

[54] **DOUBLE SYRINGE**

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[51] Int. Cl. **A61m 5/18**

[58] Field of Search **128/218 M, 218 P, 218 R, 128/220, 234, 235, 237, DIG. 28, 215, 216, 218 D; 206/47 R**

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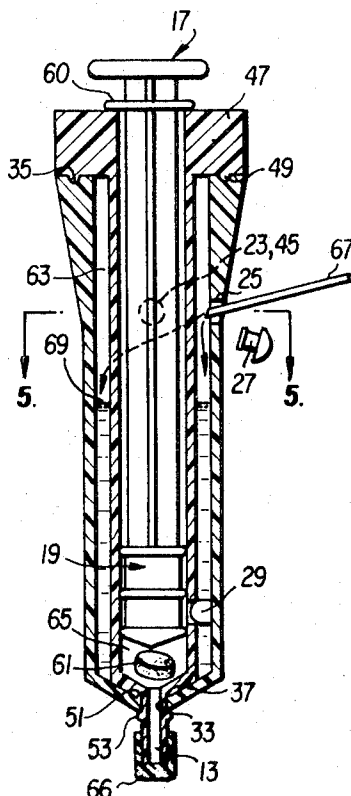
Attorney, Agent, or Firm—Griffin, Branigan and Butler

