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Sokol et al.

[11] **3,760,639**

[45] **Sept. 25, 1973**

[54] **PIPETTE ASSEMBLY**

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[73] Assignee: **Bio/Data Corporation,** Hatboro, Pa.

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[21] Appl. No.: **299,552**

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

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

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

[56] **References Cited**

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Primary Examiner—S. Clement Swisher

Attorney—Arthur H. Seidel et al.

[57] **ABSTRACT**

A pipette assembly for accurate aspiration and discharge of fixed amounts from a pipette tip is disclosed. A spring-biased cylinder is mounted for rotation about its longitudinal axis for selecting the desired volume of liquid to be discharged. A variable volume control chamber is defined between the ID of the cylinder and the OD of a stationary piston rod. Reciprocation of the cylinder varies the volume of the control chamber.

10 Claims, 6 Drawing Figures

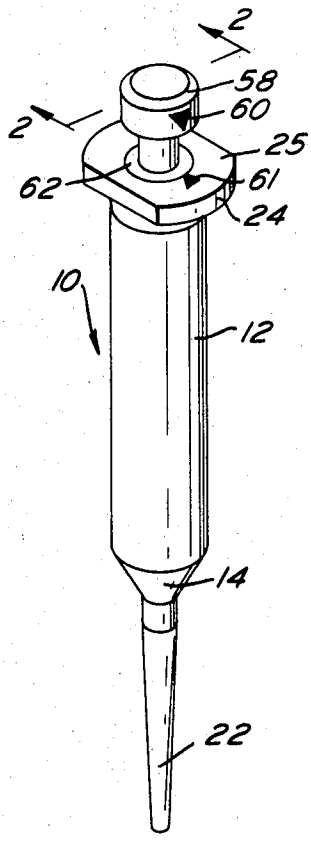


FIG. 1

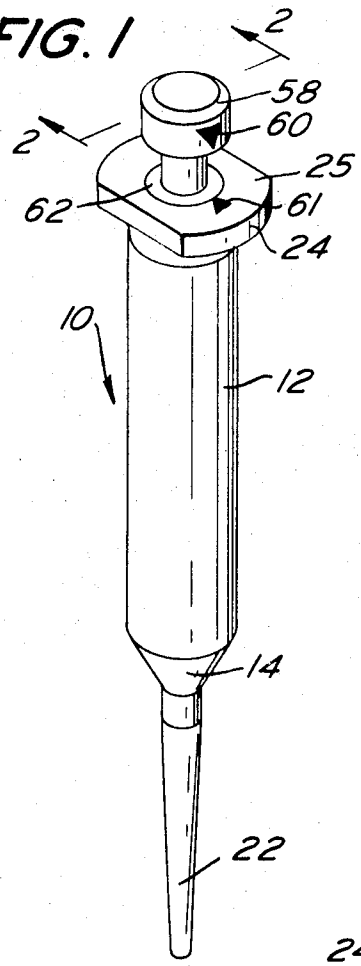


FIG. 4

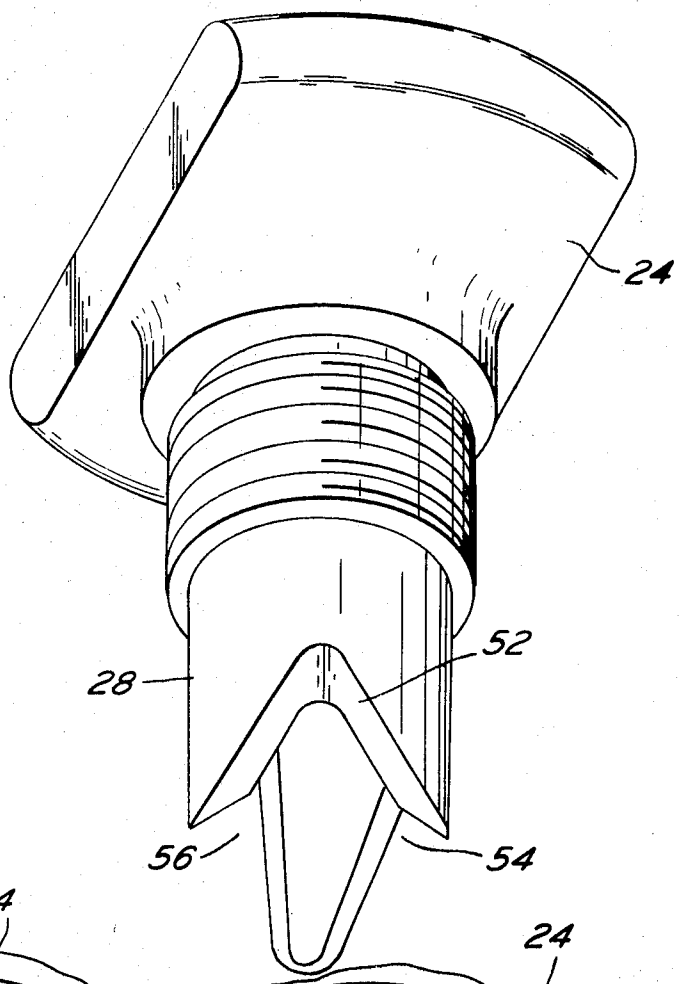


FIG. 5

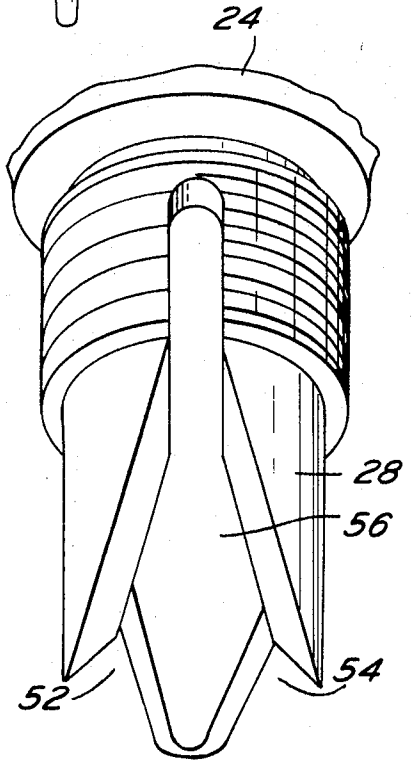
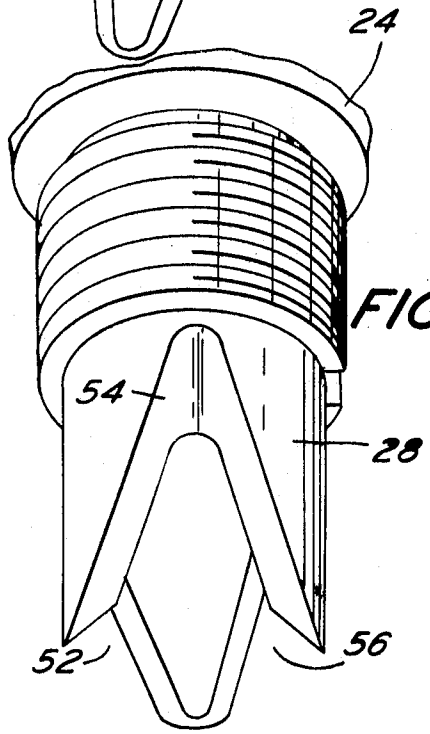


