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| 1,500,009 | 9/1967 | France..... | 128/218 P |
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- [57]

A plunger assembly for a syringe adapted to be filled through the breech end of the syringe barrel including a piston rod having a piston on the distal end thereof for insertion into the breech end of the barrel, and a piston control member slidable in an opening in the piston rod and engageable with the interior of the piston to stretch the piston and provide a vent passage around the piston during movement of the piston and piston rod in the barrel. Medicament is introduced into the syringe barrel to the desired level and the plunger rod and control member are moved relative to each other to stretch and deform the piston. The deformed piston is then moved in the syringe barrel to a desired position and released by the control member into sealing engagement with the barrel.

- [51] Int. Cl. A61m 5/22

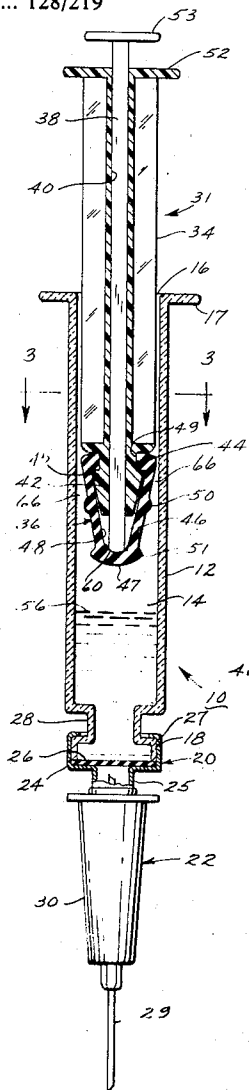
- [58] **Field of Search**..... 128/218 P, 218 PA, 219,
128/215, 216, 220, 234, 218 R; 141/27

- UNITED STATES PATENTS

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|-----------|---------|-------------------|-------------|
| 2,394,687 | 2/1946 | Hein | 128/234 |
| 2,660,168 | 11/1953 | Pontius..... | 128/218 P |
| 2,833,280 | 5/1958 | Hein, Jr..... | 128/218 P |
| 2,895,773 | 7/1959 | McConnaughey..... | 128/218 P X |
| 3,050,059 | 8/1962 | Wall et al..... | 128/218 P |
| 3,291,128 | 12/1966 | O'Neil..... | 128/219 |

