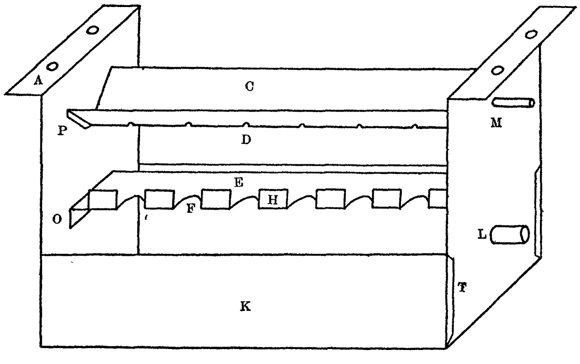


Fig. 1.

metal by using round objects such as bolts, etc., to hammer the metal around. Overlapping joints (T) are soldered to the upright ends of the tank so that the joints are water-tight.

The pattern of the rack is shown in Fig. 2. Its nature is apparent when reference is made to Fig. 1. The slots (F) are made by drilling the metal first with round holes of appropriate size and properly spaced. In our apparatus these holes were made

Fig. 2.

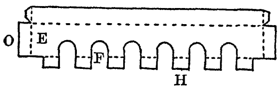
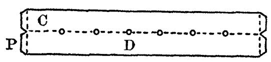


Fig. 3.



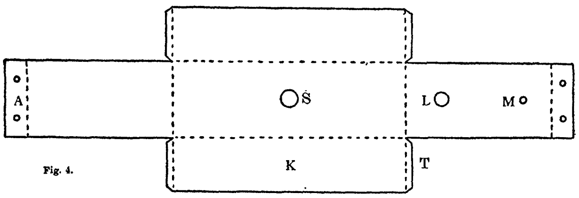


Fig. 4.

¾ inch in diameter. After the holes are drilled they are cut into slots by the tin shears. The projecting ends (H) are then turned up as guards (Fig. 1). The part above the upper dotted line (Fig. 2) is bent at a right angle to the rest (E) and forms a strengthening flange not visible in Fig. 1. The ends (O) are turned and soldered down to the ends of the tank as shown in Fig. 1.

The construction of the water-distributing trough is simple (pattern in Fig. 3). It is merely a V-shaped trough (C, Fig. 1) with nail holes (D) punched in its bottom in such a manner that they will be properly centered over the slots (F) in the rack. The ends (P), as in the case of those of the rack, are turned over and soldered down to the ends of the tank.

The outlet pipe (L) is set so that the top side of it is about ⅛ inch below the top of the side (K) of the tank and it is sufficiently large to be a positive drain. The inlet pipe (M) may be much smaller.

As stated before, our apparatus is fastened on the under side of a shelf over the laboratory sink. Water is supplied through a rubber tube slipped over the pipe M. In order for the apparatus not to interfere, even when in constant use, with ordinary use of the water faucet at the sink we had our college engineer set an ⅛ inch petcock permanently into the faucet back of its valve.

Ordinary ¾ inch flanged test tubes make excellent tissue holders. These are cut off about 2 to 2½ inches below the flange, or short enough to clear the bottom of the tank and permit a free flow of water through them. These cut ends are closed with silk or with bolting cloth. These tubes containing the tissues are suspended in the slots in the rack. The water is started and allowed to flow into the trough. It drips through the holes (D) into the tubes suspended in the slots, fills the tank and overflows through the outlet tube (L). The overflow may be allowed to fall directly into the sink or it may be carried to any desired point with a large rubber tube.

The tissue-containing tubes are constantly suspended in water even should the flow be stopped. While the water is flowing clean water constantly passes the tissues. The rate of flow may be regulated by the petcock.

Such an apparatus as this may be made of any suitable size. More or less slots may be made according to the number of students using the apparatus or the amounts of tissues being washed. Our apparatus measures 10¾ inches in length and has six ¾ inch slots. These slots may, however, be made to accommodate any size of tube.

