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(71) Applicant: **MEDSOLVE TECHNOLOGIES, L.L.C.** [US/US]; 221 Rosecrans Place, Manhattan Beach, CA 90266 (US).

(72) Inventors: **FIELD, Jeffrey**; 3061 Vista Grande, Camarillo, CA 93012 (US). **MARANO-FORD, April**; 2052 West 11th Street, Upland, CA 91786 (US). **MCCONNELL-MONTALVO, Susan**; 4635 Gershwin Place, Woodland Hills, CA 91364 (US).

(74) Agent: **MCCONAGHY, John, D.**; Fulbright & Jaworski L.L.P., 865 South Figueroa Street, 29th floor, Los Angeles, CA 90017-2571 (US).

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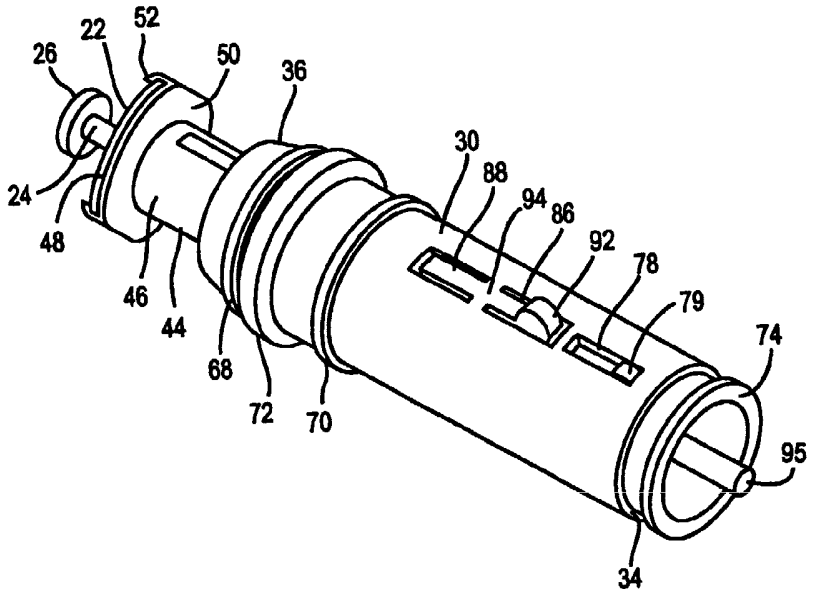
(54) Title: SAFETY SYSTEM FOR SYRINGE



(57) Abstract: A Safety system for a syringe having a housing, a syringe carriage slidably mounted within the housing and a syringe socket defined within the syringe carriage. The syringe carriage is able to assume an injection position and a retracted position. The retracted position being the safety position following injection. The syringe carriage may also be capable of assuming a cocked position for forced insertion. A retraction spring includes a loaded position and a released position. A retractable catch or frangible seat operates to release the retraction spring to withdraw the syringe needle into the housing. A spring biases the syringe carriage to the extended position and a latch selectively retains the syringe carriage in the cocked position. A cover permanently lockable can close the housing after use.

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SAFETY SYSTEM FOR SYRINGE

BACKGROUND OF THE INVENTION

The field of the present invention is systems for automatically placing and/or retracting a syringe needle.

From the standpoint of the recipient, many people find hypodermic injections unpleasant. This is particularly true with self-injections. Systems have been developed for the hypodermic insertion of syringe needles. Such placement is typically accomplished through the release of a spring loaded syringe carriage mounted within a housing. The syringe carriage receives and deploys a standard syringe. The device, frequently referred to as an inserter, is loaded with a syringe, positioned and a trigger mechanism actuated to release the carriage for rapid delivery of the associated syringe needle into the injection position. The injection is then accomplished, either manually by depressing a plunger or automatically through the use of a spring system to depress the plunger. Once the injection is complete, the entire device is simply withdrawn.

Such systems provide for the placement of the needle without the user having to advance the syringe into a hypodermic position. A simple triggering action replaces the act of insertion. Further, the needle is rapidly placed. Rapid placement of a needle hypodermically is perceived to be less painful. Substantial pressure can also be exerted around the injection site by the housing. This can give the perception that there is less pain. Consequently, such systems are a relief to many people receiving injections and particularly where those injections are self-performed.

Looking to the provider, the medical industry has contemplated the desirability of protecting personnel from accidental sharps injuries, such as needle sticks. Concerns have been expressed about the possibility of transmitting serious or potentially fatal infections as a result of sharps accidents. Federal legislation requiring the use of safe needle technology has been enacted. The Needlestick Prevention and Safety Act of 2000 requires healthcare facilities to review and make available safety-engineered sharps products. A number of syringe devices with retractable needles have been offered. Some of these

devices have employed a mechanism to release the needle hub from the needle end of the barrel and to elastically draw the needle and needle hub into the interior of the syringe. Other devices use articulated needle covers attached to the syringe which may be moved from over the needle for an injection and then replaced after the injection to prevent needle sticks.

Considering disposal, containers are used as receptacles for sharps disposal to segregate contaminated needles from other clinical materials. These aid in the prevention of accidental needle stick injuries to health care workers. As part of standard clinical procedures, the use of sharps disposal in appropriately designed bio-hazard containers has been a longstanding requirement to aid in reducing the risk to healthcare workers of the occupational exposure to HIV, hepatitis C and other diseases through accidental sticks. These containers are often produced from rigid plastic puncture resistant materials, and can be both disposable or reuseable.

SUMMARY OF THE INVENTION

The present invention is directed to a system for automatically placing and/or retracting needles using a housing with a syringe carriage movably mounted therein between operative positions. A syringe socket is provided on the syringe carriage for receipt of available syringes.

In a first separate aspect of the present invention, the system includes a retraction spring which has a loaded position and a released position in the housing. The retraction spring in the released position biases the syringe carriage toward a retracted position into the carriage. This element can be employed for the retraction of a syringe into the housing sufficiently to shield the needle associated with the syringe within the housing.

In a second separate aspect of the present invention, an insertion spring and a latch cooperate to control and perform hypodermic placement of the syringe needle. A retraction spring has a loaded position and a released position in the housing. The retraction spring in the released position biases the syringe carriage toward a retracted position. This element can be employed for the retraction of a syringe into the housing sufficiently to shield the needle associated with the syringe within the housing.

In a third separate aspect of the present invention, a retraction spring having a loaded position and a released position where the released position biases the syringe carriage toward a retracted position in the housing is controlled by a retractable catch which defines an engage position and a release position such that the retraction spring is compressed with the retractable catch in the engaged position.

In a fourth separate aspect of the present invention, a retraction spring having a loaded position and a released position which, in the released position, biases the syringe carriage toward a retracted position in the housing is constrained by a frangible retraction spring seat which includes an engage position and a release position. The retraction spring is compressed with the frangible retraction spring seat in the engage position and released with the seat in the release position.

In a fifth separate aspect of the present invention, an insertion spring cooperates with a spring stop selectively engageable with the syringe socket to bias the syringe carriage toward an injection position. The spring stop is able to disengage from the syringe socket such that the syringe socket may move toward a retracted position in the housing.

In a sixth separate aspect of the present invention, the spring stop of the fifth separate aspect employs a mechanism making the spring stop selectively engageable with the syringe socket. The housing includes a flange retaining the spring stop engaged with the syringe socket. In a cocked position, the spring stop extends across that flange. The mechanism is capable of releasing the spring stop from the syringe socket once the spring stop is displaced from the flange. The mechanism is also capable of preventing further engagement of the spring stop with the syringe socket such that the device is not reusable.

In a seventh separate aspect of the present invention, an insertion spring and a latch cooperate to control and perform hypodermic placement of the syringe needle. The latch retaining the carriage in a cocked position further includes an actuator extending from the needle end of the housing. This actuator is movable from an extended position to a trigger position with the trigger position disengaging the latch from the syringe carriage. Employing this mechanism, automatic insertion can be accomplished through pressure applied to the device

about the injection site. The pressure tends to lessen perceived pains associated with the injection. Further manipulation of a separate trigger is also avoided.

In an eighth separate aspect of the present invention, a cover is provided with the housing which includes a rigid engagement permanently lockable over the needle end. Through this permanent lock, disposal is facilitated.

In a ninth separate aspect of the present invention, the syringe carriage is movable within the main bore to define an injection position toward the needle end, a disengage position further extended toward the needle end from the injection position and a retracted position toward the plunger end from the injection position. A retractable catch at the housing includes an engage position engaged with the syringe carriage and a release position released from the syringe carriage, the retractable catch being moved to the release position with the syringe carriage moved from the injection position to the disengage position.

In a tenth separate aspect of the present invention, any of the foregoing aspects are contemplated to be employed in combination to further advantage.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a perspective view of a safety syringe system.

Figure 2 is a cross-sectional side view of the safety syringe system of Figure 1 with the carriage in the cocked position.

Figure 3 is a cross-sectional side view of the safety syringe system of Figure 1 with the carriage in the injection position.

Figure 4 is a perspective view of the safety syringe system of Figure 1 with an end cover fixed to the side of the housing.

