

NEEDLE-BASED DEVICE WITH A SAFETY MECHANISM IMPLEMENTED THEREIN

FIELD OF TECHNOLOGY

[0001] This disclosure relates generally to needle-based devices and, more particularly, to a needle-based device with a safety mechanism implemented therein.

BACKGROUND

[0002] A needle-based device may be a hypodermic syringe, a pen injector and/or a fluid collection device. Following a use of a needle thereof to inject a fluid (e.g., a medication) into a body of a patient or to extract another fluid therefrom, the needle may be covered with a cap for storage purposes. The needle may also be covered with the cap prior to the use thereof. Covering the needle with the cap and/or removing the cap of the needle may result in injuries to a user of the needle-based device. Some implementations of the needle-based device may employ a spring in a barrel of the needle-based device configured to enable retraction of the needle after use. However, a space in the barrel occupied by the spring may result in the needle-based device capable to taking in a lesser quantity of the fluid.

SUMMARY

[0003] Disclosed are methods, a device and/or a system of a needle-based device with a safety mechanism implemented therein.

[0004] In one aspect, a method includes protecting an entire length of a needle of a needle-based device protruding from a needle mount coupled to a body of the needle-based device based on providing a needle shield configured to completely encompass the entire protruding length of the needle in a first state of disuse of the needle-based device, and retracting the needle shield in a first direction toward the body of the needle-based device to cause the

needle to emerge out of the needle shield to prepare the needle-based device for a second state of use thereof.

[0005] The method also includes transitioning the needle-based device back to the first state of disuse thereof following the second state of use in accordance with a force applied in a second direction diametrically opposite to the first direction, and securedly maintaining the encompassing of the entire protruding length of the needle by the needle shield in the first state of disuse of the needle-based device based on coupling between the needle shield and the body of the needle-based device. Further, the method includes locking the needle shield with a lock button formed on the needle shield or external thereto in the first state of disuse of the needle-based device based on the lock button coupling to a groove formed on the needle shield or on an external cap.

[0006] In another aspect, a method includes protecting an entire length of a needle of a needle-based device protruding from a needle mount coupled to a body of the needle-based device based on providing a needle shield configured to completely encompass the entire protruding length of the needle in a first state of disuse of the needle-based device, additionally encompassing the entire protruding length of the needle of the needle-based device with a spring configured to rest on the needle mount on one end thereof in the first state of disuse of the needle-based device, and encompassing, through the needle shield, an entire length of the spring in addition to the entire protruding length of the needle in the first state of disuse of the needle-based device.

[0007] The method also includes retracting the needle shield in a first direction toward the body of the needle-based device to compress the spring and cause the needle to emerge out of the needle shield to prepare the needle-based device for a second state of use thereof, automatically transitioning the needle-based device back to the first state of disuse thereof following the second state of use based on decompression of the spring that provides for a force applied in a second direction diametrically opposite to the first direction, and securedly

maintaining the encompassing of the entire protruding length of the needle and the entire length of the spring by the needle shield in the first state of disuse of the needle-based device based on coupling between the needle shield and the body of the needle-based device. The second state of use of the needle-based device encompasses both drawing of a fluid and injection of the fluid via the needle-based device.

[0008] In yet another aspect, a method includes protecting an entire length of a needle of a needle-based device protruding from a needle mount coupled to a body of the needle-based device based on providing a needle shield configured to completely encompass the entire protruding length of the needle in a first state of disuse of the needle-based device, retracting the needle shield in a first direction toward the body of the needle-based device to cause the needle to emerge out of the needle shield to prepare the needle-based device for a second state of use thereof, and transitioning the needle-based device back to the first state of disuse thereof following the second state of use in accordance with a force applied in a second direction diametrically opposite to the first direction.

[0009] The body of the needle-based device is a barrel of a hypodermic syringe, a pen injector and/or a fluid collection device. The method also includes securedly maintaining the encompassing of the entire protruding length of the needle by the needle shield in the first state of disuse of the needle-based device based on coupling between the needle shield and the body of the needle-based device, and locking the needle shield with a lock button formed on the needle shield or external thereto in the first state of disuse of the needle-based device based on the lock button coupling to a groove formed on the needle shield or on an external cap.

