United States Patent

Friedman

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[54] HYPODERMIC SYRINGE DEVICE WHICH MAINTAINS STERILE CONDITION OF NEEDLE

[72] Inventor: **Benjamin Friedman,** 1064 Victory Blvd., Staten Island, N.Y. 10301

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[52] **U.S. Cl.** .....**128/218 D,** 128/221

[51] **Int. Cl.**.....**A61m 05/24,** A61m 05/26

[58] **Field of Search**.....128/215, 218 R, 218 D, 218 N, 128/221

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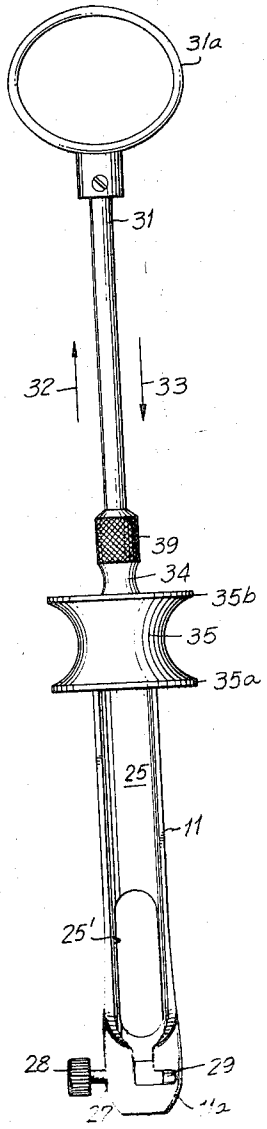
Primary Examiner—Joseph S. Reich

Attorney—Thomas E. Tate

[57] **ABSTRACT**

This invention is directed to a hypodermic syringe including a longitudinally windowed barrel having a pair of apertured ends, one of which is adapted to retain a normally fixed, but removable, needle assembly having its inner end projecting toward the other end, and the other of which is adapted to retain a reciprocable actuating rod having one end operatively connectable to the plunger of a dispensing or collecting cartridge removably retained within the barrel. Cartridges may be inserted or replaced at will through a window of the barrel without necessitating the removal of or causing contamination of the needle assembly. Releasable members are provided to secure the cartridge in its needle and actuating rod-engaging position within the barrel. Threaded members are employed for mounting the actuating rod, which members also assist in so securing the cartridge.

5 Claims, 11 Drawing Figures



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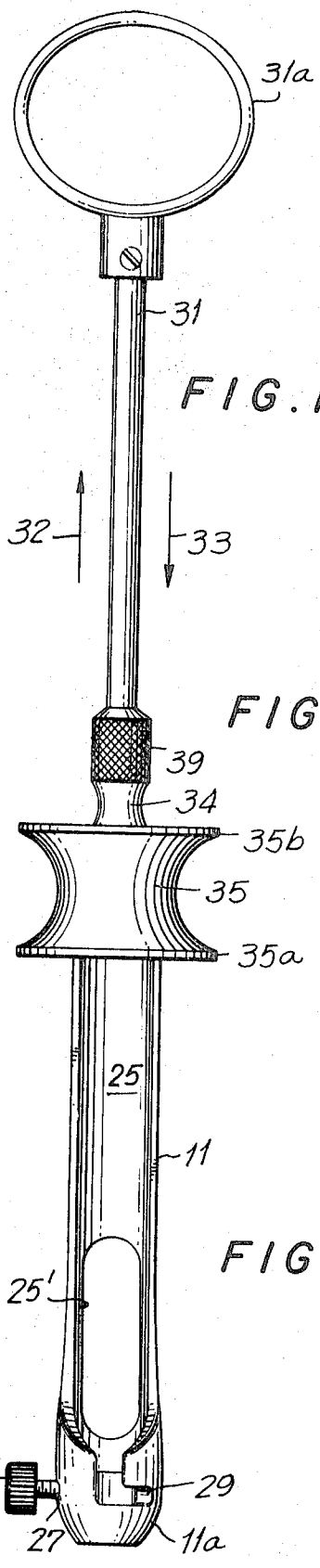


