United States Patent

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[72] Inventors **Edward L. Drummond and Michael E. Drummond, Bryn Mawr, Pennsylvania**

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[73] Assignee **Drummond Instrument Company Broomall, Pennsylvania a corporation of Pennsylvania**

[54] MICROLITER SYRINGE HAVING DISPOSABLE PARTS

10 Claims, 8 Drawing Figs.

[52] **U.S. Cl.** **128/218,** 73/425.6

[51] **Int. Cl.** **A61m 5/22,** A61m 5/24

[50] **Field of Search** 222/386, 156; 128/218, 214, 216, 214.2, 215; 73/425.4, 425.6

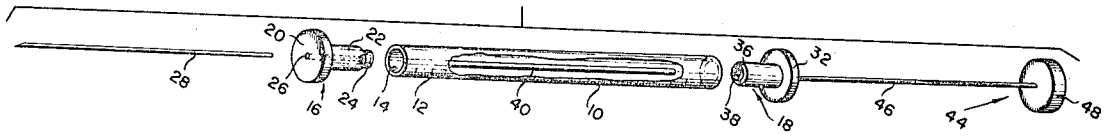
[56] **References Cited**

UNITED STATES PATENTS

3,101,084	8/1963	C.A. Hamilton	128/218
3,412,613	11/1968	R. E. Brown et al.	73/425.2

Primary Examiner—L. W. Trapp
Assistant Examiner—G. F. Dunne
Attorney—Shlesinger, Arkwright and Garvey

ABSTRACT: A microliter syringe for use as a hypodermic syringe or transfer syringe and having disposable parts which may be readily removed and replaced, the syringe including a transparent barrel having measurement graduations marked thereon, closure members having longitudinal bores removably fitted in both ends of the barrel, a capillary tube concentrically mounted within the barrel, the tube terminals extending into the bores of the closure members, a plunger insertable into, and operable longitudinally within, the capillary tube, the diameter of the plunger being substantially equal to the internal diameter of the capillary tube, for expelling fluid from the capillary tube, and delivery means beyond the terminal of the barrel remote from the plunger, through which the fluid is expelled from the syringe.



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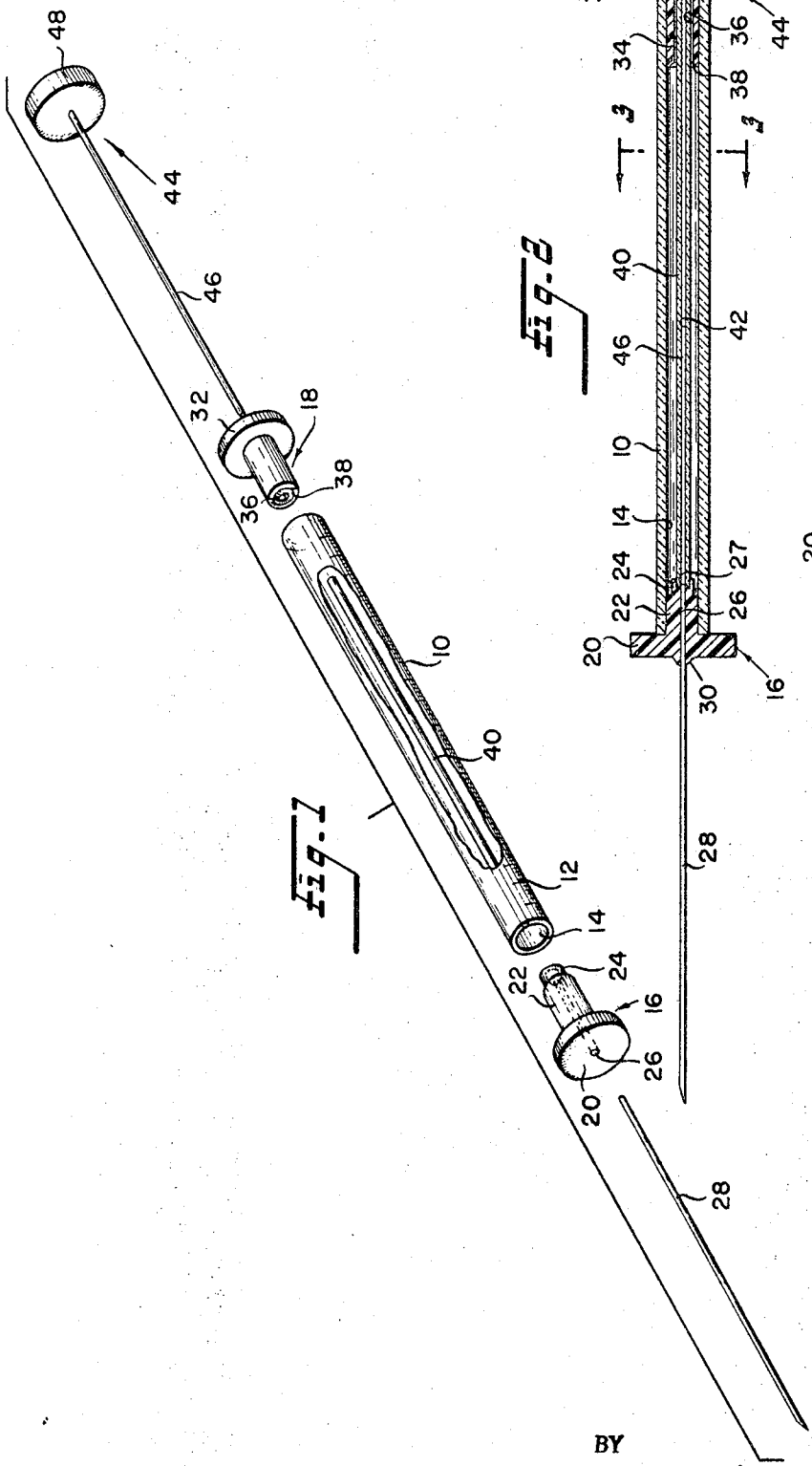

