United States Patent [19]

Spong

[11] **3,830,108**

[45] **Aug. 20, 1974**

[54] **PIPETTING DEVICE**

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

[51] **Int. Cl.** **B01l 3/02**

[58] **Field of Search**..... 73/425.4 R, 425.6, 425.4 D; 23/259, 292; 128/218 A, 218 C, 218 F, 234, 236, 318 F; 222/43, 309, 386

[56] **References Cited**

UNITED STATES PATENTS

3,013,435	12/1961	Rodrigues	73/425.6
3,244,009	4/1966	Tietje et al	73/425.6
3,290,946	12/1966	Pursell	73/425.6
3,646,817	3/1972	Hinchman et al.	73/425.6

FOREIGN PATENTS OR APPLICATIONS

618,628	2/1949	Great Britain	73/425.6

Primary Examiner—S. Clement Swisher
Attorney, Agent, or Firm—Smyth, Roston & Pavitt

[57] **ABSTRACT**

In a pipetting device having a barrel with a substantially closed end, a tubular member extends through the closed end longitudinally inwardly of the barrel. Evacuating means engaging the tubular member is variably displaceable to provide a partial vacuum in the tubular member. A pipette is provided with an enlarged reservoir and an annular flange for removably engaging the enclosed end of the barrel. A retaining means biases the flange of the pipette against the closed end of the barrel to form an axial seal so that the formation of the vacuum in the tubular member enables a column of fluid to be supported in the pipette. Releasing means cooperates with the evacuating means to displace the retaining means so that the pipette can be removed from the barrel.

37 Claims, 11 Drawing Figures

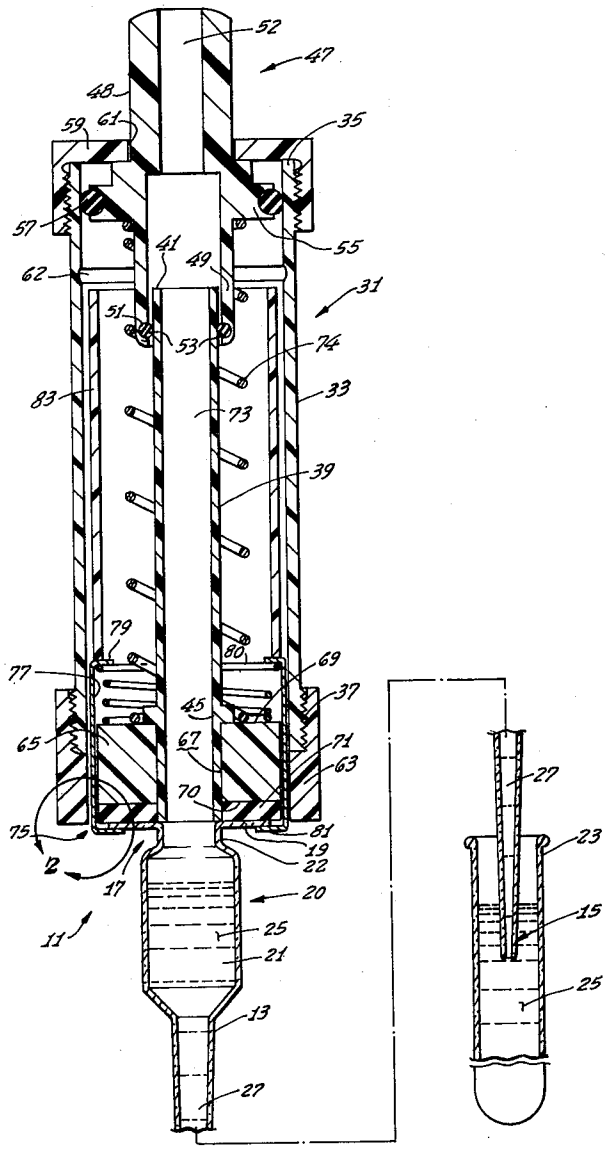

Fig. 1

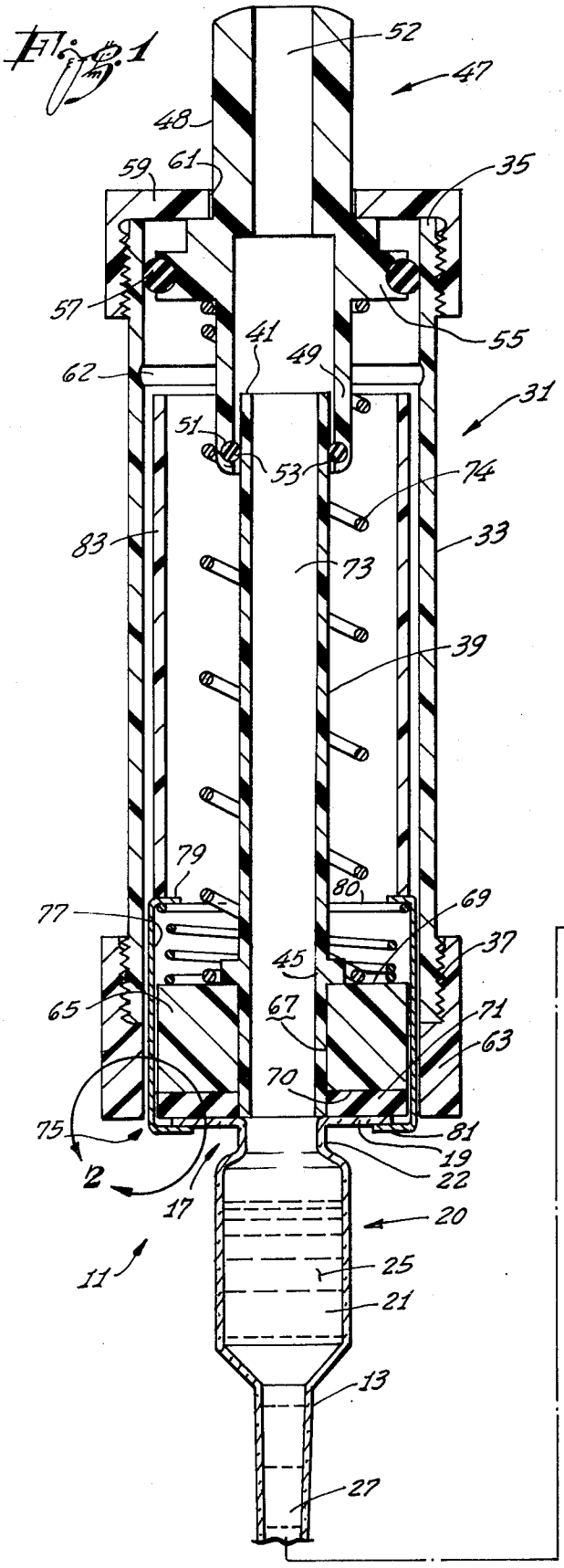
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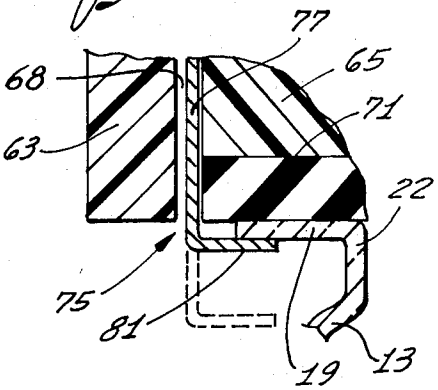
Fig. 2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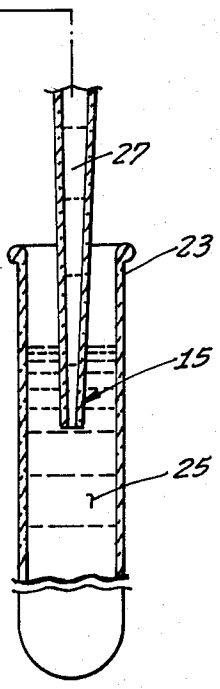
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Fig. 3

