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Killinger

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[54] **COMPACT SYRINGE**

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[52] **U.S. Cl.** ..... **128/220,** 128/218 D

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

[58] **Field of Search** ... 128/220, 216, 218 P, 218 M, 128/218 D, 218 PA, 272, 215, 218 DA; 206/63.2 R

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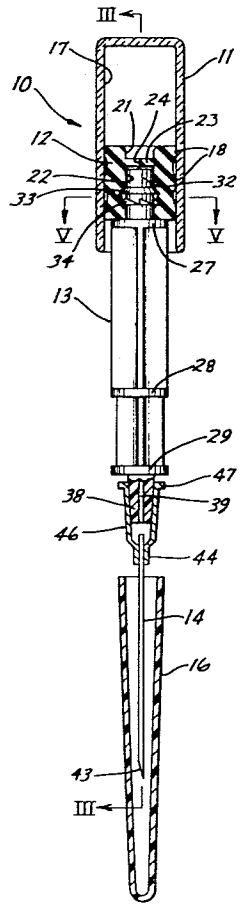
[57] **ABSTRACT**

A syringe having a liquid holding barrel closed at one end and open at the other. A piston sealingly and slidably disposed within the barrel and a rod connected to the piston and extending through and substantially beyond the open end of the barrel. A cannula is connected to the outer end of the rod, the piston and rod having a passageway extending therethrough and communicating between the interior of the barrel and the cannula. A closure yieldably obstructs the movement of fluid from the barrel through the cannula.