FIG. 6



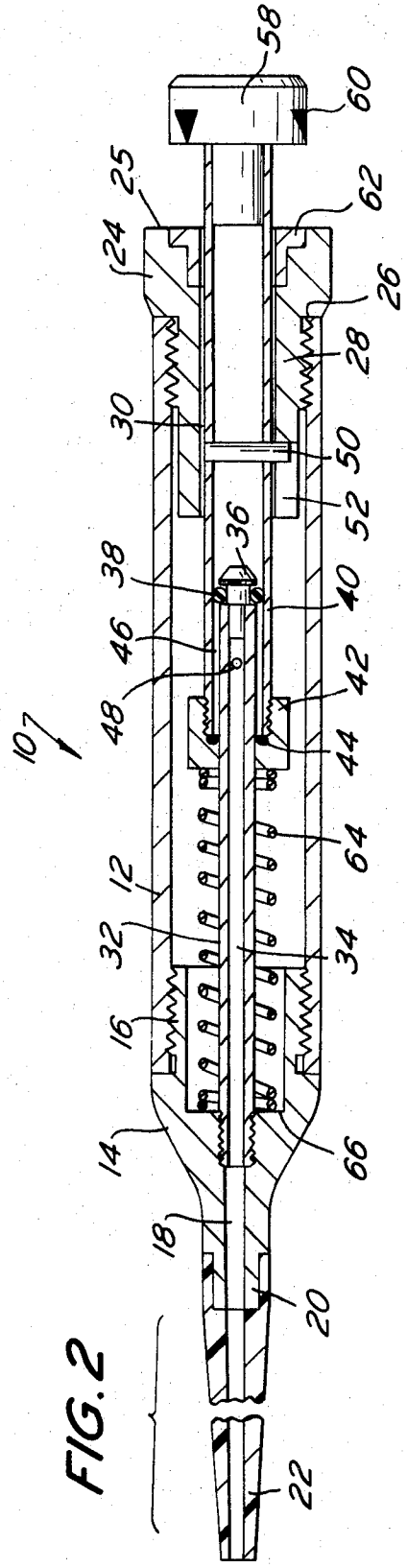

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FIG. 2

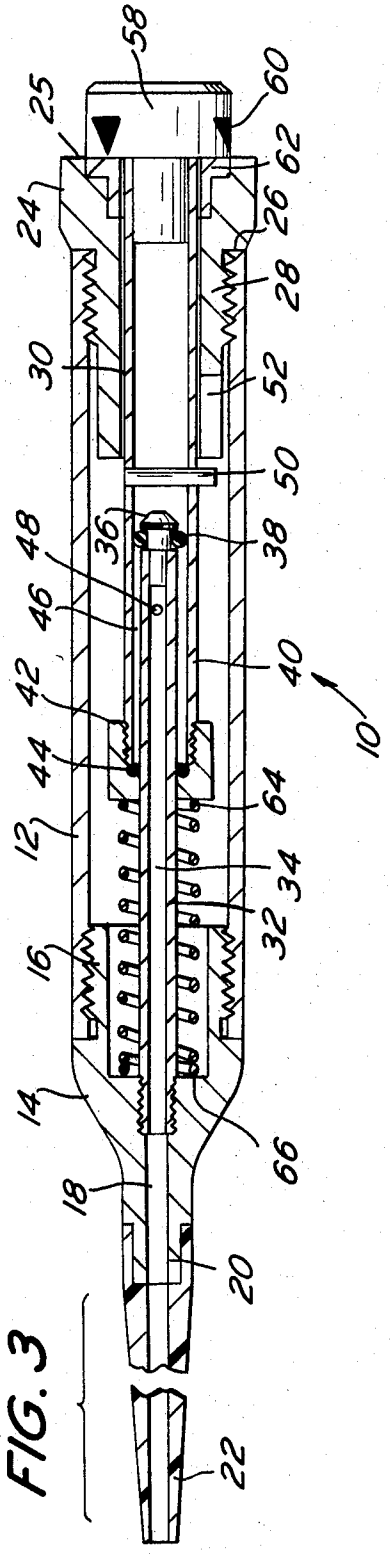

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FIG. 3

PIPETTE ASSEMBLY

This invention is directed to a manually operable pipette assembly which is more accurate than the prior art, reduces mechanical handling during usage, and increases the efficiency in dispensing at a constant rate of discharge.

A typical example of the prior art is shown in U. S. Pat. No. 3,290,946 dated Dec. 13, 1966. When the plunger in said patent is pushed in, it is necessary to keep one's finger over the hole in the plunger. Thereafter, the plunger is permitted to reciprocate away from the pipette tip to aspirate liquid into the pipette while at all times maintaining a finger over the hole of the plunger. Thereafter, dispensing is attained by removing one's finger from the hole in the plunger. Thus, the prior art is a three-step process while relying on finger manipulation and judgment for accuracy as to the amount of liquid being dispensed.

