United States Patent

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[54] APPARATUS FOR DRAWING FLUID INTO, AND DISCHARGING FLUID FROM, A PIPETTE

9 Claims, 4 Drawing Figs.

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[50] Field of Search ..... 73/425.4 P, 425.6; 141/25—27; 222/207, 210

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ABSTRACT: An apparatus for drawing fluid into, and discharging fluid from, a pipette. The apparatus includes a tubular member having caps sealing both ends thereof, a pipette partially inserted into the tubular member through one of the caps and a cylindrical member inserted through the other cap partially into the tubular member. A piston is slidably positioned therein and has a plunger manually operated so as to move the piston longitudinally of the cylindrical member. A squeeze bulb is fitted over a terminal of the tubular member, the squeeze bulb having an aperture through which the cylindrical member extends and complete evacuation of the tube is effected by exerting pressure on the squeeze bulb which forces air into the pipette to expel any fluid remaining therein. The outer periphery of the cylindrical member is slightly spaced from the wall of the cap defining the aperture therein to provide communication between the squeeze bulb and the interior of the tubular member.

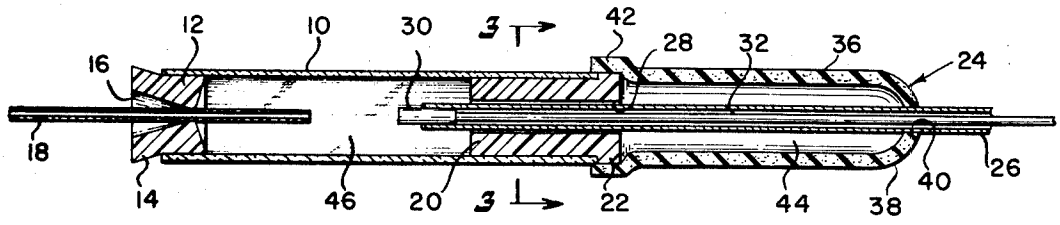


Fig. 1

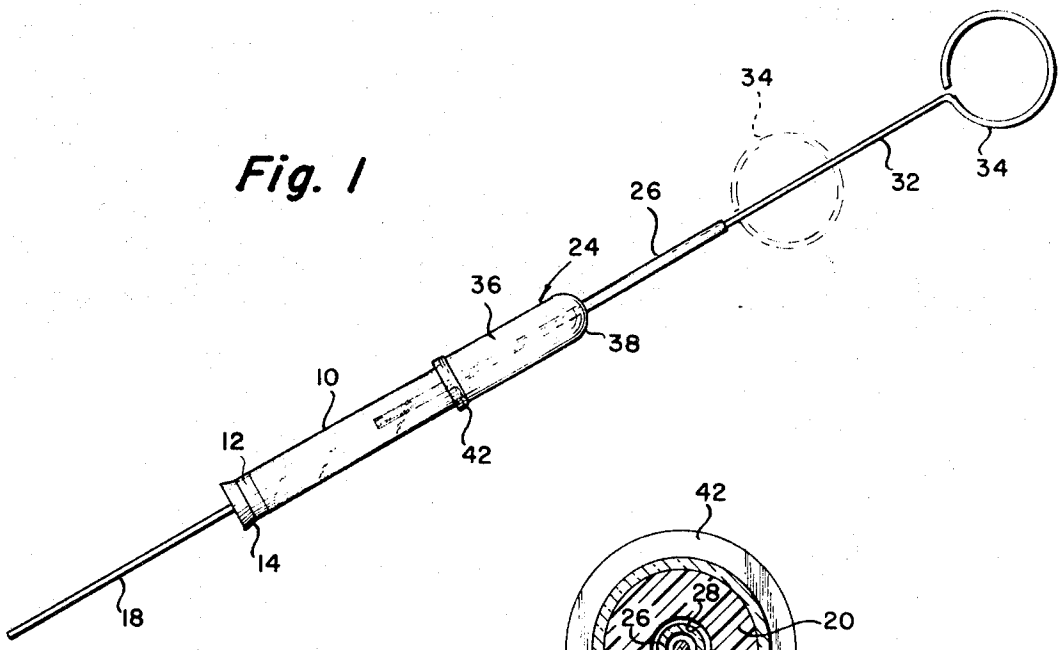


Fig. 3

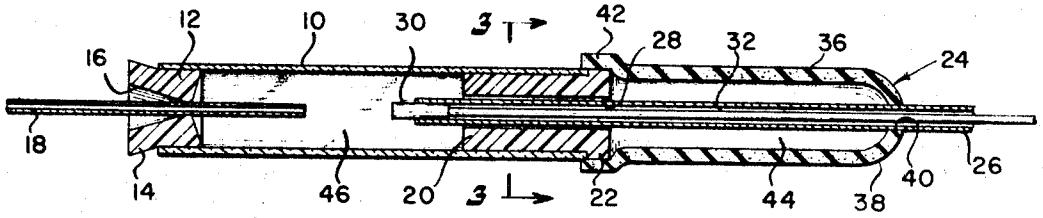
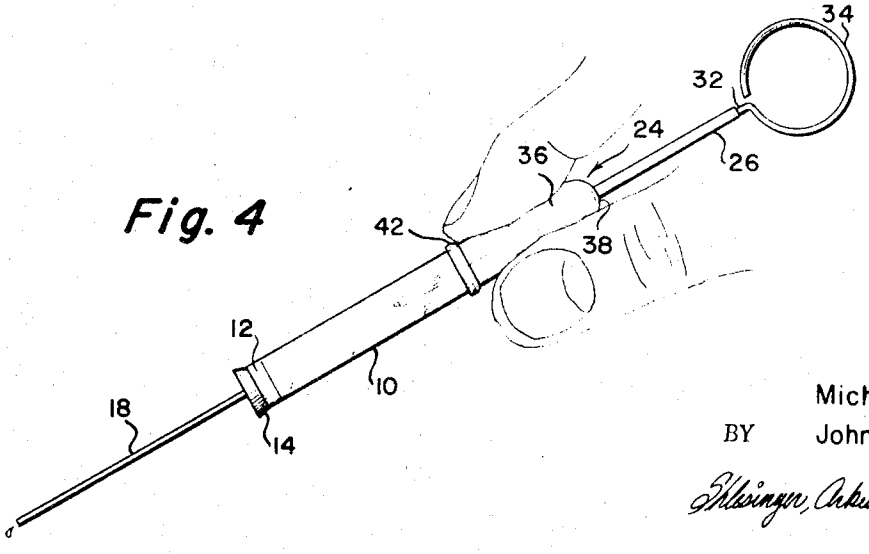


Fig. 2

Fig. 4



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APPARATUS FOR DRAWING FLUID INTO, AND DISCHARGING FLUID FROM, A PIPETTE

OBJECTS OF THE INVENTION

It is an object of this invention to provide apparatus for drawing fluid into, and discharging fluid from, a pipette by means of a pneumatic control, the pipette and pneumatic control being inserted into opposite ends of a tubular member which is closed at both ends, for selectively and accurately drawing fluid into the pipette, and for discharging the fluid from the pipette when desired.