Figure 5 is a perspective view of the system of Figure 4 with the cover in place over the end of the housing.

Figure 6 is a perspective view of the safety syringe system of Figure 1 with another end cover affixed to the side of the housing.

Figure 7 is a perspective view of the system of Figure 6 with the cover released from the sidewall of the housing.

Figure 8 is a perspective view of the system of Figure 6 with the cover in place over the end of the housing.

Figure 9 is a perspective view of a second safety syringe system.

Figure 10 is a cross-sectional side view of the safety syringe system of Figure 9 with the carriage in the cocked position.

Figure 11 is a cross-sectional side view of the safety syringe system of Figure 9 with the carriage in the injection position.

Figure 12 is a perspective view of a side loading version of the second safety syringe system.

Figure 13 is a perspective view of a third safety syringe system.

Figure 14 is a perspective view of the third safety syringe system after use.

Figure 15 is a cross-sectional view of the third safety syringe system.

Figure 16 is a cross-sectional view of the third safety syringe system after use.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Turning in detail to the drawings, a syringe insertion and/or retraction system is illustrated. The system is contemplated to receive conventional syringe structures. A common syringe typically has a barrel 20 having a finger grip flange 22. A plunger 24 is slidable in the barrel 20 and conventionally extends from one end of the barrel to a thumb button 26. A needle 28 is affixed to the barrel 20 at one end.

The safety syringe system of Figures 1 through 8 provides for both insertion and retraction. Retraction alone may be employed, either through triggering of the insertion mechanism prior to use or through assembly without the insertion mechanism. The system includes a housing 30 which is generally cylindrical in form. The housing 30 includes a main bore 32 open at both the needle end 34 and the plunger end 36. At the plunger end 36, an inwardly extending end flange 38 defines a plunger access opening 40. An end surface 42 defines an abutment. The housing 30 is formed in two halves split longitudinally to accommodate component assembly and then sonically welded or bonded together.

A syringe carriage 44 is shown to be generally cylindrical in construction. The carriage 44 is movably mounted within the main bore 32 of the housing 30 and is movable between a cocked position as seen in Figure 2 and an injection position as seen in Figure 3. Further, the syringe carriage 44 is able to move

toward a retracted position which is between the cocked position and the injection position.

The syringe carriage 44 includes a syringe socket 46. The syringe socket 46 is generally a cylindrical tube receiving the barrel 20 of the syringe. Proximal the plunger end 36 of the housing 30, the syringe socket 46 terminates in a retention socket 48. The retention socket 48 includes a flange 50 extending outwardly from the end of the syringe socket 46. Locking lugs 52 extend upwardly from opposed edges of the flange 50 to receive the finger grip flange 22 of a syringe positioned within the syringe socket 46. The underside of the flange 50 is able to abut against the end surface 42 of the housing 30 to define maximum travel of the syringe carriage 44 in a first direction. The locking lugs 52 are intended to retain the barrel 20 of the syringe permanently. In so doing, the design of the device makes it disposable following a single syringe use. Other locking mechanisms may be employed to associate the syringe carriage 44 with a syringe positioned therein. The syringe may in fact be pre-assembled and offered with the safety mechanism.

The syringe carriage 44 further includes two spring stops 54. Each spring stop 54 includes an arm 56 having a stop flange 58 adjacent one end and a pin 60 adjacent the other. The arm 56 extends longitudinally along the syringe socket 46. Cavities 62 in the side of the syringe socket 46 receive the pins 60. The spring stops 54 may be two separate components. Alternatively, the spring stops 54 may be fixed together by the stop flange 58 extending at least around one way between the two arms 56. Under that circumstance, the arms 56 may be outwardly splayed as illustrated in Figure 3 in a relaxed state. If separate pieces, the spring stops 54 are biased as illustrated in Figure 3 by the insertion spring identified below.

In considering Figure 2 and 3, it can be seen that the arms 56 extend across the inwardly extending end flange 38 with the syringe carriage 44 in the cocked position. In the injection position, the arms 56 do not so span the inwardly extending end flange 38. The clearance within the plunger access opening 40 defined by the inwardly extending end flange 38 is less than the extension of the pins 60. Thus, the spring stops 54 are unable to disengage the pins 60 from the cavities 62 until the flange 50 abuts against the end surface 42 of the housing 30.

At that circumstance, the ends of the arms 56 most proximal the pins 60 are released under the flange 50 to move outwardly. Thus, the syringe socket 46 can be moved longitudinally by the spring stops 54 until such time as the injection position is reached.

Once the spring stops 54 are released, it is difficult or impossible for them to again pass through the plunger access opening 40. If it is desired that the spring stops 54 not advance further within the main bore 32 of the housing 30, an engagement lug or lugs (not shown) can be arranged on the wall of the main bore 32 to interfere with additional movement of the spring stops 54 from the position shown in Figure 3.

A helical compression spring defines an insertion spring 64 that extends from the stop flanges 58 of the spring stops 54 to the underside of the inwardly extending end flange 38. The insertion spring 64 biases the syringe carriage 44 toward the injection position. The insertion spring 64 may also operate to pivot the spring stops 54 when released through the inwardly extending end flange 38 as can be seen in Figure 3.

Opposed latches 66 are provided in the cylindrical wall of the housing 30. These latches 66 are pivotally mounted by a living hinge at the intersection of the latches 66 with the inwardly extending end flange 38. The wall of the housing 30 is otherwise cut away from the latches 66 to allow the latches 66 to pivot outwardly as seen in Figure 3. Figure 2 illustrates each of the latches 66 engaging the stop flanges 58 of the spring stops 54. In this way, the syringe carriage 44 is retained in the cocked position. When moved outwardly, the latches 66 release the spring stops 54 such that the insertion spring 64 can extend the syringe carriage 44 to the injection position. At the injection position, the spring stops 54 are released from the syringe carriage 44 as discussed above.

The latches 66 are shown to include slide stops 68. Corresponding slide stops 70 on the side of the housing 30 define a range of travel for a lock 72. The lock 72 is a ring able to slide from the stop 68 to the stop 70. When abutting the stop 70, the lock 72 releases the latches 66 so that they will not be constrained from moving outwardly to release the spring stops 54.

The living hinges are rigid enough to prevent the latches 66 from freely moving outwardly in response to the compression forces of the insertion springs

64. Rather, an actuator 74 is employed to force the latches 66 outwardly to trigger the insertion. The actuator 74 is conveniently arranged concentrically within the main bore 32 and is able to slide longitudinally therein. In an extended position as illustrated in Figure 2, the actuator 74 does not interfere with the latches 66. In a trigger position illustrate in Figure 3, the actuator 74 has been forced inwardly in the main bore 32 and driven the latches 66 outwardly by riding against the inclined surfaces 76 of the latches 66. The actuator 74 has relief holes 77 as may be required to avoid other elements within the housing. Guide slots 78 are arranged longitudinally on the housing to receive fingers 79 on the actuator.

A second helical compression spring defines a retraction spring 80. The housing 30 includes spring mounting flanges 82 extending into the main bore 32 upon which the retraction spring 80 can be compressed. The retraction spring 80 is illustrated in a loaded position against the flanges 82 in Figure 2. The syringe carriage 44 is shown at an early stage of retraction movement in Figure 3 with the retraction spring 80 moving toward a released position biasing the syringe carriage to the retracted position. The retraction spring 80 expands against a retraction flange 84 extending from the sidewall of the syringe socket 46. This retraction flange 84 cannot extend past the stop flanges 58 on the spring stops 54, thus limiting retraction movement of the syringe carriage 44.

Retractable catches 86 are formed in the sidewall of the housing 30. These catches 86 each have an engage position as illustrated in Figure 2 and a release position as illustrated in Figure 3. Each catch 86 includes a lever 88, a catch flange 90 at one end of the lever and a tab 92 at the other. Living hinges 94 pivotally mount the catches 86 to the wall of the housing 30. The tabs 92 are preferably diametrically opposed so that they may be easily squeezed together to withdraw the catch flanges 90 for release of the retraction spring 80, as shown just accomplished in Figure 3.

As can be seen in Figure 3, when the flange 50 abuts against the end surface 42, the retraction flange 84 is not sufficiently advanced to be captured by the catch flanges 90 of the retractable catches 86. Consequently, the syringe carriage 44 cannot be locked in the injection position. Nor can the retraction spring 80 be effectively recaptured by the catch flanges 90.

In operation, the safety system of Figures 1 through 3 may come with the syringe in place or separate. In either event, the device itself is configured as illustrated in Figure 2. Principally, the retraction spring 80 is compressed and retained by the retractable catches 86. The insertion spring 64 is also compressed with the syringe carriage 44 in the cocked position. If not pre-assembled, the syringe is advanced in the syringe socket 46 until the finger grip flange 22 is retained in the retention socket 48. The needle cover 95 is retained in place until use. It can be removed from the needle end of the housing when appropriate.

If the syringe is not precharged, a standard vial may be inserted into the needle end 34 in the main bore 32 with the syringe carriage 44 remaining in the cocked position. A window (not shown) may be provided through the wall of the syringe socket 46 to illustrate gradations near full syringe capacity.