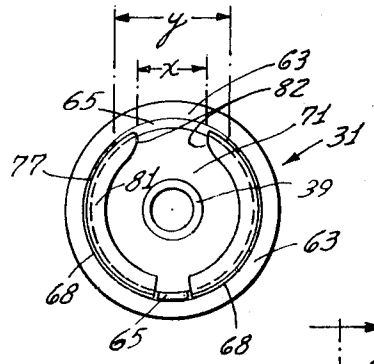


Fig. 4

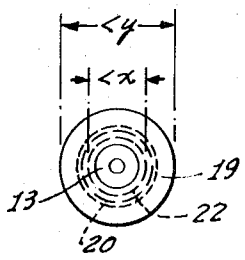


Fig. 5

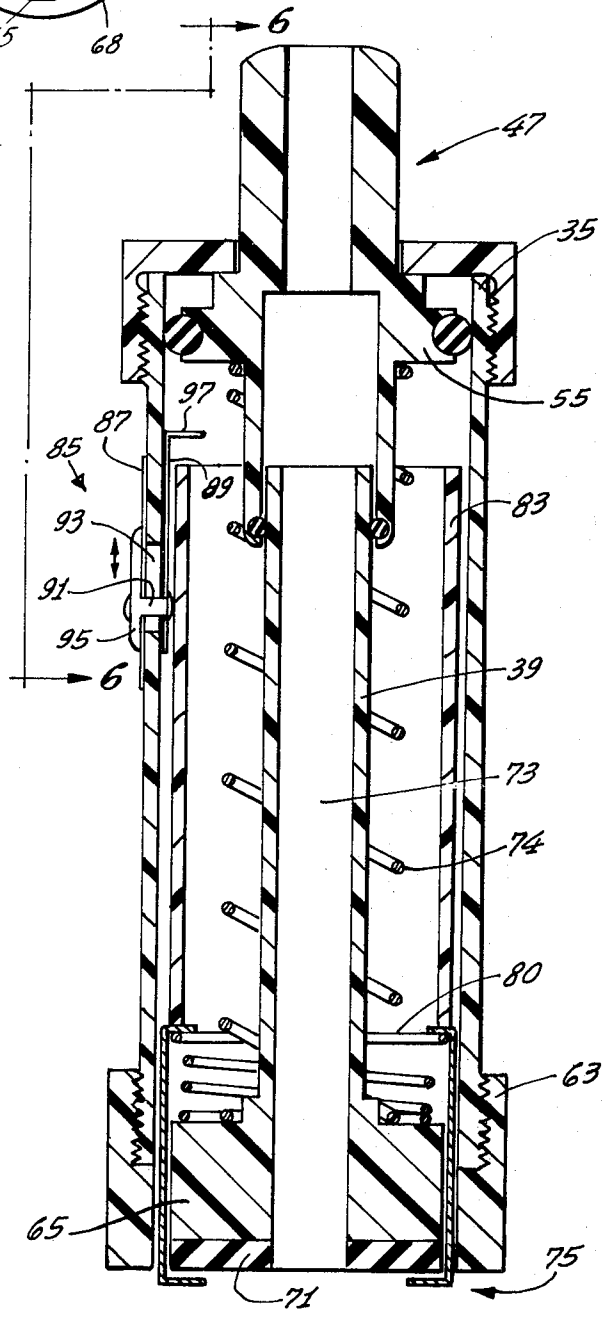


Fig. 6

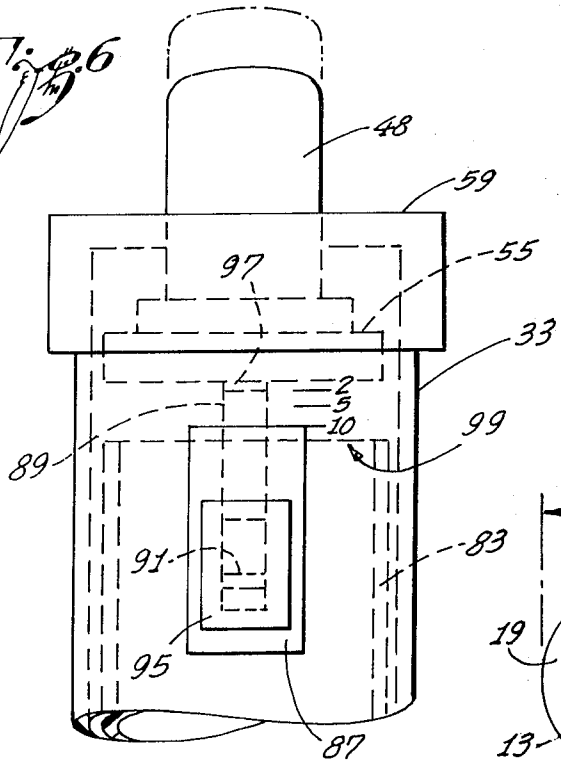
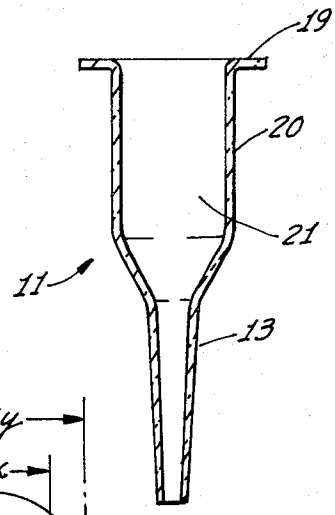