Fig. 1

Fig. 2

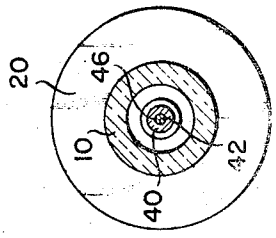

Fig. 3

INVENTORS
Edward L. Drummond
Michael E. Drummond

BY

Pennie, Edmonds, Morton, Barrows & Delahunty
ATTORNEYS

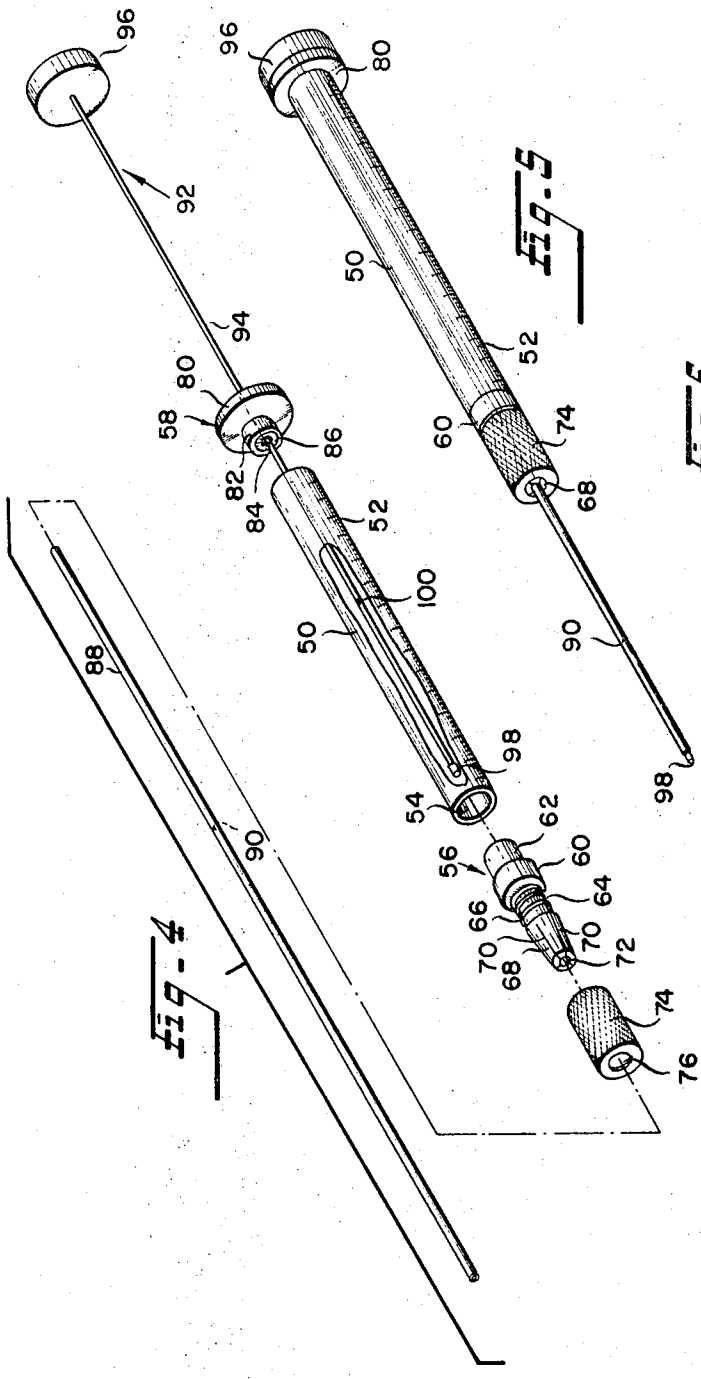

FIG. 4

FIG. 5

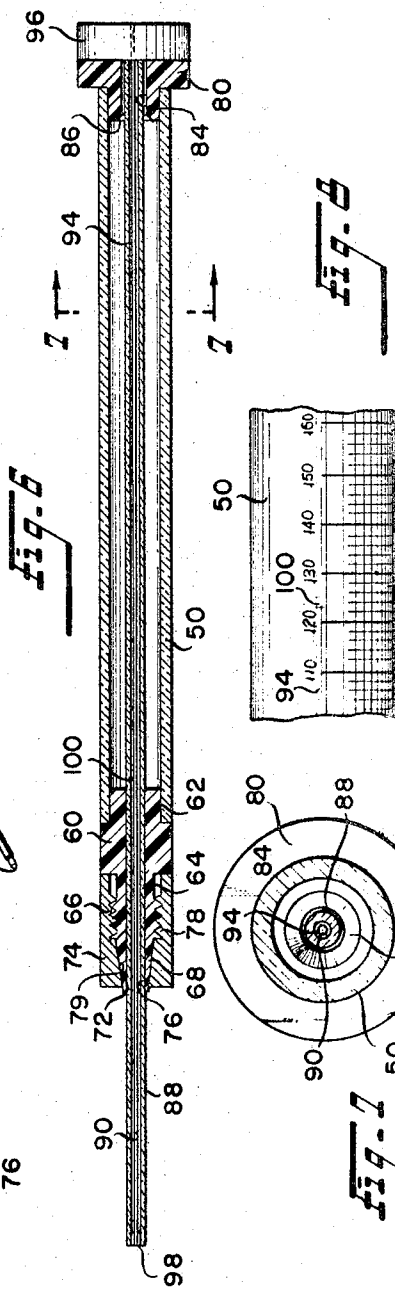

FIG. 6

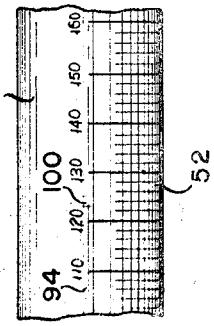

FIG. 8

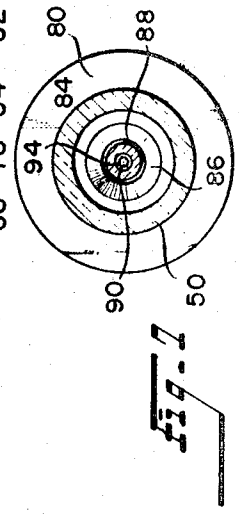

FIG. 7

INVENTORS
Edward L. Drummond
Michael E. Drummond

BY Schlesinger, Arbuckle & Hovey
ATTORNEYS

MICROLITER SYRINGE HAVING DISPOSABLE PARTS

OBJECTS AND DESCRIPTION OF FIGURES

It is an object of this invention to provide a precision microliter syringe including a plurality of simple parts of negligible cost which syringe may be readily assembled and disassembled to permit disposal and replacement of all or some of the parts, particularly those parts contacted by the fluid drawn into the syringe, thereby partially or wholly obviating cleaning and sterilization of those parts.

Another object is to provide a microliter syringe embodying a barrel marked with measurement graduations in which is positioned a capillary tube into which fluid is drawn without contacting the surface of the barrel, the capillary tube being readily removed for disposal after usage and replaced by a new tube.

A further object is to provide a microliter syringe of the character described having a plunger operable within the tube for expelling the contents therefrom, the plunger being removable for cleaning or disposal.

