NEW APPARATUS

A NON-CORRODIBLE VALVE FOR USE IN AUTOMATIC CONTROL OF FLOW OF PHYSIOLOGICAL FLUIDS

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A valve made from non-corrodible materials, with the method of construction, relevant measurements, order of assembly and final adjustments is described.

IN the apparatus first described by Schild (1946) for the automatic filling and emptying of an isolated tissue bath, the flow of fluid to and from the bath was controlled by compression of rubber tubing under the armature of a telephone relay so that when the solenoid was energised, the pressure on the tube was released and the fluid was allowed to run. Other methods have since been used for the automatic control of fluid flow. In this laboratory we have designed an automatic control valve for the flow of physiological fluids. The valve is constructed from an oil dilution valve A.M. 5U/3013 type FAW/A/221 and is controlled by a current source of 24 V. The valve consists of plastic and nylon components which do not contaminate the fluids and which have not shown any evidence of corrosion. It has been used for two years during which it has required no adjustments except periodic cleaning. The interior of the valve consists of a barrel and plunger which can be separated for cleaning. Inlet and outlet tubes are screwed into the barrel. Fig. 1.

The barrel was constructed from a 2-in. length of $\frac{3}{4}$ in. diameter perspex rod. A hole was first drilled through the long axis with a letter "D" drill (0·246 in.). The hole was then increased in diameter to a depth of $\frac{1}{2}$ in. and tapped $\frac{1}{4} \times 19$ B.S.P. A hole 1/16 in. in diameter was then drilled from the angled shelf made by the drill to meet the exterior of the barrel approximately $\frac{3}{4}$ in. from its end. This vent is necessary to control changes in air pressure caused by movement of the plunger in the barrel. The internal diameter of the other end of the barrel was correspondingly enlarged and counterbored with a flat ended drill to make the final depth 5/16 in., and threaded $\frac{1}{4} \times 19$ B.S.P. A hole for the outlet tube was made with a No. 26 drill and threaded 2 B.A., the centre being $\frac{1}{2}$ in .from the end of the barrel and in line with the vent.

The plunger was made from $1\frac{1}{4}$ in. of $\frac{1}{4}$ in. diameter P.T.F.E. rod. The diameter of one end was reduced to 0·225 in. for a length of $\frac{1}{2}$ in. and the tip was turned to form a 60° inclusive point. The other end of the plunger was drilled to a depth of $\frac{5}{8}$ in. and threaded to 4 B.A. to take the plunger screw.

The plunger screw was made from $1\frac{1}{8}$ in. of 7/32 in. diameter brass rod. One end of the rod was turned down to a distance of $\frac{7}{8}$ in. and threaded to 4 B.A. This was later secured to the plunger by a 4 B.A. half nut

suitably reduced in external diameter. At a distance of $\frac{1}{8}$ in. from the other end of the rod a 3/32 in. hole was drilled across the diameter.

The inlet and outlet tubes were made from nylon rod. The inlet tube was constructed by turning down one end of $1\frac{1}{8}$ in. of nylon rod $\frac{3}{4}$ in. diameter to a distance of 5/15 in. and threading it to $\frac{1}{4} \times 19$ B.S.P. This end was then centre drilled with a No. 1 centre drill to form the valve seating which at this stage had a diameter of 0·225 in. This end of the inlet tube was then skimmed square until the diameter of the valve seating

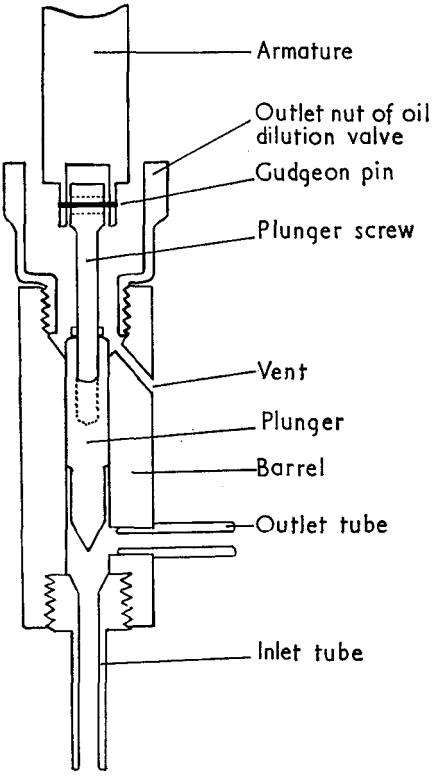

FIG. 1.

was 0·2 in. A hole was then drilled with a No. 30 drill through the long axis of the rod. The construction of the inlet tube was completed by screwing its threaded end into the barrel and turning both between the chuck and a live centre until the outside diameter was reduced to 3/16 in. For the outlet tube approximately $\frac{5}{8}$ in. length of 3/16 in. diameter nylon rod was drilled throughout its long axis with a No. 30 drill. It was threaded to 2 B.A. for a distance of 3/16 in. from one end for attachment to the barrel.

Before fitting the valve it was necessary to modify the oil dilution valve 5U/3013 type FAW/A/221, the outlet nut of which was drilled out to $\frac{3}{8}$ in. to give clearance for the plunger screw. In order that the plunger

screw could be connected to it the armature was also modified by removing the washer and drilling a hole $\frac{1}{4}$ in. diameter and $\frac{3}{4}$ in. deep in the centre of the exposed end; it was then turned down to 5/16 in. for a distance of $\frac{1}{4}$ in. A hole 1/16 in. in diameter was drilled $\frac{1}{8}$ in. from the end of the armature to take the gudgeon pin.

Before assembly the inlet tube was removed from the barrel and the latter was reamed out to 0·25 in. The plunger with the plunger screw in position was carefully lapped into the barrel by hand to give a slide fit, using fine carborundum paste. The hole in the plunger screw head was aligned within the armature and secured in position by a silver steel gudgeon pin. The loose fit acts as a universal joint to allow the plunger to move freely in the barrel. The oil dilution valve was then reassembled with the plunger protruding from the outlet nut. The inlet tube was again screwed into the barrel until it just touched the flat base of the hole. The valve seating is liable to distortion if the inlet tube is screwed too firmly. The barrel was then placed over the plunger and screwed to the outlet nut. It is usually necessary to remove the barrel several times to adjust the position of the plunger on the plunger screw until the maximum flow of fluid is obtained.

Reference

Schild, H. O. (1946). *Brit. J. Pharmacol.*, **1**, 135-138.