4 Claims, 7 Drawing Figures



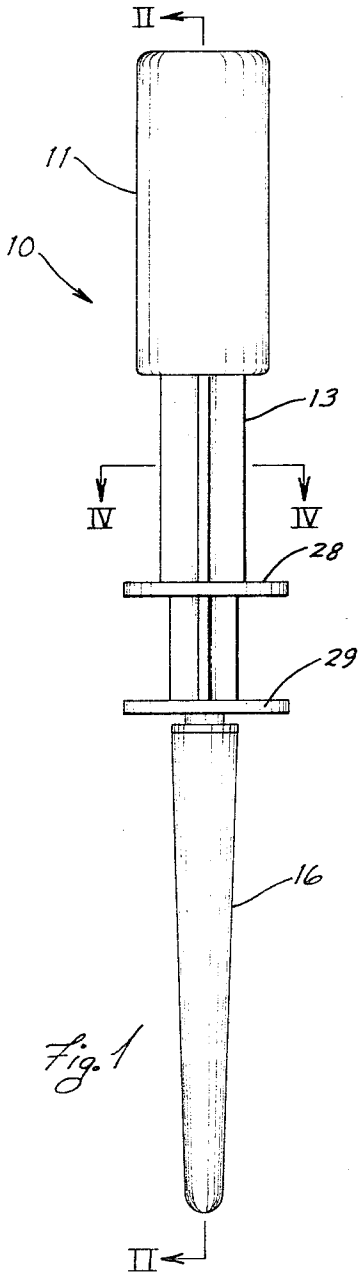


Fig. 1

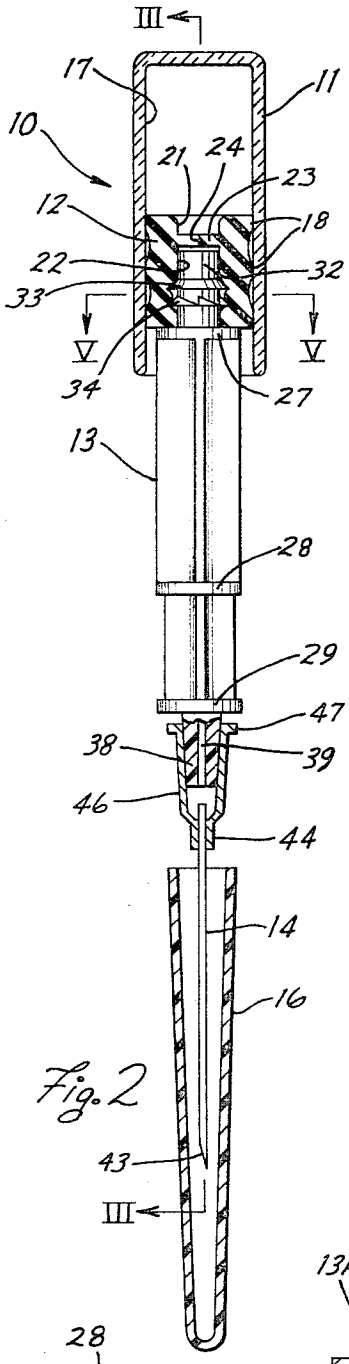


Fig. 2

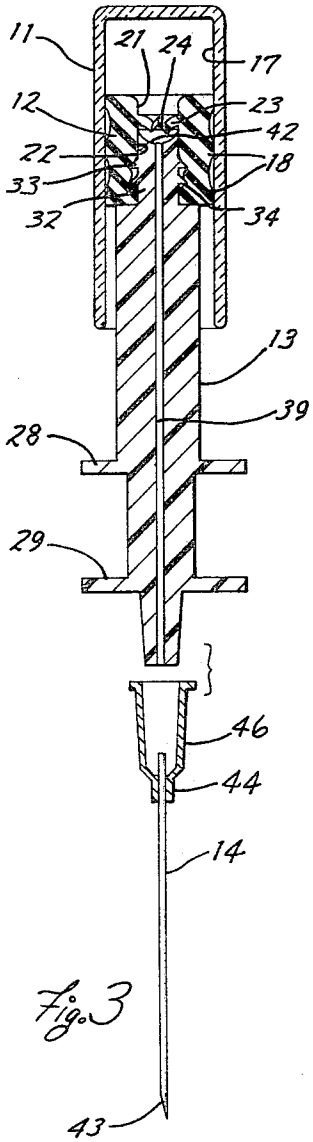


Fig. 3

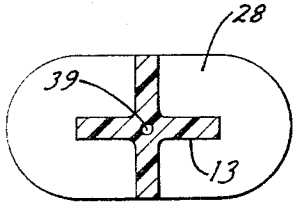


Fig. 4

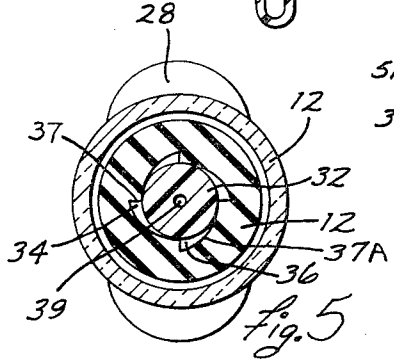


Fig. 5

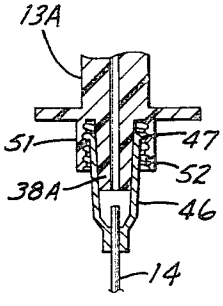


Fig. 6

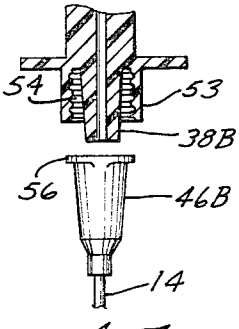


Fig. 7

COMPACT SYRINGE

This invention relates in general to a syringe for injecting fluids into a patient and, more particularly, to a type thereof which is compact in size and relatively inexpensive to manufacture.

It has become increasingly advantageous, if not economically essential, to provide single service packaging for injectable medicaments, whether they be used for direct injection into a patient or as additives for intravenous feeding. That is, the cost of the materials used in fabricating a syringe has been reduced by technological advancement, particularly relative to other costs, to the point where it is not economically sound, in most instances, to furnish a syringe of the type which is sterilized after each use so that it can be refilled for another use. Moreover, the single service syringe eliminates the risk of contamination carried from one use to the next and, in fact, avoids the possibility of contamination in general.