Other objects of the invention are to provide a microliter syringe which may be in the form of a hypodermic syringe or transfer syringe and includes a barrel having measurement graduation markings thereon, a fluid-receiving tube removably positioned in the barrel, barrel closure members in the terminals of the barrel having locating bores for the tube, a plunger extending into the tube and movable longitudinally therethrough to expel fluid, and delivery means beyond the opposite closure member through which the fluid passes to the desired point; to provide a microliter syringe of the character described wherein the delivery means is a hypodermic needle fixed to a closure member and in communication with the tube within the barrel, and to provide a microliter syringe as described, wherein the delivery means comprises an extension of the tube, the closure member including gripping means for preventing accidental longitudinal movement of the tube with respect to the barrel.

Other objects of the invention will be manifest from the following description of the preferred forms of the present invention taken in conjunction with the accompanying drawings, wherein;

FIG. 1 is an exploded view of a hypodermic syringe made in accordance with the present invention;

FIG. 2 is a longitudinal sectional view of the hypodermic syringe of FIG. 1, showing the latter in assembled position;

FIG. 3 is an enlarged, transverse sectional view taken along the line 3–3 of FIG. 2, looking in the direction of the arrows;

FIG. 4 is an exploded view of a transverse syringe constructed in accordance with the present invention;

FIG. 5 is a perspective view of the transfer syringe of FIG. 4, showing the syringe in assembled condition;

FIG. 6 is a longitudinal sectional view of the transfer syringe of FIGS. 4 and 5;

FIG. 7 is an enlarged, transverse sectional view taken along the line 7–7 of FIG. 6, looking in the direction of the arrows; and

FIG. 8 is an enlarged, fragmentary plan view of a section of the transfer syringe showing to advantage the barrel having graduation markings thereon and the relationship of the capillary tube and plunger with respect thereto.

DESCRIPTION OF FIGURES 1 to 3

In FIGS. 1 to 3, there is illustrated a hypodermic syringe constructed in accordance with the present invention and including a barrel 10 having measurement graduation markings 12 on the outer periphery thereof, the barrel including a longitudinal bore 14. The terminals of barrel 10 are adapted to receive closure members designated 16 and 18 respectively.

Closure member 16 includes a disc 20 from the central portion of one face of which issues a cylindrical portion 22, which in turn issues into a further reduced cylindrical member 24. The diameter of cylindrical portion 22 is substantially equal to the inner diameter of barrel 10 to provide a frictional fit of the closure member within the barrel terminal. A central bore 26 extends through closure member 16, which bore is enlarged at the inner end of the closure member, as indicated at 27.

In accordance with this form of the present invention, a hypodermic needle 28 is inserted into bore 26 of closure member 16 and adhesively secured or fused at 30 to the face of disc 20 opposite cylindrical portion 22.

Closure member 18 includes a disc 32, from the central portion of one face of which extends a reduced cylindrical portion 34. The diameter of cylindrical portion 34 is substantially equal to the inner diameter of barrel 10 to permit a frictional fit of the closure member within the barrel. A central bore or clearance hole 36 extends completely through disc 32 and cylindrical portion 34 of closure member 18, the bore being flared at the inner terminal of the closure member, as indicated at 38.

As shown to advantage in FIG. 2, a capillary tube 40 having a longitudinal bore 42 is positioned within, and in spaced relation to, the inner periphery of barrel 10, the capillary tube being maintained in axial alignment with the barrel by means of a force fit into enlarged bore 27 of closure member 16 at one end, and extension through clearance hole 36 of closure member 44. It will be further noted from a consideration of FIG. 2 that the diameter of bore or clearance hole 36 is slightly larger than the diameter of capillary tube 40 to permit ready insertion of the tube therein and facile removal therefrom.

It is a further salient feature of the present invention to provide a plunger generally designated 44 which includes a plunger body 46 that is preferably a straight piece of stainless steel wire, circular in cross section, the diameter of which is substantially the same as the diameter of bore 42 of capillary tube 40. One terminal of plunger body 46 is set in any suitable manner into the central portion of a plunger cap or operating member 48.

Closure members 16 and 18 and plunger cap 48 are preferably of a molded plastic material such as Teflon which may be manufactured at a negligible cost. Capillary tube 40 is precision made and is preferably redrawn glass tubing.

