United States Patent

[11] 3,534,734

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[54] **DISPOSABLE HYPODERMIC SYRINGE**
6 Claims, 7 Drawing Figs.

[52] **U.S. Cl.** **128/218,** 128/220, 128/272
[51] **Int. Cl.** **A61m 05/18**
[50] **Field of Search** ..... 128/218, 218(M). 220. 272. 218.1. 218(P). 218.1(P). 218(PA)

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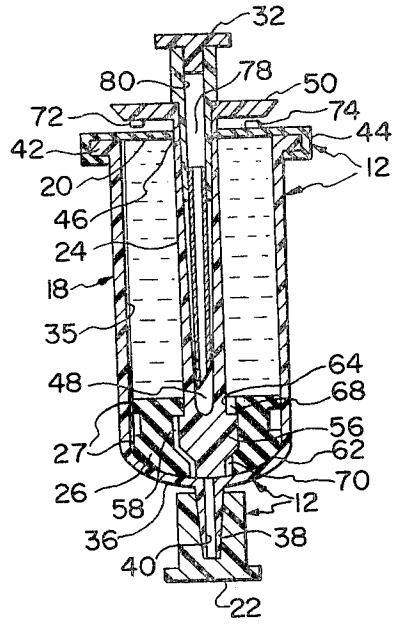
ABSTRACT: A disposable hypodermic syringe having a plastic barrel within which a piston operates to force the injection liquid forwardly from the barrel through a needle mount and its associated needle. The piston carries a rotatable manipulating plunger which moves axially with the piston and can be turned about the axis of the piston and independently of the latter. The piston has a pair of substantially axially aligned and separated passages, and the plunger has a valve body within the piston. The valve body has means effective to establish communication between the passages in one position, and effective in another position to close the passages. The passages and valve body means establish a liquid by-pass which permits the piston to be drawn rearwardly so that stored liquid at the rear side of the piston may flow through the piston to the forward side thereof for subsequent injection purposes. The plunger is hollow and receives the needle and its mount in a telescopic stored position from which the needle and mount may be withdrawn bodily for application to a pilot stem on the front wall of the barrel.



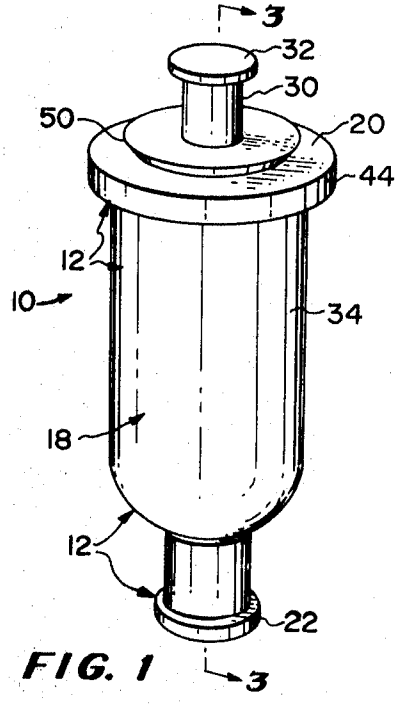
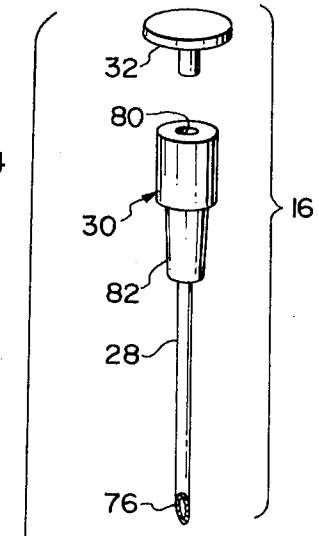