In the present invention, the number of steps is reduced when using the pipette assembly while at the same time the operator has the ability to dispense a predetermined small amount of liquid with accuracy in excess of 99 percent. Further, the pipette assembly of the present invention is less expensive and easier to assemble than some prior art devices. While the pipette assembly has a variety of uses, it is particularly adapted for use in connection with a blood coagulation analyzer such as that disclosed in U. S. Pat. No. 3,658,480 dated Apr. 25, 1972 wherein the amount of liquid being dispensed by the pipette assembly must be accurately controlled.

It is an object of the present invention to provide a novel pipette assembly.

It is another object of the present invention to provide a pipette assembly for accurately dispensing small amounts of liquids.

It is another object of the present invention to provide a pipette assembly which is easy to assemble and requires fewer steps during usage.

It is another object of the present invention to provide a pipette assembly wherein the user may selectively choose one of several fixed amounts of liquids to be dispensed.

Other objects will appear hereinafter.

For the purpose of illustrating the invention, there is shown in the drawings a form which is presently preferred; it being understood, however, that this invention is not limited to the precise arrangements and instrumentalities shown.

FIG. 1 is a perspective view of a pipette assembly in accordance with the present invention.

FIG. 2 is a sectional view taken along the line 2—2 in FIG. 1.

FIG. 3 is a sectional view similar to FIG. 2, but illustrating the components in their relative position when the spring is compressed.

FIG. 4 is a perspective view of the adapter shown in FIG. 1, but on a larger scale.

FIG. 5 is a perspective view of the end of the adapter in FIG. 4, but on a larger scale.

FIG. 6 is a perspective view of the end of the adapter in FIG. 4, but on a larger scale.

Referring to the drawing in detail, wherein like numerals indicate like elements, there is shown a pipette assembly in accordance with the present invention designated generally as **10**. The assembly **10** includes a housing **12**. Housing **12** is preferably a cylinder of aluminum, but may be made of other materials and may have other cross-sections. The housing **12** has first and second ends.

The first end of the housing **12** is provided with threads on its inner periphery engaged with threads on the outer periphery of a reduced diameter portion **16** of a pipette support designated generally as **14.** The pipette support **14** is in the form of a nose with a constantly reducing cross-sectional area from the diameter of the housing **12** down to the diameter of an axial barrel. The pipette support **14** is provided with an axial bore **18** therethrough and terminates at its free end in a reduced diameter portion **20.** The reduced diameter portion **20** is adapted to removably receive an expendable hollow pipette tip **22.** The pipette tip **22** may be a disposable pipette of high density, rigid polymeric plastic materials such as polypropylene.

The second end of the housing **12** is closed by means of an adapter **24.** The adapter **24** has an end face **25** and a shoulder **26** for contact with an end of the housing **12.** Threads on the ID of said second end of the housing **12** are engaged with threads on the OD of said adapter **24.** It will be noted that the adapter **24** extends into the second end of the housing **12** and terminates in a reduced diameter portion **28** having an axial bore **30.**

A hollow rod **32** has one end threadedly coupled to the pipette support **14.** A bore **34** in the rod **32** communicates directly with the bore **18** and the interior of the pipette tip **22.**

A head **36** has a reduced diameter portion telescoped into and fixedly secured to the other end of hollow rod **32** in any manner such as by a force fit. A seal **38** is supported by the head **36** and clamped against the end face of rod **32.** Seal **38** will perform the function of a piston. Thus, rod **32** may be referred to as a piston rod.

A cylinder **40** is disposed within the housing **12** and surrounds a portion of the rod **32.** Cylinder **40** is spaced from the outer periphery of rod **32** to define a chamber therebetween designated **46.** Seal **38** engages the ID of cylinder **40** and constitutes a sealing means for one end of the chamber **46.** A cap **42** is connected to the cylinder **40** in any convenient manner such as by threads. Cap **42** cooperates with a seal **44** which is clamped against an end face of the cylinder **40.** Seal **44** seals the other end of chamber **46.** Chamber **46** communicates with the bore **34** by means of one or more passages **48** in the rod **32.** The passages **48** are in the nature of bleed holes.