OPERATION

The operation of the microliter syringe of the present invention is conventional, the tip of hypodermic needle 28 being immersed in the fluid to be drawn into the syringe, following which plunger 44 is slowly withdrawn from capillary tube 40 until the desired measured amount, as indicated by graduations 12, is in bore 42 of capillary tube 40. Upon pushing plunger 44 in the direction of barrel 10, the leading terminal of plunger body 46 forces the liquid in advance thereof to expel the fluid through hypodermic needle 28 and out of the bore at the terminal thereof.

After use, barrel 10 is grasped firmly in one hand and a pull is exerted with the other hand on closure member 16 in a direction to withdraw the same from the terminal of the barrel. Capillary tube 40 is removed from the barrel with closure member 16 and, it is contemplated by the present invention that the capillary tube and the closure member with the hypodermic needle connected thereto may be discarded as a unit, to obviate cleaning of these parts with which the fluid has come into contact. Plunger 44 is removed from the opposite end of barrel 10 and may be either cleaned or discarded as desired. The negligible cost of these parts renders it economically feasible to dispose of them after use rather than to take the time and effort required for proper cleaning, particularly where contaminating or hard-to-clean liquids have been drawn into the syringe.

FORM OF INVENTION OF FIGURES 4 TO 8

In FIGS. 4 to 8 there is illustrated another form of the present invention which includes a barrel 50 having measurement graduations 52 marked on the outer periphery thereof, the barrel being provided with a central bore 54. The ter-

minals of barrel **50** are adapted to receive closure members designated **56** and **58**.

Closure member **56** includes a disc **60**, from the central portion of one face of which extends a cylindrical portion **62**. From the opposite face of disc **60** extends a cylindrical member **64** which is externally threaded at **66**. Cylindrical portion **64** in turn issues into a conical member **68**, which is provided with a plurality of spaced longitudinal slits **70**. A longitudinal bore **72** of predetermined diameter extends completely through closure member **56**.

In connection with closure member **56**, there is provided a knurled cylindrical collar **74** having a longitudinal bore **76**, a portion of the wall defining the bore being threaded at **78**, adjacent which threaded portion the wall is tapered as indicated at **79**.

Closure member **58** includes a disc **80**, the central portion of one face of which issues into a reduced cylindrical portion **82**, the outer periphery of which frictionally engages the inner wall of barrel **50**. A longitudinal bore or clearance hole **84** extends through closure member **58** and is flared at **86** to facilitate insertion of a capillary tube through the bore.

In accordance with the present invention, a capillary tube **88** having a bore **90** is positioned within barrel **50** with one terminal thereof extending through clearance hole **84**, the extremity of the tube being flush with the outer limit of disc **80**.

In accordance with this form of the invention, capillary tube **88** extends through and beyond barrel **50** and closure member **56** to permit use of the device as a transfer syringe. Accidental longitudinal movement of capillary tube **88** with respect to barrel **50** is prevented by virtue of collar **74**, which, when threadedly engaged with cylindrical portion **64**, causes a limited flexing of conical portion **68** inwardly under urging of tapered section **79** of the collar, to grippingly engage the outer periphery of capillary tube **88**.

The transfer syringe further includes a plunger **92** which includes a straight plunger body **94** which is preferably made of stainless steel, one terminal of which is set in a cap or operating member **96**. It will be noted from a consideration of FIG. **6** that plunger body **92** extends completely through capillary tube **88** and terminates in a tip **98** which may be made of Teflon or other suitable material to force fluids in advance thereof when it is desired to expel the same from the transfer syringe. Intermediate the length of body **94**, there is provided a marking **100**, which, when the syringe is in the position shown in FIG. **6**, coincides with one of the markings on the syringe and, for example, designates the **100**-lambda mark on the graduated barrel.

OPERATION

The operation of the transfer syringe illustrated in FIGS. **4** to **8** is very similar to that of the hypodermic syringe illustrated in FIGS. **1** to **3**. In this connection, however, it will be noted that where, for example, mark **100** on plunger body **94** coincides with the **100**-lambda marking of graduated barrel **50**, then subtract **100** from the amount shown on the barrels. For amounts over **100** lambdas read the amount directly, using the bottom of tip **98** as the reference point. In this way, amounts from **1** lambda up to the capacity of the capillary tube may be accurately measured.

In accordance with this form of the invention, closure members **56** and **58** and cap **96** are also preferably of a molded construction such as Teflon and collar **74** is of metallic construction. Capillary tube **88** is preferably of precision redrawn glass tubing.