Another object is to provide apparatus of the character described wherein the pneumatic control includes a piston operable longitudinally of a cylindrical member, one terminal of which is partially inserted into the tubular member, means being connected to the piston to effect manual movement of the piston within the cylindrical member to accurately draw fluid into the pipette, by movement of the piston in one direction, and to discharge the fluid from the pipette by movement of the piston in the opposite direction.

A further object is to provide apparatus as described, with the addition of a squeeze bulb connected to the apparatus for effecting complete evacuation of the fluid from the pipette.

A still further object is to provide apparatus of the character described including a plunger which terminates in a finger loop for ready operation of the piston within the cylindrical member by the user.

Other objects will be manifest from the following description of the presently preferred form of the present invention taken in conjunction with the appended drawings.

DESCRIPTION OF FIGURES OF THE DRAWING

FIG. 1 is a side elevational view of the apparatus of the present invention;

FIG. 2 is an enlarged longitudinal sectional view of the same;

FIG. 3 is a sectional view taken along the line 3–3 of FIG. 2, looking in the direction of the arrows, and

FIG. 4 is a view similar to FIG. 1 illustrating the operation of the squeeze bulb forming a part of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

The apparatus of the present invention includes a tubular member **10** which is open at both ends. A removable cap **12** of rubber or plastic is inserted into one end of tubular member **10**, the outer periphery of one end of the cap being enlarged at **14** to limit the entry of the cap into the tubular member. Cap **12** is provided with a central aperture **16** which as shown to advantage in FIG. **2** is conical in conformation to facilitate insertion of one terminal of pipette **18** partially into tubular member **10**.

