

[54] **PIPETTES**

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 [58] Field of Search **73/425.4 P, 425.6**

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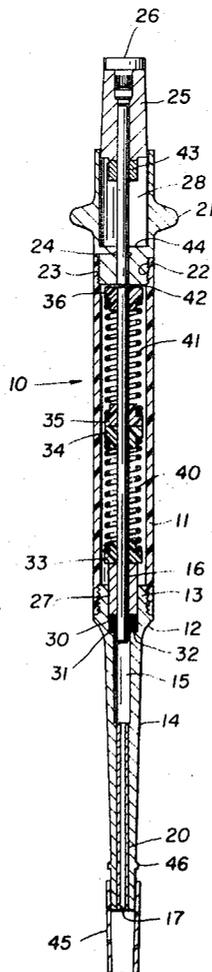
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[57] **ABSTRACT**

A manual pipette having piston slideably mounted in a hollow barrel to first displace a measured quantity of air from the barrel and then draw a like quantity of liquid into the barrel from a container of liquid being pipetted. A spring biased seal is provided around the piston so that the seal remains air tight even after the seal becomes worn from protracted use.

2 Claims, 2 Drawing Figures



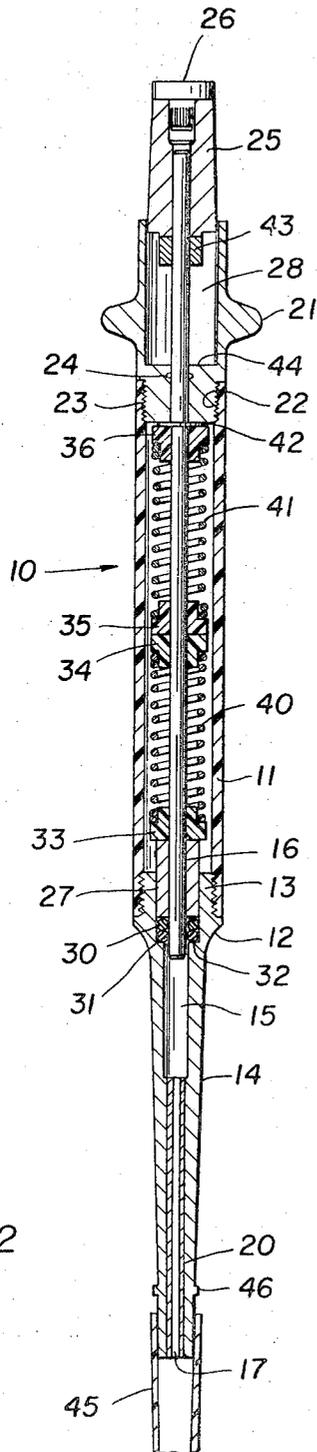


FIG. 2

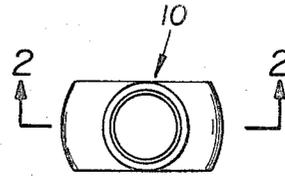


FIG. 1

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PIPETTES

This invention relates to pipettes, especially to manual pipettes that employ expendible tips into which a liquid is drawn.

Over the past several years, the conventional mouth pipette has been giving way to manual pipettes. While the mouth pipette has been entirely satisfactory in use, and indeed may be preferred by the skilled technician who can manipulate it quite well and can dispense fluids from it with great accuracy, it has several disadvantages when compared to manual pipettes, specially those adapted to use a disposable tip. In the first place, the mouth pipette requires that the technician using it develop a certain facility for drawing a measured quantity of liquid into the pipette, and for dispensing exact amounts of liquid from the pipette. Secondly, when used for pipetting liquids from different samples, e.g., from different blood plasma samples when performing prothrombin time determination tests, a clean pipette must be used for each sample. A third disadvantage of mouth pipettes is that careless use may result in drawing samples of biological fluids, such as plasma or blood cells, into the mouth with consequent risk of infection by pathogenic organisms contained in such samples.

The advantages of manual pipettes with disposable tips are manifest. Relatively unskilled technicians can draw and dispense exact quantities of a liquid. Disposable tips are clean when packaged and are disposed of after each use so that if their price is comparatively low, they involve less expense than is incurred in recleaning mouth pipettes. Also, since they are disposed of after each use, they eliminate the possibility of cross contamination between different samples being pipetted.