Once appropriately charged, the lock 72 is slid to the stops 70, arming the device. The housing 30 is then advanced to about the injection site. The housing 30 is forced against the site, causing the actuator 74 to move from the extended position to the trigger position. In the trigger position, the actuator 74 engages the latches 66, moving them outwardly to release the spring stops 54. The syringe carriage 44 then moves rapidly to the injection position resulting in the insertion of the needle 28. The injection may then be given.

Once the injection is complete, the device may be removed from the site at the user's option. The tabs 92 are then compressed to release the retraction spring 80. The retraction spring 80 biases the syringe carriage 44 toward the retracted position with the retraction flange 84 approaching or contacting the stop flanges 58. At this point, the needle 28 of the syringe no longer extends from the end of the system at the needle end 34 thereof.

Once triggered and retracted, the device can no longer be employed. The retractable catches 86 can no longer engage the retraction spring 80. Further, the spring stops 54 will no longer engage the syringe socket 46 or move through the plunger access opening 40 defined by the inwardly extending end flange 38. The retraction spring 80 biases the syringe carriage 44 from again moving to the injection position.

The embodiment of Figures 1 through 3 are shown in Figures 4 through 8 to incorporate end covers. Such covers allow classification of the assembly as safe for disposal in other than a hard sharps container. The covers are shown to exhibit disengageable attachment to the sides of the housings.

Figures 4 and 5 illustrate a rigid cover 96 which is disengageably attached to the wall of the housing 30 prior to deployment by a button 98 received in a hole 100 on the cover 95. A tie 102 extends from the rigid cover 96 to the housing 30. The rigid cover 96 includes rigid engagements 104 in the form of locking lugs which are permanently lockable to a flange 106 on the outer end of the actuator 74. In this way, the cover 96 is locked to the housing 30, preventing access to the needle 28. To avoid the prospect of the needle 28 extending through the hole 100, the hole 100 is intentionally misaligned with the needle 28. A biohazard warning symbol may be placed on the outside of the cover 96 and on the wall of the housing 30 around the button 98. These warning symbols will be hidden until the cover 96 is separated from the housing 30 prior to the device being discarded.

In Figures 6 through 8, a thin sheet provides a cover 108. The sheet cover 108 may be paper and is disengageably tacked to the sidewall of the housing 30. Adhesive is on the outwardly facing surface. A tie 110 again retains the cover 108 in association with the device. A sheet of material 112 which does not adhere to the adhesive on the paper cover 108 is provided for protection of the adhesive. This material 112 is removed as shown in Figure 6. The cover 108 is then pulled from the sidewall of the housing 30, as illustrated in Figure 7. Finally, the cover 108 is positioned across the needle end 34 of the assembly with the adhesive fixing the cover 108 to the end of the actuator 74. The same arrangement for biohazard symbols as with the hard cover 96 is contemplated.

Turning to the safety system of Figures 9 through 12, needle insertion and retraction are provided for in this device. Retraction alone is also possible as with the prior embodiment. A housing 120 includes a generally cylindrical main bore 122. Side bores 124 and 126 are fully open to the main bore 122. Finger gripping elements 128 are shown to either side of the housing at the plunger end 130. The needle end 132 is shown to be fully open across the body of the housing 120. However, portions could be closed with an access port remaining in the center if desired. The plunger end 130 includes a plunger access opening 134. To

facilitate assembly, the housing 120 is formed in two halves split longitudinally and then sonically welded or bonded together.

A syringe carriage 136 is slidably positioned within the housing 120 such that it is guided by the main bore 122 to move longitudinally. The syringe carriage 136 includes a syringe socket 138 that accommodates the barrel 20 of a syringe. A retention socket 140 at the end of the syringe socket 138 includes a flange 142 with locking lugs 144 diametrically opposed to permanently retain the finger grip flange 22 of the syringe.

The syringe carriage 136 is shown in a cocked position in Figure 10. In Figure 11, the syringe carriage 136 is illustrated in the injection position. As will be discussed below, the syringe carriage 136 is then moved toward the plunger end 130 to a retracted position. An insertion mechanism is found in the side bore 124 and a retraction mechanism is found in the side bore 126.

An insertion spring 146 is positioned in the side bore 124 against the end wall of the housing 120 at the plunger end 130. As illustrated in Figure 10, the insertion spring 146 is in compression biasing the syringe carriage 136 toward the needle end 132. A frangible insertion spring seat 148 is mounted to the sidewall of the syringe carriage 136.

A latch 150 is configured like the retraction catch 86 in the first embodiment. A lever 152 is cut from the sidewall of the housing 120 but for living hinges to either side thereof. A retainer element 154 extends from adjacent one end of the lever 152 inwardly of the side bore 124. An actuator 156 is adjacent the other end of the lever 152 and sticks outwardly of the housing 120 for manual actuation. The latch 150 is illustrated in the extended position in Figure 10 as it engages the frangible insertion spring seat 148. This position maintains the insertion spring 146 in compression.

A lock 158, consisting of an arcuate piece and a guide which runs in a groove (not shown) slides over the end of the lever 152 having the retainer 154. With this slid from over the retainer 154, as illustrated in Figure 11, the latch 150 can be actuated. The actuator 156 is depressed so that the latch 150 assumes a trigger position. In this position, the insertion spring 146 is released to bias the syringe carriage 136 into the position as illustrated in Figure 11.

A retraction spring 160 is located in the side bore 126. The spring 160 is illustrated in a loaded position in compression in both Figures 10 and 11. A spring seat 162 extends into the side bore 126 from the wall of the housing 120. A frangible retraction spring seat 164 is also shown to be mounted to the wall of the housing 120. The seat 164 is illustrated in the engaged position in both Figures 10 and 11. The retraction spring 160 is in the loaded position in compression.

For retraction, the housing 120 includes a housing breaker 166 having a blade 168 to break the frangible insertion spring seat 148 under forced contact therewith. A carriage breaker 170 is mounted to the syringe carriage 136 and includes a blade 172 to break the frangible retraction spring seat 164 upon forced engagement. Both of the frangible spring seats 148 and 164 include a scored area that is easily broken from the main element. With pressure on the thumb button 26 of the syringe with the plunger 24 already fully extended into the barrel 20, the breakers 166 and 170 cut the frangible seats 148 and 164. With the seat 148 broken, the insertion spring 146 no longer can bias the syringe carriage 136. Thus, the retraction spring 160 is not resisted by the insertion spring 146.

Breaking the spring seat 164, defining a release position, releases the retraction spring 160 to extend against the carriage breaker 170 and drive the syringe carriage 136 toward a retracted position. The retraction spring 160 is of sufficient size to position the syringe carriage 136 far enough toward the plunger end 130 that the needle 28 of the associated syringe is again within the housing 120. As the frangible spring seats 148 and 164 are destroyed in the retraction, the device is not reusable. Similar cover mechanisms to those defined in the first embodiment may be employed to establish a sharps container for disposal.

Figure 12 illustrates a side loading version of the safety system of Figures 9 through 11. A longitudinal slot 174 extends along the syringe carriage 136. The housing 120 also includes a longitudinal slot 176 which is aligned with the longitudinal slot 174. The longitudinal slot 174 of the spring carriage 136 extends to a reconfigured retention socket 178 which includes two shoulders intersecting the slot 174 to receive the finger grip flange 22 of the syringe when laterally placed.

In operation, the insertion spring 146 and the retraction spring 160 are provided in compression. The syringe may be provided already positioned and

may also be charged. Alternatively, this may be left to the user. The needle end 132 of the housing 120 may conveniently receive the access end of a standard vial for charging of the syringe. With the system configured as illustrated in Figure 12, graduations on the barrel 20 are visible for metering amounts filling a small portion of the syringe.

When prepared, the device is placed about the injection site. The lock 158 is slid into the unlocked position and the actuator 156 is depressed. This action releases the insertion spring 146 to rapidly drive the syringe carriage 136 into the injection position. The thumb button 26 may then be depressed to complete the injection. At the operator's option, the device may be removed from the injection site. The thumb button 26 is further depressed to break the frangible insertion spring seat 148 and the frangible retraction spring seat 164. The components may be configured to provide for a breaking of the seat 148 slightly ahead of the seat 164 to insure that the operator fully actuates the release mechanism. With this breaking, the insertion spring 146 is released from engagement with the syringe carriage 136 and the retraction spring 160 is released to engage the syringe carriage 136, driving the syringe carriage 136 to the retracted position. Again, covers as illustrated for the first embodiment may be equally applied with this embodiment. With the modification of Figure 12, the syringe may be alternatively removed from the device and disposed of independently thereof.

Turning to the safety system of Figures 13 through 16, needle retraction is provided for in this device. The system includes a housing 180 which is generally cylindrical in form. The housing 180 includes a main bore 182 which is open at both the needle end 184 and the plunger end 186. The housing may be formed as a complete cylinder as the components can be loaded from the plunger end 186. Of course, the housing 180 may be formed in two halves split longitudinally and sonically welded or bonded together as with the other embodiments.