[0010] Other features will be apparent from the accompanying drawings and from the detailed description that follows.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] The embodiments of this invention are illustrated by way of example and not limitation in the figures of the accompanying drawings, in which like references indicate similar elements and in which:

Figure 1 is a schematic view of a needle-based device, according to one or more embodiments.

Figure 2 is a schematic view of multiple configurations of a needle mount of the needle-based device of **Figure 1**, according to one or more embodiments.

Figure 3 is a schematic view of coupling of a needle shield to the needle-based device of **Figure 1** to encompass a needle thereof, according to one or more embodiments.

Figure 4 is a schematic view of the needle-based device of **Figure 1** with wings on lateral sides of an outer wall of a barrel thereof, according to one or more embodiments.

Figure 5 is a schematic view of the needle-based device of **Figure 1** with a ring on the outer wall of the barrel thereof, according to one or more embodiments.

Figure 6 is a schematic view of the needle-based device of **Figure 1** in a spring-based configuration of a needle shield thereof, according to one or more embodiments.

Figure 7 is a schematic view of an external cap configured to at least partially cover the needle shield of the needle-based device of **Figures 1** and **3**, according to one or more embodiments.

Figure 8 is a process flow diagram detailing the operations involved in implementing a security mechanism in the needle-based device of **Figure 1**, according to one or more embodiments.

Figure 9 is a schematic view of the spring-based embodiment of **Figures 6-7** with external cap, needle mount and needle shield thereof as modular elements.

Figure 10 is an illustrative view of retraction of the needle shield in the spring-based embodiment of **Figure 6**.

Figure 11 is a schematic view of a locking mechanism of a needle-based device in accordance with the embodiments of **Figures 6** and **7**, but as a variant thereof.

Figure 12 is a schematic view of an external lock button utilized in the needle-based device of **Figure 6**.

Figure 13 is an illustrative view of a safety mechanism of the needle-based device of **Figure 6**, with a longer needle mount.

[0012] Other features of the present embodiments will be apparent from the accompanying drawings and from the detailed description that follows.

DETAILED DESCRIPTION

[0013] Example embodiments, as described below, may be used to provide methods, a system and/or a device of a needle-based device with a safety mechanism implemented therein. Although the present embodiments have been described with reference to specific example embodiments, it will be evident that various modifications and changes may be made to these embodiments without departing from the broader spirit and scope of the various embodiments.

[0014] **Figure 1** shows a needle-based device 100, according to one or more embodiments. In one or more embodiments, needle-based device 100 may be a hypodermic syringe, a hypodermic needle, a pen injector, a blood collection device and/or a fluid injector/extractor. It should be noted that needle-based device 100 may not only be limited in use to medical applications but may also be used in biological applications and/or chemical applications. For example, needle-based device 100 may be used to extract a requisite quantity of a solvent/fluid from a vial/bottle. All reasonable applications are within the scope of the exemplary embodiments discussed herein.

[0015] In one or more embodiments, needle-based device 100 may include a plunger 102 configured to be moved in and out of a barrel 104 thereof. In one example implementation, barrel 104 may be cylindrical and plunger 102 may be appropriately designed (e.g., also

cylindrical) to enable slidable movement thereof within barrel 104 and in and out of barrel 104. In another example implementation, barrel 104 may be shaped like a square prism or a rectangular prism and plunger 102 may be appropriately shaped to enable the aforementioned slidable movement. All possible shapes and configurations of barrel 104 and plunger 102 that enable the slidable movement of plunger 102 within barrel 104 and in and out of barrel 104 are within the scope of the exemplary embodiments discussed herein.