The cylinder **40** is provided with a limit stop **50** which may take the form of a radially outwardly directed pin. The reduced diameter portion **28** on the adapter **24** is provided with circumferentially spaced recesses **52, 54** and **56,** each adapted to selectively receive the pin **50** and thereby limit the extent of movement of the cylinder **40** in a direction away from the pipette support **14.** The depth of the recesses **52, 54** and **56** is each different.

In a typical embodiment, the depth of the recess **56** is 0.742 inch and is chosen so as to result in a discharge of 0.2 ml from the pipette tIp **22.** Also, the depth of recess **54** was 0.355 inch to result in a discharge of 0.1 ml from the pipette tip **22.** Also, the depth of recess **52** was 0.158 inch so as to discharge 0.05 ml from the pipette tip **22.** The depth of the recesses **52–56** and other related dimensions on other components may be varied

as desired to effect any particular volume of discharge from the pipette tip **22**.

In order that the desired volumetric discharge may be selectively attained, the assembly **10** includes a selector **58** having a reduced diameter portion telescoped into and fixedly secured to the cylinder **40** in any desired manner such as a force fit. The selector **58** is provided with a plurality of pointers **60** circumferentially disposed about the selector **58** and preferably each of a different color. Each pointer **60** may be selectively aligned with an indicator point **61** on the end face **25** of the adapter **24**. Adapter **24** is provided with a stepped bearing **62** to facilitate rotational support of the casing **40** about its longitudinal axis.

The rod **32** is stationary. The cylinder **40.** may rotate about its axis and is also adapted for movement in an axial direction. A spring **64** surrounds the hollow rod **32.** One end of spring **64** engages a face **66** on the pipette support **14.** The other end of spring **64** engages the cap **42** and biases the cylinder **40** in a direction away from the pipette support **14.** In FIG. **3,** the spring **64** has been compressed to its maximum extent, chamber **46** has its maximum volume, and the selector **58** has contacted the bearing **62.** In FIG. **2,** the spring **64** has expanded to the extent permitted by entry of the limit stop **50** into the recess **54.**

The pipette assembly may be used as follows: The volume of liquid to be discharged is first selected by pushing on selector **58** until limit stop **50** is outside the recesses **52, 54** and **56.** Then the selector **58** is rotated. The pointer **60** may be supplemented with numerical indicia. When the pointer **60** is aligned with an indicator **61** on the end face **25,** limit stop **50** will be aligned with one of the recesses **52, 54,** and **56.** Then pressure on selector **58** is released so that the cylinder **40** reciprocates in an axial direction, under the bias of spring **64,** until the limit stop **50** bottoms out in the selected recess. As shown in FIGS. **4–6,** each of the recesses **52, 54** and **56** is generally V-shaped at least at the end face of portion **28** to make it easy for the limit stop **50** to enter its recess and take into consideration that the components are slightly misaligned.

Thereafter, the assembly **10** is held in a position so that the pipette tip **22** is immersed in the liquid. Then, the selector **58** is manually pushed until it bottoms out as shown in FIG. **3.** As the selector **58** and cylinder **40** move in an axial direction, the spring **64** is compressed and the volume of chamber **46** increases by the selected amount. This creates a suction effect whereby the selected or desired amount of the liquid is aspirated into the pipette **22.** Thereafter, the assembly **10** is moved to a location wherein the pipette tip **22** is juxtaposed to the desired receptacle such as a test tube. The finger pressure applied to the selector **58** may then be released permitting the spring **64** to expand and effect discharge from the pipette tip **22** into the receptacle.

As the spring **64** expands, dischrage from pipette tip **22** is at the rate of expansion of the spring **64.** Discharge may be at a constant rate by using spring **64** in the form of a constant force spring. Expansion of the spring **64** decreases the volume of chamber **46** and continues until the limit stop **50** bottoms out in the selected recess **52, 54** or **56** on the reduced diameter portion **28** of the adapter **24.** Since discharge of the liquid from the pipette tip **22** coincides with expansion of the spring **64,** any components of the liquid are intimately mixed while being discharged and are further mixed with any liquid in the receptacle.