A syringe carriage 188 is also shown to be generally cylindrical in construction and movably mounted within the main bore 182 of the housing 180. The carriage 188 is shown in Figure 15 to be in an injection position. In Figure 16, the syringe carriage 188 is shown to have moved to a retracted position. In the injection position, the needle 28 extends from the needle end 184 of the housing 180. In the retracted position, the needle 28 is fully drawn into the main bore 182.

A disengage position further extended toward the needle end 184 from the injection position will be discussed below.

The syringe carriage 188 includes a syringe socket 190 which is generally a cylindrical tube receiving the barrel 20 of the syringe. Proximal the plunger end 186 of the housing 180, the syringe socket 190 terminates in a retention socket 192. The retention socket 192 includes a flange 194 extending outwardly from the end of the syringe socket 190. Locking lugs 196 extend upwardly from opposed edges of the flange 194 to receive the finger grip flange 22 of a syringe positioned within the syringe socket 190. The locking lugs 196 are intended to retain permanently the barrel 20 of the syringe. In doing so, the design of the device makes it disposable following a single syringe use. Other locking mechanisms may be employed to associate the syringe carriage 188 with a syringe position therein. The safety device may be prepackaged with a syringe in position or provided separately.

A radially extending flange 198 extends across the plunger end 186 of the housing 180 from about the syringe carriage 188. This flange 198 is axially displaced a small amount from the flange 194 and is thin enough to operate as a resilient element capable of allowing the syringe carriage 188 to extend beyond the injection position to a disengage position when the thumb button 26 of a syringe positioned in the syringe carriage. The flange 198 is deformed by the plunger end 186 of the housing 180 as the syringe carriage 188 is forced toward the disengage position from the injection position in a manner similar to a Belleville spring.

A helical compression spring defines a retraction spring 200. The housing 180 includes a spring mounting flange 202 extending into the main bore 182 upon which the retraction spring 200 can be compressed. The retraction spring 200 is illustrated in a loaded position against the flange 202 in Figure 15. The syringe carriage 188 is shown in the injection position in Figure 15 and in the retracted position in Figure 16. In the retracted position, the retraction spring 200 has driven the syringe carriage toward the plunger end 186 of the housing 180. The retraction spring 200 expands against a stop 204 extending from the sidewall of the syringe socket 190.

A driver 206 is also arranged as a flange annularly about the syringe socket 190. The driver 206 engages retraction stops 208 which are resiliently mounted in the sidewall of the housing 180. The resilient mounting is accomplished through cuts in the sidewall defining extended arms 210 having the retraction stops 208 at the unsupported ends. This resilient mounting allows initial assembly of the syringe carriage 188 from the plunger end 186 of the housing 180. The retraction stops 208 with the driver 206 define the retracted position of the syringe carriage 188 in the housing 180.

Retractable catches 212 are also formed in the sidewall of the housing 180. These catches 212 each have an engage position as illustrated in Figure 15 and a release position with the catches 212 moved radially outwardly from the engage position. Each catch 212 is mounted at the unsupported end of an arm 214. The arms 214 have sufficient rigidity to retain the stop 204 which are biased by the retraction spring 200 in the injection position. When the thumb button 26 is pressed down with greater force than required for injection, the driver 206 forces the catches 212 outwardly to the release position. The arms 214 are designed so as not to provide sufficient resilience to recover from movement to the release position. This may be accomplished with a notch in the arm 214 or through the length of the arm 214 relative to the forced displacement from the driver 206. As the arms 214 are forced beyond their yield point by the driver 206 to the release position, they do not recover to the engage position once the driver 206 is allowed to withdraw.

The stop 204 is shown to be spaced from the driver 206. This displacement provides for the retractable catches 212 to be located therebetween. Before the driver 206 is forced toward the catches 212, both the retraction spring 200 and the driver 206 operate to prevent the syringe carriage 188 from extending excessively from the needle end 184 of the housing 180. Once the syringe carriage 188 has been forced to the disengage position and the catches 212 permanently forced to the release position, the catches 212 will no longer interfere with the stop 204 and the syringe carriage 188 will be free to retract toward the plunger end to the retracted position. The driver 206 extends from the syringe carriage 188 further than the stop 204 so that the stop can pass across the

catches 212 without permanent deformation of the catches 212 during assembly. The driver 206 cannot.

As the thumb button 26 is depressed to release the syringe carriage 188, the user is in position for controlling the syringe retraction. By rapidly releasing pressure on the thumb button 26, the syringe and associated needle 28 can be snapped into the retracted position. By retaining pressure on the thumb button 26, a slow retraction may be effected. The latter is advantageous where concerns regarding atomizing medicine or body fluids arise.

To prevent premature retraction, a ring lock 216 is initially positioned about the housing 180 and over the retraction catches 212. A stop 218 for the ring lock 216 is positioned about the outer surface of the housing 180. The ring lock 216 is able to move to the stop 218 to release the retractable catches 212, as seen in Figure 16.

A rigid end cover 220 is disengageably attached to the wall of the housing 180 by a button 222 received in a hole 224 on the cover 220 prior to deployment of the cover 220. A tie 226 extends from the rigid cover 220 to the housing 180. The rigid cover 220 includes rigid elements 228 in the form of locking lugs which are permanently lockable to a flange 230 on the plunger end 186 of the housing 180. In this way, the end cover 220 is locked to the housing 180, preventing access to the needle 28. A biohazard warning symbol may be placed on the outside of the cover 220 and on the wall of the housing 180 around the button 222. As can be seen by a comparison of Figures 13 and 14, these warning symbols will be hidden until the cover 220 is separated from the housing 180 prior to the device being discarded.

In operation, the safety system of Figures 13 through 16 may come with the syringe in place or may come separately from any syringe. In either event, the device itself is configured as illustrated in Figures 13 and 15 with a needle cover 95 protecting the needle 28 and operators from the needle 28. The retraction spring 200 is compressed with the syringe carriage 188 in the injection position. The ring lock 216 is arranged over the retractable catches 212. The ring lock 216 may have tape or some other mechanism in place to further insure against premature actuation.

The injection is given with the assembly in the configuration of Figure 15 with the ring lock 216 in either of the locked or unlocked positions. Once the injection is given, the needle 28 may be removed from the injection site prior to retraction at the user's option. With the ring lock 216 in the unlocked position, the thumb button 26 is more forcefully depressed into the syringe, which in turn forces the syringe carriage 188 to move to the disengage position against the resistance of the resilient element 198. Upon reaching the disengage position, the driver 206 releases the syringe carriage by by forcing the retractable catches 212 to the release position. The speed of retraction is then within the control of the user. In the retracted position, the needle 28 is covered by the housing 180 to protect users and others against sharps injuries.

To provide an integral biohazard container, the end cover 220 is locked in place over the end of the device. Preferably the hole 224 is not aligned with the needle 28 to avoid the needle passing through the hole 224 when the syringe or the syringe carriage 188 are pushed into the housing from the plunger end 186.

Thus, safety insertion and/or retraction systems for the placement of standard syringes for injections are disclosed. While embodiments and applications of this invention have been shown and described, it would be apparent to those skilled in the art that many more modifications are possible without departing from the inventive concepts herein. The invention, therefore is not to be restricted except in the spirit of the appended claims.

Claims:

1. A safety system for a syringe, comprising

a housing including a main bore, a needle end and a plunger end;

a syringe carriage movable within the main bore to define a cocked position displaced from the needle end, an injection position toward the needle end from the cocked position and a retracted position toward the plunger end from the injection position and including a syringe socket for receiving and retaining a syringe;

an insertion spring biasing the carriage toward the injection position;

a latch selectively retaining the carriage in the cocked position;

a retraction spring including a loaded position and a released position in the housing, the retraction spring in the released position biasing the syringe carriage toward the retracted position.

2. The safety system of claim 1 further comprising

a retractable catch at the housing including an engage position extending into the main bore and a release position displaced outwardly from the engage position, the retraction spring being compressed in the loaded position between the housing and the retractable catch with the retractable catch in the engage position.

3. The safety system of claim 2, the retractable catch further including a lever operatively mounted relative to the housing, a catch flange adjacent one end of the lever extending into the main bore in the engage position and displaced outwardly from the engage position in the release position and a tab extending outwardly from the housing adjacent the other end of the lever.

4. The safety system of claim 3, the lever having a living hinge and being pivotally mounted by the living hinge to the housing.

5. The safety system of claim 1, the syringe carriage further including a spring stop selectively engageable with the syringe socket and extending outwardly thereof, the insertion spring being between the housing and the spring stop.

6. The safety system of claim 5, the spring stop having an arm extending longitudinally along the syringe socket, a stop flange extending

outwardly from the syringe socket adjacent one end of the arm and a pin engageable with the syringe socket adjacent the other end of the arm.

7. The safety system of claim 6, the housing having an inwardly extending end flange adjacent the plunger end defining a plunger access opening to the main bore, the arm extending through the plunger access opening with the syringe carriage in the cocked position, the clearance between the plunger access opening and the arm being smaller than the extension of the pin into the syringe socket.

8. The safety system of claim 6, the latch engaging the stop flange with the syringe carriage in the cocked position.

9. The safety system of claim 1, the latch including an actuator extending from the needle end and movable from an extended position to a trigger position, the trigger position disengaging the latch from the syringe carriage.

