

# United States Patent

Hinchman et al.

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[54] **PIPETTE**

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**Related U.S. Application Data**

[63] Continuation-in-part of Ser. No. 770,663, Oct. 25, 1968, abandoned.

[52] U.S. Cl. .... **73/425.6**

[51] Int. Cl. .... **G01n 1/14, B011 3/02**

[58] Field of Search ..... **73/425.6; 141/24-27; 128/233, 223**

[56] **References Cited**

**UNITED STATES PATENTS**

1,747,523 2/1930 McCormick ..... **73/425.6**

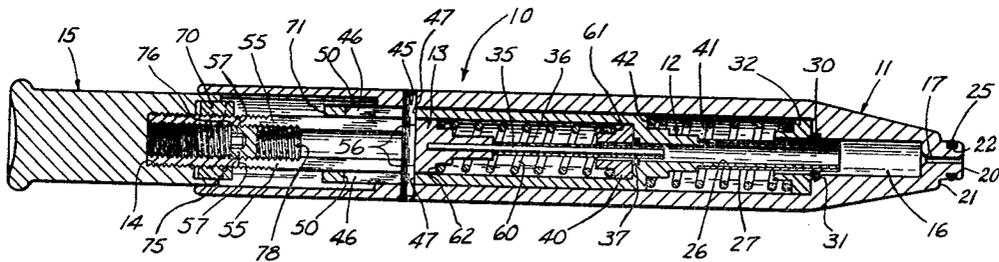
2,660,342	11/1953	Ruf .....	73/425.6 X
3,045,494	7/1962	Gerarde .....	73/425.6
3,494,201	2/1970	Roach .....	73/425.6
3,500,689	3/1970	Band .....	73/425.4

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[57] **ABSTRACT**

A pipette pump having two pistons therein with a smaller one of said pistons telescoped and movable within a larger of said pistons. The pistons are normally held in projected position by a pair of springs one of which is much stronger than the other so that the larger piston against which it acts is depressed after the smaller piston. The travel of each piston is adjustable and the pistons are both depressed by depressing a cap which is fixed to the smaller piston.

**10 Claims, 7 Drawing Figures**



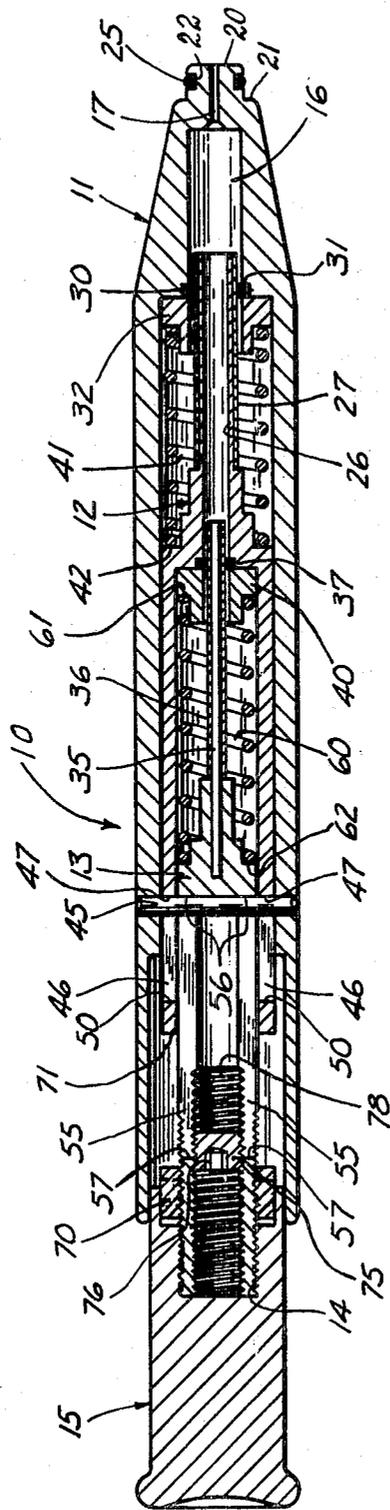


Fig. 1.