Fig. 10



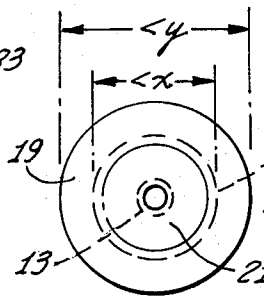


Fig. 11

Fig. 7

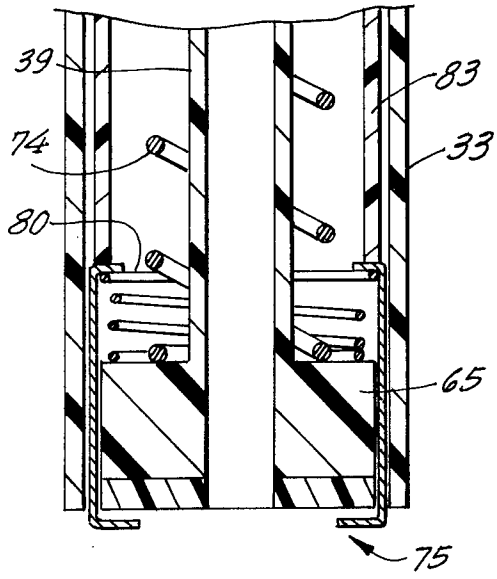
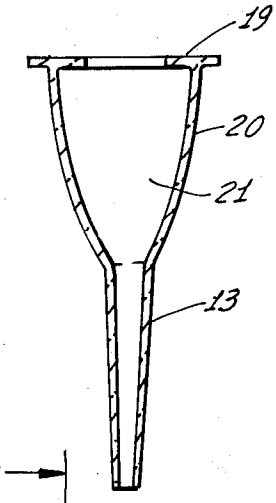


Fig. 8



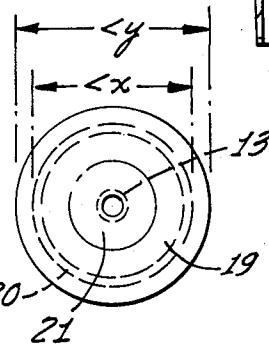


Fig. 9

PIPETTING DEVICE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to devices for supporting a measured quantity of fluid in a pipette and specifically to means for removably engaging the pipette to form a seal between the pipette of the device.

2. Description of the Prior Art

In many technical and experimental laboratories, it is often desirable to transfer small but relatively exact quantities of a fluid from one vessel to one or a multiplicity of other vessels. For example, in a medical laboratory, it may be desirable to separate a particular blood sample into a multiplicity of test tubes so that separate tests can be performed on the sample. The separation of the sample is typically accomplished by means of an eyedropper or pipette consisting of a narrow glass tube into which the sample is drawn by suction. Since the quantity of fluid which can be supported in the eyedropper is typically relatively small, large quantities of the sample have been separated by repeatedly transferring small quantities of the sample between the vessels. It can be appreciated by those skilled in the art that this procedure is extremely time consuming and therefore expensive.

The pipettes have been provided with graduations so that relatively exact quantities of the fluid can be transferred. However, where repeated use of the pipette has been made in order to transfer large quantities of fluid, the inaccuracy of the graduations have been compounded by the repeated use of the pipette.

The pipettes have consisted of relatively long glass tubes having a first end tapered to form the tip of the pipette. These pipettes have been used in conjunction with pipetting devices configured to receive a second end of the pipette and form a radial seal therewith. The pipetting devices have included a tubular member cooperating with an evacuating means for providing partial vacuum within the tubular member. Elastomeric means engaging the tubular member at one end thereof have defined an orifice for receiving the second end of the pipette. The orifice has connected the regions interior of the tubular member with the regions interior of the pipette so that the formation of the partial vacuum in the tubular member has enabled the support of a column of fluid in the pipette.

These pipetting devices have been extremely cumbersome and often dangerous to use. For example, to form the radial seal around the second end of the pipette, the glass tube has been pushed longitudinally into the orifice of the elastomeric means. In order to form an effective seal, the inside diameter of the orifice has been made substantially smaller than the outside diameter of the pipette. Thus, a high degree of force has accompanied the insertion of the pipette into the orifice. In some cases, the pipette has broken and this has resulted in severe injury to the user.

The pressure of the elastomeric means on the second end of the pipette has provided support for the pipette. Movement of the pipette in an axial direction has been resisted by the sheer forces developed between pipette and the elastomeric means while movement of the pipette in a lateral direction has been resisted by the compression forces developed between the pipette and

the elastomeric means. This lateral support has been particularly ineffective and the first end has been relatively free to swing laterally. For example, the surface area of the pipette contacting the elastomeric means has been minimal so that the elastomeric means has been easily compressed. To compound the problem, pipettes which are typically 5 to 12 inches long have been supported in an orifice typically one-half inch long. Thus, the lateral movement of the second end within the orifice a distance such as one-sixteenth inch has been accompanied with a lateral swing of the first end a distance such as 3 inches. This has made it particularly difficult to insert the first end of the pipette into the test tubes. In some cases the pipette has swung with sufficient force to break the test tubes with resulting loss or contamination of the sample.

SUMMARY OF THE INVENTION

In the present invention the pipette includes a narrow tube portions of which are enlarged to form a reservoir for containing relatively large quantities, such as 10 milliliters, of the fluid. Portions of the pipette also define an annular flange in proximity to the second end of the pipette.

This improved pipette is preferably used in conjunction with a device having a tubular member disposed longitudinally within a barrel. Evacuating means are preferably disposed at one end of the tubular member to form a partial vacuum in the tubular member. Elastomeric means having a particular surface substantially perpendicular to the axis of the barrel can be disposed at the other end of the tubular member. In this configuration the flanges of the pipette can be butted against the particular surface of the elastomeric means to form an axial seal therewith.