373,594 4/1923 Germany 128/219

4 Claims, 3 Drawing Figures



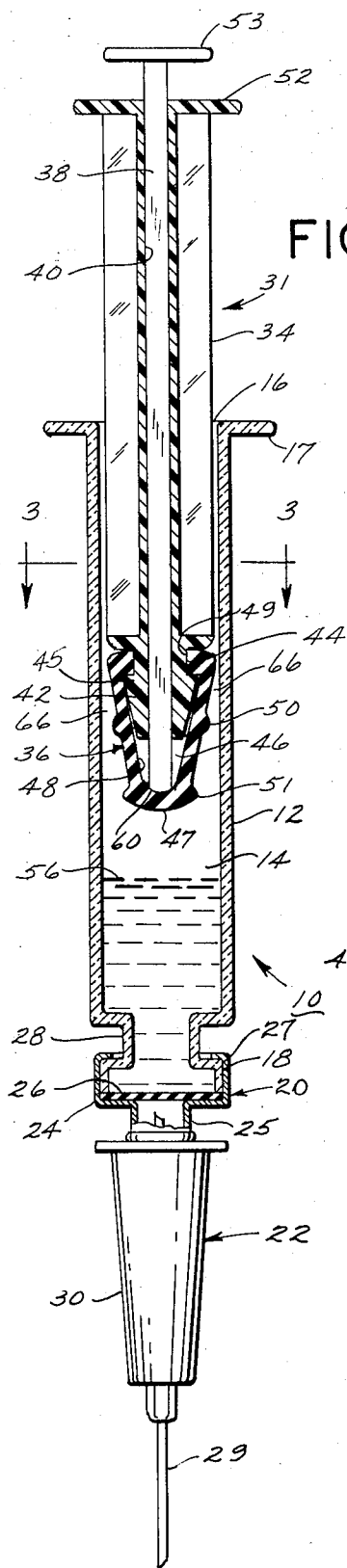


FIG. 1

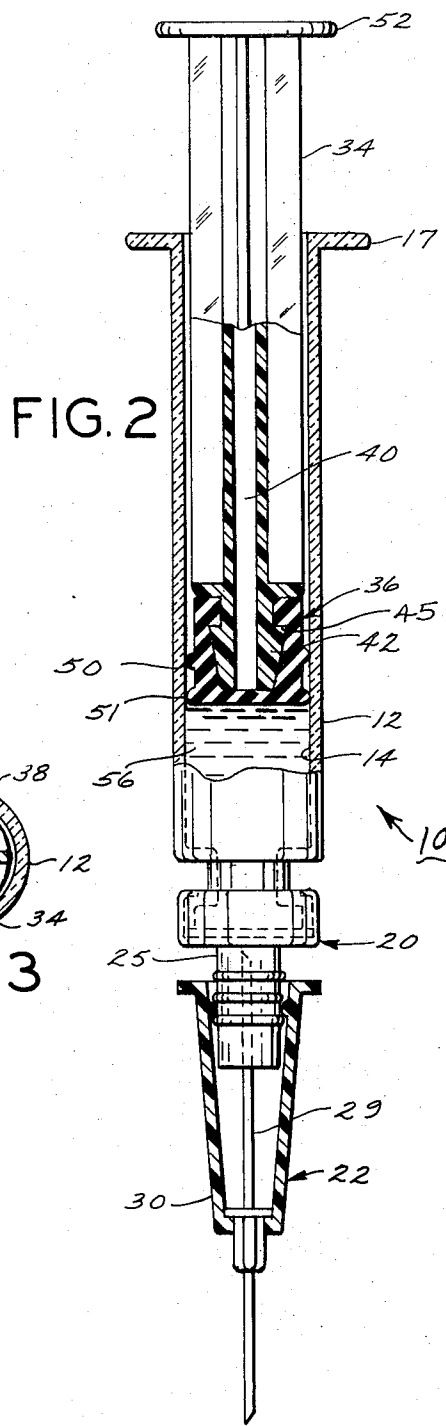


FIG. 2

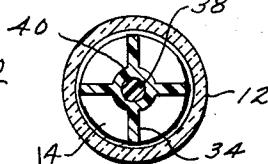


FIG. 3

BREECH LOADED SYRINGE WITH DEFORMABLE PISTON

BACKGROUND OF THE INVENTION

This invention relates to syringes and more particularly to syringes of the type which are filled from the breech end, and to the method of filling such syringes.

In conventional syringes, the barrel of the syringe is filled to a desired level through the needle connected to its distal end. Such a method of filling the syringe is undesirable if the filled syringe is to be stored for subsequent use. For example, there is danger that the needle tip will become clogged by dried medicament unless the syringe is used soon after filling. Also, there is danger of contamination of the medicament either by contact with other members or by air.

One method of filling syringes from the breech end is disclosed in the Gettig, et al, patents, U.S. Pat. Nos. 3,391,671 and 3,470,671. These patents disclose a process and apparatus which include the use of an automatic machine having a reciprocating rod and sleeve which move the piston into the breech end of the filled syringe barrel to a desired location in the barrel with the sleeve providing a vent around the piston to avoid trapping air between the piston and the medicament. The rod and sleeve, which are part of the machine, are then retracted from the barrel leaving the piston sealingly engaged with the barrel. When it is desired to use the syringe, a piston rod must be attached to the piston to enable the user to manipulate the piston, for example, to discharge medicament from the barrel. Some of the disadvantages of this method and apparatus are that relatively expensive machinery is required, and such a method does not readily lend itself to filling operations where only a relatively few syringes are to be filled at a time or where a relatively few syringes are to be filled to different levels.