The opposite terminal of tubular member **10** as provided with a removable cap **20** constructed of Teflon or other suitable rigid material, the main body portion thereof being in substantially airtight relationship with the inner periphery of tubular member **10**. The outer extremity of cap **20** is enlarged to provide an abutment flange **22** engageable with the near terminal of tubular member **10**.

It is a salient feature of the present invention to provide a pneumatic assembly generally designated **24** which is operable within tubular member **10**. Assembly **24** includes a cylindrical member **26** which is inserted through an axial opening in cap **20**, the cross-sectional area of the opening being larger then that of the cylindrical member, thereby providing a space **28** between the cylindrical member and the cap for purposes which will be hereinafter more fully set out.

A piston **30** made of Teflon or other suitable material is positioned within, and engageable with the walls of, cylindrical member **26** for longitudinal movement therein. A plunger or rod **32**, made of a suitable material, such as stainless steel, is attached to one end of piston **30**, which plunger extends

completely through cylindrical member **26** and terminates in a finger loop **34**, which facilitates operation by the user.

The pneumatic assembly further includes a squeeze bulb **36** of elongated resilient construction, one terminal of which **38** is domed-shaped and provided with an aperture **40** through which cylindrical member **26** passes. It will be noted that aperture **40** is substantially the same size as the cylindrical member in order to provide an airtight relationship between these members.

The opposite terminal of squeeze bulb **36** is flanged at **42** for sleeved engagement over abutment flange **22** of cap **20** and the adjacent terminal of tubular member **10**. There is thereby provided an air space **44** between the walls of squeeze bulb **36** and cylindrical member **26**.

Referring now to FIG. **2**, it will be noted that when the outer terminal of pipette **18** is placed in a fluid, a closed air chamber is created within space **46**, between caps **12** and **20**, with the result that any movement of piston **30** longitudinally of cylindrical member **28** will affect the air pressure within pipette **18**.

OPERATION

In use of the apparatus of the present invention, the tip, of pipette **18** is inserted in the fluid to be drawn into the pipette, at which time plunger **32** is in the lowered position shown in dotted lines in FIG. **1**. Upon finger engagement with loop **34** and movement of plunger **32** outwardly, by virtue of the closed air chamber within tubular member **10**, a suctioning pressure is exerted within pipette **18** to draw the fluid into the pipette, the amount and rate of flow of the fluid drawn into the pipette being accurately controlled by the movement of piston **30** within cylindrical member **28**.

When the desired amount of fluid has been drawn into pipette **18**, it is removed from the fluid, and piston **30** remains in the same position within cylindrical member **28** to retain the fluid within the pipette.

The fluid is dispensed by pushing plunger **32** downwardly with loop **34** to move piston **30** towards the inner end of cylindrical member **28**, thereby increasing the air pressure within the adjacent end of terminal **18**, and discharging the fluid from the pipette.

In order to discharge any remaining drops of fluid which may be retained in the pipette, finger pressure is inserted on squeeze bulb **36** as shown to advantage in FIG. **4**, thereby causing the air within space **44** to travel through space **28** into closed air chamber **46** of tubular member **10**. This exerts additional air pressure through pipette **18** in a direction to discharge any drops of fluid within pipette **18**.

Alternatively, the fluid within the pipette may be quickly and completely expelled from the pipette by squeezing bulb **36**.

It has been found that optimum results are obtained when the total internal volume of the apparatus, including the tubular member and the squeeze bulb is approximately 1500 microliters and the volume of the small cylindrical member is in the range of 100 to 300 microliters. The ratio of apparatus volume to cylindrical member is, therefore, in the range of 15:1 to 5:1.

It has further been determined that a small cylindrical member volume of 150 microliters should be employed when using pipettes in the size range of 20 to 100 microliters and that a 250 microliter volume cylindrical member should be employed for pipettes in the size range of 50 to 200 microliters.