FIG. 1



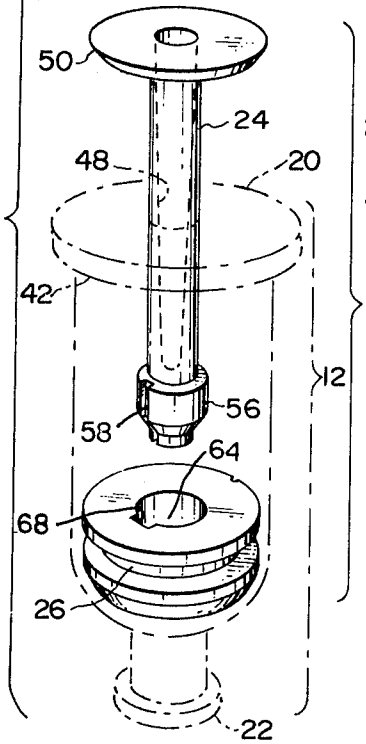


FIG. 2

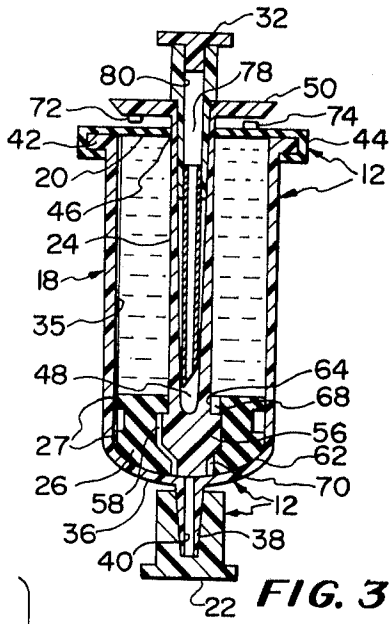


FIG. 3

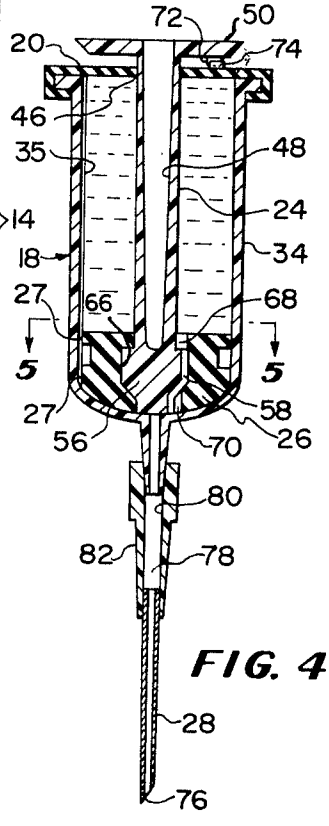


FIG. 4

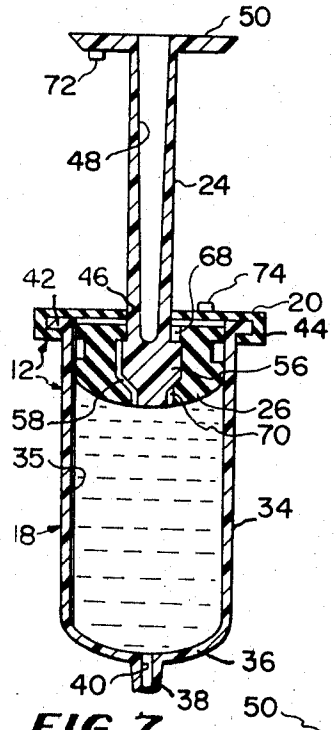


FIG. 7

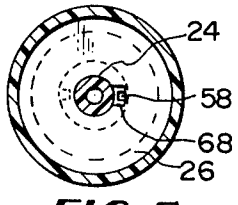


FIG. 5

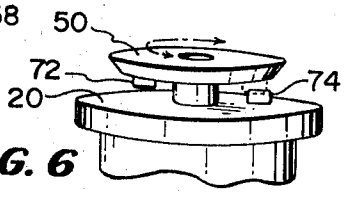


FIG. 6

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DISPOSABLE HYPODERMIC SYRINGE

The present invention relates generally to a hypodermic syringe and has particular reference to a novel inexpensive disposable syringe which may be sterilized and prefilled in the laboratory for subsequent use in the field, after which the syringe may be discarded. The invention finds particular use in military applications for emergency treatment under battle conditions where the prefilled syringe may be either self-administered or administered by either medical or nonmedical personnel to a patient, the syringe being prefilled with an appropriate antibiotic, a pain killing serum, a narcotic, or other liquid which has been predetermined for the anticipated conditions of service. The invention is, however, not limited to such use and a hypodermic syringe embodying the principles of the present invention may find use in other fields wherever a simple, one-shot, premeasured injection of liquid medicament is required.