A method of filling syringes which permits the economical filling of syringes from the breech end is disclosed in the copending application of Marvin D. Stumpf and Elmer A. Koenig, entitled "Breech Loaded Syringe and Method of Breech Loading Syringes," Ser. No. 860,223, filed Sept. 23, 1969, now U.S. Pat. No. 3,705,582 and assigned to the assignee of the present invention. The disclosed syringe of this copending application includes a plunger assembly having a sheath around the plunger that slides axially over the piston to temporarily compress the same and provide a vent passage for the escape of air around the piston as the plunger assembly is inserted into the barrel of the syringe. The piston and sheath may be operated manually to insert the piston. After the plunger assembly is positioned in the desired location, the sheath is moved in an opposite direction to release the piston into sealing engagement with the bore. This same plunger is conveniently used to manipulate the piston during operational use of the syringe. While such a syringe has proven quite satisfactory, some difficulty has been found in initially inserting the piston within the sleeve while insuring against any contamination of the piston preparatory to insertion of the plunger assembly into the syringe barrel. This problem is avoided by use of an arming cap disclosed in copending application of Elmer A. Koenig, entitled "Arming Cap for Breech Loaded Syringe," Ser. No. 78,767, filed Oct. 7, 1970, now U.S.

Pat. No. 3,707,968 and assigned to the assignee of the present invention. The arming cap enables the user to cause the surrounding sleeve to deform the piston preparatory to insertion into the barrel without touching the piston. The arming cap also provides a predetermined positioning to the proper location for efficiently deforming the piston. While the cap may be economically formed of a plastic material, it is an additional member, and the user is required to use both hands in effecting deformation of the piston.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide a syringe having an improved plunger assembly permitting the filling of the syringe through its breech end while avoiding the above-mentioned disadvantages.

Another object of the present invention is to provide an improved method of introducing fluid into the breech end of a syringe and for installing the plunger and piston assembly therein.

Still another object of the present invention is to provide an improved plunger assembly for use in syringes of the breech-filled type.

In accordance with one form of the present invention, a plunger assembly includes an elongate member having an opening therethrough, a piston disposed on one end of the elongate member, and a piston control member movable in the opening and adapted to urge the piston into a deformed condition in response to relative movement between the control member and the elongate member for providing a vent passage across the piston during movement of the elongate member and piston in the barrel of the syringe.

In accordance with another aspect of the present invention, an improved method of filling a syringe from the breech end is provided which includes the steps of providing a piston carrying member with a piston connected to one end thereof and a piston control member extending in the piston, effecting relative movement between the piston carrying member and the control member to deform the piston, and inserting the piston carrying member, the piston control member, and the piston into the barrel of a syringe and, with the piston deformed, moving the same to a desired level, and then effecting relative movement between the piston carrying member and the piston control member to allow the piston to move into sealing engagement with the syringe barrel.

These as well as other features and advantages of the present invention will be apparent from the following detailed description and accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a cross-sectional elevational view of a syringe and plunger assembly in accordance with a preferred embodiment of the present invention;

FIG. 2 is a cross-sectional elevational view showing the syringe barrel and plunger assembly of FIG. 1 with the piston in sealing engagement with the bore of the syringe barrel; and

FIG. 3 is a cross-sectional view taken along the line 3—3 of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawing, a hypodermic syringe,

generally designated at 10, is shown, for example, as a sliding needle type syringe including a conventional tubular syringe barrel 12 defining a fluid chamber 14 open at the proximal or breech end 16 thereof. There is also provided at the breech end an annular flange or finger grip 17. Chamber 14 has a distal or forward end 18 closed by a conventional connector 20 for attaching a hub and needle assembly 22 which may also be of conventional construction.

The connector 20 includes a metal connection member 24 and a seal 26, such as a rubber diaphragm, disposed between the distal end 18 of the barrel 12 and an interior wall of the connection member 24. The connection member 24 is secured by forming, such as by crimping, its proximal or rearward end over a barrel shoulder 27 provided by a neck 28 of reduced diameter at the distal end of the barrel.

The assembly 22 includes a needle cannula 29 and a hub 30 secured thereto which engages and is slidable on an axially extending shaft portion 25 of the connecting member 24. The needle and hub assembly 22 is movable between a position in which the needle 29 is disposed within the connecting member 24 with the pointed proximal end thereof disposed axially forward or distally of the diaphragm member 26 such as shown in the drawing, and a position in which the proximal end of the needle has pierced the diaphragm 26 and the needle is in fluid communication with the chamber 14.

The syringe 10 also includes a plunger assembly indicated generally at 31 and shown disposed partially in the chamber 14 in FIG. 1. The assembly 31 includes a piston rod 34 with a resilient piston 36 connected to its distal end, and a piston control member or rod 38 disposed in an axially extending opening or bore 40 in the piston rod 34. As shown in the drawings, the bore 40 extends along the longitudinal axis of the piston rod.