FIG. 1

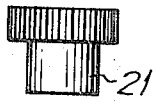


FIG. 3a

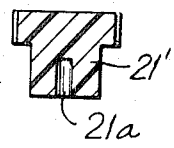


FIG. 3b

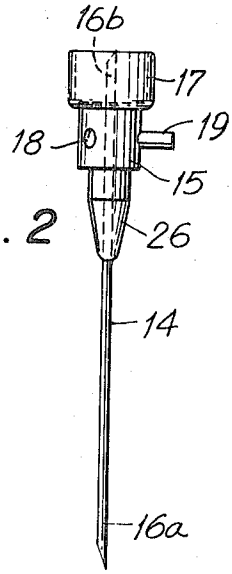


FIG. 2

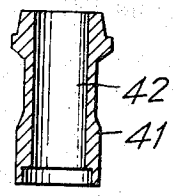


FIG. 6

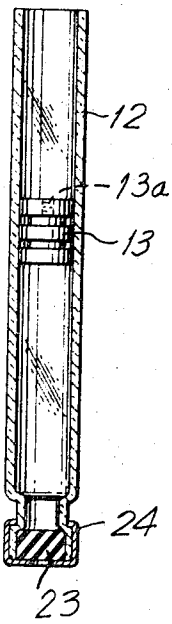


FIG. 5

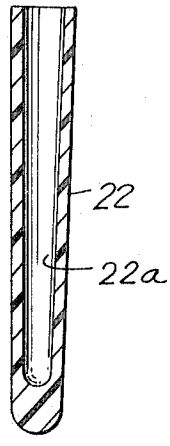


FIG. 4

INVENTOR.
BENJAMIN FRIEDMAN

BY Samuel Jay Fish
ATTORNEY

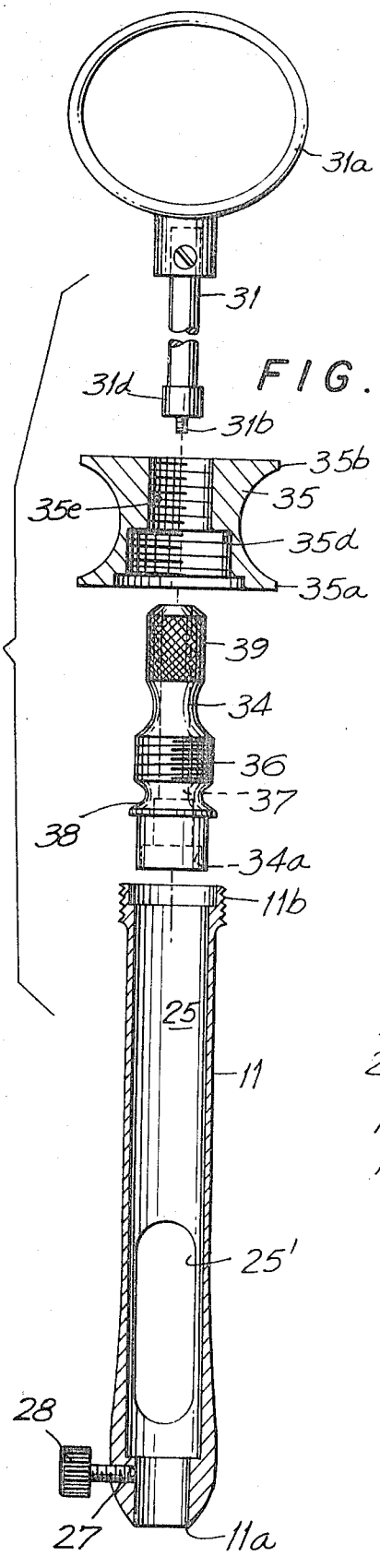


FIG. 8

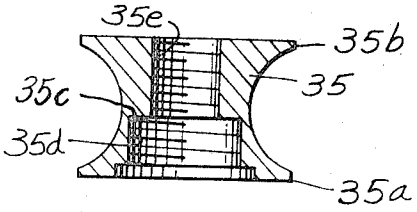


FIG. 7

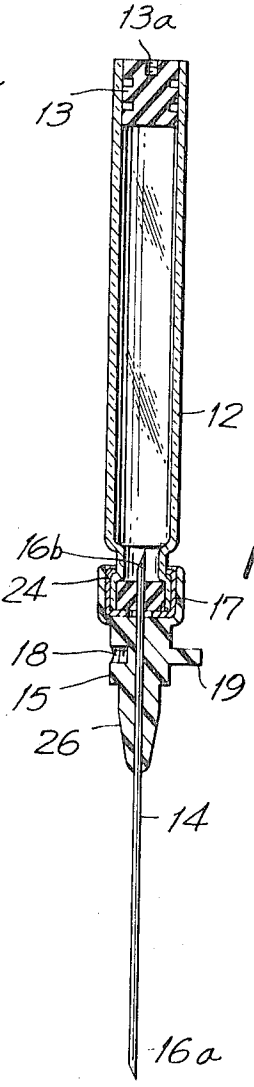


FIG. 10

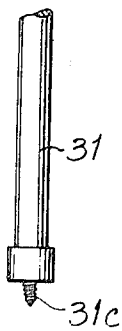


FIG. 9

INVENTOR.
BENJAMIN FRIEDMAN

BY Daniel Jay Tick
ATTORNEY

HYPODERMIC SYRINGE DEVICE WHICH MAINTAINS STERILE CONDITION OF NEEDLE

DESCRIPTION OF THE INVENTION

The present invention relates to a hypodermic syringe device. More particularly, the invention relates to a hypodermic syringe device which maintains the sterile condition of the needle substantially at all times, without the autoclaving of said syringe device.

In known types of hypodermic syringe devices, the needle and cartridge must be manually positioned in the barrel. Once the needle is used, it must be covered again with a protective shield and removed with the cartridge as a unit after each injection, in order to maintain the sterility of said needle. If a second or third injection is required for the same patient with the same needle, the shield must be replaced with each change of cartridge. At the present time, dentists use disposable needles. The puncturing end of the disposable needle must thread onto a nipple of the syringe barrel. The puncturing needle point must pass through a fine bore through said nipple. A syringe of this type must be completely autoclaved before the needle is threaded onto the barrel of the syringe. If it is not autoclaved, the sterile disposable needle becomes contaminated. This is a serious shortcoming of a hypodermic syringe device utilized in dentistry. There can be no such contamination in the syringe of the present invention.

In a normal procedure, a dentist first determines a point of injection somewhere in the patient's mouth. He must then insert the needle of the hypodermic syringe device at the selected point and draw the plunger of a cartridge affixed to the needle outward, away from the patient, in order to aspirate. If the fluid in the cartridge is clear, the dentist may proceed with the injection. If blood appears in the fluid in the cartridge, however, the dentist must select a new point for the injection, until there is no blood visible in the cartridge. The needle may thus be used a few times, until the point of injection is determined.

The principal object of the present invention is to provide a new and improved hypodermic syringe device and needle.

An object of the present invention is to provide a hypodermic syringe device which maintains the needle in sterile condition substantially at all times, without the need for autoclaving the syringe. All that is required is a cold sterilizing solution to maintain the syringe ready for use. The needle of the present invention never touches any part of the syringe of the invention when it is inserted with the cartridge and fixed in the syringe ready for an injection. This is why my syringe does not require autoclaving prior to use. All that is required is the removal of the syringe from a cold sterile solution.

An object of the present invention is to provide a hypodermic syringe device which permits the same needle to be utilized a number of times, with a number of different cartridges, without contaminating the needle and the contents of the cartridge, as hereinbefore described.