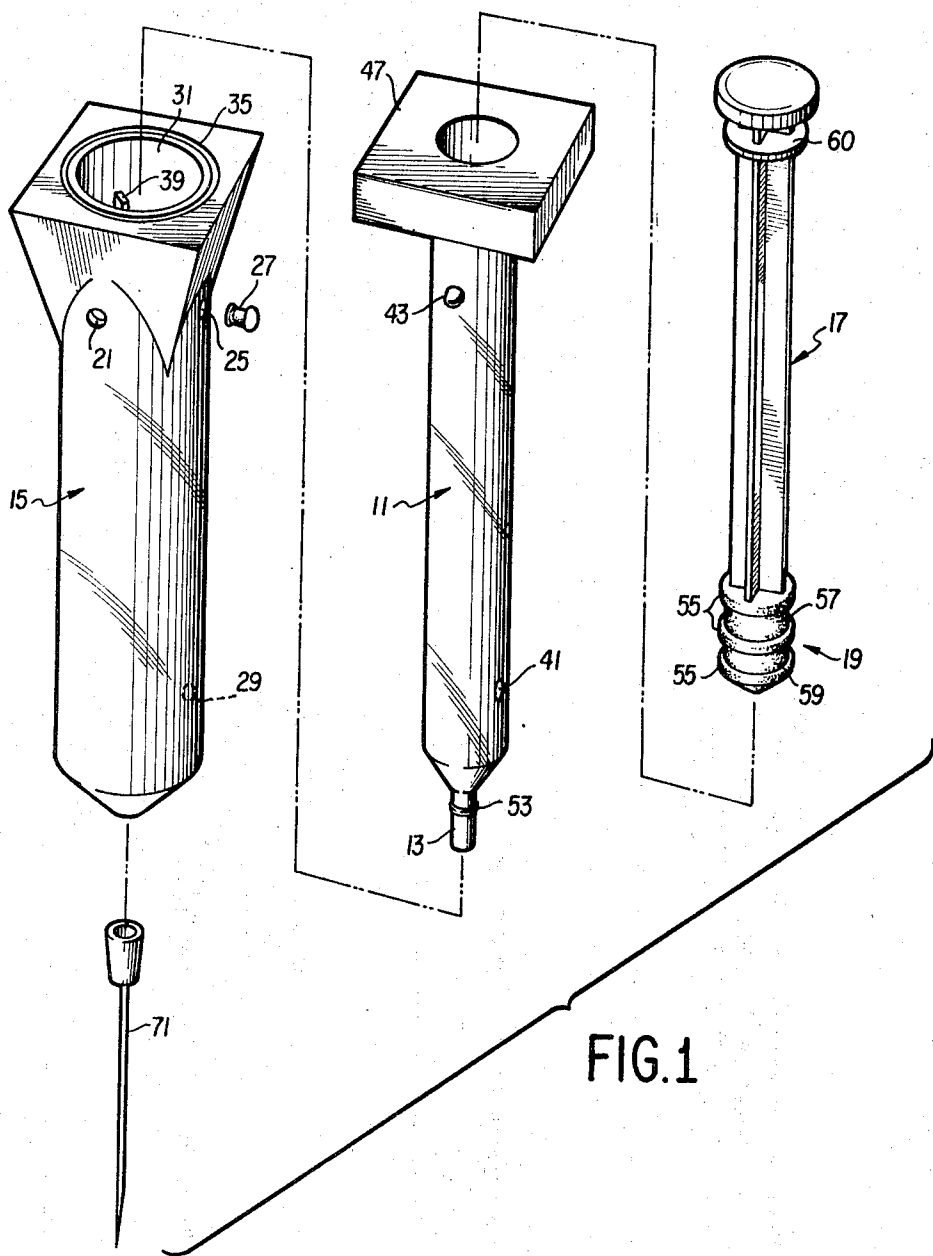
[57] **ABSTRACT**

A double syringe assembly is disclosed which com-

prises an outer housing enclosing an inner housing. The two housings define an outer reservoir between them and an inner reservoir inside the inner housing. There are three ports in the outer housing and one port in the inner housing. Further, there are corresponding sealing beads on the outer surface of the inner housing for covering and uncovering two of the outer-housing ports and a sealing bead on the inner surface of the outer housing for covering and uncovering the inner-housing port. A separate plug is provided for covering and uncovering the third outer-housing port. The inner housing has a needle mounting tube extending from an end thereof which is inserted through an opening in the end of the outer housing. The needle mounting tube has a bead formed on the outer surface thereof which prevents axial movement between the two housings, but allows rotational movement. A protruding annularly-shaped sealing ring is formed on the inner surface of the outer-syringe, encircling the opening. Further, an annularly-shaped slot is formed about the base of the needle mounting tube on the outer surface of the inner syringe for receiving the sealing ring. Thus a seal is formed to hold diluent in the outer reservoir. In addition, a similar arrangement of sealing elements is provided at the opposite end of the syringe assembly.