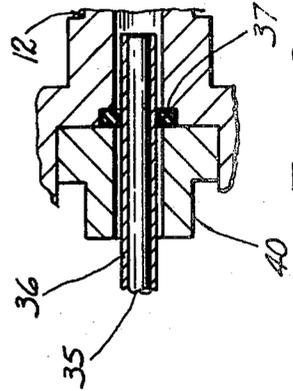
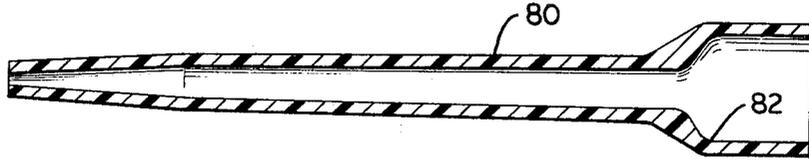


Fig. 2.

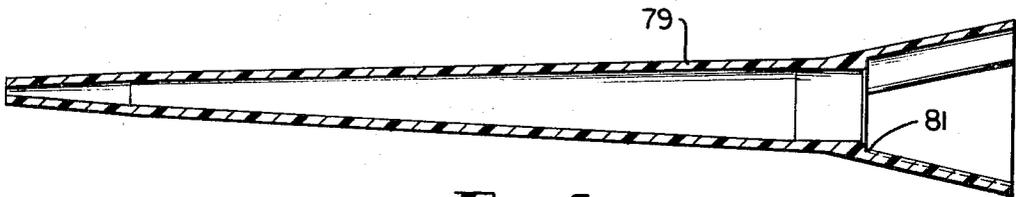
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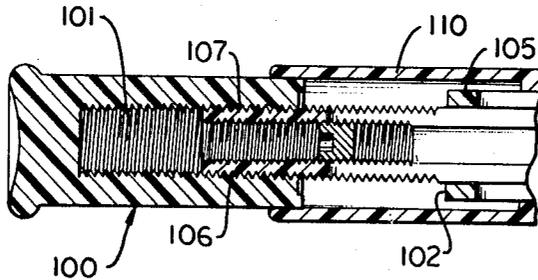
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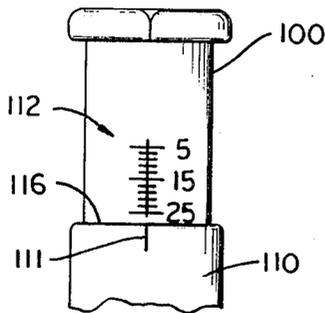
**Fig. 3.**



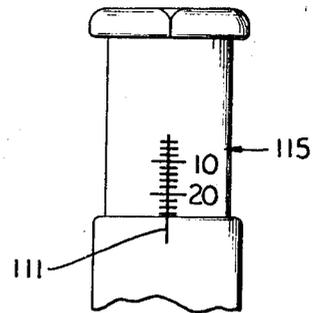
**Fig. 4.**



**Fig. 5.**



**Fig. 6.**



**Fig. 7.**

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## PIPETTE

## CROSS-REFERENCES TO RELATED APPLICATIONS

This application is a continuation-in-part of application Ser. No. 770,663, filed Oct. 25, 1968 now abandoned.

## BACKGROUND OF THE INVENTION

## 1. Field of the Invention

This invention relates to a pipette pump.

## 2. Description of the Prior Art

Various types of pipettes are used for medical testing and the like. For many years glass pipettes have been known and available. Such pipettes are emptied by the use of the finger or the mouth. In more recent years plastic pipettes of predetermined volume capacity have come into widespread use. The latter type of pipette in many cases is more convenient to use than the former and also is disposable. It is desirable, however, to provide a pipette which is less expensive, more accurate and more convenient to use. A representative grouping of prior art might include: U.S. Pat. Nos. 2,902,035 to Hartley; 3,062,056 to Wicoff; and 3,290,946 to Pursell.

## SUMMARY OF THE INVENTION

The present invention is an improved pipette pump for use with disposable pipettes. It may include a housing having a chamber therein, said chamber having an opening communicating with atmosphere and through which air is expelled for pumping, a piston reciprocally mounted on said housing for movement into and out of said chamber, and an O-ring sealingly mounted on said housing, said piston being slidable through said O-ring and sealing against said O-ring.