What we claim is:

1. Apparatus for drawing fluid into, and discharging fluid from, a pipette including:

a. a transparent tubular member,

b. caps sealing both ends of said tubular member,

c. one of said caps having an aperture in communication with said tubular member,

d. a pipette partially inserted through the aperture of said one cap into said tubular member,

e. a cylindrical member partially inserted into said tubular member through said other cap,
f. said cylindrical member being spaced from said tubular member,
g. a piston within, and movable longitudinally through, said cylindrical member,
h. a plunger one terminal of which is connected to said piston and extending through said cylindrical member,
i. the free terminal of said plunger issuing into a finger engaging loop,
j. whereby upon placing the outer end of the pipette into a fluid and moving said piston outwardly through said cylindrical member a controlled quantity of fluid is drawn into the pipette and, upon inward movement of the piston, the fluid is expelled from the pipette, and
k. a resilient squeeze bulb,
l. one terminal of said squeeze bulb being dome shaped and provided with an aperture through which said cylindrical member passes,
m. the outer terminal of said squeeze bulb being engaged over a terminal of said tubular member,
n. the outer periphery of said cylindrical member being slightly spaced from the wall of said other cap defining the aperture therein,
o. whereby upon squeezing of said squeeze bulb air is directed under pressure through the space between the cylindrical member and the other cap aperture, and through the tubular member into the inner end of the pipette for exerting an expelling force on fluid within the pipette.

2. The apparatus of claim 1 wherein:
a. the ratio of the volume of the apparatus including the tubular member and squeeze bulb with respect to the volume of said cylindrical member, is in the range of 15:1 to 5:1.

3. The apparatus of claim 2, wherein:
a. a cylindrical member having a volume of 250 microliters is employed for pipettes in the size range of 50 to 200 microliters.

4. The apparatus of claim 2, wherein:
a. the volume of the tubular member and squeeze bulb is approximately 1500 microliters, and the volume of the small cylindrical member is in the range of 100 to 300 microliters.

5. The apparatus of claim 4, wherein:
a. a cylindrical member having a volume of 150 microliters is employed for pipettes in the size range of 20 to 100 microliters.

6. Apparatus for drawing fluid into, and discharging fluid from, a pipette including:
a. a tubular member,
b. caps sealing both ends of said tubular member,
c. both of said caps being provided with apertures,
d. a pipette inserted through the aperture of one of the said caps partially into said tubular member,
e. a cylindrical member inserted through the aperture of said other cap partially into said tubular member,
f. a piston slidably positioned in said cylindrical member,
g. means connected to said piston for moving the latter within said cylindrical member,
h. whereby upon placing the outer end of the pipette into a fluid and moving said piston outwardly through said cylindrical member a controlled quantity of fluid is drawn into the pipette and, upon inward movement of the piston, is expelled from the pipette, and
i. a resilient squeeze bulb engaged over a terminal of said tubular member,
j. said squeeze bulb being provided with an aperture through which said cylindrical member extends to a point beyond the squeeze bulb,
k. the outer periphery of said cylindrical member being slightly spaced from the wall of said other cap defining the aperture therein,
l. whereby, upon squeezing of said squeeze bulb, air is directed under pressure through the space between the cylindrical member and the other cap aperture, and through the tubular member into the inner end of the pipette, for exerting an expelling force on the fluid within the pipette.

7. The apparatus of claim 6, wherein:
a. the ratio of the volume of the apparatus including the tubular member and squeeze bulb with respect to the volume of said cylindrical member, is in the range of 15:1 to 5:1.

8. The apparatus of claim 6, wherein:
a. the volume of the tubular member and squeeze bulb is approximately 1500 microliters, and the volume of the small cylindrical member is in the range of 100 to 300 microliters.

9. Apparatus for drawing fluid into, and discharging fluid from, a pipette, including
a. a large tubular member,
b. cap means sealing both ends of said tubular member, forming an air chamber therebetween,
c. said cap means being provided with apertures,
d. a pipette inserted through the aperture of one of said cap means partially into the air chamber of said tubular member,
e. a small cylindrical member inserted through the aperture of said other cap means partially into the air chamber of said other tubular member,
f. a piston within, and movable longitudinally through, said small cylindrical member,
g. a plunger, one terminal of which is connected to said piston, for moving the piston through the small cylindrical member,
h. a collapsible bulb mounted over one end of said large tubular member, providing a closed chamber, and
i. an air passageway in said other cap means connecting the closed chamber of said collapsible bulb with the air chamber of said large tubular member,
j. whereby, upon squeezing of said collapsible bulb, air is directed under pressure through the air passageway, and through the tubular member into the inner end of the pipette, for exerting and expelling force on the fluid within the pipette.