10 Claims, 7 Drawing Figures





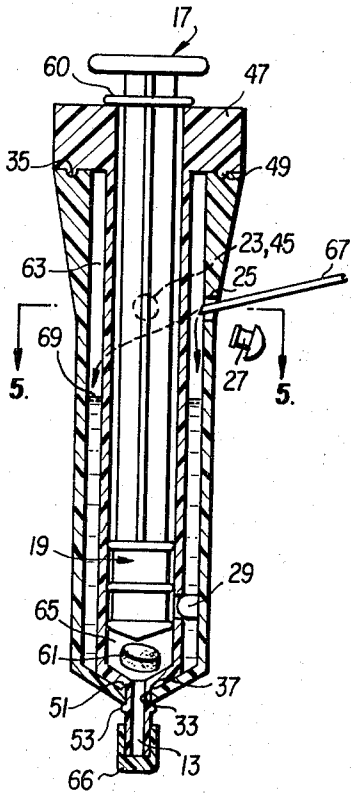


FIG. 2

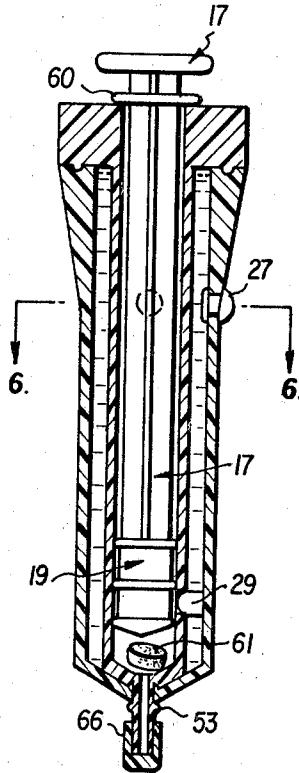


FIG. 3

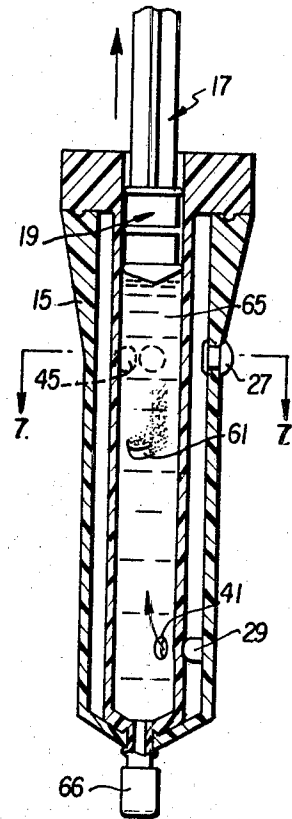


FIG. 4

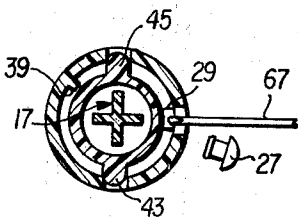


FIG. 5

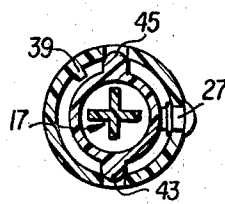


FIG. 6

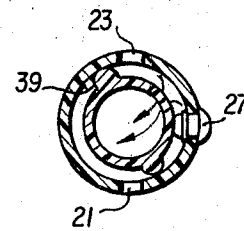


FIG. 7

DOUBLE SYRINGE

BACKGROUND OF THE INVENTION

This invention relates generally to the art of hypodermic syringes, and has particular reference to disposable plastic syringes which may be prefilled in a laboratory with diluent and medicament, in separate compartments, for subsequent intermixing and use, after which the syringes may be discarded.

This invention finds particular use in military applications for emergency treatment under battlefield conditions where a prefilled syringe may either be self-administered or administered by medical and non-medical personnel. Such a syringe is prefilled with an appropriate dry medicament — an antibiotic, a pain killing serum, a narcotic, or the like — and a diluent that must be mixed in predetermined portions with the medicament. However, the invention is not limited to military uses and hypodermic syringes embodying principles of this invention may find use in other fields where simple one-shot, premeasured injections must be quickly administered.

There are a variety of patented syringes having two or more compartments for storing, intermixing and injecting a mixed medicament and a diluent, some of which are described in: U.S. Pat. Nos. 553,234 to Finot; 1,154,677 to Wedig; 2,869,543 to Ratcliff et al; 3,161,195 to Taylor et al; 3,534,734 to Budreck; 3,678,930 to Schwartz; and 3,680,558 to Kapelowitz.

Of these U.S. Pats. Finot (553,234) describes a syringe wherein a diluent is stored in an outer chamber and a passageway to an inner chamber is opened in response to rotation of outer and inner cylinders. Although having some advantages over other dual chambered syringes, Finot's syringe assembly, as well as other dual chambered syringes, has not been widely used. One likely reason for this is that Finot's passageway between his outer and inner chambers is defined by sealing members which have the function of forming a seal between his outer and inner cylinders. Finot's sealing members are flat and press against one another rather than intermesh. It is thought that such a system is not only somewhat complicated but also may not provide a tight seal. Further, Finot's outer chamber can only be filled by first sucking a charge into his inner chamber and then transferring it to his outer chamber. This involves an unduly long amount of time for charging syringes. In addition, Finot's outer and inner cylinders are held together by threaded members. Such threaded members are unduly difficult to manufacture and time consuming to assemble. In this regard it appears that the cost for manufacturing Finot's syringe would probably prevent it from being sold as a disposable item.

A dual chambered disposable syringe which may be prefilled in a laboratory should have the following qualities to be of practical value:

- it should be inexpensive to manufacture;
- it should be easily and quickly fillable with a diluent and a medicament;
- it should provide for easy and quick transference of diluent from a storage reservoir to a plunger reservoir without the diluent or medicament being unduly exposed to atmosphere; and
- it should be easy to assemble, with the parts thereof being assembled with relatively little effort and in relatively little time.

It is an object of this invention to provide such a dual chambered syringe.

SUMMARY OF THE INVENTION

According to principles of this invention a dual chambered syringe comprises an outer housing enclosing an inner housing. The two housings defined an outer reservoir between them and an inner reservoir in the inner housing. There are three ports in the outer housing and one port in the inner housing. Further, there are corresponding sealing beads on the outer surface of the inner housing for covering and uncovering two of the outer-housing ports and a single sealing bead on the inner surface of the outer housing for covering and uncovering the inner-housing port. A plug is provided for plugging and unplugging the third outer-housing port.