One object of the invention is to provide an improved pipette pump.

A further object of the invention is to provide an improved pipette.

Another object of the invention is to provide a pipette which is less expensive, more accurate and more convenient to use than existing pipette pumps and to provide a pipette which is easy to adjust with regard to liquid dispensed.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a section taken axially and longitudinally of the pipette pump of the present invention;

FIG. 2 is an enlarged detail view similar to FIG. 1 and showing certain of the parts illustrated in FIG. 1;

FIGS. 3 and 4 are enlarged axial sectional views of disposable pipette tips usable with the pipette pump of the present invention;

FIG. 5 is a fragmentary section similar to FIG. 1 of an alternative form of the pipette pump; and

FIGS. 6 and 7 are fragmentary side elevational views of the structure illustrated in section in FIG. 5 showing views of the structure in generally the same operating position but with the cap in FIG. 6 being rotated 180° about its axis relative to its position in FIG. 7 so as to show the scales on the opposite sides of the cap.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now more particularly to the drawings, there is illustrated a pipette pump 10 which includes a housing 11, a large piston 12 slidably received and telescoped with the housing 11 and a small piston 13 slidably received and telescoped within the large piston 12. A cap 15 having internal threads 14 is threadedly attached to the small piston 13. The housing 11 has a chamber 16 formed therein, said chamber communicating with a passage 17 which extends through a tip mount or projection 20. The projection 20 functions to mount a pipette tip 79 or 80 (FIGS. 3 and 4) which fits over the projection 20 and which in the case of pipette 80 abuts the radially extending surface 21 adjacent thereto. The tip mount 20 has an outwardly opening recess 22 therein which receives an O-ring 25. The O-ring 25, which may be formed of rubber or other suitable

sealing material, assists in providing a sealed connection to the pipette tip so that no leakage occurs between the tip mount 20 and the pipette tip.

The large piston 12 includes a cylindrical portion 26 which is externally covered by an extruded sleeve 27 of a fluorocarbon resin such as Teflon fixedly secured to the cylindrical portion 26. The Teflon sleeve 27 sealingly engages an O-ring 30 which is seated within a recess 31. The Teflon material is slick and thus easily slides against the O-ring 30. The base and one wall of the recess 31 are formed by the housing 11. The other wall of the recess 31 is formed by a lower retainer 32 which squeezes against the O-ring 30 and causes it to sealingly engage the Teflon sleeve 27. The small piston 13 includes a cylindrical rod 35 fixedly embedded within the main body of the piston 13. The rod 35 has an extruded fluorocarbon sleeve 36 such as Teflon fixedly received thereon. The Teflon sleeve 36 slidably engages the O-ring 37 which is squeezed into sealing engagement with the sleeve 36 by means of the retainer 40 in the same fashion that the retainer 32 squeezes the O-ring 30 into sealing engagement with the sleeve 27. Both O-rings 30 and 37 are formed of rubber or other suitable sealing material. It has been found that the above mentioned extruded Teflon sleeves can be moved through their O-rings many hundreds of thousands of times without appreciable wear.

A compression spring 41 is received about the large piston 12 and bears against the radially extending abutment surface 42 of the large piston and also bears against the retainer 32. The spring 41 functions to hold the large piston 12 against a stop pin 45 which extends completely through the housing 11. The large piston 12 has a pair of slots 46 therein which define the limits of movement of the large piston inside the housing 11. The large piston is shown in its projected position, that is, with the spring 41 in its most extended position and holding the large piston 12 with the ends 47 of the slots 46 against the pin 45. The opposite ends 50 of the slots 46 define the other limit of travel of the large piston 12.