10. The safety system of claim 9, the latch further including a living hinge and being pivotally mounted by the living hinge to the housing.

11. The safety system of claim 10 further comprising

a lock about the housing and slidable over the latch to prevent pivotal movement of the latch from the extended position to the trigger position.

12. The safety system of claim 1 further comprising

a cover including a rigid engagement permanently fixable at the needle end of the housing.

13. The safety system of claim 12, the latch including an actuator extending from the needle end and movable from an extended position to a trigger position, the trigger position disengaging the latch from the syringe carriage, the cover being permanently lockable over the end of the actuator proximal the needle end of the housing.

14. The safety system of claim 12, the cover being sheet material with adhesive on one side.

15. The safety system of claim 12, the cover further including a tie extending to the housing and a disengageable attachment between the cover and the side of the housing.

16. The system of claim 1, the syringe carriage further including a side opening into the socket to laterally receive the syringe.

17. The system of claim 16, the housing further including a longitudinal housing slot, the side opening being a longitudinal carriage slot, the longitudinal slots being aligned for lateral receipt of the syringe into the syringe socket.

18. The safety system of claim 1 further comprising

a frangible retraction spring seat at the housing including an engage position extending into the main bore from the housing and a release position separated from the housing, the retraction spring being compressed in the loaded position between the housing and the frangible retraction spring seat with the frangible retraction spring seat in the engage position.

19. The safety system of claim 18, the syringe carriage further including a carriage breaker engageable with the frangible spring seat with the syringe carriage beyond the injection position toward the needle end.

20. The safety system of claim 1, the syringe carriage further including a frangible insertion spring seat extending outwardly thereof, the insertion spring being between the housing and the frangible insertion spring seat.

21. The safety system of claim 20, the housing further including a housing breaker engageable with the frangible insertion spring seat with the syringe carriage beyond the injection position toward the needle end.

22. A safety system for a syringe, comprising

a housing including a main bore, a needle end and a plunger end;

a syringe carriage movable within the main bore from an injection position toward the needle end to a retracted position toward the plunger end from the injection position and including a syringe socket for receiving and retaining a syringe;

a retraction spring including a loaded position and a released position in the housing, the retraction spring in the released position biasing the syringe carriage toward the retracted position;

a retractable catch at the housing including an engage position extending into the main bore and a release position displaced outwardly from the engage position, the retraction spring being compressed in the loaded position between the housing and the retractable catch with the retractable catch in the engage position.

23. A safety system for a syringe, comprising

a housing including a main bore, a needle end and a plunger end;

a syringe carriage movable within the main bore from an injection position toward the needle end to a retracted position toward the plunger end from the injection position and including a syringe socket for receiving and retaining a syringe;

a retraction spring including a loaded position and a released position, the retraction spring in the released position biasing the syringe carriage toward the retracted position;

a frangible retraction spring seat including an engage position extending into the main bore from and a release position separated from one of the housing and the syringe carriage, the retraction spring being compressed in the loaded position between the other of the housing and the syringe carriage and the frangible retraction spring seat with the frangible retraction spring seat in the engage position.

24. A safety system for a syringe, comprising

a housing including a main bore, a needle end and a plunger end;

a syringe carriage movable within the main bore to define an injection position toward the needle end, a disengage position further extended toward the needle end from the injection position and a retracted position toward the plunger end from the injection position and including a syringe socket for receiving and retaining a syringe, a stop engaging the retractable catch with the syringe carriage in the injection position and a driver, the stop and the driver being to either side of the retractable catch with the syringe carriage in the injection position;

a retraction spring biasing the syringe carriage toward the retracted position;

a retractable catch at the housing including an engage position extending into the main bore and engaged with the syringe carriage and a release position displaced outwardly from the engage position and released from the syringe carriage;

a resilient element between the syringe carriage and the housing biasing the syringe carriage toward the injection position from the disengage position and extending outwardly from the syringe carriage to engage the plunger end of the housing with the syringe carriage in the injection position.