Supporting means can be disposed to extend across the barrel between the evacuating means and the elastomeric means. Retaining means biased in the direction of the evacuating means can extend through the supporting means to engage the flanges of the pipette and thereby form the axial seal with the elastomeric means. Furthermore, releasing means can be operable in conjunction with the evacuating means to displace the retaining means so that the pipette can be moved laterally to disengage the device.

This configuration offers significant advantages over the prior art. First it will be noted that the pipette and the device can be joined by the operation of the releasing means and the relative lateral movement of the pipette. A high degree of force is neither necessary nor desirable to form the axial seal and for this reason there is no tendency for the pipette to break. Furthermore, the force accompanying the mounting of the pipette can be applied to a nonbreakable member so there is no danger of injury to the user. Additionally, the butt joint formed between the elastomeric means and the flanges of the pipette provide a high degree of lateral support for the pipette. The flanges provide an increased surface area so that the compressive forces of the elastomeric means offer greater resistance to the lateral swing of the pipette. This significantly enhances the relative ease with which the tip of the pipette can be inserted into a test tube so that the device is highly desirable for laboratory use. Additionally, the retaining means aids in the longitudinal support of the pipette so that the contiguous relationship of the pipette and the device is enhanced. Furthermore, relatively large quan-

tities of the fluid can be drawn off with a single use of the device resulting in increased accuracy and a significant savings in time.

These and other advantages of the present invention will become more apparent with a detailed discussion of the preferred embodiments taken in conjunction with the associated drawings.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is an axial cross section of a pipette assembled to a pipetting device and including the features of the present invention;

FIG. 2 is an enlarged detail view of the elements shown interiorly of the circular line 2 — 2 of FIG. 1;

FIG. 3 is a bottom view of pipetting device shown in FIG. 1;

FIG. 4 is a top view of the pipette shown in FIG. 1;

FIG. 5 is an axial cross section of a further embodiment of the pipetting device;

FIG. 6 is an elevation view of the pipetting device taken on line 6 — 6 of FIG. 5;

FIG. 7 is a partial axial cross section of still a further embodiment of the pipetting device;

FIG. 8 is an axial cross section of one embodiment of the pipette;

FIG. 9 is a plan view of the pipette illustrated in FIG. 8;

FIG. 10 is an axial cross section of a further embodiment of the pipette; and

FIG. 11 is a plan view of the pipette illustrated in FIG. 10.

DESCRIPTION OF PREFERRED EMBODIMENTS

A pipette is shown in FIG. 1 and designated generally by the reference numeral 11. The pipette 11 preferably includes walls 13 which extend longitudinally between a first end 15 and a second end 17 of the pipette 11. In the preferred embodiment the walls 13 provide the pipette 11 with a generally tubular configuration.

The walls 13 can include wall portions 22 which engage an annular flange 19 at the second end 17 of the pipette 11. The annular flange 19 preferably extends radially outwardly of the wall portions 22 in a plane substantially perpendicular to the axis of the pipette 11.

The walls 13 can also include enlarged portions 20 having a substantially greater diameter than other portions of the walls 13 and defining a reservoir 21. Although the reservoir 21 can be defined at any location between the first end 15 and the second end 17 of the pipette 11, the enlarged portions 20 are preferably in proximity to the flange 19.

The first end 15 of the pipette 11 can be narrowly constricted to augment its insertion into a vessel 23 containing a fluid 25. Under these circumstances a vacuum can be formed interiorly of the pipette to support a column 27 of the fluid 25. The pipette 11 can be provided with graduations indicating the volume of the fluid 25 in the column 27.

A pipetting device 31 can engage the pipette 11 to enhance the formation of the vacuum. Such a device 31 can include a barrel 33 having a first end 35 and a second end 37. A tubular member 39 having a first end 41 and a second end 43 can be disposed coaxially interiorly of the barrel 33. The tubular member 39 can include a flange 45 preferably extending radially outwardly in proximity to the second end 37 of the barrel 33. The tubular member 39 is preferably constructed of a material resistant of contamination and corrosion. For example, in the preferred embodiment, the tubular member 39 is formed from stainless steel.

Evacuating means such as that shown generally at 47 can include a plunger 48 extending through the first end 35 of barrel 33, and first portions 49 extending in proximity to the first end 41 of the tubular member 39. In the preferred embodiment, the evacuating means 47 has characteristics for axial movement with respect to the barrel 33 and the tubular member 39. First portions 49 can have a generally cylindrical configuration with an inside diameter greater than the outside diameter of the tubular member 39. This will enable the first portions 49 to extend in a coaxial relationship with the tubular member 39 beyond the first end 41 thereof. The first portions 49 can define an annular recess 51 on the interior surface thereof for receiving an O-ring 53. The O-ring 53 is preferably disposed to slide upon the outer surface of the tubular member 39 and form a seal therewith.

The evacuating means 47 can define a passage 52 extending between the regions interior of the first portions 49 and the tip of the plunger 48. Second portions 55 of the evacuating means 47 can provide an annular flange extending radially outwardly to compress an O-ring 57 between the outermost surface of the second portions 55 and the innermost surface of the barrel 33. The first end 35 of the barrel 33 can be exteriorly threaded to register with a first cap 59. The first cap 59 can define a hole 61 through which the plunger 48 preferably extends. The hole 61 and the second portions 55 provide lateral support for the evacuating means 47 while permitting the axial displacement thereof.

The second end 37 of the barrel 33 can be exteriorly threaded to register with a second cap 63. The second cap 63 preferably includes supporting means 65 substantially enclosing the second end 37 of the barrel 33. The supporting means 65 can define a hole 67 for receiving the second end 43 of the tubular member 39. In this embodiment, a first surface 69 of the supporting means 65 preferably engages the flange 45 of the tubular member 39 interiorly of the barrel 33.