An object of the present invention is to provide a hypodermic syringe device of simple structure which functions with efficiency, effectiveness and reliability.

An object of the present invention is to provide a hypodermic syringe device of simple structure without springs, which collect dirt within the head of the syringe, as in known syringe devices.

In accordance with the present invention, a hypodermic syringe device comprises a hollow cylindrical barrel for housing a cartridge having a plunger therein and for supporting a hollow hypodermic needle in operative proximity with the cartridge. The barrel has a pair of opposite end bases each having an aperture formed therethrough and a window formed in the side thereof to permit insertion and removal of a cartridge in the barrel and a needle in the barrel and extending through one of the base apertures thereof. The barrel has holding means in the area of the one of the base apertures for holding the needle in a fixed position so that different cartridges may be inserted and removed via the window while the same needle may be utilized with each cartridge and remains in sterile condition. An actuating rod is axially movably mounted on the barrel and passes through the other of the base apertures thereof for operative connection with the plunger of a cartridge in the barrel for moving the plunger to draw fluid into the cartridge and to eject fluid out of the cartridge via the needle.

The window of the barrel preferably comprises substantially half the barrel extending longitudinally.

A second window is formed in the opposite side of the barrel. The second window is smaller than the first-mentioned window.

The holding means of the barrel comprises an internally threaded bore formed through a side of the barrel and an externally threaded member threadedly coupled with the bore and extending into holding contact with a needle in the barrel.

A protective sleeve is removably mounted over the part of the needle extending from the barrel. The needle is held in position by the holding means of the barrel in a manner whereby the protective sleeve is freely mountable and dismountable.

The protective sleeve is held on the needle by friction, in one embodiment of the invention.

Locking means for mounting the actuating rod on the barrel comprises an externally threaded part of the barrel in the area of the other of the base aperatures. An externally threaded sleeve is slidably mounted on the actuating rod for free movement in axial directions. A coupling member has a pair of internally threaded parts of different diameter forming a shoulder therebetween in the coupling member. One of the internally threaded parts of the coupling member is threadedly coupled with the externally threaded part of the barrel and the other of the internally threaded parts of the coupling member is threadedly coupled with the externally threaded sleeve on the actuating rod.

The fastening means at an end of the actuating rod fastens the end of the actuating rod to the plunger of a cartridge so that the plunger moves with the actuating rod. The fastening means may comprise a pointed helically externally threaded fastening member. The fastening means may comprise an externally threaded fastening member adapted to threadedly engage an internally threaded bore in the plunger of a cartridge.

In accordance with the present invention, a needle for conducting fluid into and out of a cartridge in a hypodermic syringe device comprises a solid cylindrical body member. A hollow needle is embedded in the body member and extends therethrough in axial directions. The needle is positioned so that a considerably greater length thereof extends from one end of the body member than from the other end of the body member. A hollow cylindrical cover extends from one end of the body member and surrounds the shorter length of the needle in spaced relation therewith.

The body member comprises plastic material having a substantially smooth outside surface and the cover comprises plastic material. A shallow bore may be formed in the substantially smooth outside surface of the body member and an extending peg member may be formed therein in diametrically spaced relation with the bore.

In order that the present invention may be readily carried into effect, it will now be described with reference to the accompanying drawing, wherein:

FIG. 1 is an elevation of the barrel and actuating rod of a syringe constructed in accordance with this invention as they appear prior to attachment of the needle assembly and prior to insertion of a cartridge therein;

FIG. 2 is an elevation of one embodiment of a needle assembly for use therewith;

FIG. 3*a* is an elevation of an embodiment of a cap for the inner end of the needle assembly of FIG. 2;

FIG. 3*b* is a longitudinal section of a modification of the cap of FIG. 3*a*;

FIG. 4 is a longitudinal section of a friction cover for the outer end of the needle assembly of FIG. 2;

FIG. 5 is longitudinal section of a typical cartridge that may be used in connection with the syringe of this invention;

FIG. 6 is a longitudinal section of an adapter that may be employed whenever shorter cartridges are to be used;

FIG. 7 is a longitudinal section of a locking element for the syringe;

FIG. 8 is an exploded view, partly in section, of the syringe of FIG. 1;

FIG. 9 is a fragmentary elevation of a modification of the lower end of the actuating rod; and

FIG. 10 is a longitudinal section showing the ultimate connected relationship between the needle assembly of FIG. 2 and the cartridge of FIG. 5.