Incident to the increasing interest in the single service syringe has been the desire for a reduction in cost, hence, in size of the syringe. In pursuing the problem of size reduction, it occurred to me that the piston in the syringe barrel could advantageously be connected to the cannula and thereby reduce the overall length of the syringe, while retaining the same liquid capacity. Moreover, this would simplify the provision of closure means or valve means for preventing a leak of the liquid from the syringe barrel during a storage period. Furthermore, this arrangement would provide for a far greater flexibility in syringe capacities with a minimum of component parts.

Accordingly, the primary object of this invention is the provision of a compact, single service syringe capable of relatively inexpensive fabrication and including a totally enclosed compartment in which the liquid to be injected is stored until time for the injection.

A further object of this invention is the provision of a syringe, as aforesaid, which is leak-proof, under normal storage conditions, which is virtually contamination-proof, and which is comprised of components which provide for a maximum of capacity variation with a minimum number of components.

Other objects and purposes of the invention will become apparent to persons familiar with this type of device upon reading the following specification and examining the accompanying drawings, in which:

FIG. **1** is a side elevational view of a syringe embodying the invention;

FIG. **2** is a partially exploded sectional view substantially as taken along the line II-II in FIG. **1**;

FIG. **3** is a sectional view substantially as taken along the line III—III in FIG. **2**;

FIG. **4** is a sectional view taken along the line IV—IV in FIG. **1**;

FIG. **5** is a sectional view taken along the line V—V in FIG. **2**;

FIG. **6** is a fragment of FIG. **3** illustrating a modified construction; and

FIG. **7** is a fragment of FIG. **3** showing a further modification.

For convenience in description, the terms "upper," "lower" and words of similar import will have reference to FIGS. **1, 2** and **3** and parts thereof. The terms "inner," "outer" and derivatives thereof will have reference to the geometric center of said syringe or any major components thereof.

SUMMARY OF THE INVENTION

The objects and purposes of the invention, including those set forth above, have been met by providing a syringe having an axially elongated cylindrical and cup-shaped barrel in which a resiliently flexible piston is slidably and sealingly disposed. Rod means is connected at one end to the piston and at the other end to a cannula. An axial opening through the piston, which connects with a passageway through the rod, serve as a communication between the interior of the barrel and the cannula. A yieldable closure means, such as a slit membrane in the piston, yieldably obstructs movement of the liquid from within the barrel through the passageway and out the cannula.

DETAILED DESCRIPTION

The syringe assembly **10,** a preferred embodiment of which is illustrated in FIGS. **1** and **2,** is comprised of a barrel **11,** a piston **12** disposed within said barrel **11,** a rod **13** connected at one end to said piston, and a cannula **14** connected to the other end of the rod **13.** A sheath **16** is provided to cover the cannula prior to use thereof.

The barrel **11** is cup-shaped, preferably cylindrical, axially elongated and it may be fabricated from glass, plastic or some other substantially rigid material.

The piston **12,** which is fabricated from an elastomeric material, such as synthetic rubber, is substantially cylindrical in shape and slightly larger in outside diameter than the inside diameter of said barrel **11,** which with said piston defines a chamber **17.** The piston **12** preferably has a plurality, here three, of radially extending, spaced ridges **18** which improve the sealing engagement between it and the inner wall of the barrel **11.**

In a preferred embodiment of the invention, the piston has two coaxial recesses **21** and **22** in the opposite axial ends thereof, which recesses are spaced from each other to form a relatively thin membrane **23** integral with the piston **12.** The membrane **23** has a slit **24** substantially diametrically thereof and therethrough whereby said membrane acts as a valve obstructing the flow of fluids through the piston under circumstances where the pressure on opposite sides of the membrane is substantially equalized.