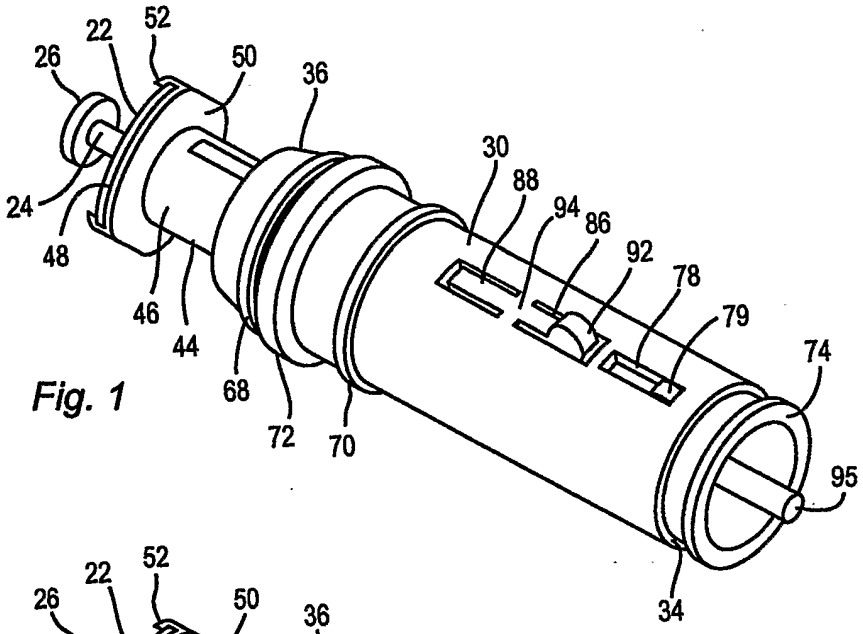

Fig. 1

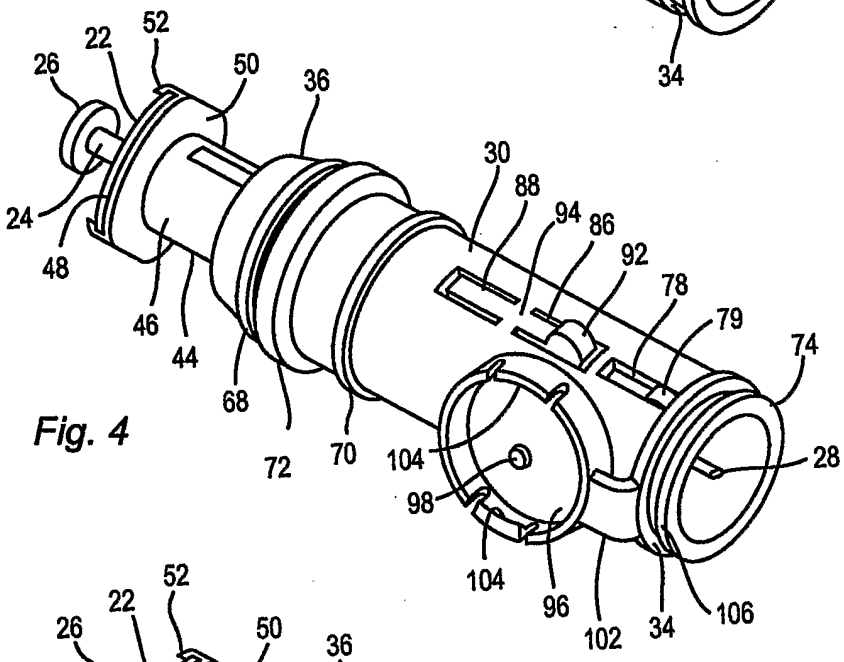

Fig. 4

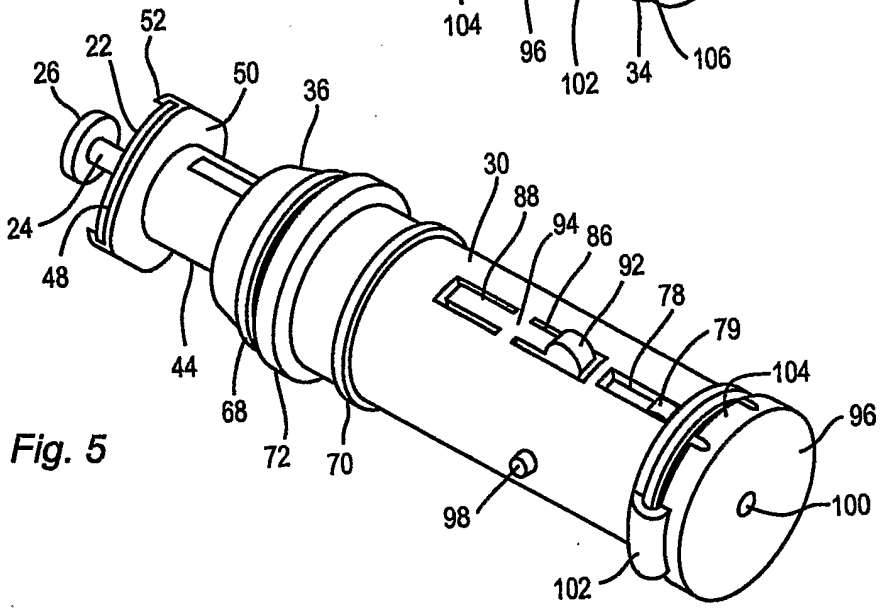

Fig. 5

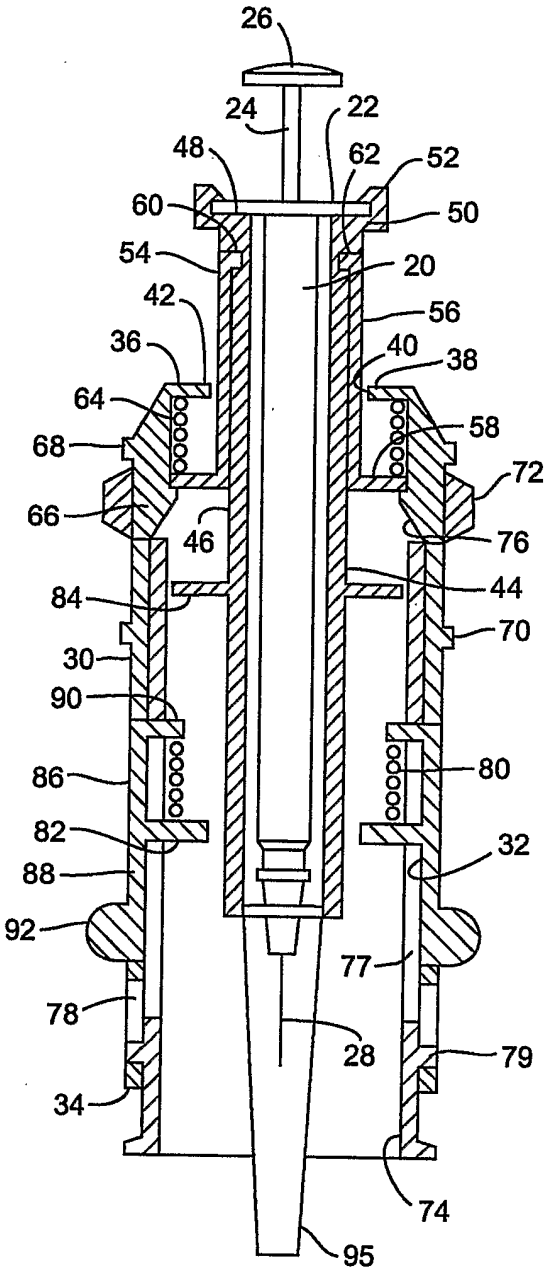
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Fig. 2

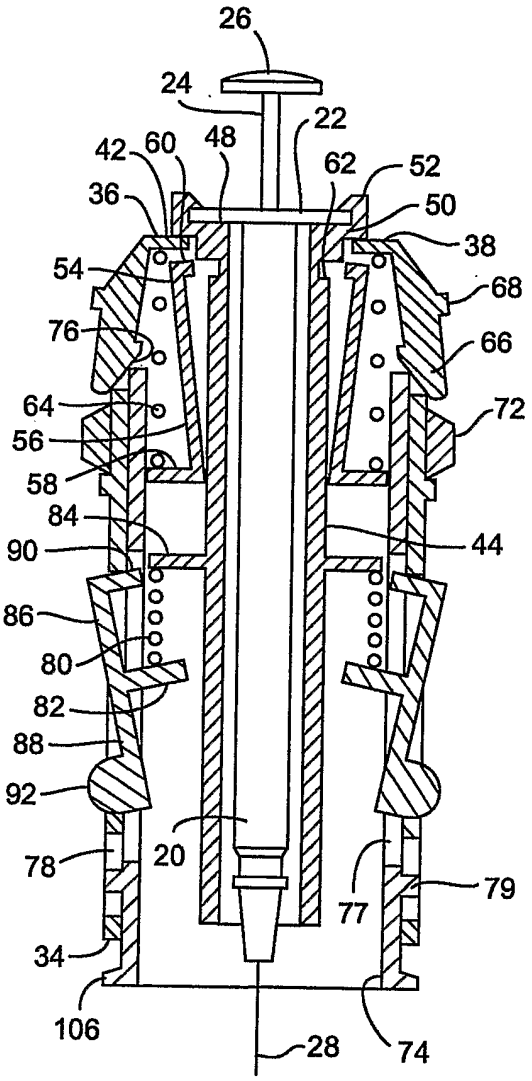
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Fig. 3

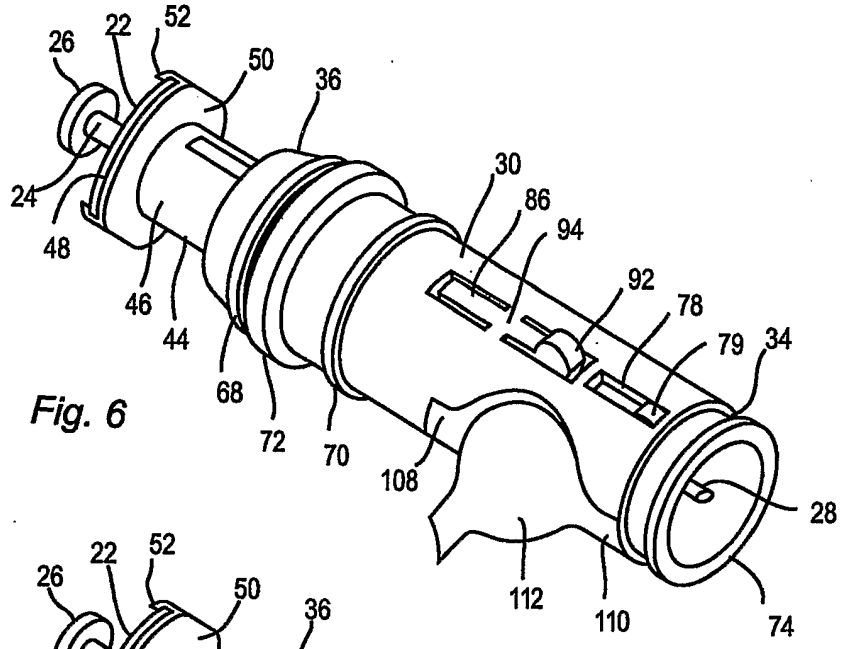
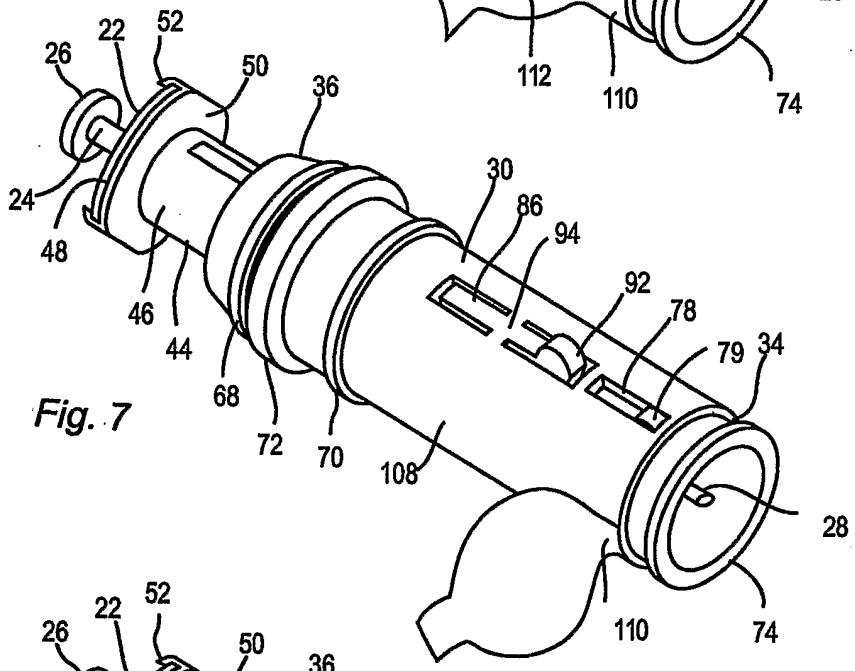


Fig. 6



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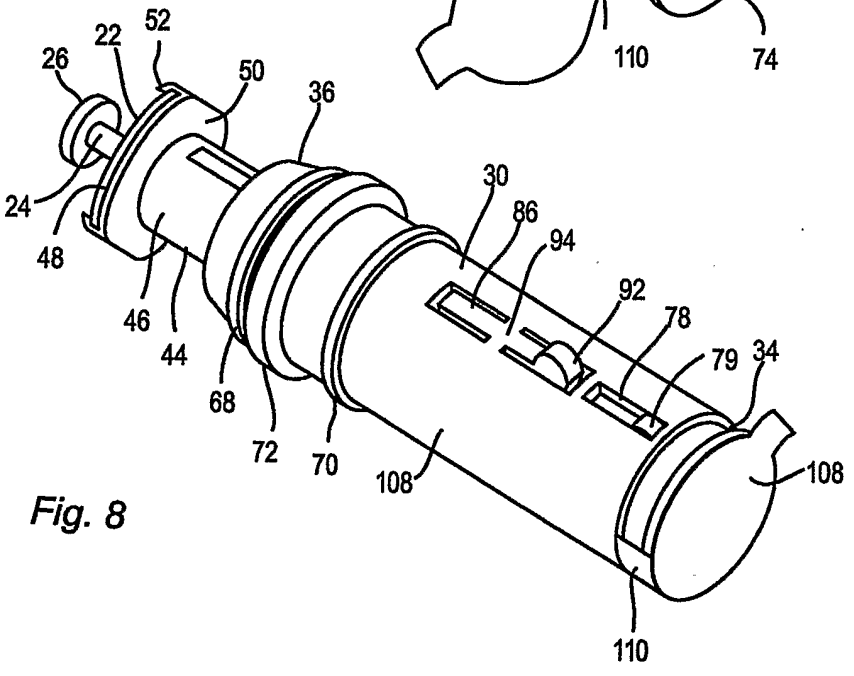