[0016] In one or more embodiments, a base 106 of plunger 102 may enable a user 150 to press plunger 102 into barrel 104 using a thumb of a hand 152 thereof; base 106 may also enable user 150 to draw plunger 102 out of barrel 104 using the thumb and/or other fingers of hand 152. In one or more embodiments, user 150 may be able to use the other fingers (e.g., forefinger and middle finger) and, optionally, a palm of hand 152 to stabilize needle-based device 100 while utilizing the thumb to press plunger 102 into barrel 104; user 150 may hold needle-based device 100 through another hand (e.g., hand 154) and draw plunger 102 out of barrel 104 using the thumb and/or the other fingers of hand 152. The use of plunger 102 and barrel 104 are well known to one skilled in the art with respect to needle-based devices; detailed discussion thereof is, therefore, skipped for the sake of convenience, brevity and clarity.

[0017] It should be noted that, in all states of operation of needle-based device 100, at least some portion of plunger 102 (e.g., at least base 106) may be outside barrel 104. It should also be noted that at least some portion of plunger 102 may be inside barrel 104 in all states of operation of needle-based device 100. For example, an end of plunger 102 farthest away from an end thereof including base 106 may be a plunger head 108. In one or more embodiments, plunger head 108 may be inside barrel 104 in all states of operation of needle-based device 100. In one or more embodiments, as shown in **Figure 1**, a cross-sectional diameter of plunger head 108 may be less than a cross-sectional diameter of barrel 104, and a cross-sectional diameter of base 106 may be more than the cross-sectional diameter of

barrel 104. The aforementioned designs are crucial to enable plunger 102 to move within barrel 104 to perform functionalities associated with needle-based device 100. Without base 106, it may not be possible for a position of plunger head 108 within barrel 104 to be desirably controlled. Without plunger head 108, plunger 102 may fall out of barrel 104 in a vertical position of needle-based device 100 with base 106 at a bottom thereof. Also, a portion of barrel 102 between plunger head 108 and an end 110 of barrel 104 farthest away from base 106 may include a fluid drawn from a vial/bottle by needle-based device 100. Said portion may not be able to hold the fluid without plunger head 108.

[0018] **Figure 1** also shows a needle mount 112, according to one or more embodiments. In one or more embodiments, an end 114 of a needle 116 may be inserted into needle mount 112 (e.g., a needle hub) such that needle 116 protrudes from needle mount 112. In one or more embodiments, needle 116 may include a hollow (e.g., cylindrical) bore along a length thereof. In one or more embodiments, another end 118 of needle 116 may be beveled into a point. In one or more embodiments, end 118 of needle 116 may be configured to first touch a vial/bottle during extraction of a fluid therefrom or an arm of a patient during injection of the fluid therein. In one or more embodiments, needle mount 112, in turn, may be directly coupled to barrel 104 by way of end 110 thereof farthest from base 106. Thus, in an implementation where barrel 104 and plunger 102 together may form a syringe, needle mount 112 and, thereby, needle 116 may be attached to the syringe.

[0019] **Figure 2** shows multiple configurations of needle mount 112, according to one or more embodiments. In a first configuration, needle mount 112 may have a wing 202_{1,2} on each lateral side thereof in a direction approximately perpendicular to a length of barrel 104 when needle mount 112 is coupled to barrel 104. A portion 204 of needle mount 112 with no wings may be configured to be directly coupled (e.g., based on a screw mechanism) to barrel 104. In the first configuration, wings 202_{1,2} may be of uniform width. In a second configuration, again, needle mount 112 may have a wing 212_{1,2} on each lateral side thereof

in the direction approximately perpendicular to the length of barrel 104 when needle mount 112 is coupled to barrel 104. Again, in the second configuration, a portion 214 of needle mount 112 with no wings may be configured to be directly coupled (e.g., based on a screw mechanism) to barrel 104. However, unlike the first configuration, wings 212₁₋₂ may be only partially of uniform width, only to then taper off to a reduced width (or no width).

[0020] **Figure 3** shows coupling of a needle shield 302 to needle-based device 100 to encompass needle 116 thereof, according to one or more embodiments. Here, in one or more embodiments, needle shield 302 may be cylindrical or shaped like a rectangular prism/square prism based on the design of needle mount 112 and/or barrel 104. Additionally, in one or more embodiments, needle shield 302 may be hollow to enable encompassing the protruding needle 116 therewithin. In one or more embodiments, an outer wall 304 of barrel 104 proximate end 110 may have a connector 306 thereon to enable an end 308 of needle shield 302 to clasp onto connector 306 while needle shield 302 completely encompasses the protruding needle 116 therewithin. In one or more embodiments, an inner cross-sectional diameter of needle shield 302 may be more than an outer cross-sectional diameter of needle mount 112 and an outer cross-sectional diameter of barrel 104 to enable the sliding of needle shield 302 over needle mount 112 and barrel 104.