The rod **13** (FIG. **2**) is elongated and, throughout most of its length, is X-shaped in cross-section (FIG. **4**) in order to minimize the amount of material utilized while maintaining adequate strength and rigidity in said rod. There are three annular and radially disposed flanges **27, 28** and **29** (FIG. **2**) integral with said rod and located near the upper end thereof, near the middle thereof, and near the lower end thereof, respectively. The lower flanges **28** and **29,** as shown in FIG. **1,** are elongated transversely of said rod **13** in one diametrical direction, and they are so spaced with respect to each other that the first and second fingers of a normal adult hand can be inserted between these two flanges for controlling the movement of the rod **13** relative to the barrel **11.**

The rod **13** has an integral, upwardly extending and substantially cylindrical stem **32** which is of approximately the same diameter as the inside diameter of the cylindrical recess **22** in the piston **12.** The stem **32** has

an upper, annular flange **33,** the peripheral surface of which is beveled so that it slopes downwardly and outwardly away from the stem and thereby resists disengagement of the stem from within the piston **12** after it is inserted into the recess **22.**

The stem **32** also has a second, lower flange means **34** which, in this embodiment, is comprised of four segments **36** (FIG. **5**), the radial edges of which define involute curves **37A** terminating at their outermost points in radial surfaces **37** extending back to the stem. The radial surfaces **37** of the segments **36** positively oppose rotation of the stem **32** relative to the piston **12** in one rotational direction, thereby permitting rotation of the rod **13** and piston **12** relative to the barrel **11** in order to break loose any seizing that may occur between the piston and the barrel during a period of prolonged storage. The flange means **34** also has a downwardly and outwardly sloping peripheral surface to facilitate insertion of the stem into the piston and resist removal thereof.

The lower end of the rod **13** is provided with an integral nozzle **38** which is coaxial and substantially cylindrical, but preferably has an outer surface which converges slightly downwardly. A passageway **39** extends substantially coaxially completely through the rod **13** including the stem **32** and nozzle **38.** The rod **13** may be fabricated from plastic, glass or any other convenient material. When the stem **32** is properly disposed within the recess **22,** the upper flange **27** is snugly against the lower end of the piston **12** and the upper end of the stem **32** is preferably spaced a short distance from the membrane **23.** The upper end of the stem **32** has a slight concavity **42** which coaxially encircles the upper end of the passageway **39.** Thus, as shown in FIG. **3,** the edges of the membrane **23** defining the slit **24** therein can move downwardly into the concavity **42** when fluid in the chamber **17** is exposed to a compressive force, whereby the fluid can enter the passageway **39.**

The cannula **14** may be substantially conventional with a sharpened tip **43** at the lower end thereof. The upper end of the cannula **14** is firmly embraced by the lower, reduced end portion **44** of the coupling sleeve **46** which is substantially cylindrical and has an internal surface which diverges upwardly slightly so that it can firmly and frictionally engage and be sleeved upon the nozzle **38.** The cannula will normally be fabricated from metal but the sleeve **46** can be fabricated from plastic, glass, metal or the like. The lower end **44** is permanently connected to the cannula **14,** as by being molded thereto or affixed thereto by an adhesive.

The sheath **16** is substantially cylindrical, relatively narrow in cross section and closed at the lower end thereof. Said sheath has, at least at its upper end, an upwardly diverging inner surface designed to sleeve snugly upon and frictionally engage the outer surface of the sleeve **46.** Said sleeve **46** is preferably provided at its upper edge with a radially outwardly extending flange **47** against which the upper end of the sheath **16** abuts in order to prevent an excessive gripping between the sheath and the sleeve. Thus, when the sheath **16** is pulled downwardly, relative to the sleeve **46,** it will release from the sleeve, rather than causing the sleeve to release from the nozzle **38.**

ASSEMBLY AND OPERATION

Persons skilled in the field of making and using syringes will perceive the operation of said syringe assembly **10** from the foregoing description. However, the assembly of the syringe and its functioning will be summarized briefly hereinafter for convenience.

Normally, the barrel **11** will be placed in an upwardly opening position and filled with a fluid, such as a liquid medicament, prior to the assembly of the syringe. The piston **12,** having been connected to the stem **32** of the rod **13,** will then be inserted into the chamber **17** of the barrel **11.** Usually, piston **12** will be moved downwardly into the barrel **11** so that any air on top of the liquid can escape up through the slit in the membrane **23** and be expelled from the syringe. At the same time, the air leaving the barrel, which will normally be sterile, will purge non-sterile air from within the passageway **39** in the rod **13.** The sleeve **46** on the cannula **14** is then telescopically mounted upon the nozzle **38** so that accidental disengagement therebetween is not likely to occur. The sheath **16** is then mounted upon the sleeve **46** and the syringe **10** is ready for use, storage or shipment, as desired.