However, the manual pipettes presently in use do not employ transparent liquid receptacles with scale markings thereon for a technician to see the quantity of liquid drawn into and dispensed from the pipette. Rather, the pipettes utilize a manually reciprocal piston that moves between two fixed stops that are set by the manufacturer depending on the volume capacity for which the pipette is provided. The volume capacity of the pipette thus is dependent on the cross-sectional area of the piston and the longitudinal displacement of the piston, i.e., the distance the piston moves between the two stops.

The object of the present invention is to provide an easy to manufacture, low cost pipette that accurately draws and dispenses an exact prescribed quantity of liquid, and which retains its accuracy in drawing and dispensing the prescribed quantity of liquid over a long period of time during which the pipette is given protracted use.

In carrying out the invention, a hollow barrel is provided with a permanent tip and an internal piston or plunger that is spring biased away from the tip to an initial controlled position. The plunger can be moved against the force of the spring to a second position determined by a fixed stop, and, in being so moved, displace a predetermined volume of air from the pipette. Upon release of the plunger and restoration to its initial controlled position, a like volume of liquid is drawn into the pipette. The liquid is not drawn into the permanent tip of the pipette, but rather into a disposable tip placed at the end of the permanent tip. A seal, in the form of an O-ring, is provided so that as the piston is

reciprocated the fixed quantity of air is expelled from the pipette without any leakage of air past the seal. The seal is subjected to a spring biased force so that even as it wears as the result of frequent reciprocations of the piston over long periods of time, the seal is constantly urged into an airtight contact with the piston.

Features and advantages of the invention may be gained from the foregoing and from the following description of a preferred embodiment thereof.

In the drawing:

FIG. 1 is a top plan view of a pipette; and

FIG. 2 is a longitudinal cross-sectional view of the pipette taken along line 2—2 of FIG. 1 particularly showing the present invention.

Referring now to the drawing, the pipette 10 comprises a main barrel 11 that is an elongated hollow cylinder preferably formed of a thermosetting plastic, although an aluminum alloy, stainless steel or other suitable material may be used. The barrel is internally threaded at both ends. At its forward end, an aluminum tip 12 is provided with a reduced section 13 that is externally threaded for engagement with barrel 11. The tip 12 is formed with a rather elongated portion 14 that permits deep insertion into small diameter test tubes and increased visibility at the end of the permanent tip. Tip 12 is internally bored to provide a passageway therethrough, the initial part 15 of the passageway being a relatively wide diameter bore so as to accommodate the plunger piston 16 when depressed. The remote end 17 of the passageway is also of a relatively wide diameter so that it can accommodate a liner 20. The liner preferably is of stainless steel so that it may be readily cleaned in the event a liquid being pipetted is inadvertently drawn into the pipette.

At the remote end of barrel 11 a finger grip or crossbar 21 is externally threaded at 22 so that it can be secured to the threaded section 23 of the barrel. A central aperture 24 is provided so that plunger piston 16 can freely pass through crossbar 21. An oilite bushing (not shown) may be placed in aperture 24 to guide the movement of plunger 16 through the crossbar. The bushing would be secured in place by being press fitted in the crossbar aperture.

Plunger piston 16 is simply an elongated shaft that is knurled at its remote end so that a knob 25 can be press-fitted thereon. A plastic insert 26 is placed at the top of knob 25 and it can be marked with a numeral representing the pipette's volumetric displacement. Alternatively insert 26 and barrel 11 can be color coded to indicate the pipette's volumetric displacement. Knob 25 is slightly conical in longitudinal section for aesthetic reasons. Its greatest diameter, however, is such as to enable the knob to fit within the recessed part 28 of cross bar 21.

The forward end of plunger piston 16 passes through an aluminum bushing or sleeve 27 which is loosely fitted over piston 16 and with the reduced section 13 of tip 12. Piston 16 further passes through two O-rings 30 and 31 which are located between bushing 27 and an internal shoulder 32 formed on tip 12. The O-rings are snugly fitted over piston 16 and within tip 12 so as to enable piston 16 to reciprocate relative to the O-rings without any air leaking upwards (as viewed in FIG. 2) through pipette 10. As will later be seen, bushing 27 exerts a longitudinal pressure on O-rings 30 and 31 so that even as their internal surface in contact with piston 16 wears, they are constantly being forced into airtight

contact with piston 16 and the internal surface of tip 12.