A particular aspect of the syringe assembly is that it is constructed such that it can be assembled by merely inserting the inner housing into the outer housing. In this regard, both housings are constructed of a plastic. The inner housing has a needle-mounting tube extending from an end thereof which is inserted through an opening in the end of the outer housing. The needle-mounting tube has a bead formed on its outer surface which, in one embodiment, must be forced through the opening in the outer housing, but which, after passing through the opening, prevents axial movement between the two housings. In another embodiment the bead is formed on the needle-mounting tube after it has been inserted through the opening. Also, an annularly-shaped sealing ring is formed on the inner surface of the outer housing about the outer housing opening. Further, an annularly-shaped sealing groove is formed about the base of the needle mounting tube on the inner housing for receiving the sealing ring. Thus, a seal is formed to hold the diluent in the outer reservoir. In addition, a similar arrangement of sealing elements is provided at the opposite ends of the housings. BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objects, features and advantages of the invention will be apparent from the following more particular description of a preferred embodiment of the invention, as illustrated in the accompanying drawings in which reference characters refer to the same parts throughout the different views. The drawings are not necessarily to scale, emphasis instead being placed upon illustrating principles of the invention in a clear manner.

FIG. 1 is an exploded isometric view of a syringe assembly employing principles of this invention;

FIGS. 2-4 are sectional views of the FIG. 1 syringe assembly, each view depicting a different phase of operation of the syringe assembly;

FIG. 5 is a sectional view taken on line 5-5 in FIG. 2;

FIG. 6 is a sectional view taken on line 6-6 in FIG. 3;

and
FIG. 7 is a sectional view taken on line 7-7 in FIG. 4.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, an inner housing 11, including a needle-mounting tube 13, is insertable into an outer housing 15; and a plunger 17, including a rub-

ber tip 19, is insertable into the inner housing 11. Both the inner and outer housings are constructed of polypropylene plastic, as is the main body of the plunger 17.

The outer housing 15 has three ports 21 (FIG. 1), 23 (FIG. 2) and 25 (FIG. 1) located at an upper (as seen in FIGS. 1-4 end thereof. The first and second ports 21 and 23, which serve as breather ports, are located opposite one another, and the third port 25, which serves as a filling port, is positioned ninety degrees from the first and second ports 21 and 23. The third port 25 is coverable and uncoverable by a plastic plug 27. In this regard, the plug 27 may be force fitted into the third port 25, however, for greater security it may be screw fitted.

An outer housing bead 29 protrudes inwardly from the inner surface of the outer housing 15.

The outer housing 15 has a relatively large opening 31, for receiving the inner housing 11, at its upper end and a relatively smaller opening 33 (FIG. 2), through which the needle-mounting tube 13 extends, located at its lower end. Surrounding the outer-housing large opening 31, and facing axially upwardly is a sealing groove 35. Encircling the smaller opening 33, and protruding axially inwardly, is a sealing ring 37 (FIG. 2).

A post 39 (FIGS. 1 & 5-7) protrudes inwardly from the inner surface of the outer housing 15. Both the post 39 and the bead 29 are of polypropylene plastic and may be formed integrally with the outer housing 15; however, in the preferred embodiment, the bead is fused or welded to the outer-housing 15 by a method such as sonic welding.

The inner housing 11 has a single inner-housing port 41 located at the lower end thereof, the position of the inner-housing port 41 corresponding to the position of the outer-housing bead 29. Further, the inner housing 11 has two plastic beads 43 and 45 protruding from its outer surface at positions such that they cover the first and second outer-housing ports 21 and 23 when the outer-housing bead 29 covers the inner-housing port 41. Again, these beads may be formed integrally with or fused to the inner housings 11.

A flange 47 protrudes laterally from the upper end of the inner housing 11. An annular sealing ring 49 (FIGS. 2-4) protrudes from the lower surface of the flange 47 and is designed to mesh with the sealing groove 35 of the outer housing 15. Similarly, an annularly-shaped sealing groove 51 encircles the base of the needle-mounting tube 13 and is designed to receive the sealing ring 37 of the outer housing 15.