Piston rod 34 may be formed of plastic, or other suitable material, and is shown having a head 42 at its distal end which is frusto conical in cross-section for easy insertion into hollow piston 36. The head 42 provides a groove 44 in the piston rod between the main body portion of the piston rod 34 and the proximal end of the head for receiving, in tight frictional engagement therewith, the proximal end portion of piston 36.

The piston 36 is of elastic and resilient material, such as rubber, and is formed hollow so that it has a chamber 46 having interior walls 48. The chamber 46 is closed by a distal end wall portion 47 and open at its proximal end by an opening 49 of reduced diameter for receiving the head 42 of the piston rod 34. The proximal end of head 42 provides an annular shoulder 45 which is greater in diameter than piston opening 49 so as to maintain the piston and piston rod secured together. Piston 36 is also provided with a pair of axially spaced radially outer, annular sealing surfaces or rings 50 and 51 adapted to sealingly engage the chamber walls of barrel 12, as seen in FIG. 2.

Bore 40 in piston rod 34 is shown cylindrical, and extends entirely through the piston rod, including the head 42 thereof. The piston control member 38, which is shown in FIG. 1 extending entirely through bore 40 from the distal end to the proximal end, is longer than the piston rod 34 so that the proximal end thereof extends outwardly of the proximal end of the piston rod. As more clearly seen in FIG. 3, the bore 40 and control member 38 are circular in cross-section and the mem-

ber 38 is guided for sliding movement by the walls of bore 40. In the drawing, the proximal end of control member 38 is provided with an annular flange 53 while the piston rod 34 is provided with a flange 52 at its proximal end so that the control member and piston rod are readily manually manipulated, as will be more fully explained hereinafter.

In filling the syringe 10, the barrel 12 is positioned in an upright position with the breech end 16 above the distal end 18 thereof, such as shown in FIG. 1, and before the plunger and piston control assembly 31 is inserted into the barrel 12, medicament, such as liquid medicament indicated at 56, is introduced into the breech end 16 to fill the barrel to a desired predetermined level. The assembly 31, for example, is then hand grasped with the thumb on the proximal or outer surface of the piston control member flange 53, and the index and adjacent fingers under the piston rod flange 52. With the assembly 31 held in this manner, manual forces are applied to urge the flanges 52 and 53 toward each other so that the lower or distal end, indicated at 60, of the control member 38 moves in a distal direction relative to the piston rod 34. The distal end 60 engages the interior walls 48 of piston 36 at the distal end wall portion 47 at the longitudinal axis of the barrel 12 to deform the piston. As apparent from FIG. 1, control rod 38 stretches or extends the piston 36 to deform it. Piston 36 is shown secured essentially only at the proximal end portion thereof and when stretched by rod 38, shoulder 45 of the head 42 assists in holding the proximal end portion in place while other portions of piston 36 are axially slidable and extendable relative to the head.

As the piston 36 becomes longer due to such stretching, the outer diameter of the main portion thereof becomes smaller with the outer periphery including the sealing rings 50 and 51 moving radially inwardly to produce axially extending fluid bypass passages, such as shown at 66, across piston 36 to vent the chamber 14 during movement of the piston therein. By holding the piston rod 34 and control member 38 in the relative position shown in FIG. 1, and moving the same in chamber 14, the piston and piston rod are readily moved toward the liquid 56 since the chamber portion forward or distally of the piston 36 is vented by passages 66 to atmosphere.

With the piston 36 deformed, the plunger is easily moved in either direction within chamber 14 without trapping and compressing air or creating a suction force. The piston 36 may be deformed before or after the plunger 32 is inserted into the breech end of the barrel 12.

After the piston is positioned at a desired location in chamber 14, such as adjacent to or in contact with the liquid 56, the applied forces tending to hold the piston rod 34 and control member 38 in their relative positions shown in FIG. 1, are released and the resilient force of rubber piston 36 causes the piston to shorten and become larger in diameter so that the seal rings 50 and 51 move radially outwardly from the stretched or deformed position (FIG. 1) into sealing engagement with the barrel 12, as shown in FIG. 2. The control member 38 may be removed from the plunger assembly 31 by moving it axially rearwardly from the bore 40 in the piston rod 34 and either disposed of or utilized in the manner described above in another plunger assembly similar to plunger assembly 31.