Briefly, the invention contemplates the provision of a disposable hypodermic syringe comprising a plastic cylindrical barrel having a thin, elastomeric, diaphragmlike rear wall and a front wall with a bosslike pilot stem thereon. An elastomeric piston is slidable in the barrel and normally assumes a forward position therein. A hollow manipulating plunger is slidingly mounted and sealed in the rear wall of the cylindrical barrel and has an enlarged valve head which fits snugly within a socket in the piston so that when it is pulled rearwardly the piston will also move rearwardly in the cylinder. The plunger is capable of turning movement about its axis and, when turned to one position, a pair of registering grooves in the head and the piston allows the liquid medicament which is stored in the barrel rearwardly of the piston to pass through the piston to the end so that the assembly of piston and plunger may be retracted. After the piston of the assembly has thus been retracted and the plunger has been turned away from its position of groove registry, forward movement of the piston and the plunger forces the liquid out of the barrel through the pilot stem. A hollow steel hypodermic needle having a needle mount is normally stored in telescopic fashion within the hollow plunger, but when the syringe is put to use, the needle is withdrawn from the plunger and the mount attached to the pilot stem. After the syringe has been assembled with the piston in its forward position, it may be filled with the liquid medicament by projecting a conventional filling needle through the diaphragmlike rear wall, air escaping in an annular stream around the filling needle and the thus punctured hole being self-sealing when the filling needle is withdrawn.

By an arrangement such as that briefly outlined above, an extremely simple yet efficient syringe is provided, the syringe being capable of manufacture at such a relatively low cost as to justify its disposability after a single use. Ease of manipulation so that the syringe may be properly operated by a medically unskilled and untrained person regardless of whether an injection be self-administered or otherwise administered constitutes another feature or advantage of the particular syringe constituting the present invention. An additional advantageous feature of the invention resides in the construction of a hypodermic syringe which normally is transported in a condition where the plunger is in an advanced position so that inadvertent pressure upon the manipulating plunger will not eject liquid from the barrel, thereby making it unnecessary to provide a protective enclosure for the syringe as a whole. Finally, the provision of a hypodermic syringe which is rugged and durable and, therefore, will withstand rough handling prior to its single use without becoming damaged or getting out of order, and one which consumes but little space when in the pocket or otherwise on the person of the user are further considerations that have been borne in mind in the development of the present invention.

Other features of advantage, not at this time enumerated, will readily suggest themselves as the nature of the invention is better understood from a consideration of the following detailed description.

The invention consists in the several novel features which are hereinafter set forth and are more particularly defined by the claims at the conclusion hereof.

In the accompanying single sheet of drawings forming a part of this specification, one illustrative embodiment of the invention is shown.

In these drawings:

FIG. 1 is a perspective view of a hypodermic syringe embodying the present invention, such view showing the syringe in its stored condition;

FIG. 2 is an exploded perspective view of the syringe exclusive of the barrel assembly;

FIG. 3 is a longitudinal sectional view taken on the line 3–3 of FIG. 1;

FIG. 4 is a longitudinal sectional view similar to FIG. 3 but showing the syringe in its operative position immediately prior to piston retraction;

FIG. 5 is a transverse sectional view taken substantially on the line 5–5 on FIG. 4;

FIG. 6 is a fragmentary perspective view of the forward region of the syringe barrel and plunger, illustrating schematically the function of a pair of interengaging or coacting limit stops which are employed in connection with the invention; and

FIG. 7 is a longitudinal sectional view similar to FIG. 4 but showing the piston in its retracted position immediately prior to performance of its forward operative liquid-injecting stroke.

Referring now to the drawings in detail, a hypodermic syringe embodying the principles of the present invention is designated in its entirety by the reference numeral 10 and involves in its general organization three principal assemblies, namely, a barrel assembly 12, a plunger assembly 14, and a needle assembly 16. The barrel assembly 12 is best illustrated in FIG. 3 while the plunger assembly 14 and the needle assembly 16 are best illustrated in FIG. 4. Said barrel assembly 12 consists of three parts, namely, a barrel proper 18, a rear wall 20, and a cup-shaped protective cap 22. The plunger assembly 14 consists of two parts, namely, a plunger stem 24 and a piston 26. The needle assembly 16 consists of three parts, namely, a needle proper 28, a needle mount 30, and a protective filler plug 32.

Considering now the barrel assembly 12, the barrel proper 18 (hereinafter referred to simply as the "barrel") is in the form of a plastic shell which is of relatively deep cup-shaped configuration and embodies a cylindrical side wall 34, a dished front wall 36, and a pilot stem 38 which projects forwardly from the central region of the bottom wall 36 and defines an axial discharge bore 40 in communication with the interior of the barrel. This bore 40 is normally adapted to be closed by the removable protective cap 22. The rear rim of the barrel is formed with an annular, outwardly extending, radial flange 42 which is designed for interlocking sealing engagement with an encompassing reentrant rim flange 44 on the rear wall 20 of the barrel assembly 12. Said rear wall 20 is formed of rubber or other suitable elastomeric material and is of flat diaphragmlike configuration, the wall serving sealingly and permanently to close the rear rim of the barrel 18. The rear wall 20 of the barrel assembly has formed therein a central circular opening 46 for sliding and sealing reception therethrough of the plunger stem 24 of the plunger assembly 14, as will be described subsequently.