When it becomes desirable to use the syringe **10,** the sheath **16** is disengaged and removed from the sleeve **46** so that the cannula **14** is exposed. The syringe **10** is then placed in the hand of the operator so that the first and second fingers of such hand are disposed between the flanges **28** and **29** on opposite sides of the rod **13.** The upper closed end of the barrel **11** is pressed against the palm of the same hand, roughly adjacent the thumb. Thus, by moving the first and second fingers, toward the thumb, the piston **12** is moved into the barrel **11** whereupon the liquid in the chamber **17** is expelled through the slit in the membrane **23,** through the passageway **39** and into the cannula **14** from which it is discharged.

While this type of syringe is normally designed for a single use and subsequent disposal, it would be possible to sterilize and reuse at least some parts of the syringe, such as the barrel **11,** the rod **13** and the cannula **14.**

It will also be recognized that, under some circumstances, it may be desirable to furnish the syringe **10** without the cannula **14** and its sleeve **46** mounted on the rod **13.** In such case, the nozzle may be covered with a small cap and the cannula will be mounted on the rod at the time of use. This will reduce the size of the package for shipment.

ALTERNATE STRUCTURE

FIG. **6** illustrates an alternate structure for the nozzle **38** at the lower end of the rod **13** of FIG. **2.** Specifically, the rod **13A** (FIG **6**) has a nozzle **38A** which is encircled by a substantially concentric cylinder **51** spaced radially from the nozzle **38A** and having a spiral groove **52** in the inner surface thereof. Thus, the diametrically elongated flange **47** on the upper end on the sleeve **46** can be moved upwardly within the cylinder **51** by rotating the cannula relative to the rod **13A** until the sleeve **46** firmly and snugly engages the nozzle **38A.**

In the alternate structure illustrated in FIG. **7,** the cylinder **53** has coaxial adjacent grooves **54** in its internal surface. The flange **56** on the sleeve **46B,** which is also diametrically elongated in one direction, simply snaps along said grooves as it is inserted into the cylinder until the sleeve **46B** snugly engages the nozzle **38B.**

It will be seen that the capacity of the syringe assembly **10** can be varied as desired over a wide range by

merely using a barrel **11** and cooperating piston **12** of various diameters. All other components of the syringe may remain the same. Also, for small variations, such as several cubic centimeters, of capacity, a slightly longer or shorter barrel **11** can be furnished without any other changes in the syringe. Both the diameter and length of the barrel can be changed for maximum variations.

Although a particular preferred embodiment of the invention has been disclosed in detail for illustrative purposes, it will be recognized that variations or modifications of the disclosed apparatus, including the rearrangement of parts, lie within the scope of the present invention.

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

1. A syringe for dispensing a liquid medicament, comprising:

hollow cylindrical barrel means having a closed axial end and an open axial end;

elastomeric piston means sealingly and slidably disposed within said barrel means for movement lengthwise thereof, said piston means having a central opening therethrough in a direction substantially parallel with the direction of movement of said piston means;

closure means yieldably obstructing the flow of liquid from said barrel means, said closure means comprising a membrane integral with said piston means and extending across said opening, said membrane having a slit therethrough;

elongated rod means having an end portion adjacent one end thereof extending into and firmly held within said opening in said piston means, said rod means having a central passageway therethrough and being longer than said barrel means, whereby said rod means projects outwardly through the open axial end of said barrel means;

one-way gripping means coacting between said end portion and said piston means

1. for preventing relative rotation between said end portion and said piston means in one rotational direction to thereby permit rotation of the rod means and the piston means relative to the barrel means to break loose any seizing that may occur between the piston means and the barrel means and

2. for permitting axial insertion of said end portion into said opening of said piston means while preventing said end portion from being axially separated from said piston means; said one-way gripping means including projection means fixed to said end portion and projecting radially outwardly therefrom for distorting the portion of said piston means defining the opening therethrough, the axial end face of said projection means which faces away from the other end of said rod means being formed with an inclined surface thereon which slopes downwardly and outwardly toward said other end of said rod means to facilitate axial insertion of said rod means into the opening formed in said piston means, the other axial end face of said projection means extending outwardly substantially radially relative to the longitudinal axis of said rod means for preventing said rod means from being axially separated from said piston means; and laterally projecting grip means on said rod means near the other end thereof.