[0021] In one or more embodiments, needle shield 302 may first receive the protruding needle 116 on needle mount 112 through end 308 thereof. In one or more embodiments, needle shield 302 may then be slid over needle mount 112 until end 308 clasps onto connector 306 on outer wall 304 of barrel 104. In the state of needle shield 302 completely encompassing the protruding needle 116, the other end (e.g., end 310) of needle shield 302 may completely enclose end 118 of needle 116. **Figure 3** shows needle shield 302 to be transparent (e.g., needle shield 302 may be made of plastic, glass etc.). However, it should be noted that needle shield 302 may be translucent or opaque in certain embodiments. Here, the outer wall of needle shield 302 may include cuts (not shown) that reveal needle 116 while

needle 116 is still protected by needle shield 302. All reasonable variations are within the scope of the exemplary embodiments discussed herein.

[0022] In one or more embodiments, the sliding of needle shield 302 over needle mount 112 may be facilitated by wings 202₁₋₂ on needle mount 112. For the aforementioned purpose, optionally, grooves 312₁₋₂ may be provided on an inner wall 314 of needle shield 302. In one or more embodiments, wings 202₁₋₂ of needle mount 112 may be received within grooves 312₁₋₂ during relative sliding of wings 202₁₋₂ with respect to grooves 312₁₋₂. While **Figure 3** shows grooves 312₁₋₂ as cutting across inner wall 314 of needle shield 302 into an entire thickness thereof, it should be noted that grooves 312₁₋₂ may not cut across inner wall 314 of needle shield 302 completely in one or more alternative embodiments. In one or more embodiments, needle shield 302 may slide until reception thereof within connector 306. In one or more embodiments, connector 306 may be a flexible pair of flaps 316₁₋₂ forming a groove 318₁₋₂ to receive end 308 of needle shield 302 therewithin.

[0023] Thus, in one or more embodiments, user 150 may cover needle 116 with needle shield 302 for temporary protection (e.g., for transportation to a site of a patient). In one or more embodiments, needle 116 may be covered using needle shield 302 also after use thereof. In one or more embodiments, the covering of needle 116 with needle shield 302 may not only protect needle 116 but also prevent undesirable accidents arising out of unwanted contact therewith. In one or more embodiments, in order to enable injection of a fluid (e.g., a medication) into a body of a patient, needle 116 may be uncovered based on pushing needle shield 302 further downward. In one or more embodiments, as connector 306 may be flexible, user 150 may be able to apply enough downward pressure to enable end 308 of needle shield 302 to pop out of grooves 318₁₋₂ of connector 306 and slide further downward along barrel 104. In one or more embodiments, during the course of needle shield 302 sliding further downward along barrel 104, needle 116 pops out of end 310 of needle shield 302 such that needle 116 is uncovered.

[0024] In one or more embodiments, needle shield 302 may indirectly move further downward along barrel 104 when user 150, after drawing plunger 102 outward from barrel 104, places needle shield 302 against a cap of a vial or a bottle and pushes barrel 104 inward toward the vial or the bottle. In one or more embodiments, this may automatically cause end 308 of needle shield 302 to pop out of grooves 318₁₋₂ of connector 306 and slide further downward along barrel 104, thereby uncovering needle 116. In one or more embodiments, user 150 may hold needle shield 302 to maintain a position thereof in which needle 116 is exposed to inject a fluid (e.g., medication) into a body of a patient or extract blood therefrom. In one or more embodiments, once the task is done, a force may be applied in an opposite direction on needle shield 302 by user 150 to restore a state of complete encompassment of needle 116 by needle shield 302.