Considering now the plunger assembly 14, the plunger stem 24 (hereinafter referred to simply as the "plunger") is formed of an elongated plastic member of generally cylindrical configuration, and the rear end of the plunger is provided with a relatively deep, axially or longitudinally extending tapered socket 48 and an annular, outwardly extending, radial, rim flange 50. The latter constitutes a manipulating flange for actuating the plunger assembly 14. The forward region of the plunger 24 is formed with an enlarged valve body 56 having a generally longitudinally or axially extending groove 58 formed therein. The piston 26 is formed of rubber or other suitable

elastomeric material and the forward side 62 of the piston is of convex configuration so as to conform to the curvature of the dished front wall 36 of the barrel 18. Said piston is provided with an axial, open-ended, cylindrical bore 64, the medial region of which is enlarged so as to provide a socket 66 for reception of the enlarged valve body 56 of the plunger 24. Said valve body may be forced into the socket 66 by reason of the elasticity of the material of which the piston is formed. A pair of generally longitudinally or axially aligned, spaced grooves 68 and 70 is provided in the wall of the bore 64 above and below the valve body 56 and such grooves are designed for register with the aforementioned groove 58 when the plunger 24 is turned with respect to the valve body 56 in such a manner as to bring the various grooves into register with one another. When such groove registry takes place, liquid communication is established through the piston 26 from one end of the fluid chamber within the barrel to the other. When the plunger 24 is turned so that the various aforementioned grooves are out of register with one another, the piston is sealed against passage of liquid therethrough.

In order that the operator or user of the syringe may readily bring the plunger 24 to its position of groove registry, a forwardly extending protuberance 72 on the manipulating flange 50 is designed for abutment or engagement with a cooperating rearwardly extending protuberance 74 on the elastomeric rear wall 20 of the barrel assembly 18 when such groove registry takes place.

Considering the needle assembly 16, the needle proper 28 (hereinafter referred to simply as the "needle") is hollow. It is preferably formed of stainless steel, and the forward end thereof is tapered as at 76 for flesh penetration purposes as is customary with conventional hypodermic needles. The rear end of the needle is frictionally held within a longitudinal bore 78 in the needle mount 30. The bore 78 communicates with an enlarged, rearwardly disposed counterbore 80 which is designed for removable reception therein of the protective filler plug 32. The mount 30 is of stepped configuration, and has a lower tapered shank section 82 of reduced diameter for removable telescopic reception in the rear open end of the tapered socket 48 in the plunger 24.

In the preparation of the herein described hypodermic syringe, after the three assemblies 12, 14 and 16 have been individually put together, they may be assembled upon one another to produce the composite syringe assembly (see FIGS. 1 and 3) wherein the needle assembly 16 assumes its stored position within the socket 48 of the plunger 24 while the piston 26 assumes a forward position within the barrel 18. The plunger assumes a position wherein the protuberance 72 is remote from the protuberance 74. With the parts thus in position, the interior of the barrel rearwardly of the piston 26 may be filled with a predetermined quantity of the liquid medicament by piercing the elastomeric rear wall 20 of the barrel assembly 12 with a commercial filling needle and injecting the liquid into the barrel 18. During the filling operation, air will escape forcibly by a bleeder action wherein it bypasses the commercial filling needle and flows rearwardly around the wall of said needle in the usual manner of injection filling. After such filling operation, the puncture which is created by the filling needle is self-sealing. The thus filled syringe is substantially leakproof inasmuch as the cylindrical side wall 34 of the barrel 18 is rigid with the result that inward pressure thereon will not raise the pressure of liquid within the barrel. Due to the fact that the manipulating flange 50 on the plunger 24 is of appreciable radial extent, it substantially covers the flexible elastomeric rear wall 20 of the barrel assembly 12 and protects the latter from contact with extraneous objects.

When the hypodermic syringe is to be put to use for liquid injecting purposes, the cap 22 is removed from the pilot stem 38 on the front wall 36 of the barrel 18 and then discarded, after which the needle assembly 16 will be withdrawn from its stored position within the socket 48 of the needle 24 and attached to the pilot stem as shown in FIG. 4. In order to retract the piston 26, it is necessary to rotate the plunger 24 until the protuberance 72 engages the protuberance 74, at which time the grooves 68 and 70 in the piston 26 will register with the groove 58 in the plunger 24 and the enlarged valve body 56 so that a liquid passage is established through the piston as previously described, thus allowing the piston to be drawn rearwardly while liquid in the rear region of the barrel 18 passes through the registering grooves and fills the forward region of the barrel in advance of the piston.