The limits of travel of the small piston 13 are in some cases also determined by the pin 45 which extends through a pair of slots 55 in the opposite sidewalls of the small piston 13. Thus the slots 55 have ends 56 which are shown in engagement with the pin 45 and which determine the limit of projection of the small piston 13. The slots 55 also have ends 57 which determine the maximum amount of depression of the small piston 13. Received between the small piston and the retainer 40 is a further compression spring 60. The compression spring 60 acts against an abutment surface 61 on the retainer 40 and also acts against an abutment surface 62 on the small piston 13. The spring 41 is substantially stronger than the spring 60 and is also under a certain amount of precompression when in the illustrated position of the figure. The relative strengths of the springs and the precompression are such that the spring 60 is fully compressed before any compression is effected or any additional compression is effected in the spring 41.

Threadedly received upon the external threaded surface of the small piston 13 is an annular small piston adjustment member 70. The small piston adjustment member 70 can be threaded rightwardly as shown in the drawing to a position closer to the large piston. As shown in the drawing, the annular member 70 is near its most leftwardly adjusted position. In operation, the cap 15 is forced or pressed rightwardly into the housing 11 and the small piston 13 moves rightwardly compressing the spring 60 until such time as the annular member 70 contacts the abutment surface 71 of the large piston 12. At this time, the operator experiences a substantial stop action. Further greater pressure exerted upon the cap 15 toward depressing the cap into the housing causes the spring 41 to be compressed and causes the large piston to be moved rightwardly until the member 75 contacts the pin 45. The member 75 is the large piston adjustment member. The member 75 is externally threaded and can be adjusted to any desired position within the internal threads 78 of the small piston 13 by means of an Allen head screwdriver being received within the Allen head recess 76 in the member 75.

In operation the present device contains all of the liquid within the pipette tip 79 or 80. In order to attach the pipette tip to the tip mount 20, the O-ring 25 should be lubricated with silicon grease. The tip is then placed on the tip mount 20 by using a general pushing and turning motion so that the recess 81 or 82 seats on the O-ring 25. In order to dispense a small volume, the cap 15 is depressed until the first stop is felt. As suggested above this first stop occurs when the small piston adjustment 70 engages the abutment 71 on the leftward end of the large piston 12. The operator should not push the cap rightwardly past this point. Next the disposable tip is placed into the liquid in a container (not shown) and retained there while slowly allowing the cap to return to the original illustrated position. The liquid in the container will thereby be transferred into the disposable tip.

In order to dispense the liquid once it has been so drawn into the disposable tip, the cap is again slowly depressed to the first stop position. The cap is held in that position for approximately one second and then the operator continues to depress the cap at a moderate rate until the second stop is felt. As suggested above the second stop will be felt when the member 75 contacts the pin 45. This procedure will dispense the small volume for which the pipette was calibrated. Calibration of the pipette for a specific volume is, of course, effected by adjusting the position of the small piston adjustment member 70 by screwing the member rightwardly or leftwardly on the small piston 13. This may be effected by a spanner wrench.

In order to obtain and dispense a large volume of liquid, the cap is depressed until the second stop is felt. As mentioned, this occurs when the member 75 contacts the pin 45. The disposable tip is then placed into the liquid and the cap is slowly allowed to return to the illustrated position. The liquid is then dispensed by depressing the cap at a moderate speed until the second stop is reached. The operator should completely depress the cap until the second stop is reached without hesitation at the first stop.

Referring now to FIGS. 5, 6 and 7 there is illustrated an alternative form of the invention which is generally identical to the embodiment of FIG. 1 except that the cap 100 has a threaded recess 101 formed therein which is much deeper than the recess in the embodiment of FIG. 1. The adjustment member 70 is eliminated so that the cap 100 instead contacts the abutment surface 102 of the large piston 105. The position of the cap on the small piston 106 is adjustable by rotation of the cap on the small piston so that the threads 107 move the cap rightwardly or leftwardly relative to the abutment surface 102. The size of the Teflon covered rod corresponding to rod 35 is selected so as to cause one complete 360° rotation of the handle 100 relative to the small piston to produce a change in dispensed volume of a given amount. Referring to FIGS. 6 and 7, it can be seen that housing 110 has an indicator mark 111 thereon. Also the cap 100 has two scales 112 and 115 thereon which are located 180° from one another and which include markings which are intermediate of one another in the axial direction. The indicator mark 111 and the scales 112 and 115 indicate a particular reading when the edge 116 is flush with a particular mark in the scale and when the mark 111 extends perpendicularly from the middle of the particular mark.