With the medicament sealed in barrel 12 between the seal 26 and piston 36 as shown in FIG. 2, the filled syringe can be readily transported for use or storage as desired. The syringe may, of course, be filled and stored with or without a hub and needle assembly, such as assembly 22, attached thereto. When it is desired to use the filled syringe, the hub and needle assembly 22 is moved relative to barrel 12 so that the proximal pointed end of needle 29 pierces the diaphragm 26 to position the needle in fluid communication with the liquid 56. The syringe is shown in FIG. 2 without control rod 38 and in condition to be used to discharge the medicament 56 from the barrel 12 through the distal end thereof, for example, to inject the medicament into a patient. The medicament 56 may be discharged, after needle 29 is moved through seal 26, by using the plunger rod 34 in the usual manner during operational use of the syringe 10, that is, by placing the thumb on the flange 52 and two fingers under the barrel flange 17 and moving these flanges toward one another. Aspiration of course may also be effected by moving the piston rod 34 in a proximal direction relative to the barrel 12.

The plunger assembly 31 is thus readily introduced into the breech end of the barrel 12 without trapping or compressing air by merely effecting relative movement between the piston rod 34 and the control member 38 to stretch the piston 36 to produce the vent passages axially across the piston, and the piston may be inserted to any desired position within the chamber 14 by using only one hand. The piston 36 is placed in sealing engagement with the syringe barrel by merely releasing the forces required to deform the piston in effecting the desired venting. Since many of the parts of syringe 10, including control rod 38, may be economically formed of plastic material, the syringe may be of the single-use type. Also, where desired, the control member 38 may be a permanent part of a filling device such as at a manually operable filling station.

While a preferred form of the invention has been shown and described herein, it will be understood by those skilled in the art that various changes and modifications thereto may be made without departing from the true spirit and scope of the invention.

What is claimed is:

1. A syringe comprising a barrel defining a fluid chamber having an opening at the rearward end thereof for receiving a medicament, a plunger assembly axially movable in said chamber and including a hollow resilient piston disposed in said chamber and having an opening at the rearward end thereof, a forward end

wall, and an annular side wall portion with peripheral sealing means thereon for sealing and sliding engagement with said chamber, and a piston rod extending into said hollow piston and connected to said rearward end to manipulate said piston in said chamber during operational use of the syringe, said piston rod extending into said piston through said opening and having an axial bore extending therethrough from the forward end to the rearward end, and piston control means extending through said bore and having a forward end engageable with the interior of said forward end wall of said piston, said control means including a control rod portion disposed in and axially slideable in said bore along a straight line to a forward position in response to applied forces thereon to move said forward end wall of said piston forwardly relative to the rearward end of said piston to stretch said piston and reduce the diameter of said annular side wall portion to thereby move at least a portion of said peripheral sealing means radially inwardly from said chamber to provide a fluid bypass passage between the forward and rearward ends of said piston for venting a portion of said chamber forward of said piston during movement of said piston in said chamber, said control rod portion being axially slideable in a rearward direction relative to said forward end wall to remove said control means from said piston rod and to release said stretched piston and allow the resiliency thereof to return said forward end wall rearwardly and said peripheral sealing portion radially outwardly into sealing engagement with said chamber, said piston being movable thereafter in said chamber in response to applied forces on said piston rod during operational use of the syringe.

2. The syringe of claim 1 wherein the length of said control means is greater than the length of said piston rod and has a rearward end rearwardly of said piston rod for receiving said applied forces thereon.

3. The syringe of claim 2 wherein said barrel, said piston rod, and said control means each have laterally extending flange means thereon at the rearward ends thereof for facilitating manual actuation thereof.

4. The syringe of claim 3 wherein said piston rod has a head portion at its forward end disposed within said piston and has an annular groove adjacent the rearward end of said head portion for receiving the rearward end portion of said piston to secure said piston to said piston rod, said annular walls being stretched in an axial direction relative to said head to provide said fluid bypass passage.

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