Fig. 8

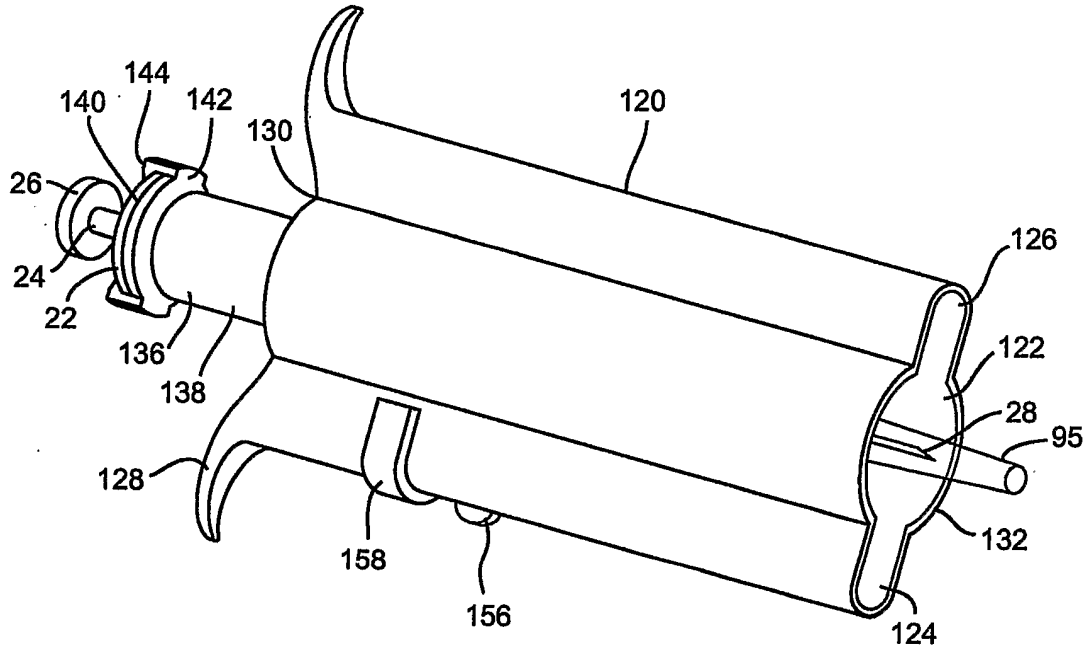
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Fig. 9

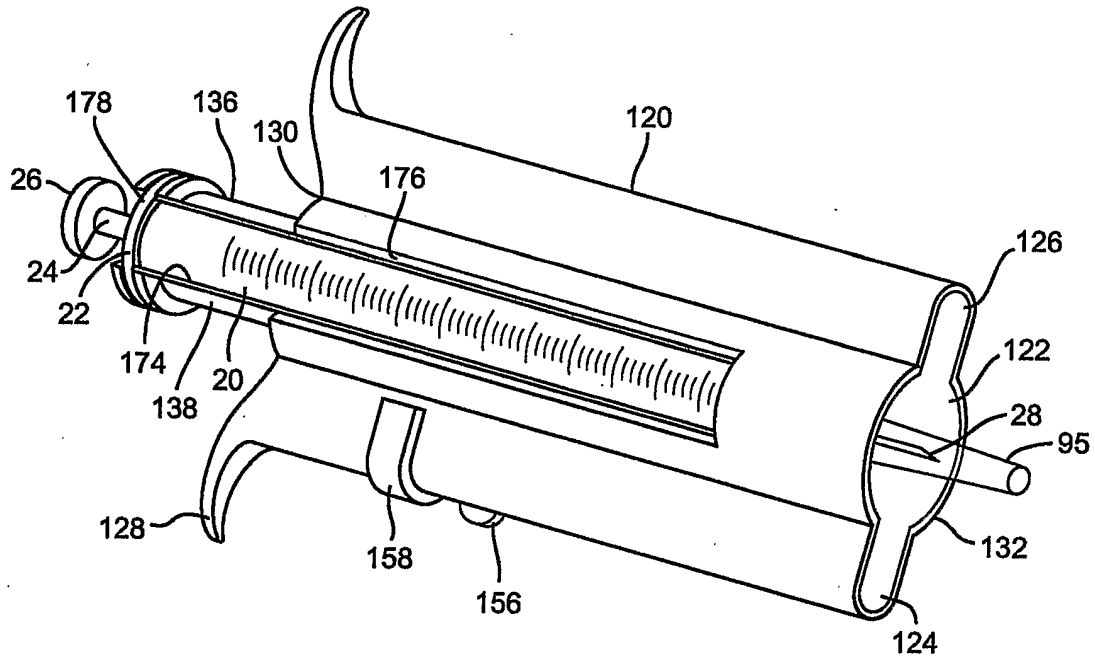
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Fig. 12

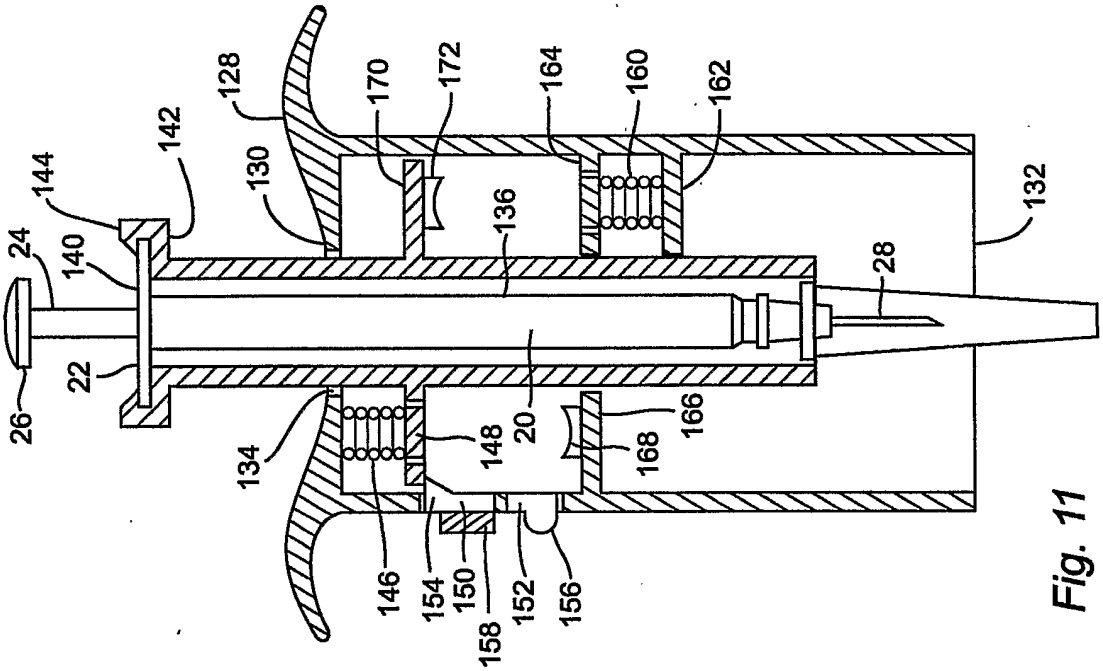
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Fig. 11