In the FIGS., the same components are identified by the same reference numerals.

The syringe of this invention includes a hollow cylindrical barrel **11** adapted to receive and retain a cartridge **12** having a reciprocable plunger **13** mounted therein.

The lower end of the barrel **11** is adapted to support an assembly including a hollow hypodermic needle **14** having its inner end insertable into the lower end of said cartridge.

The needle assembly, as shown in FIG. 2, comprises a solid cylindrical body member **15**. The hollow needle **14** is embedded in the body member **15** and extends axially therethrough. The needle **14** is positioned so that a considerably greater length **16***a* thereof extends from one end of the body member **15** than from the other end of said body member. Thus, a considerably shorter length **16***b* extends from the other end of the body member **15**. The body member **15** preferably comprises rigid plastic material having a substantially smooth cylindrical outer surface.

A hollow cylindrical skirt or cover **17** extends from one end of the body member **15** and surrounds the shorter length **16***b* of the needle **14** in spaced relation therewith, as shown in FIG. 2. The cover **17** preferably comprises plastic material. The body member **15** preferably has a radial bore **18** formed therein and is provided with a radial peg member **19** extending outwardly therefrom in diametrically opposed relation to the bore **18** as shown in FIG. **10**.

The needle assembly, as shown in FIG. **2**, may be stored and/or transported in sterile condition by being covered with a friction cap **21**, of the type shown in FIG. **3***a*, which fits over the cylindrical cover **17** of said needle, thereby covering and protecting the shorter end **16***b* of said needle, and by being covered by a friction cover or protective sleeve **22**, as shown in FIG. **4**, which fits over and covers and protects the longer part **16***a* of the needle **16**.

The modified cap **21'** of FIG. **3***b* is solid, rather than hollow, and has an axial bore **21***a* formed therein to receive the shorter end **16***b* of the needle. Each of the caps **21** and **21'** and the sleeve **22** may comprise plastic material.

When the needle **14**, of FIG. **2**, and the cartridge **12**, of FIG. **5**, are in operative relation, the shorter part **16***b* of the needle **14** penetrates penetrable material **23** at one end of said cartridge and extends into the fluid-containing portion of said cartridge. The penetrable material **23** may comprise a rubber diaphragm. At such time, the cover **17** fits loosely around the lower portion **24** of the cartridge **12** which houses the penetrable material **23**. The needle is thus affixed to the cartridge in the usual manner. The needle cover **22** may remain on the needle part **16***a* for as long as desired, after the needle and cartridge are inserted into the barrel **11** of the hypodermic syringe device.

The barrel **11**, as shown in FIGS. **1** and **8**, has a pair of opposite end bases **11***a* and **11***b*. Each of the end bases **11***a* and **11***b* of the barrel **11** has an aperture formed therethrough. In accordance with the present invention, a window **25** is formed in the side of the barrel **11**, as shown in FIGS. **1** and **8**. The window **25** permits insertion and removal of a needle assembly in said barrel and then the sequential insertion and removal of one or more of the cartridges **12** as required without having to remove the previously inserted needle assembly. The window **25** preferably comprises substantially half the barrel **11** extending longitudinally, or at least a length somewhat greater than that of the longest acceptable cartridge, so that any sized cartridge **12** may be easily inserted into said barrel via said window and may be easily removed from said barrel, without difficulty.