Four nylon members 33, 34, 35, and 36 fit loosely on plunger 16 and within barrel 11 and serve as bearing members for compression springs 40 and 41. Member 33 bears against bushing 27 while member 36 bears against the C-washer 42 which is snapped into a groove formed on plunger piston 16. Thus plunger 16 is spring biased so as to cause washer 42 to stop against the underside of crossbar 21 and bushing 27 is spring biased to press on O-rings 30 and 31. While two springs 40 and 41 and four bearing members have been shown, a single spring and two bearing members could be used. A single spring, however, was found to bow and contact the inner surface of barrel 11. This caused squeaking as piston 16 reciprocated and the spring bowed with the consequence that the use of two shorter springs as shown is preferred.

The initial controlled position of plunger 16 therefore depends on the placement of the groove for washer 42. Two or more grooves could be machined on plunger 16 and the pipette volume would then depend on which of the grooves was used to receive washer 42. The volume of the pipette is determined by the stroke of plunger 16 which is limited at one extreme by the engagement of C-washer 42 with crossbar 20 and at the other extreme by the engagement of a stop 43 with the bottom 44 of recess 28 in crossbar 21. Stop 43 is shown abutting knob 25, but it is selectively positioned along piston 16 and then locked in place by means of a set screw.

A part of a disposable tip 45 is shown wedge fitted over the end of permanent tip 12. The fit will be air tight so that as plunger 16 is depressed, the expelled air leaves the pipette by way of tip 45. The only requirement of tip 45 is that its internal volume be greater than the volume of liquid to be drawn by the pipette.

In operation, pipette 10 is pressed into the open end of a disposable tip 44. The pipette is then grasped so that the barrel is placed between the forefinger and the middle finger with the inside of the fingers engaging the underside of crossbar 21. The thumb is placed to engage insert 26 on knob 25. The thumb then depresses plunger 16 (until stop 43 engages surface 44) to expel air from the pipette after which the pipette, i.e., the disposable tip 45 thereof, is inserted in the liquid to be drawn and thumb pressure released to allow springs 40 and 41 to restore plunger 16 to its initial position with washer 42 engaging the underside of crossbar 21. The desired quantity of liquid is drawn into the disposable

tip and the pipette is then removed from the liquid. The pipette is then brought to the receptacle that is to receive the liquid and plunger 16 is depressed by thumb pressure to expel the liquid. The disposable tip is then removed by placing the pipette tip in a parallel sided slot so that the side walls (which are tapered) fit between the end of tip 45 and the peripheral ring 46 formed on tip 42. Now by moving the pipette along the slot, its tapered sides will wedge tip 45 off the pipette.

While a preferred embodiment of the invention has been disclosed, it is clear that other embodiments which do not depart from the spirit and scope of the invention may be conceived of, and therefore it is to be understood that the specification and drawing are to be interpreted as illustrative rather than in a limiting sense.

What is claimed is:

1. A manual pipette comprising a cylindrical barrel which is internally threaded at both ends, a permanent tip threaded into one end of said barrel, said tip having a bore therethrough which is enlarged to provide an internal ledge proximate to where said tip is connected to said barrel, a crossbar grip threaded into the other end of said barrel, said grip having an axial opening therethrough, said opening having a first smaller diameter proximate to where said grip is connected to said barrel and a larger diameter at its remote end, a piston mounted for reciprocating movement within said barrel and extending from within said permanent tip below the ledge formed therein through said barrel and said grip, a stop member secured to said piston, an annular sealing member abutting the ledge formed in said permanent tip through which said piston reciprocates, bushing means abutting said sealing member, compression spring means positioned between said bushing means and said stop member for biasing said stop member into engagement with said grip and for biasing said bushing means into engagement with said sealing means so as to maintain an air tight seal around said piston, a knob member secured to the remote end of said piston, and a second stop member secured to said piston proximate to said knob member and positioned to limit the displacement of said piston by engaging said grip when said piston is moved a predetermined distance against the bias of said spring means.

2. A manual pipette according to claim 1 wherein said spring means comprises a pair of springs arranged in tandem.

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