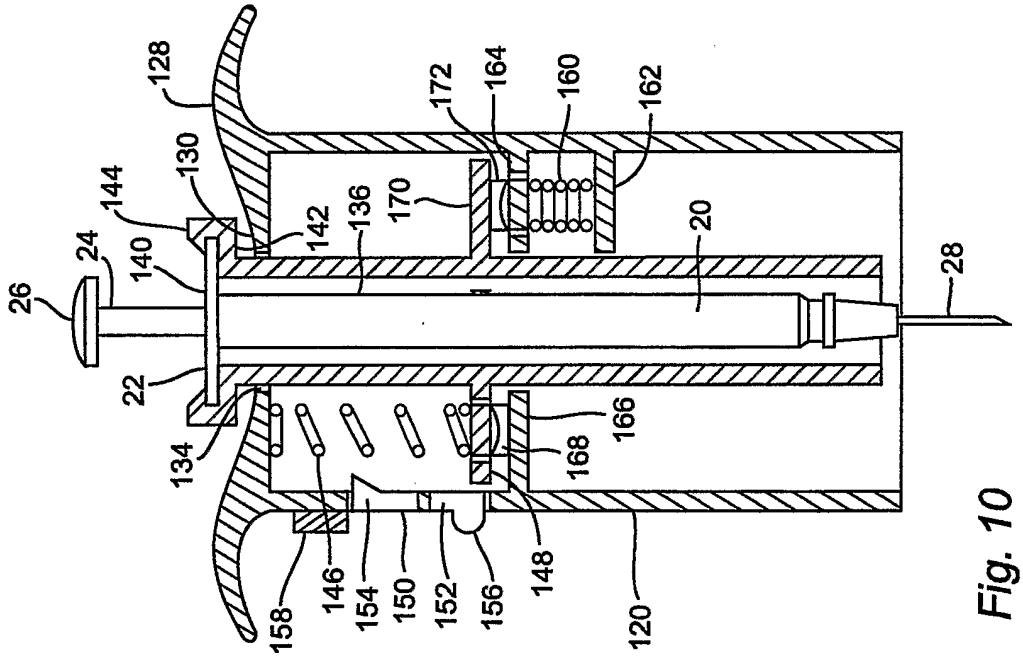
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Fig. 10

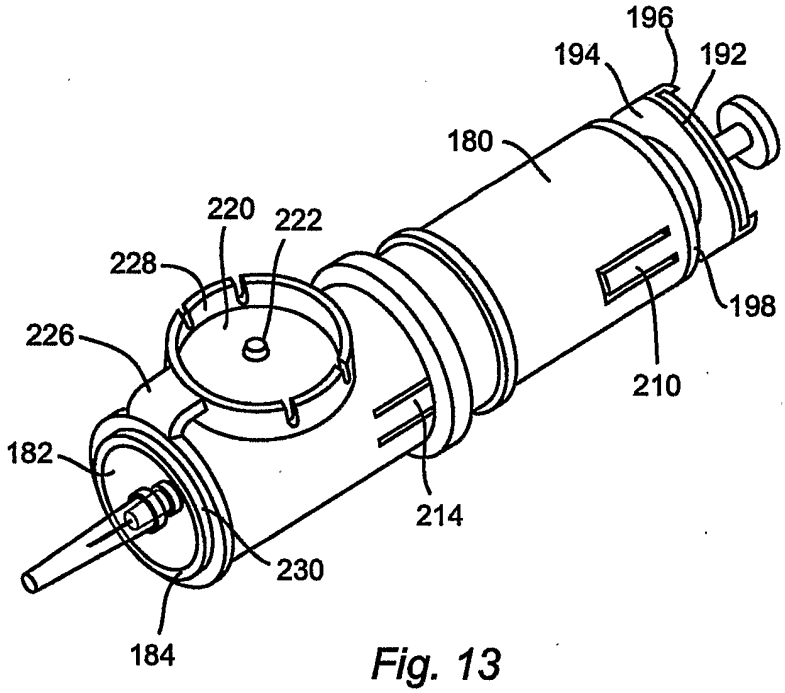
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Fig. 13

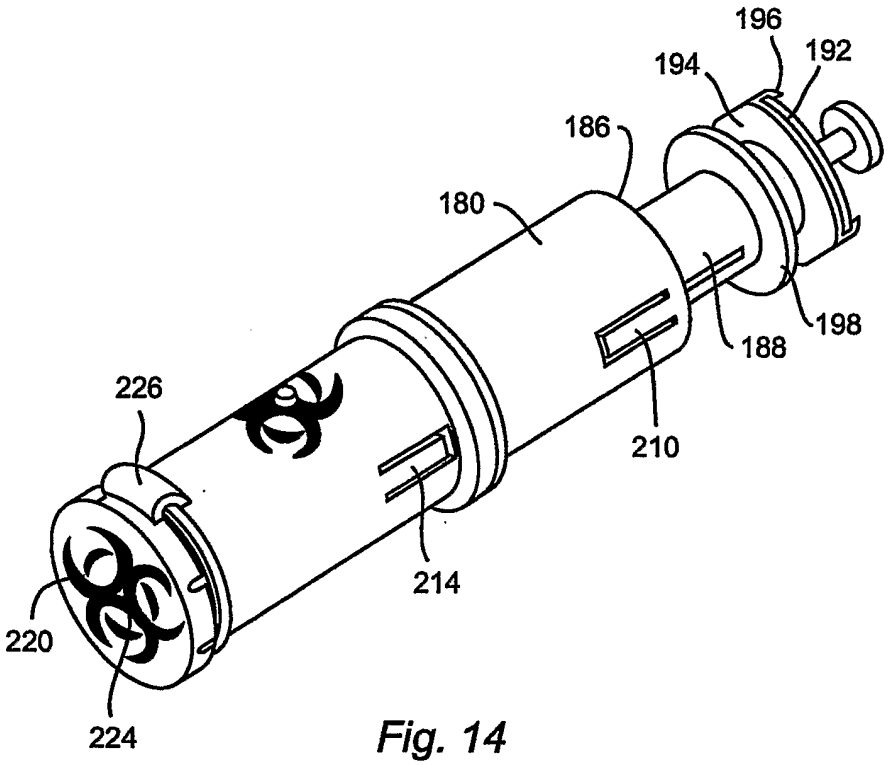
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Fig. 14

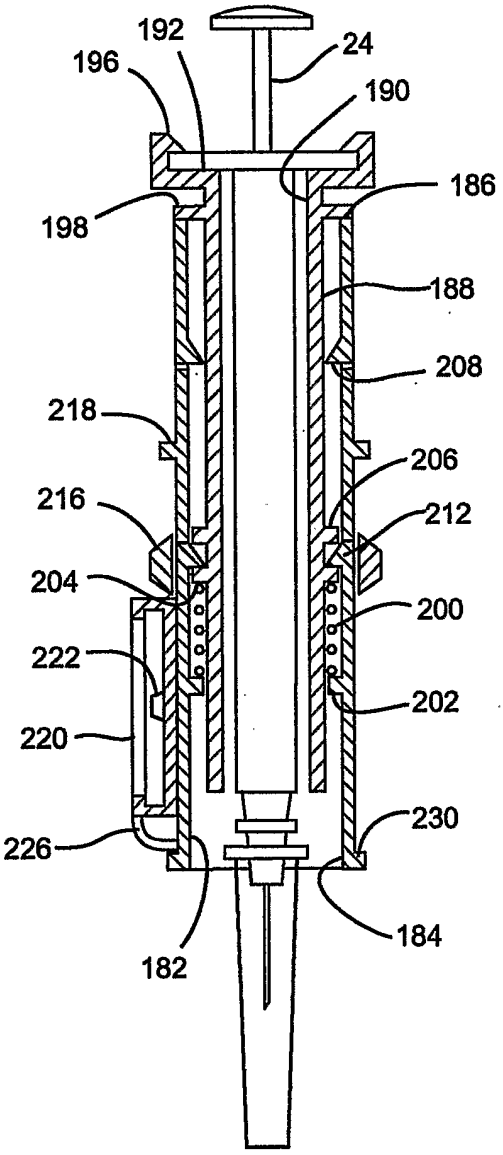
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Fig. 15

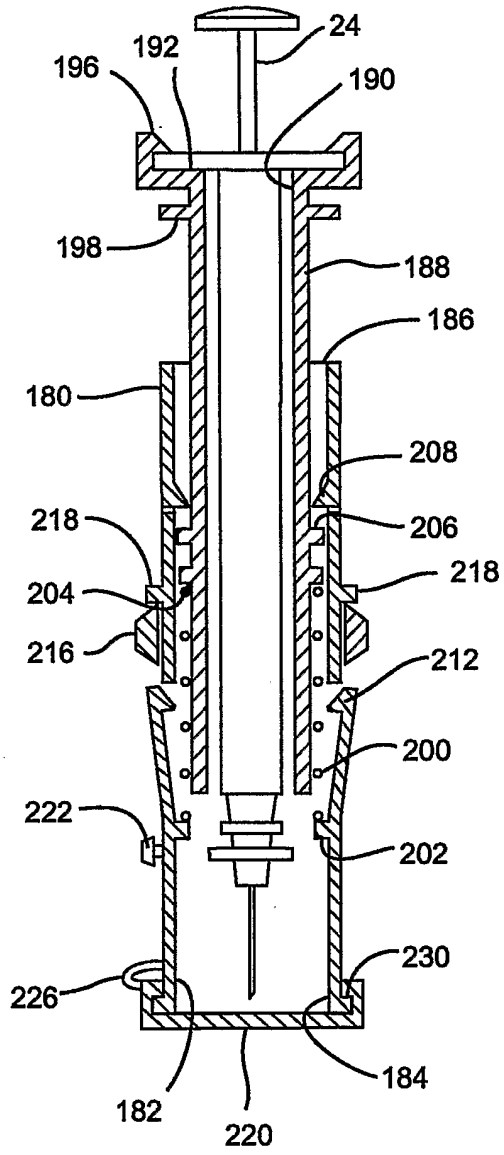
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Fig. 16