An annularly shaped bead 53 extends around the outer surface of the needle-mounting tube 13 and is in one embodiment, designed to be forced or "popped" through the smaller opening 33 of the outer housing 15. Thereafter, the annularly-shaped bead 53 retains the outer and inner housings 15 and 11 against relative axial movement but allows relative rotational movement between them.

In another embodiment the annularly-shaped bead 53 is formed on the needle-mounting tube 13 after it has been inserted through the opening 33 by melting and shaping a portion of the needle-mounting tube. Similarly, in still another embodiment it is formed by sonically welding a locking ring in position after assembly.

The rubber plunger tip 19 comprises three sealing members 55 which define two sealing section 57 and 59. The first sealing section 57 is designed to overlap

and backup the seal of the inner-housing port 41 when the plunger 17 is fully depressed. The second sealing section 59 designed to provide still another backup seal for preventing the diluent from reaching a medicament through the inner housing port 41 (FIGS. 2 and 3). A safety stop 60 is integral with the plunger 17 to prevent crushing of a medicament 61.

To assemble the syringe assembly depicted in the drawings, the inner housing 11 is inserted into the outer housing 15 through the outer-housing large opening 31, until the needle-mounting tube 13 protrudes through the smaller opening 33 at the lower end of the outer housing 15. Force must be used to "pop" the annularly shaped bead 53 on the needle-mounting tube 13 through the small opening 33 and once this is accomplished the annularly-shaped bead 53 prevents relative axial movement and thereby holds the sealing ring 37 in the sealing groove 51 and the sealing ring 49 in the sealing groove 35. Thus, an outer reservoir 63 is formed between the outer and inner housings 11 and 15 which is sealed at both ends thereof. It should be understood that this method of attaching the outer and inner housings 11 and 15 allows relative rotational movement between these two members.

Normally, at this time, the outer and inner housings are rotated to a position where the outer-housing bead 29 covers the inner-housing port 41 and the first and second inner-housing beads 43 and 45 cover the first and second outer-housing ports 21 and 23.

When it is desired, the medicament 61 is placed inside an inner reservoir 65, defined by the inner housing 11, and the plunger 17 is inserted into the inner reservoir 65. A cap 66 is mounted on the end of the needle-mounting tube 13. The syringe assembly is now in an attitude as is depicted in FIGS. 2 and 5.

Also when desired, liquid diluent is inserted into the third outer housing filling port 25 by means of a thin, needle-like inserting device 67 which is sufficiently small that it allows air to escape around its sides through the third outer-housing port 25. In this manner the outer reservoir 63 is filled to a point 69 which is immediately below the third outer-housing port 25. The inserting device 67 is then removed from the third outer-housing port 25 and the plug 27 is inserted into the third outer-housing port 25 to effectively close off this port. At this point the syringe assembly is fully charged with both medicament and diluent, as depicted in FIGS. 3 and 6, and is ready for use at an appropriate time.

To use the charged syringe assembly, with reference to FIGS. 4 and 7, the outer and inner housings 11 and 15 are rotated relative to one another so that the outer-housing bead 29 uncover the inner-housing port 41 and the first and second inner-housing beads 43 and 45 uncover the first and second outer-housing breather ports 21 and 23. The post 39 limits rotational movement between the outer and inner housings 11 and 15 as shown in FIG. 7.

The plunger 17 is then withdrawn from the inner reservoir 65, as shown in FIG. 4, thereby creating a vacuum in the inner reservoir 65. Atmospheric pressure acts through the first and second outer-housing ports 21 and 23 to transfer the diluent from the outer reservoir 63 through the inner-housing port 41 into the inner reservoir 65. The outer and inner housings 11 and 15 are then rotated in an opposite direction until the outer-housing bead 29 covers the inner-housing port 41

and the first and second inner-housing beads 43 and 45 cover the first and second outer-housing ports 21 and 23. At this point the diluent and the medicament 61 intermix to form a solution to be injected into a patient. The cap 66 is then removed and replaced with a needle 71 (FIG. 1) which is inserted into the body of a patient. The plunger 17 is then depressed, ejecting the medicine from the inner reservoir 65 through the needle 71 into the patient.