A second surface of the supporting means 65 can face outwardly of the barrel 33 to engage elastomeric means such as a rubber washer 71. The washer 71 preferably engages the annular flange 69 of the pipette 11 to form an axial seal therebetween. The washer 71 is typically adhered to the supporting means 65 and the supporting means 65 adhered to the tubular member 39 to form respective seals therebetween. In this manner the pipette 11 and the pipetting device 31 define a cavity 73 including regions interior of the plunger 48, the first portions 49, the tubular member 39, the washer 71, and the walls 13 of the pipette 11. It can be appreciated that as the evacuating means 47 approaches the first end 41 of the tubular member 39, the volume of the cavity 73 decreases. Similarly, as the evacuating means 47 is displaced from the first end 41 of the tubular member 39, the volume of the cavity 73 increases. These features give rise to the preferred operation of the pipetting device 31.

For example, the user can place his thumb over the end of the plunger 48 to enclose the passage 52. Then by depressing the plunger 48, the volume of the cavity 73 can be decreased so that air within the cavity 73 will

be forced out the first end **15** of the pipette **11.** If the evacuating means **47** is then raised while the first end **15** of the pipette **11** is below the surface of the fluid **25** the volume of the cavity **73** will increase so that a partial vacuum is formed therein. The lesser pressure in the cavity **73** will enable the greater atmospheric pressure to force the fluid **27** into the pipette **11.**

The resulting column **27** can be supported as long as the thumb of the user forms a seal across the passage **52.** This will enable the pipette **11** with the column **27** supported therein to be moved to a second vessel, and the fluid **25** can be deposited in the second vessel by breaking the seal across the passage **52.** Due primarily to the size of the reservoir **21,** a substantial portion of the fluid **25** can be transferred with a single use of a pipette **11.** This provides substantial savings in time and expense over pipettes of the prior art.

Biasing means such as a metallic spring **74** can engage the first surface **69** of the supporting means **65** and the second portions **55** of the evacuating means **47** to bias the evacuating means **47** in a position maximizing the volume of the cavity **73.** In this manner, the evacuating means **47** can be automatically displaced to form the partial vacuum in the cavity **73.**

The supporting means **65** can include at least one slot **68** extending through the supporting means in an axial direction. Furthermore, each of the slots **68** can have the configuration of a portion of a cylinder wherein the outside diameter of the cylinder is substantially equal to the inside diameter of the barrel **33.**

The pipetting device **31** can include retaining means shown generally at **75** for biasing the flange **19** against the washer **71** in order to augment the formation of a seal therebetween. The retaining means **75** can be formed from plastic or a metallic material such as stainless steel. In a preferred embodiment, the retaining means **75** includes central portions **77,** which are configured to extend through the slots **68** and an annular flange **79** extending radially inwardly from the central portions **77** at a first end of the retaining means **75.** The annular flange **79** preferably has an inside diameter less than the outside diameter of the spring **74.**

At a second end of the retaining means **75,** a second annular flange **81** can extend radially inwardly from the central portion **77.** The second flange **81** has a preferred outside diameter greater than the outside diameter of the flange **19** and a preferred inside diameter greater than the outside diameter of the wall portions **22** in proximity to the flange **19.** These preferred dimensions will enable the second flange **81** to engage the flange **19** interiorly of the retaining means **75.**

The distance between the first and the second flanges **79** and **81,** respectively, is desirably greater than the axial dimension of the supporting means **65,** the washer **71,** and the flange **19.** As illustrated in FIG. **2,** this will permit displacement of the retaining means **75** in an axial direction to augment the assembly of the pipette **11** and the device **31.**

The second flange **81** can have a horseshoe configuration and a pair of ends **82** shown best in FIG. **3.** The ends **82** of the flange **81** are preferably spaced a distance *x* greater than the outside diameter of the wall portions **22** in proximity to the flange **19** (FIG. **4**). Similarly, the central portions **77** of the retaining means **75** in closest proximity to the ends **82** can be spaced a distance y greater than the outside diameter of the flange **19.** These preferred dimensions will enable the pipette **11** to be moved laterally through the ends **82** to an operable position between the washer **71** and flange **81.**

A second biasing means such as a metallic spring **80** can be disposed to engage the first surface **69** of the supporting means **65** and the flange **79** of the retaining means **75.** The spring **80** preferably has a diameter greater than the spring **74,** so that the spring **74** can extend interiorly of the spring **80** to engage the first surface **69.** The spring **80** desirably biases the retaining means **75** so that the flange **81** presses the flange **19** against the washer **71** to form a seal therebetween.

At least one annular recess **62** can be defined on the interior surface of the barrel **33** to receive the O-ring **57** at a location corresponding to a known volume, such as 10 milliliters, of the fluid **25** in the column **27.** In operation, the user can depress the plunger **48** until the O-ring **57** registers with the recess **62.** Then, with a reduced pressure on the plunger **48,** the spring **74** can displace the evacuating means **47** so that the known volume, such as 10 milliliters, of the fluid **25** is drawn into the pipette **11.** It can be appreciated that other annular recesses, such as the recess **62,** can be defined on the interior walls of the barrel **33** at locations corresponding to other volumes of the fluid **25,** such as 5 milliliters and 15 milliliters. Thus, the recess **62** enables the removal of a known quantity of the fluid **25** from the vessel **23.**

A releasing means, such as the cylinder **83,** can be disposed interiorly of the barrel **33** to engage the first flange **79** at one end of the cylinder **83.** The other end of the cylinder **83** preferably extends to a position on the side of the recess **62** opposite the second portions **55** of the evacuating means **47.** When it is desirable to insert or remove the pipette **11** of the device **31,** the user typically will depress the plunger **48** so that the second portions **55** extend beyond the recess **62** to engage the releasing means **83.** Further displacement of the plunger **48** will displace the releasing means **83** and the retaining means **75** so that the second flange **81** is spaced from the washer **71.** This will enable the flange **19** of the pipette **11** to be inserted into or removed from the flange **81.**

This feature is particularly advantageous since the primary force used to assemble the pipette **11** and the pipette device **31** is applied to the plunger **48** which can be formed from nonbreakable material. No force need be applied to the pipette **11;** in fact, the user need not even touch the pipette **11** if it is otherwise supported. This would seem to have significant applications where the fluid **25** in the pipette **11** is radioactive, pathogenic, toxic, or contaminated. It also overcomes the problem associated with the prior art wherein the significant forces which were applied to the pipette **11** often broke the pipette resulting in injury to the user. Where the prior art relied upon these forces to create an effective seal between the device **31** and the pipette **11,** this seal is automatically formed in accordance with the present invention by the retaining means **75.**

The various elements of the pipetting device are preferably formed from a plastic material such as polypropylene where not otherwise specified. The plastic material can be color coded to signify preferred use with different sizes and models of pipettes.