It will be noted from the above description that the present invention provides a pipette pump which is less expensive. This is true because the disposable portion of the device includes only the tip and not the complete pump. The pump can be used repeatedly and will have a long service life. It will also be evident from the above description that the present invention is more accurate and more convenient to use than existing pipette arrangements.

The invention claimed is:

1. In a pipette pump, a housing having a chamber therein, said chamber having an opening communicating with atmosphere and through which air is expelled for pumping, a piston reciprocally mounted on said housing for movement in a direction into and out of said chamber, an O-ring of flexible resilient material, said piston being slidable through said O-

ring means mounting said O-ring on said housing and squeezing the O-ring in sealing engagement with said piston, said piston including a rigid member having a sleeve thereon of extruded fluorocarbon, said sleeve being slidable through said O-ring and in sealing engagement against said O-ring, said sleeve having a constant external cross section taken perpendicularly to its direction of movement into and out of said chamber whereby said sleeve maintains its sealing engagement against said O-ring as said piston is moved into and out of said chamber.

2. A pipette pump comprising a housing, said housing having a chamber therein, said chamber having an opening communicating with atmosphere and through which air is expelled for pumping, a first piston reciprocally mounted on said housing for movement into and out of said chamber, and a second piston reciprocally mounted on said first piston for movement into and out of said chamber.

3. The pipette pump of claim 2 additionally comprising a first spring acting between said housing and said first piston, a second spring acting between said first piston and said second piston, one of said springs having a substantially different spring rate than the other of said springs whereby depressing of said second piston flexes one of said springs prior to flexing the other of said springs.

4. The pipette pump of claim 2 additionally comprising a first spring acting between said housing and said first piston, a second spring acting between said first piston and said second piston, said second piston being slidable inside of said first piston, stop means mounted on said housing for said first and second pistons, said first spring yieldably retaining said first piston against said stop means, said second spring yieldably retaining said second piston against said stop means, said second piston being movable through a given travel in said first piston and engageable with said first piston to move said first piston through a given travel in said housing, said second spring having a substantially less spring rate than said first spring whereby said second piston must move through its entire travel in said first piston before said first piston moves through its travel in said housing.

5. The pipette pump of claim 4 additionally comprising a first O-ring sealingly mounted on said housing, said first piston being slidable through said first O-ring and sealing against said first O-ring, a second O-ring sealingly mounted on said first piston, said second piston being slidable through said second O-ring and sealing against said second O-ring.

6. The pipette pump of claim 5 additionally comprising a cap threadedly secured to said second piston and slidable in said housing, said cap projecting from said housing and providing means for depressing said pistons.

7. The pipette pump of claim 6 additionally comprising means for adjusting the travel of said second piston in said first piston, said means for adjusting including an annular member threaded onto the exterior of said second piston and engageable with said first piston, and means for adjusting the travel of both of said pistons in said housing, said last-mentioned means including an externally threaded member threadedly received and threadedly adjustable within said second piston and engageable with said first stop means.

8. The pipette pump of claim 6 wherein said cap has a scale thereon and said housing has an indicator marker thereon, said cap being rotatable on said second piston to vary the extent to which said cap is threaded on said second piston, said cap being positioned to engage said second piston when said second piston has moved through its entire travel in said first piston whereupon said cap can move said first piston against the urging of said first spring.

9. The pipette pump of claim 2 additionally comprising a first O-ring sealingly mounted on said housing, said first piston being slidable through said first O-ring and sealing against said first O-ring, a second O-ring sealingly mounted on said first piston, said second piston being slidable through said second O-ring and sealing against said second O-ring.

10. The pump of claim 9 wherein said first piston includes a rigid member having a sleeve thereon of extruded fluorocarbon and wherein said second piston includes a rigid member having a sleeve thereon of extruded fluorocarbon, each of said sleeves being slidable through a respective one of said O-rings and sealing against its respective O-ring.

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