[0025] Thus, in one or more embodiments, needle-based device 100 may be provided with needle shield 302 configured to protect needle 116 in a state of disuse thereof (e.g., storage, transportation, post-injection of a fluid, post-collection of a fluid) and to be retractable to reveal needle 116 for use (e.g., injection of a fluid, collection of a fluid) thereof. It should be noted that while **Figures 2** and **3** show wings (202₁₋₂, 212₁₋₂) on lateral sides of needle mount 112, it is possible that wings may be present on lateral sides of barrel 104 instead in one or more alternative embodiments. Here, in one or more embodiments, needle mount 112 may be smaller in size and plainer.

[0026] **Figure 4** shows needle-based device 100 with wings 402₁₋₂ on lateral sides of barrel 104 on outer wall 304 thereof proximate end 110, according to one or more embodiments. Here, in one or more embodiments, needle shield 302 may slide over wings 402₁₋₂ to lock onto connector 306 on outer wall 304 to shield needle 116. In one or more embodiments, needle shield 302 may be pushed further downward along barrel 104, thereby uncovering/revealing needle 116, based on pressure applied to needle shield 302 such that end 308 pops out of connector 306. Again, in one or more embodiments, needle shield 302

may be pulled back to a position in which needle shield 302 completely encompasses the protruding needle 116.

[0027] It is to be noted that while **Figure 4** shows wings 402₁₋₂ in a configuration similar to the first configuration thereof in needle mount 112 of **Figure 2**, wings 402₁₋₂ may also be in a configuration similar to the second configuration thereof in needle mount 112 of **Figure 2**. Further, all reasonable variations that allow for relative movement between needle shield 302 and needle mount 112/barrel 104 are within the scope of the exemplary embodiments discussed herein. In **Figure 4**, needle mount 112 may be smaller than the embodiments of **Figures 2-3** because of the absence of wings thereon.

[0028] Referring back to **Figure 3**, it should be noted that configuration of wings 202₁₋₂ therein may, again, not be limited. It may be possible for wings 212₁₋₂ to be on lateral sides of needle mount 112 instead of wings 202₁₋₂. Further, as discussed above, grooves 312₁₋₂ may not completely cut across inner wall 314 of needle shield 302. In this embodiment, wings 212₁₋₂ may be received within grooves 312₁₋₂ and may slide relatively thereto. Here, the tapering on wings 212₁₋₂ may enable needle shield 302 to be locked onto needle mount 112/barrel 104, without a requirement of connector 306. Again, needle shield 302 may be pushed downward to reveal/uncover needle 116, as discussed above. Needle shield 302 may then be manually restored to an original position thereof in which needle shield 302 completely encompasses the protruding needle 116.

[0029] **Figure 5** shows needle-based device 100 with a ring 502 on outer wall 304 of barrel 104 proximate end 110, according to one or more embodiments. Here, needle mount 112 may be in the same configurations as in **Figures 2-3**; alternatively, needle mount 112 may be smaller and without any wings thereon. In one implementation, ring 502 (e.g., of uniform thickness) may protrude from outer wall 304 of barrel 104; in addition, an underside of ring 502 may have a groove 504 complementary to a protrusion 506 on end 308 of needle shield 302. Again, needle shield 302 may first receive needle 116 on needle mount 112 through

end 308 thereof. Needle shield 302 may be moved downward toward barrel 104 such that, after a point, protrusion 506 of needle shield 302 locks onto groove 504 of ring 502. In this state, needle shield 302 may completely encompass the protruding needle 116 therewithin.

[0030] In one or more embodiments, ring 502 may be made of a flexible material. Also, in one or more implementations, while ring 502 may change shape due to flexibility thereof, ring 502 may not change a position thereof along barrel 104. In one or more embodiments, an appropriate downward pressure (e.g., by user 150) may enable protrusion 506 to pop out of groove 504 and cause needle shield 302 to go further downward along barrel 104. In one or more embodiments, this may uncover/reveal needle 116 for use on a patient (e.g., to extract blood, to inject a fluid, to prick a finger) or on a vial/bottle (e.g., to extract a fluid). In one or more embodiments, following use of needle 116, an upward pressure may be applied to enable protrusion 506 to once again lock into groove 504 to enable needle shield 302 completely encompass needle 116 again.