The concepts of this invention also can be embodied as shown in FIG. **5** wherein the tubular member **39** and the supporting means **65** are integral with the second

cap **63.** This embodiment is particularly advantageous since it augments the ease with which the device **31** can be manufactured and assembled. It also ensures that air will not leak between the supporting means **65** and the tubular member **39** to vent the cavity **73.** In this embodiment, the tubular member **39,** the supporting means **65,** and the cap **63** are preferably constructed of a plastic material such as polypropylene.

Another feature of the invention is illustrated in FIG. **5** wherein a longitudinally displaceable stopping member is shown generally at **85.** The stopping member **85** typically has characteristics for engaging the second portions **55** of the evacuating means **47** at levels corresponding to the longitudinal displacement of the stopping member **85** and the volume of the fluid **25** of the column **27.** The stopping member **85** can include first portions **87** snugly engaging the outer surface of the barrel **33** and second portions **89** snugly engaging the inner surface of the barrel **33.** The first and second portions **87** and **89,** respectively, can be maintained in a fixed relationship by a connecting member **91** which is preferably disposed interiorly of a slot **93** extending through the side of the barrel **33.** The connecting member **91** preferably has a longitudinal dimension significantly less than that of the slot **93** so that the stopping member **85** can be displaced longitudinally on the barrel **33.** A thumbpiece **95** can be connected to the first portions **87** to augment the displacement of the stopping member **85.**

A flange **97** can extend radially inwardly of the second portions **89** at the end thereof nearest the first end **35** of the barrel **33.** Desirably, the flange **97** engages the second portions **55** of the evacuating means **47** at a level corresponding to the desired volume of the fluid in the column **27.** Since the flange **97** is longitudinally displaceable with the stopping member **85,** the desired volume can correspond to the disposition of the first portions **87** on the outer surface of the barrel **33.** Furthermore, the barrel **33** can be provided with indicia shown generally at **99** (FIG. **6**) corresponding to the desired volume of the column **27.** The indicia **99** will enable the user to move the thumbpiece **95** to the desired volume of the column **27** so that the flange **97** engages the second portions **55** at a level corresponding to that volume.

Attention is now directed to FIG. **7** wherein the tubular member **39** is illustrated to be integral with the supporting means **65** and with the barrel **33.** This embodiment of the invention is particularly desirable since it involves a minimum of material, parts, and subassemblies. In this embodiment, the tubular member **39** is preferably constructed of the same material as the supporting means **65** and the barrel **33.**

In addition to the embodiment shown in FIG. **1,** the pipette **11** can be configured as shown in FIG. **8** so that the enlarged portions **20** of the walls **13** extend from the flange **19** between the inside and outside circumference thereof. In this embodiment access to the reservoir **21** would be difficult so that the user would be influenced to dispose of the pipette **11** rather than clean it. This would be particularly advantageous in some fields of use. This pipette could be advantageously used with any of the foregoing embodiments of the device **31** but preferably the dimension *x*, as shown in FIG. **3,** would be greater than the outside diameter of the enlarged portions **20** of the walls **13.**

In a further embodiment of the pipette **11,** the annular flange **19** extends radially outwardly from the enlarged portions of the walls **13.** This embodiment, shown in FIG. **10,** permits greater access to the reservoir **21** so that the pipette can be more easily cleaned and reused if desired.

The concepts of this invention provide significant advantages over the prior art. By enlarging portions of the walls **13** in the pipette **11,** the reservoir **21** can be defined to provide the pipette with a relatively large capacity. This is particularly desirable when relatively large quantities of a sample are taken from a first vessel and disposed in a second vessel. With the enlarged capacity of the pipette **11,** repeated trips between the first and second vessels can be avoided.

The pipette **11** can be used in conjunction with the pipetting device **31** to support a measured volume of the fluid **25** in the pipette **11.** In order to do so, however, it is desirable that an effective seal be formed between the pipette **11** and the device **31.** Attempts to form a radial seal between the pipette **11** and the device **31** have provided the hazards and other disadvantages previously discussed with respect to the prior art. In the present invention the flange **81** biases the flange **19** against the elastomeric washer **71** to form an axial seal therebetween. It is believed that the concept of providing an axial seal between a pipette and a pipetting device is broadly new. The axial seal can be automatically formed by the retaining means **75** which in turn can be biased to provide the sealing characteristics desired. The axial seal can be formed with the flange **19** which provides a high degree of lateral support for the pipette **11.**

The cylinder **83** can cooperate with the evacuating means **47** to displace the flange **81** from the washer **71.** In this position the pipette **11** can be moved laterally to engage or disengage the washer **71.** The pipette **11** need only be supported during this assembly step. The high degree of force applied to the pipette **11** is neither necessary nor desirable and for this reason it is not likely to break and produce a hazard for the user. The major force used in the assembly step is applied to the plunger **48** which can be formed from nonbreakable materials. The device **31** can include the stopping member **85** or the recess **62** to provide the user with an indication as to the volume of the fluid **25** supported in the column **27.**

Although this application has been disclosed and illustrated with reference to particular applications, the principles involved are susceptible of numerous other applications which will be apparent to persons skilled in the art. The invention is, therefore, to be limited only as indicated by the scope of the appended claims.

I claim:

1. A pipetting device for use with a pipette having a hollow configuration and a flange extending outwardly from one end thereof, comprising:

a tubular member having first and second ends;

evacuation means engaging the tubular member to withdraw air therefrom and form a partial vacuum therein;

elastomeric means extending outwardly of the tubular member and adapted to engage the flange of the pipette on one side thereof;

retaining means extending in proximity to the elastomeric means for engaging the flange of the pipette on the side thereof opposite the one side;

means for resiliently biasing the retaining means against the flange of the pipette to form a seal between the flange and the elastomeric means; whereby,

the evacuation of the tubular member by the evacuation means reduces the pressure in the pipette so that a column of fluid can be supported in the pipette,

2. The pipetting device recited in claim **1** further comprising:

supporting means having a fixed relationship with the tubular member and extending outwardly therefrom; and

the biasing means being disposed between the supporting means and the retaining means to bias the retaining means in the direction of the elastomeric means so that the seal is formed between the flange of the pipette and the elastomeric means.