2. A syringe according to claim **1,** including elongated cannula means having one end thereof connected to the other end of said rod means and communicating with the passageway therethrough, said cannula means including a sleeve portion of enlarged inside and outside diameter adjacent said rod means, said inside diameter diverging toward said rod means, and said sleeve portion including a flange fixed adjacent the free end thereof and projecting outwardly therefrom;

wherein said rod means has a substantially cylindrical portion at the other end thereof, said cylindrical portion converging toward said cannula means for snug frictional engagement within the inside diameter of said sleeve portion;

wherein said rod means has a sleeve part at said other end thereof disposed outwardly from and positioned in surrounding relationship to said cylindrical portion for defining an annular space therebetween, said sleeve part having the inside surface thereof formed with groove means thereon, said sleeve portion of said cannula means projecting into said annular space with said flange being engaged within the groove means for fixedly securing said cannula means to said rod means;

wherein said sleeve portion of said cannula means is axially longer than said sleeve part so that a portion of said sleeve portion projects outwardly beyond the free end of said sleeve part when said cannula means is mounted on said rod means; and

elongated sheath means closed at one end and open at the other end for sealingly enclosing and surrounding said cannula means, the inside surface of said sheath means adjacent said other end being snugly and slidably engagable with the external surface of said sleeve portion where same projects outwardly beyond said sleeve part.

3. A syringe according to claim **1,** wherein said projection means includes an annular flange fixed to and surrounding said end portion and projecting radially outwardly therefrom, and wherein said one-way gripping means also includes a plurality of circumferentially spaced projections fixed to said end portion and projecting radially outwardly therefrom for distorting the portion of said piston means defining the opening therethrough, said projections being axially spaced from said annular flange and including a substantially radially directed face on one side thereof and a sloped face extending inwardly from the outer end of said radial face to the outer periphery of said end portion, whereby said projections effectively prevent rotation between said piston means and said rod means only in said one rotational direction.

4. A syringe for dispensing a liquid medicament, comprising;

hollow cylindrical barrel means having a closed axial end and an open axial end;

elastomeric piston means sealingly and slidably disposed within said barrel means for movement lengthwise thereof, said piston means having a central opening therethrough in a direction substantially parallel with the direction of movement of said piston means;

closure means yieldably obstructing the flow of liquid from said barrel means, said closure means com-

prising a membrane integral with said piston means and extending across said opening, said membrane having a slit therethrough;

elongated rod means having an end portion adjacent one end thereof extending into and firmly held within said opening in said piston means, said rod means having a central passageway therethrough and being longer than said barrel means, whereby said rod means projects outwardly through the open axial end of said barrel means;

one-way gripping means coacting between said end portion and said piston means for preventing relative rotation therebetween in one rotational direction, thereby permitting rotation of the rod means and the piston means relative to the barrel means to break loose any seizing that may occur between the piston means and the barrel means; and

said one-way gripping means includes a plurality of circumferentially spaced projections fixed to said end portion and projecting radially outwardly therefrom for distorting the portion of said piston means defining the opening therethrough, said projections including a substantially radially directed face on one side thereof and a sloped face extending inwardly from the outer end of said radial face to the outer periphery of said end portion, whereby said projections effectively prevent relative rotation between said piston means and said rod means only in said one rotational direction;

the axial end face of each said projection which faces away from the other end of said rod means being formed with an inclined surface thereon which slopes downwardly and outwardly toward said other end of said rod means to facilitate insertion of said rod means into the opening formed in said piston means, the other axial end face of each said projection extending outwardly in a substantially radial plane relative to the longitudinal axis of said rod means for preventing said rod means from being axially separated from said piston means; and

laterally projecting grip means on said rod means near the other end thereof.

* * * * *