[0031] The ring (e.g., ring 502) embodiment of **Figure 5** is merely an example embodiment. Other embodiments involving rings that facilitate covering of needle 116 and uncovering thereof are within the scope of the exemplary embodiments discussed herein. In one or more embodiments, wings (202₁₋₂, 212₁₋₂) on needle mount 112 may further aid the locking/unlocking/relocking of needle shield 302 at/from appropriate positions. All reasonable variations are within the scope of the exemplary embodiments discussed herein.

[0032] **Figure 6** shows needle-based device 100 in a spring-based configuration of needle shield 302, according to one or more embodiments. Here, in one or more embodiments, needle mount 112 with wings 212₁₋₂ may be directly inserted into barrel 104 via end 110 farthest from base 106. In one example implementation, barrel 104 may have grooves (not shown) on an inside wall thereof proximate end 110 onto which needle mount 112 may be screwed. Other forms of coupling needle mount 112 to barrel 104 are within the scope of the exemplary embodiments discussed herein. In one or more embodiments, barrel 104 may

have a ring 602 (e.g., analogous to ring 502, but may be structurally different; ring 602 may be made of flexible material) formed on outer wall 304 thereof proximate end 110. In some embodiments, ring 602 may be integrally formed with barrel 104, while in some other embodiments, ring 602 may be an element separate from barrel 104.

[0033] In one or more embodiments, a spring 604 may be placed over needle mount 112 such that spring 604 encompasses the protruding needle 116 along an entire length thereof. In one or more embodiments, now when spring 604 encompassing needle 116 is received within needle shield 302 through end 308 thereof and needle shield 302 is moved downward toward barrel 104, end 308 of needle shield 302 may press against ring 602. In one or more embodiments, further application of pressure (e.g., through hand 152 of user 150) may compress ring 602 and push ring 602 inside end 308 to be received within needle shield 302. In one or more embodiments, in this state, needle shield 302 may completely encompass the protruding needle 116 and spring 604.

[0034] In one or more embodiments, when no further external pressure is applied, needle shield 302 may comfortably shield the protruding needle 116 and spring 602. In one or more embodiments, although ring 602 may not lock needle shield 302 in a position, needle shield 302 may be prevented from falling outward when needle-based device 100 is flipped over because a cross-sectional inner diameter of ring 602 may be more than a cross-sectional inner diameter of end 308. In one or more embodiments, needle shield 302 may be hollow. In one or more embodiments, further, a cross-sectional inner diameter of end 310 of needle shield 302 farthest away from end 308 may be smaller than a cross-sectional diameter of spring 604. Thus, in one or more embodiments, needle shield 302 may be prevented from falling downward by spring 604 when needle-based device 100 is held in an upright position.

[0035] In one or more embodiments, if spring 604 were not present, needle shield 302 may slip and fall downward. However, in one or more embodiments, upon further application of pressure in a downward direction toward barrel 104 by user 150 or by pressing end 310 of

needle shield 302 against a surface (e.g., an arm of a patient, a cap of a vial/bottle) that exerts a normal reaction in the downward direction, needle shield 302 moves in the downward direction along barrel 104, thereby compressing spring 604 also in the same direction to uncover/reveal needle 116. In one or more embodiments, the uncovered/revealed needle 116 may then be utilized appropriately (e.g., for injecting a fluid into a patient, for pricking a finger/body part of the patient, for pricking a cap of a vial/bottle). Following use of needle 116, the force along the direction of compression of spring 604 may be relaxed (e.g., by taking needle-based device 100 out of the surface, user 150 stopping the application of pressure in the downward direction) to enable spring 604 revert to an uncompressed version thereof; in the uncompressed state of spring 604, needle shield 302 may once again completely encompass the protruding needle 116 and spring 604.