3. The pipetting device set forth in cliam **2** further comprising releasing means cooperating with the evacuating means to displace the retaining means from the elastomeric means so that the pipette can be removed from the pipetting device.

4. The pipetting device defined in claim **3** wherein the retaining means comprises:

a cylinder defined by first and second ends;

at least a first flange disposed radially inwardly of the first end of the cylinder;

at least a second flange disposed radially inwardly of the second end of the cylinder wherein the first flange is disposed between the releasing means and the biasing means; and

the flange of the pipette is disposed between the elastomeric means and the second flange of the retaining means.

5. The pipetting device set forth in claim **3** wherein the evacuating means includes:

first portions slidingly engaging the tubular member and forming a seal with the tubular member, the first portions and the tubular member defining a cavity having a volume which increases when the evacuation means is displaced in a first direction decreases when the evacuation means is displaced in a second direction opposite to the first direction.

6. The pipetting device recited in claim **5** wherein the evacuating means further comprises:

second portions extending outwardly of the first portions and having characteristics for being displaced in the second direction to engage the releasing means and for being displaced further in the second direction to force the second flange of the retaining means from the flange of the pipette so that the pipette can be removed from the pipetting device.

7. A pipetting device comprising:

a barrel having an elongated configuration and defined by first and second ends;

a tubular member disposed internally of the bartel and extending at least a portion of the distance between the first and second ends thereof;

evacuation means disposed in proximity to the first end of the barrel, the evacuation means engaging the tubular member to evacuate air from the tubular member and to form a partial vacuum in the tubular member;

elastomeric means disposed in proximity to the second end of the barrel and extending between the tubular member and the barrel;

a pipette having a generally cylindrical configuration;

a flange extending radially outwardly of the pipette, the flange defined by first and second axially displaced surfaces;

means extending beyond the elastomeric means and engaging the first surface of the flange for resiliently biasing the second surface of the flange against the elastomeric means to form a seal between the flange and the elastomeric means; whereby,

the evacuation of air from the tubular member lowers the pressure within the pipette so that a column of fluid can be supported in the pipette.

8. The pipetting device set forth in claim **7** wherein the biasing means comprises:

retaining means extending from the barrel beyond the elastomeric means and including flange portions extending radially of the barrel to engage the flange of the pipette; and

a spring engaging the retaining means interiorly of the barrel to bias the retaining means against the flange of the pipette and to bias the flange of the pipette against the elastomeric means to form the seal.

9. The pipetting device set forth in claim **8** further comprising:

a cap having first portions registering with the second end of the barrel and second portions defining an orifice communicating with the tubular member;

biasing means disposed between the retaining means and second portions of the cap to force the retaining means axially against the flange of the pipette; and

releasing means cooperating with the evacuating means for compressing the biasing means so that the pipette can be removed from the retaining means.

10. The pipetting device set forth in claim **9** wherein the second portions of the cap are defined by an innermost surface in contact with the biasing means and an outermost surface in contact with the elastomeric means.

11. The pipetting device recited in claim **10** further comprising:

third portions of the cap having a generally cylindrical configuration and defining at least one slot extending axially through the cap for receiving the retaining means;

a first flange disposed at one end of the retaining means to engage the biasing means;

a second flange disposed at the other end of the retaining means to engage releasably the first surface of the flange of the pipette; and

the biasing means having characteristics for providing an axial force on the first flange of the retaining means to bias the second flange of the retaining means against the flange of the pipette and to bias the flange of the pipette against the elastomeric means to form the seal.

12. The pipetting device recited in claim **11** wherein the releasing means is disposed between the evacuating means and the first flange of the retaining means so that

displacement of the evacuating means compresses the biasing means to release the pipette.

13. The pipetting device recited in claim **12** wherein the releasing means is integral with the retaining means.

14. The pipetting device defined in claim **9** wherein the tubular member is integral with the cap and the orifice comprises an extension of the interior surface of the tubular member.

15. The pipetting device set forth in claim **14** wherein the cap is integral with the barrel.

16. A pipetting device for use with a pipette having a flange disposed in proximity to one end thereof, comprising:

a barrel having a first end and a second end;

supporting means substantially enclosing the second end of the barrel and defined by first surface facing inwardly of the barrel and a second surface facing outwardly of the barrel;

elastomeric means disposed on the second surface of the supporting means to engage the flange of the pipette and form an axial seal therewith;

first means having a hollow configuration and extending at least partially between the supporting means and the first end of the barrel;

second means slidingly engaging the first means and forming a cavity with the first means and the pipette, the second means having characteristics for being displaced toward the second end of the barrel to decrease the volume of the cavity and for being displaced toward the first end of the barrel to increase the volume of the cavity; whereby,

displacement of the second means toward the first end of the barrel decreases the pressure within the cavity so that a column of fluid can be supported within the pipette.

17. The pipetting device recited in claim **16** further comprising:

third means extending through the second end of the barrel for engaging the flange of the pipette on the side thereof opposite the elastomeric means; and

fourth means biasing the third means so that the flanges of the pipette are forced against the elastomeric means to form the axial seal.

18. The pipetting device set forth in claim **17** further comprising:

portions of the supporting means defining at least one slot extending between the first and second surfaces of the supporting means;

first portions of the third means extending through the slots in the supporting means;

second portions of the third means extending inwardly of the first portions of the third means and in proximity to the first surface of the supporting means to engage the fourth means; and

third portions of the third means extending inwardly of the first portions of the third means and disposed in proximity to the supporting means to engage the flanges of the pipette.

19. The pipetting device recited in claim **17** further comprising:

fifth means disposed to engage the first surface of the supporting means and the second means to bias the second means from the second end of the barrel; and

the fourth means disposed outwardly of the fifth means to engage the first surface of the supporting means and second portions of the third means.

20. The pipetting device recited in claim **16** wherein the barrel, the supporting means, and the first means are integral.

21. The pipetting device set forth in claim **16** further comprising:

portions of the second means slidingly engaging the interior surface of the barrel; and

third means contiguous with the barrel and having portions thereof which engage the portions of the second means at a position corresponding to the volume of the column of fluid supported in the pipette.

22. The pipetting device set forth in claim **21** wherein the third means includes;

portions of the barrel defining an annular recess on the interior surface of the barrel; whereby

the portions of the second means register with the portions of the barrel at a position corresponding to the volume of the column of the fluid in the pipette.

