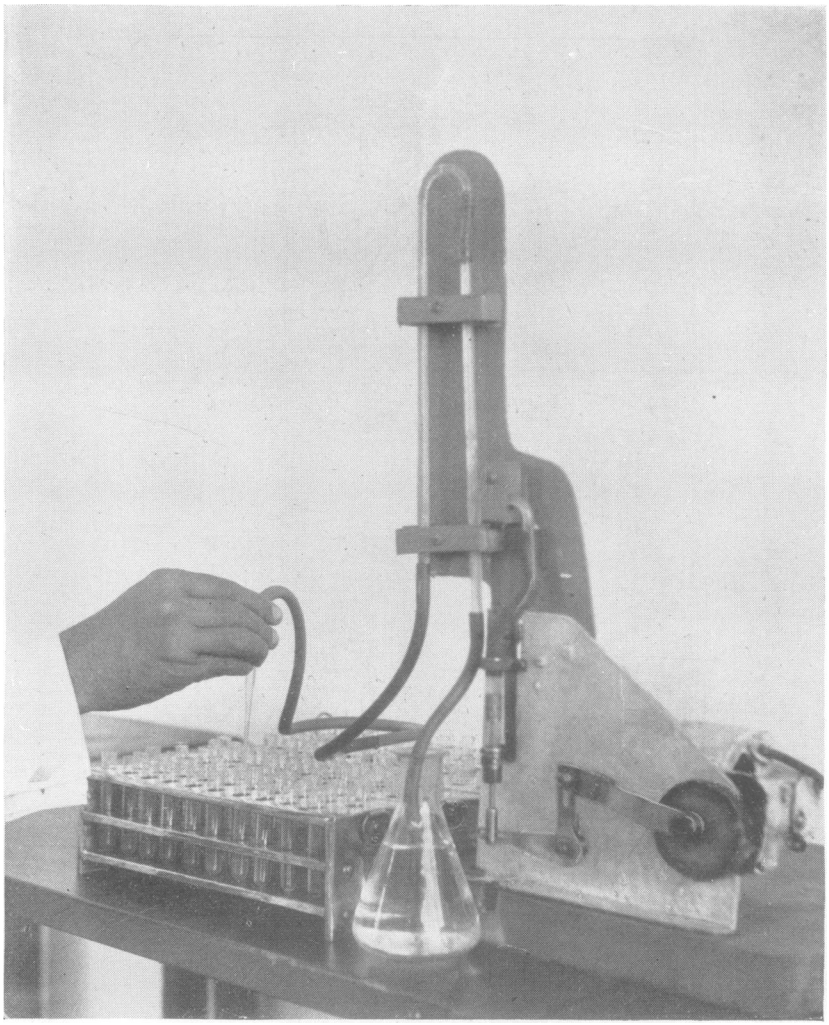

FIG. 2.—Apparatus in operation.

varying quantities of fluid with this automatic pipette is done as follows : The stroke length of the plunger rod is adjusted by means of the knurled knob on the crank pin housing A. As this leaves the plunger in a position which makes the reading on the syringe difficult, it is adjusted by selecting one of the holes on the plunger rod and fixing the pin through the holes and the slot in the long arm of the crank bell C. The stroke length of the plunger can also be adjusted by varying the position of the connecting link on the small arm of the crank bell C. If the apparatus is calibrated, one need not go on making adjustments for different quantities of fluid required. This can be done by varying the position of the pointer fixed to the crank pin and noting the volume of fluid expelled by the plunger and marking the same on the brass cover plate of the housing A. Thus it can be calibrated from 0 to 2 ml. for an increase of every 0·25 ml. in volume.

I take this opportunity of thanking numerous individuals who were attached to the workshop of the Chief Royal Engineer, Colombo sub-area, for providing materials and preparing the apparatus, at a time when they were preoccupied with " top priorities " for the units that were leaving Ceylon for action. I am much indebted to the Professor of Physics, University of Ceylon, for providing the T tube and valve systems for the apparatus. My thanks are no less due to several friends in the Tata Iron and Steel Company without whose assistance it would not have been possible to submit this paper for publication.

REFERENCE

Smith, M. S. (1944). *J. Lab. clin. Med.*, **29**, 872.