[0036] In the scenario of injecting a fluid into the body of a patient, needle-based device 100 may first be placed against a cap of a vial/bottle from which the fluid is to be extracted. When end 310 is pressed against the cap, the normal reaction from the cap pushes needle shield 302 downward, thereby compressing spring 604. The downward movement of needle shield 302 and the compression of spring 604 exposes needle 116 that pricks the cap. Plunger 102 may also be pushed in by way of user 150 pressing base 106 in an upward direction toward needle mount 112 such that plunger head 108 contacts needle mount 112. Now, pulling plunger 102 back may create a gap between needle mount 112 and plunger head 108. Said gap may constitute a low pressure region, thereby enabling the fluid to fill the gap by way of gushing in through the hollow needle 116.

[0037] Now, the desired quantity of the fluid may be filled in the gap. The gap may be controlled based on graduated marks (e.g., shown as graduated marks 606) on barrel 104. Once the desired quantity of fluid is available in the gap, user 150 may take needle-based device 100 out of the vial/bottle, thereby decompressing spring 604 to restore spring 604 to the original shape thereof. User 150 may then place end 310 of needle shield 302 against

the arm of a patient, which, again, compresses spring 604 as discussed above, and exposes needle 116. The exposed needle 116 may prick a skin of the patient; the pressing of base 106 may compress a volume of the gap, thereby creating a high pressure region therein. The fluid may be squeezed through the hollow needle 116 into the body of the patient.

[0038] Once the fluid is injected into the body of the patient, needle-based device 100 may be extracted out of the arm of the patient. This decompresses spring 604 and restores needle shield 302 to the position in which needle shield 302 completely encompasses the exposed needle 116 and spring 604. Needle-based device 100 may also be employed to prick a finger tip of the patient to extract blood or to extract another fluid from a bottle/vial; additionally, needle-based device 100 may be used to extract venom from a body portion of a mammal. The details with respect to the figures discussed above make the aforementioned uses obvious. All reasonable variations are within the scope of the exemplary embodiments discussed herein.

[0039] With respect to **Figure 6**, it is obvious that needle shield 302 may be retracted to reveal needle 116 and released to close needle 116 at will. Also, wings 212₁₋₂ on needle mount 112 may aid the secure coupling between needle shield 302 and barrel 104. It is possible to envision the embodiment of **Figure 6** without wings 212₁₋₂. To summarize, the embodiment of **Figure 6** may be employed in two distinct modes of operation with respect to the use of needle-based device 100 where needle shield 302 is retracted to compress spring 604 and to reveal needle 116. In one or more embodiments, the first distinct mode of operation of use of needle-based device 100 may be the extraction of a fluid from a vial/bottle or a body (e.g., arm) of a mammal (e.g., a human), and the second distinct mode of operation of use of needle-based device 100 may be the injection of said fluid into the body of the mammal or a body of another mammal. No current solutions exist where an analogous needle is shielded and exposed for use during both the extraction of a fluid and the injection thereof. Yet another mode of operation of the embodiment of **Figure 6** may be related the

state of disuse of needle-based device 100 where needle 116 is completely shielded/encompassed by spring 604 and needle shield 302.

[0040] **Figure 7** shows an external cap 702 configured to at least partially cover needle shield 302, according to one or more embodiments. In one or more embodiments, external cap 702 may be made of a transparent (e.g., plastic, glass), a translucent (e.g., rubber) or an opaque material to cover the slits and cuts on needle shield 302. In one or more embodiments, an outer surface 704 of external cap 702 may have a groove 706 therein. Correspondingly, in one or more embodiments, needle shield 302 may have a lock button 708 on an outer surface thereof. In one or more embodiments, lock button 708 of needle shield 302 may be configured to be received into groove 706 on external cap 702 to lock needle-based device 100 (e.g., in a state of disuse thereof).

[0041] In one or more embodiments, the use of external locking may prevent reuse of needle-based device 100, or at least needle 116 therein. Although **Figure 7** shows needle shield 302 as covering needle 116 and spring 604, concepts associated with the external locking may also be applicable across the embodiments of **Figures 1-5**. In one or more embodiments, the external locking may prevent movement of needle shield 302, which, in turn, prevents reuse of needle-based device 100. Alternatively, needle shield 302 itself may include both lock button 708 and groove 706. Here, locking may be done merely using elements of needle shield 302. In another alternative implementation, lock button 708 may be external to needle shield 302. For example, lock button 708 may be on external cap 702 and groove 706 may be on needle shield 302. Here, lock button 708 of external cap 702 may be received within groove 706 of needle shield 302.