It should be understood by those skilled in the art that the system of beads and ports provided in this invention is relatively uncomplicated but yet provides an effective means of opening and closing passages between reservoirs and to atmosphere. Further, these passages are totally separate from the sealing areas so that they do not inhibit effective operations of seals.

In addition, the provision of a separate charging port which is coverable and uncoverable by a plug allows the syringe assembly to be charged with diluent without moving the beads and ports relative to one another and thereby, perhaps, deforming these elements so that they cannot later perform their proper function.

In addition, the arrangement of the annularly-shaped bead 53 on the needle-mounting tube 13, the smaller opening 33 in the outer housing 15, and the sealing elements 35, 49, 37 and 51, allow relatively easy and fast assembly of the syringe assembly, but yet provide effective seals and allow rotation between the housings.

While the invention has been particularly shown and described with reference to a preferred embodiment, it will be understood by those skilled in the art that various changes in form and detail may be made therein without departing from the spirit and scope of the invention. For example, this device could be constructed with only one bead-coverable outer-housing port at the upper end thereof; however, two breather ports and beads are provided in the preferred embodiment so that equal and opposite forces of the beads pushing against the inner housing will offset one another. Further, it would be possible to dispense with a separate plug-coverable diluent insertion port since diluent could be inserted through a bead-coverable port; however, this may require that the inner and outer housings be rotated relative to one another twice before the assembly is actually used to administer an injection. Such undue operation could deform the beads and ports and cause leaks which could make the syringe assembly inoperable.

In addition, the sealing grooves and rings could have many shapes other than those disclosed herein.

The embodiments of the invention in which an exclusive property or privilege are claimed are as follows:

1. A syringe comprising:

a cylindrically-shaped hollow outer housing having a relatively large opening at a first end thereof, a smaller opening at a second end thereof and at least one port in a sidewall thereof, said at least one port being located closer to said outer-cylinder first end than to said outer-cylinder second end, said cylindrically-shaped hollow outer housing including a first sealing means encircling said large opening and a second sealing means encircling said smaller opening;

a cylindrically-shaped hollow inner housing having an outer diameter less than the outer-housing inner diameter inserted in said outer-housing through said large opening, said inner housing having a rela-

tively large opening at a first end thereof, a smaller opening at a second end thereof, and a port in a sidewall thereof, said port being located closer to said inner-housing second end than to said inner-housing first end, said cylindrically-shaped hollow inner housing including a first sealing means encircling said large opening for engaging said first sealing means of said outer housing and a second sealing means encircling said smaller opening for engaging said second sealing means of said outer housing, said inner-housing defining an inner reservoir in the interior thereof;

a plunger inserted into said inner reservoir of said inner housing through said large opening, said plunger including a tip thereon for engaging the inner surface of said inner housing, and thereby preventing fluid flow in said inner reservoir past said tip;

a mounting means holding said inner housing tightly inside said outer housing with said respective large and small openings of said inner and outer housings being adjacent one another, said inner and outer housings forming an outer reservoir therebetween, said mounting means allowing relative rotation between said inner and outer housings, but yet providing sufficient axial restraint to hold said first sealing means of said outer housing in tight engagement with said first sealing means of said inner housing, thereby preventing fluid leakage from an outer-reservoir first end, and said second sealing means of said outer housing in tight engagement with said second sealing means of said inner housing, thereby preventing fluid leakage from an outer-reservoir second end;

wherein, a first bead means is included on an inner surface of said outer housing for covering and uncovering said port in said inner housing in response to relative rotation between said inner and outer housings, a second bead means is included on an outer surface of said inner housing for covering and uncovering said at least one port in said outer housing in response to relative rotation of said inner and outer housings and said bead means are angularly positioned relative to one another so that they simultaneously cover and uncover said ports.

2. A syringe as claimed in claim 1 wherein said cylindrically-shaped hollow outer housing includes a second port in a sidewall thereof, said second port being located closer to said outer-housing first end than to said outer-housing second end, and wherein is further included a plug for insertion into said second outer-housing port for selectively covering and uncovering said second outer-housing port.