A somewhat shorter window **25'** formed in the side of the barrel **11** opposite that having the first window **25** and permits the user to apply pressure from another finger when inserting or removing a cartridge or a cartridge and needle combination into or from the barrel **11**.

In preparing the hypodermic syringe device for use, a needle assembly is first inserted into the barrel **11** of the hypodermic syringe device via the window **25** thereof. The needle assembly is positioned so that its end **16***a*, which should retain its cover **22**, extends beyond the hypodermic syringe device. The body member **15** of the needle **14** is in position at the lower end base **11***a* of the barrel **11**. An extending portion **26** (FIG. **2**) of the body member **15** extends through the aperture formed through the lower base **11***a* of the barrel **11** and retains the friction cover **22**. The cartridge **12** is then inserted into the barrel **11** via the window **25** in a manner whereby the lower end part **24** of said cartridge is inserted into the cover **17** of the needle **14** and the part **16***b* of said needle penetrates the penetrable material **23** of said lower end part. It is also possible, of course, to affix the needle **14** and the cartridge **12** to each other in the aforedescribed manner before inserting the combination of said needle and said cartridge as a unit into the barrel **11** via the window **25**. In accordance with the present invention, however, the needle assembly is affixed in position in the barrel **11**, in the manner hereinafter described, and the cartridge may be readily removed and replaced by another, without requiring the removal of the needle and thereby preventing contamination of said needle. There is no contamination, because no part of the needle ever touches or contacts any part of the syringe.

A holding device is provided in the area of the aperture of the lower base **11***a* of the barrel **11** and functions to hold the needle **14** in position so that different cartridges may be inserted and removed via the window **25** while the same needle may be utilized with each cartridge and remains in sterile condition. The holding device comprises an internally threaded bore **27**, as shown in FIGS. **1** and **8**, formed through a side of the barrel **11**. A setscrew **28** is threaded into the bore **27** and extends into holding contact with a needle assembly in the barrel **11**. The setscrew **28** may simply lock the needle assembly in place by merely abutting the body member **15** thereof. This is sufficient to hold the needle assembly in position in the barrel **11**. However, in order to provide a more secure locking contact to insure that the needle **14** remains in the barrel **11**, said needle assembly may be positioned in said barrel, in the aforedescribed manner, and then rotated on its axis until the peg **19** thereof extends through a slot **29** formed in the area of the aperture of the lower end base of said barrel. When the peg **19** extends through the slot **29**, the shallow bore **18** is aligned with the setscrew **28** for needle assembly locking purposes.

An actuating rod **31**, as shown in FIGS. **1** and **8**, is axially movably mounted on the barrel **11** and passes through the aperture of the upper end base **11***b* of said barrel for operative connection with the cartridge **12** in said barrel. The actuating rod **31** is coupled or affixed to the plunger **13** of the cartridge **12** (FIG. **5**) in a manner whereby said plunger moves with said actuating rod. Thus, when the actuating rod **31** is moved in the direction of an arrow **32**, the plunger **13** of the cartridge **12** moves in the same direction and draws fluid into said cartridge via the affixed needle **14**. When the actuating rod **31** is moved in the direction of the arrow **33** (FIG. **1**), the plunger **13** moves in the same direction and ejects fluid out of the cartridge **12** via the affixed needle **14**. The actuating rod **31** has a ring **31***a* affixed to the upper end thereof to permit facile manual control of said actuating rod. The ring **31***a* may be affixed to the end of the actuating rod **31** by any suitable means such as, for example, by a screw or pin.

The actuating rod 31 may be fastened to the plunger 13 of the cartridge 12 by any suitable means. Thus, for example, as shown in FIG. 8, an externally threaded fastening member 31*b* may be provided at the lower extremity of the actuating rod 31. The fastening member 31*b* may be threadedly engaged with an internally threaded bore 13*a* formed in the upper surface of the plunger 13 of the cartridge 12, as shown in FIG. 5. The internally threaded bore 13*a* of the plunger 13 is provided by a metal sleeve inserted into a bore formed in said plunger. An internally threaded sleeve may be provided at the end of the actuating rod 31 for cooperation with an externally threaded projection on the plunger 13.