The operation of the transfer syringe of FIGS. **4** to **8** is substantially the same as described above in connection with that form of the invention illustrated in FIGS. **1** to **3**.

After usage, plunger **92** is removed from capillary tube **88**, following which collar **74** is loosened to permit facile removal of tube **88** for replacement by a new tube. As above indicated, plunger **92** may be either discarded and replaced by a new member or cleaned and reused.

In installing a new capillary tube **88**, the latter is inserted through clearance hole **84** until a terminal thereof extends slightly beyond disc **80**. The protruding terminal of tube **88** is then lightly tapped against any suitable object, until the terminal is flush with the outer face of disc **80**. When this has been done and plunger **92** inserted into the tube to its maximum extent, as illustrated in FIG. **6**, the terminal of plunger tip **98** is uniplanar with a terminal of capillary tube **88**. This assures accurate measurements of fluid drawn into the capillary tube to be made.

While there has been herein shown and described the presently preferred forms of the present invention, it is to be understood that such has been done for purposes of illustration only, and that various changes may be made therein within the scope of the claims hereto appended.

We claim:

1. A microliter syringe comprising:
a. a barrel having an axial bore;
b. closure members fitted over the terminals of said barrel;
c. said closure members having longitudinal bores extending therethrough;
d. at least one of said closure members being removable;
e. a disposable tubular member positioned within the axial bore of said barrel;
f. the terminals of said tubular member being held in the longitudinal bores of said closure members;
g. a fluid-expelling member extending into the longitudinal bore of said tubular member;
h. said fluid-expelling member being movable longitudinally through the longitudinal bore of said tubular member; and
i. delivery means beyond the other of said closure members in communication with said tubular member.

2. The microliter syringe of claim **1** wherein both of said closure members are removable.

3. The microliter syringe of claim **1** wherein said tubular member is a capillary tube.

4. The microliter syringe of claim **1**, wherein:
a. said delivery means comprises a hypodermic needle fixed to one of said closure members; and
b. said hypodermic needle being in communication with the longitudinal bore of one of said closure member.

5. The microliter syringe of claim **1**, wherein:
a. said delivery means comprises an extension of said tubular member; and
b. means engaged with one of said closure members for gripping engagement with said tubular member to prevent accidental movement of said tubular member with respect to said barrel.

6. A microliter syringe comprising:
a. a barrel having an axial bore;
b. closure members removably engaged with the terminals of said barrel;
c. each of said closure members having longitudinal bores extending therethrough;
d. a removable capillary tube positioned within the axial bore of said barrel;
e. the terminals of said capillary tube being engagedly held in the longitudinal bores of said closure members;
f. said capillary tube having a longitudinal bore in communication with the longitudinal bores of said closure members;
g. a plunger removably engaged with said capillary tube and one of said closure members, said plunger including;
h. a plunger body extending through the longitudinal bore of the closure member into the longitudinal bore of said capillary tube;
i. the inner terminal of said plunger body being of substantially the same diameter in cross section as the longitudinal bore of said tube; and
j. fluid delivery means engaged with the other of said closure members and in communication with the longitudinal bore of said capillary tube, for conducting fluid to a point externally of the syringe.

7. The microliter syringe of claim 6 wherein said fluid delivery means includes a hypodermic needle fixed to the other of said closure members.

8. The microliter syringe of claim 6, wherein:

a. said fluid delivery means comprises an extension of said capillary tube through the longitudinal bore of said closure member and beyond the limits of said barrel; and

b. means carried by said closure member for grippingly engaging said capillary tube extension for preventing accidental displacement of the capillary tube.

9. The microliter syringe of claim 8, wherein said means for grippingly engaging said capillary tube extension comprises:

a. an externally threaded cylindrical portion engaged with one of said closure members;

b. a conical portion issuing from said cylindrical portion;

c. said conical portion being provided with a plurality of longitudinal slits;

d. a cylindrical collar having a core for engagement over said conical portion;

e. said cylindrical collar including a threaded internal wall for operative engagement with the threaded cylindrical portion: and

f. the internal wall of said cylindrical collar further including an internal tapered wall portion for exerting a force on said conical portion to grip said capillary tube extension.

10. The microliter syringe of claim 6, wherein:

a. one terminal of said capillary tube is force fit into the longitudinal bore of one of said closure members; and

b. the opposite terminal of said capillary tube extending through the longitudinal bore of said other closure member.