3. A syringe as claimed in claim 1 wherein said mounting means comprises a needle-mounting tube which is integral with said inner housing and which protrudes longitudinally outwardly at said second end of said inner housing, with an interior passage thereof forming said smaller opening in said inner housing, said needle-mounting tube being of such a size and shape to fit through said smaller opening in said outer housing, said needle-mounting tube including a bead protruding from the outer surface thereof which is of such size and shape, and is so positioned that it retains the inner and outer housings against axial movement so that said respective first sealing means of said inner and outer housings and said respective second sealing means of

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said inner and outer housings are maintained in close contact with one another but yet relative rotation is allowed between said inner and outer housings.

4. A syringe as claimed in claim 3 wherein said bead protruding from the outer surface of said needle-mounting tube is of such a size and shape that it may be force "popped" through said smaller opening in said outer housing.

5. A syringe as claimed in claim 3 wherein said cylindrically-shaped hollow outer housing includes a second port in a sidewall thereof, said second port being located closer to said outer-housing first end than to said outer-housing second end, and is further included a plug for insertion into said second outer-housing port for selectively covering and uncovering said second outer-housing port.

6. A syringe as claimed in claim 3 where:

said outer-housing first sealing means comprises an annularly shaped sealing groove which faces axially in the direction of said first end and said inner housing first sealing means comprises a flange and an annularly shaped sealing ring protruding from a bottom surface of said flange in an axial direction toward said second end, said sealing ring being constructed of such a size and shape as to fit into said outer-housing sealing groove; and

said inner housing second sealing means comprises an annularly shaped sealing groove axially facing said second end and said outer housing second sealing means is a sealing ring protruding from the inner surface thereof axially toward its first end, and being of such a size and shape as to fit into said inner-housing sealing groove.

7. A syringe as claimed in claim 1 wherein a post is integral with said outer housing and is located along the inner surface thereof, said post being of such a size, and being positioned, so as to limit relative rotation between the outer and inner housings by engaging one of said beads.

8. A syringe as claimed in claim 1 wherein is further included a needle mounting tube integral with said inner housing which protrudes longitudinally outwardly at said second end of said inner housing, with an interior passage thereof forming said smaller opening in said inner housing, said needle mounting tube being of such a size and shape to fit snugly through said smaller opening in said outer housing.

9. A syringe as claimed in claim 1 wherein said plunger tip includes at least three axially separated sealing members for engaging the inner surface of said inner housing.

10. In a syringe comprising:

a cylindrically shaped hollow outer housing having a

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relatively large opening at a first end thereof, and a smaller opening at a second end thereof, said cylindrically shaped hollow outer housing including a first sealing means encircling said large opening at a first end thereof, and a smaller opening at a second end thereof; and

a cylindrically shaped hollow inner housing, having an outer diameter less than the outer-housing inner diameter, inserted into said outer-housing through said large opening, said inner housing having a relatively large opening at a first end thereof and a smaller opening at a second end thereof, said inner housing including a first sealing means encircling said large opening for engaging said first sealing means of said outer housing and a second sealing means encircling said smaller opening for engaging said second sealing means of said outer housing, said inner-housing defining an inner reservoir in the interior thereof, said inner housing including a needle mounting tube protruding outwardly at said second end which forms said smaller opening in said inner housing;

means to hold said inner and outer housings in such relative axial positions that their respective first sealing means are in engagement and their respective second sealing means are in engagement to form an outer reservoir between said inner and outer housings, but yet to allow rotational movement between said inner and outer housings and said inner and outer housings including means for opening and closing a passage between said inner and outer reservoirs in response to rotational movement between said inner and outer housings; and

a plunger inserted into said inner reservoir of said inner housing through said inner-housing large opening, said plunger including a tip thereon for engaging the inner surface of said inner housing, thereby preventing fluid flow in said inner cylinder past said tip;

the improvement wherein said needle-mounting tube is adapted to both have a hypodermic needle mounted on a tip thereof and to form said holding means by being of such a size and shape as to fit snugly through said smaller opening in said outer housing, said needle-mounting tube having a bead on the outer surface thereof which is of such a size, shape and location as to remain in contact with the outer surface of said outer housing around said smaller opening to thereby hold said inner and outer housings in said sealed, rotatable axial positions.

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