Another type of fastening arrangement is shown in FIG. 9, wherein a pointed helically externally threaded fastening member 31*c* is affixed to, and extends from, the lower extremity of the actuating rod 31. The actuating rod 31 is first moved downward so that the fastening member 31*c* comes into contact with the upper surface of the plunger 13, which plunger usually comprises rubber or similar material, and is moved further and rotated under pressure or force so that said fastening member is gradually turned into said plunger in the manner of a wood screw. When there is no further use for the cartridge, the actuating rod 31 is rotated about its axis in the reverse direction from the direction in which it was rotated in order to insert the fastening member 31*c* into the plunger 13. This removes the fastening member 31*c* from the plunger and permits the actuating rod 31 to be moved away from the fastening contact with said plunger and out of the cartridge 12.

A lock for mounting the actuating rod 31 on the barrel 11 comprises a sleeve 34 and a coupling member 35, as shown in FIGS. 1 and 8. The barrel 11 is externally threaded in the area of its upper base 11*b*, as shown in FIG. 8. The sleeve 34 is externally threaded, as shown by the threads 36 thereon in FIG. 8. The sleeve 34 has an axially extending bore 37 formed therethrough which has a diameter sufficient to permit the actuating rod 31 to pass therethrough. The sleeve 34 is thus slidably mounted on the actuating rod 31 and is freely movable in axial directions along said actuating rod.

The coupling member 35 is of substantially hollow cylindrical configuration having opposite base end plates 35*a* and 35*b* of substantially annular configuration. As shown in FIGS. 7 and 8, the coupling member 35 has a pair of internally threaded parts of different diameter forming a shoulder 35*c* (FIG. 7) in said coupling member. The lower internally threaded part 35*d* has a larger diameter than the upper internally threaded part 35*e*.

The sleeve 34 and the coupling member 35 are both freely slidably mounted on the actuating rod 31 and are held on said rod by an end portion 31*d* of said actuating rod of larger diameter than the rest of said rod. The diameter of the portion 31*d* of the actuating rod 31 is greater than that of the internal axial bore 37 of the sleeve 34. A flange 38 on the sleeve 34 under the external threading 36 (FIG. 8) and having a diameter greater than that of the upper bore 35*e* prevents the coupling member 35 from moving off said sleeve in the direction of the arrow 33 (FIG. 1).

When the hypodermic syringe device is to be assembled, the coupling member 35 and the sleeve 34 are threadedly engaged with each other, by moving them together so that the threaded portion 36 of said sleeve is threadedly engaged with the internally threaded part 35*e* of said coupling member. This is facilitated by a knurled portion 39 (FIGS. 1 and 8) which enables manual grasping of the sleeve 34 to enable rotation thereof into the coupling member 35. After the member 35 and the sleeve 34 have been coupled, the ring 31*a* is removed from the associated end of the actuating rod 31 to permit the coupled unit to be slid downwardly thereover, after which the ring 31*a* is replaced and the lower end of the rod 31 is inserted into the barrel. The threading at the upper end base 11*b* of the barrel 11 is then engaged with the internally threaded part 35*d* of the coupling member 35. The coupling member 35 and the sleeve 34 are thus removably affixed to the upper end of the barrel 11, and the actuating rod 31 remains freely reciprocable in said barrel.

When the syringe is to be used, the actuating rod 31 is first retracted to permit access to the inside of the barrel 11 after which a needle assembly (with the friction cover 22 still in place over the needle 14) is inserted from within the barrel through the base 11*b* and locked into position by the setscrew 28. A cartridge 12 is then inserted into the barrel with its plunger 13 in opposition to the free end of the retracted actuating rod 31 and the sleeve 34 is rotated to advance same, relative to the coupling member 35 and the barrel 11, to cause the extension 34*a* to engage the adjacent end of the cartridge and advance the cartridge into its fully seated position within the barrel 11 so that the lower end of the cartridge is received within the element 17 of the needle assembly and the upper portion 16*b* of the needle projects through the rubber plug 23 into communication with the interior of the cartridge.