It is to be noted at this point that the various passage-forming grooves 58, and 68, 70 are relatively wide while the thickness of the protuberance 74 on the rear elastomeric wall 20 of the barrel assembly 16 is relatively small. Thus, it is immaterial which direction of rotation of the plunger 24 is resorted to in bringing the two protuberances into contiguity and the protuberance 72 may fall on either side of the protuberance 74 with assurance that the various grooves will move into registry.

As soon as registry of the aforesaid grooves in the enlarged valve body 56, the plunger 24 and the piston 26 has been attained, the application of pulling force to the annular manipulating flange 50 will serve to retract the piston 26, providing, of course, that groove registry is maintained during the pulling operation. After the piston 26 has been fully retracted, the manipulating flange may be turned so as to move the various grooves out of registry and so that the piston is again sealed against the passage of liquid therethrough. The working injection stroke of the plunger and the piston may then be effected as soon as the steel needle 28 is inserted in the tissue or flesh of the patient. After the injection has been made, the entire syringe may be discarded if desired.

The invention is not to be limited to the exact arrangement of parts shown in the accompanying drawings or described in this specification as various changes in the details of construction may be resorted to without departing from the spirit or scope of the invention. Therefore, only insofar as the invention is particularly pointed out in the accompanying claims is the same to be limited.

I claim:

1. A disposable hypodermic syringe adapted for a single application and comprising a cylindrical barrel defining an internal liquid chamber and having a front wall provided with a pilot stem and an open rear end, a rear wall extending across and closing said open rear end of the barrel and provided with a circular hole therethrough, a piston slidable in said barrel between forward and rear positions, a plunger secured to said piston for sliding movement in unison therewith and projecting through and in sealing relationship with said hole in the rear wall, said plunger being independently rotatable with respect to said piston, cooperating valve means on said plunger and piston said cooperating valve means comprising a pair of substantially axially aligned and separated passages in the piston, one of which communicates with the interior of the barrel on one side of the piston and the other of which communicates with the interior of the barrel on the other side of the piston, and a valve body formed on said plunger and having means effective when the plunger is in one rotational position to establish communication between said passages, said valve body being effective when the plunger is in another position effectively to close said passages, and a needle assembly including a needle mount removably receivable over said pilot stem.

2. A disposable hypodermic syringe adapted for a single application and comprising a cylindrical barrel defining an internal liquid chamber and having a front wall provided with a pilot stem and an open rear end, a rear wall extending across and closing said open rear end and provided with a circular hole therethrough, a piston slidable in said barrel between forward and rear positions, a plunger secured to said piston for sliding movement in unison therewith and projecting through and in sealing relationship with the hole in said rear wall, said plunger being independently rotatable with respect to the piston, said piston being formed with a central bore therethrough, the forward end region of the plunger project-

ing through said bore in sealing relationship with respect to the piston, the medial region of said bore being enlarged, a valve body on said plunger and substantially filling said enlarged medial region of the bore, the wall of said bore forwardly and rearwardly of said valve body being provided with aligned, spaced grooves communicating with the interior of the barrel on opposite sides of the piston respectively, said valve body being provided with a marginal groove which is intermediate said aligned grooves and registers with said aligned grooves when the plunger is in one rotational position whereby said plunger and piston may be drawn rearwardly while liquid passes through said grooves from the rear side of the piston to the front side thereof, said valve body effectively closing the aligned grooves in the wall of said bore when said plunger is in another rotational position, and a needle assembly including a needle mount removably received over said pilot stem.

3. A disposable hypodermic syringe as set forth in claim 2 and wherein the plunger is provided with a relatively deep socket therein designed for storage of the needle assembly within the same, the needle mount of the needle assembly having a shank section frictionally receivable in the open end region of said socket when said needle assembly is stored within the latter.

4. A disposable hypodermic syringe as set forth in claim 3 and wherein the rear wall is in the form of a relatively thin elastomeric diaphragm capable of being punctured by a filling needle to produce a self-sealing filling opening.

5. A disposable hypodermic syringe as set forth in claim 4 and including, additionally, a radial manipulating flange on said plunger exteriorly of the barrel and closely overlying said rear wall in protective relationship.

6. A disposable hypodermic syringe as set forth in claim 5 and including, additionally, interengageable means on said manipulating flange and rear wall effective when in interengaging relationship to maintain the plunger in said one position of groove registry.