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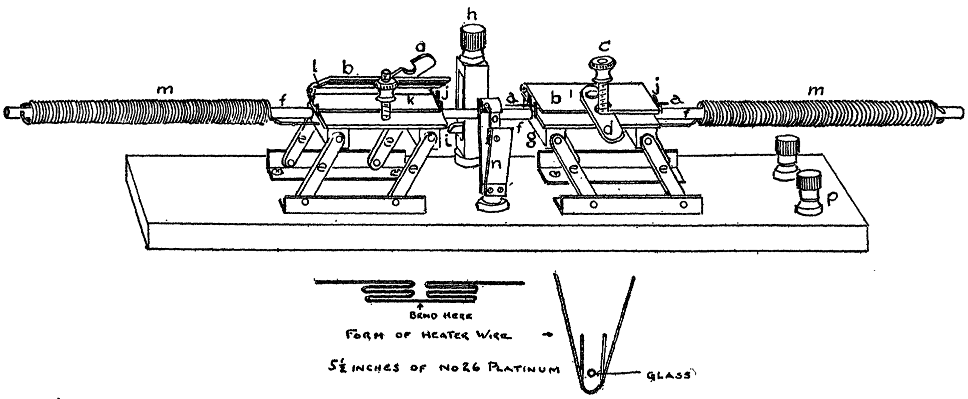
A MACHINE FOR PULLING GLASS MICROPIPETTES AND NEEDLES

In designing a machine for this work a study was first made of the hand movements of an expert in making needles and pipettes. The essential movements seemed to be a removal of the glass from the heater at the correct temperature followed by a rather quick horizontal pull-out.

In the machine as designed a parallel motion was devised which, when the glass becomes plastic enough to stretch under a light pull, lifts the glass up and out of the heater, and, at the same time, increases the pull by an increase of leverage. The result is a rapid pull-out at the correct instant.

The machine as shown in the diagram is in its final position after pulling two needles, and one needle (a) is still held in the machine by the clamp (b) though the locking nut (c) has been unscrewed (much more than is necessary to release the latch (d)). It is obvious from the drawing that the clamps (b) remain always parallel to the base due to the hinged side bars (e) but perhaps it is not so clear that the alignment rod (f) passes with a sliding fit through the cross-bars (g) of the clamps (b) so that the two clamps must move up and down together, always remaining in alignment with each other. To "set" the machine the clamps are pressed down until, by turning the knurled knob (h), the retaining bar (i) may be swung over the alignment rod (f). The clamps are then opened and a glass rod or capillary of double length is dropped between the guides (j). This rod or capillary will rest on the leather pads (k) and when the clamps are closed and latched will be held firmly by the rubber pads (l). The retaining bar (i) may now be swung off, without changing the position of the machine, though the glass will now be under the tension of the springs (m). In this position the glass rod or capillary will pass through the heater (n) and upon switching on the current the glass will become softened. It will pull out, first slowly and then, as the clamps rise, the action will become rapid, ending with a quick pull-out, and two needles or pipettes will be pointed and ready for bending.



This machine has a number of elements which can be adjusted to give any form of needle or pipette point desired. This is necessary as different types of points are often required, but no change in adjustment is necessary for glass of different diameters.

The heating element is a platinum wire in a V-shaped holder of mica. A resistance must be used in series with the heater with a snap switch to turn on and off. If the platinum wire is too small it may burn out. At least size No. 26 should be used. The best form of the wire is shown in the diagram. The width of the heater determines the length of glass softened and so controls the length of the tapering shank of the point. With the form shown this will be about correct, but the shank can be lengthened by spreading the loops of the wire if desirable. The temperature of the heater depends upon the current which flows and this can be adjusted by the series resistance to give a safe temperature which will not burn out the platinum. At this temperature, the color of the wire is a bright yellow. A current of 7½ amperes may be used for No. 26 platinum wire.

The heater is adjustable in position and should be set squarely under the glass rod. The heater can be raised and lowered and the loops may be bent in and out. If the heater is too low or too open at the top of the loops the heat will not be maintained long enough as the glass rises, and the final taper may be too short or the tip broken. On the other hand if the heater is too high the final taper will be too long or the tip fused.

One other adjustment that can be made is the position, up and down, of the bar that locks the machine while the glass is being clamped in place. The lower this bar is adjusted the less will be the initial tension on the glass. It should be kept fairly low.

It will be seen that each of these adjustments affects the others. Thus an increase of heater current or a raising of the heater, or a lowering of the locking bar will all act to increase the heat delivered to the glass. The main thing seems to be a rather intense heat at the start, maintained as the glass rises until just before the pull-out. The exact setting, however, can only be made experimentally.

With the machine adjusted to give the type of point desired, it is possible to turn out pipettes or needles at the rate of four to six per minute. This machine is now in use in Dr. Chambers' laboratories.

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