In order to permit the utilization of cartridges of shorter length than that of the cartridge 12, a cartridge adapter sleeve 41 (see FIG. 6) may be employed. The cartridge adapter has an axial bore 42 for free passage of the actuating rod 31 therethrough. When a cartridge adapter 41 is used, it is interposed between the top of the cartridge and the bottom of the sleeve 34. The respective ends of the adapter 41 are suitably flanged or recessed to mate with the adjacent end portions of the sleeve 34 and the cartridge.

While the invention has been described by means of specific examples and in a specific embodiment, I do not wish to be limited thereto, for obvious modifications will occur to those skilled in the art without departing from the spirit and scope of the invention.

What I claim is:

1. A hypodermic syringe including; a cylindrical barrel for removably retaining a needle assembly at one end, a reciprocable cartridge plunger-actuating rod at its other end and for removably housing a plunger-containing cartridge intermediate said needle assembly and said actuating rod; the wall of said barrel being provided with a first window that is sufficiently long to permit insertion and removal of said needle assembly at said one end and to permit the insertion and removal of said cartridge into and out of said barrel, said cartridge, when housed within said barrel, being provided with a penetrable closure in opposition to said needle assembly and with a reciprocable plunger in opposition to said actuating rod, said needle assembly including an axially disposed hollow needle having its inner end projectable through the penetrable closure of said cartridge for communication with the interior thereof; means for operably connecting the adjacent end of said actuating rod with the plunger of said cartridge when said cartridge is housed within said barrel; holding means for removably retaining said needle assembly in a fixed position at said one end of said barrel; and locking means for mounting said actuating rod at said other end of said barrel, said locking means comprising an externally threaded part of said barrel adjacent said other end thereof, an externally threaded sleeve slidably mounted on said actuating rod for free axial movement with respect thereto, and a coupling member having a pair of internally threaded parts of different diameter defining a shoulder therebetween within said coupling member, one of the internally threaded parts of said coupling member being threadedly coupled with the externally threaded part of said barrel and the other of the internally threaded parts of said coupling member being threadedly coupled with the externally threaded sleeve on said actuating rod.

2. The hypodermic syringe of claim 1 in which said barrel is provided with a second window disposed in opposition to said first window, and in which the holding means of said barrel includes a radial internally threaded bore formed through the side of said barrel adjacent the said one end thereof and a setscrew threadedly engaged into said bore and projectable into holding contact with said needle assembly; said needle assembly including a protective sleeve removably mounted over that part of said needle extending from said barrel, said needle

assembly being held in position by the holding means of said barrel in a manner to permit the free mounting and dismounting of said protective sleeve.

3. The hypodermic syringe of claim 2 in which said needle assembly comprises a solid body member adapted to fit within the said one end of said barrel for engagement by said holding means and including an end portion projectable beyond the said one end of said barrel, and a hollow needle extending axially through said body member and embedded therein with its ends projecting beyond the ends thereof, that end of said body member extending inwardly towards the interior of said barrel being provided with a hollow cylindrical cover surrounding the inwardly projecting end of said needle in spaced relation thereto, said protective sleeve being removably attached to the other projecting end of said body member.

4. The hypodermic syringe of claim 3 in which said needle assembly holding means additionally includes a bayonet joint defined by a generally L-shaped slot formed in the wall of said barrel adjacent to said setscrew and having a leg in open communication with the adjacent end of said first window and a peg fixed to and extending radially from said body member for reception into said L-shaped slot.

5. The hypodermic syringe of claim 4 in which said body member is also provided with a radial bore adapted to be aligned with and receive the inner end of said set screw when the said peg of said needle assembly is fully seated within the L-shaped slot of said bayonet joint.

* * * * *