Since discharge is at the rate of expansion of spring **64,** discharge is at a rate substantially greater than the rate of discharge under the effect of gravity. Thus, the liquid being discharged is pushed out of the end of pipette tip **22** by a column of pressurized air in rod **32** and chamber **46.** Hence, discharge need not be in a downward direction. The assembly **10** has been found to have a volumetric accuracy of 99.75 percent. Such accuracy is difficult to attain with prior art devices when dealing with small volumes as described above.

The entire assembly **10,** if desired, may be made from materials so that it may be sterilized. In the event of an overfill of liquid, contamination may be prevented by making the cylinder **40,** hollow rod **32,** and head **36** from stainless steel. The remaining elements are preferably made from non-corrosive materials such as aluminum, brass and the like.

While selection of the amount to be dispensed is preferably attained by rotating the cylinder **40** relative to adapter **24,** it is within the scope of the invention te attain such selection by rotating adapter **24** relative to cylinder **40** which would be limited to axial movement.

The present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof and, accordingly, reference should be made to the appended claims, rather than to the foregoing specification as indicating the scope of the invention.

We claim:

1. A pipette assembly comprising a housing having first and second ends, a pipette tip support coupled to said first end of said housing, said support having a bore therethrough, a stationary hollow rod in said housing and communicating with said bore, a cylinder in said housing surrounding said rod and spaced therefrom to define a chamber of variable volume, the volume of said chamber increasing when said cylinder moves toward said pipette tip support, sealing means between said rod and cylinder for sealing the ends of said chamber, spring means biasing said cylinder away from said pipette tip support to effect a decrease in the volume of said chamber, said rod having a passage communicating with said chamber, and limit stop means for limiting the extent of movement of said cylinder in a direction away from said pipette tip support due to the bias of said spring means.

2. A pipette assembly in accordance with claim **1** wherein said limit stop means is selectively operable to limit the extent of movement of the cylinder in a direction away from the pipette support to predetermined distances.

3. A pipette assembly in accordance with claim **2** wherein said limit stop means includes an adapter supported by said housing, said adapter having a plurality of recesses of different depths, each adapted to receive the limit stop member on said cylinder.

4. A pipette assembly in accordance with claim **1** wherein said cylinder is rotatably supported by the housing for rotation about the axis of the cylinder, and means connected to the cylinder for selectively rotating the cylinder about its axis relative to the housing.

5. A pipette assembly in accordance with claim **1** wherein said spring means controls discharge at a rate defined by the rate of expansion of the spring means

and greater than the rate of discharge under the effect of gravity.

6. A pipette assembly in accordance with claim **1** wherein said limit stop means includes an adapter supported by said housing, said adapter having a plurality of circumferentially spaced recesses on an end thereof, said adapter surrounding said cylinder, said cylinder having a limit stop pin adapted to enter each of said recesses, and means for selectively rotating one of said adapter and cylinder about the longitudinal axis of the cylinder.

7. A pipette assembly in accordance with claim **1** wherein said chamber surrounds said rod, a head closing said rod at the end of the rod remote from said pipette tip support, said sealing means for sealing the ends of said chamber including a piston connected to said hollow rod and a seal supported by said cylinder for movement therewith.

8. A pipette assembly comprising a support housing, a pipette tip support coupled to said housing, said support having a bore therethrough, a hollow rod in said housing and communicating with said bore, a cylinder in said housing surrounding said rod and spaced therefrom to define a chamber of variable volume, sealing means between said rod and cylinder for sealing the ends of said chamber, means defining a passage communicating said chamber with the interior of said rod, spring means biasing said cylinder away from said pipette tip support whereby discharge from said pipette tip is at the rate of expansion of the spring means, and means for selectively limiting the extent of movement of said cylinder to a plurality of predetermined distances in a direction along the longitudinal axis of said cylinder due to the bias of said spring means.

9. A pipette assembly in accordance with claim **8** wherein said last-mentioned means includes an adapter supported by said housing and having a plurality of circumferentially spaced recesses of different depths, and means for rotating said cylinder about its longitudinal axis, a limit stop member secured to said cylinder and adapted to be received in said recesses.

10. A pipette assembly in accordance with claim **8** including a pipette tip removably mounted on said pipette tip support, said sealing means including a piston connected to said rod and a seal supported by said cylinder for movement with the cylinder, said spring means including a coil spring surrounding said rod.

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