23. The pipetting device recited in claim **21** wherein the third means comprises:

a stopping member slidingly engaging the barrel and axially displaceable with respect thereto;

portions of the stopping member extending radially inwardly of the barrel to engage the portions of the second means; whereby

the displacement of the stopping member with respect to the barrel corresponds to the volume of the column of fluid supported in the pipette.

24. A pipetting device for use with a pipette having a hollow configuration and a flange extending outwardly from one end thereof, comprising:

a tubular member having first and second ends;

evacuation means engaging the tubular member to withdraw air therefrom and to form a partial vacuum therein;

elastomeric means extending outwardly of the tubular member to engage the flange of the pipette on one side thereof;

retaining means engaging the flange of the pipette on the side thereof opposite the one side to bias the pipette against the elastomeric means so that a seal is formed therebetween;

supporting means having a fixed relationship with the tubular member and extending outwardly therefrom;

biasing means disposed between the supporting means and the retaining means to bias the retaining means in the direction of the elastomeric means so that the seal is formed between the pipette and the elastomeric means; and

releasing means cooperating with the evacuating means to displace the retaining means from the elastomeric means so that the pipette can be removed from the pipetting device.

25. The pipetting device defined in claim **1** wherein the retaining means comprises:

portions of a cylinder defined by first and second ends;

at least a first flange disposed radially inwardly of the first end of the cylinder;

at least a second flange disposed radially inwardly of the second end of the cylinder wherein the first

flange is disposed between the releasing means and the biasing means; and

the flange of the pipette is disposed between the elastomeric means and the second flange of the retaining means.

26. The pipetting device set forth in claim **24** wherein the evacuating means includes:

first portions slidingly engaging the tubular member and forming a seal therewith, the first portions and the tubular member defining a cavity the volume of which increases when the evacuation means is displaced in a first direction and the volume of which decreases when the evacuation means is displaced in a second direction.

27. The pipetting device recited in claim **26** wherein the evacuating means further comprises:

second portions extending outwardly of the first portions and having characteristics for displacement in the second direction to engage the releasing means and further displacement in the second direction to force the second flange of the retaining means from the flange of the pipette so that the pipette can be removed from the pipetting device.

28. A pipetting device comprising:

a barrel having an elongated configuration and defined by first and second ends;

a tubular member disposed interiorly of the barrel and extending at least a portion of the distance between the first and second ends thereof;

evacuation means disposed in proximity to the first end of the barrel, the evacuation means engaging the tubular member to evacuate air therefrom and to form a partial vacuum therein;

elastomeric means disposed in proximity to the second end of the barrel and extending between the tubular member and the barrel;

a pipette having a generally cylindrical configuration;

a flange extending radially outwardly of the pipette defined by first and second axially displaced surfaces;

first surface of the flange removably engaging the elastomeric means to form a seal therebetween;

retaining means biased to engage the second surface of the flange so that the pipette is forced in an axial direction against the elastomeric means to form the seal;

a cap having first portions registering with the second end of the barrel and second portions defining an orifice communicating with the tubular member;

biasing means disposed between the retaining means and the second portions of the cap to force the retaining means axially against the flange of the pipette; and

releasing means cooperating with the evacuating means for compressing the biasing means so that the pipette can be removed from the retaining means.

29. The pipetting device recited in claim **28** wherein the second portions of the cap are defined by an innermost surface in contact with the biasing means and an outermost surface in contact with the elastomeric means.

30. The pipetting device recited in claim **29** further comprising:

third portions of the cap having a generally cylindrical configuration and defining at least one slot extending axially through the cap for receiving the retaining means;

a first flange disposed at one end of the retaining means to engage the biasing means;

a second flange disposed at the other end of the retaining means to engage releasably the second surface of the flange of the pipette; wherein

the biasing means has characteristics for providing an axial force on the first and second flanges of the retaining means to bias the pipetting device against the elastomeric means and form the seal therebetween.

31. The pipetting device recited in claim **30** wherein the releasing means is disposed between the evacuating means and the first flange of the retaining means so that displacement of the evacuating means compresses the biasing means to release the pipette.

32. The pipetting device recited in claim **31** wherein the releasing means is integral with the retaining means.

33. The pipetting device recited in claim **28** wherein the tubular member is integral with the cap and the orifice comprises an extension of the interior surface of the tubular member.

34. The pipetting device set forth in claim **33** wherein the cap is integral with the barrel.

35. A pipette having first and second ends and characteristics for receiving a fluid by suction, comprising:

walls disposed between the first and second ends of the pipette and defining a cavity for receiving the fluid;

first portions of the walls having a diameter less than a particular diameter and defining first portions of the cavity;

second portions of the walls having a diameter greater than the particular diameter and defining second portions of the cavity, wherein the second portions of the cavity have a greater volume per unit length than the first portions of the cavity so that the second portions define a reservoir for supporting a substantial quantity of the fluid;

a flange extending radially from the walls at the second end of the pipette and in a plane transverse to the direction between the first and second ends;

first portions of the flange extending radially outwardly of the walls; and

second portions of the flange extending radially inwardly of the walls to define an orifice providing access to the cavity.

36. The pipette recited in claim **35** wherein the pipette has a generally tubular configuration and the first portions of the flange extend radially outwardly to a diameter greater than the diameter of the first portions of the walls.

37. In combination for use with a pipette to provide a controlled supply of fluid;

first means having a tubular configuration and defined by a first and second ends;

second means disposed at the first end of the first means to engage the pipette and to form with the pipette an axial seal so that regions interior of the pipette communicate with regions interior of the first means;

third means slidingly engaging the first means at the second end of the first means and having characteristics for being displaced in a first direction a first

particular distance and for being displaced in a second direction opposite to the first direction to support a column of fluid in the pipette;

fourth means engaging the third means at the first particular distance to provide an indication when the third means has been displaced to the first particular distance;

the second means comprising:

fifth means having elastomeric properties and defined by a first surface extending radially of the first means at the first end of the first means and

sixth means extending longitudinally of the first means and beyond the first surface of the fifth means to engage the pipette, the sixth means biased to force the pipette against the first surface of the fifth means to maintain the axial seal; and

the third means having characteristics for being displaced in the first direction a second particular distance greater than the first particular distance to engage the sixth means and to oppose the bias on the sixth means so that the pipette can be removed from the sixth means.

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