[0042] In yet another alternative implementation, external cap 702 may cover lock button 708 of needle shield 302 to prevent premature/accidental locking during transportation or handling of needle-based device 100. In one example implementation, external cap 702 may

be designed like a pen cap. Other configurations of external cap 702 are within the scope of the exemplary embodiments herein.

[0043] Thus, exemplary embodiments discussed above provide for safety mechanisms with respect to needle-based device 100. The manual shielding available in typical syringes may require capping a needle after use thereof. The capping and uncapping may cause needle injuries to a user. Additionally, in a spring-based typical implementation of a syringe that allows for a needle to be retracted therewithin, some space may be reserved in a barrel for the spring. This may result in loss of space for medication. The automatic retraction of needle shield 302 in the exemplary embodiments discussed herein may also allow for one-handed operation of needle-based device 100. All reasonable variations are within the scope of the exemplary embodiments discussed herein.

[0044] It should be noted that exemplary embodiments discussed above have been placed in the context of a hypodermic syringe and needle 116, with barrel 104 and plunger 102. However, concepts associated with the exemplary embodiments discussed herein are applicable across embodiments where needle mount 112 is coupled to a body (alternative to barrel 104) of needle-based device 100 and needle 116 protrudes from needle mount 112. In one or more embodiments, needle shield 302 may encompass the protruding needle 116 in a state of operation; needle shield 302 may be retracted to reveal/uncover needle 116. In one or more embodiments, needle shield 302 may also be protected through external cap 702, as discussed above. All reasonable variations in and combinations of the exemplary embodiments discussed with respect to **Figures 1-7** are within the scope of the exemplary embodiments discussed herein.

[0045] **Figure 8** shows a process flow diagram detailing the operations involved in implementing a security mechanism in a needle-based device (e.g., needle-based device 100), according to one or more embodiments. In one or more embodiments, operation 802 may involve protecting an entire length of a needle (e.g., needle 116) of the needle-based

device protruding from a needle mount (e.g., needle mount 112) coupled to a body (e.g., barrel 104) of the needle-based device based on providing a needle shield (e.g., needle shield 302) configured to completely encompass the entire protruding length of the needle in a first state of disuse of the needle-based device. In one or more embodiments, operation 804 may involve retracting the needle shield in a first direction toward the body of the needle-based device to cause the needle to emerge out of the needle shield to prepare the needle-based device for a second state of use thereof.

[0046] In one or more embodiments, operation 806 may involve transitioning the needle-based device back to the first state of disuse thereof following the second state of use in accordance with a force applied in a second direction diametrically opposite to the first direction. In one or more embodiments, operation 808 may then involve securedly maintaining the encompassing of the entire protruding length of the needle by the needle shield in the first state of disuse of the needle-based device based on coupling between the needle shield and the body of the needle-based device.

[0047] **Figure 9** shows the spring-based embodiment of **Figures 6-7** with external cap 702, needle mount 112 and needle shield 302 as modular elements. In one or more embodiments, as clearly indicated by **Figures 6** and **9** and as discussed above, needle shield 302 may be mounted onto barrel 104 (body of needle-based device 100) directly or, for example, through the user of a connector (such as ring 602) such that needle shield 302 encompasses both spring 604 and needle 116. As discussed with reference to **Figure 6**, the relative cross-sectional areas/diameters of needle mount 112, needle shield 302 and ring 602 may automatically enable protection of needle 116 and prevent accidental sticks caused by needle 116 otherwise. It should be noted that there may be snaps (not shown) formed on barrel 104 (or body of needle-based device 100) to enable direct coupling of needle shield 302 thereonto.

[0048] **Figure 10** shows retraction of needle shield 302 in the spring-based embodiment of **Figure 6**, according to one or more embodiments. As discussed above, once pressure is applied in a downward direction toward barrel 104 by user 150 or by pressing end 310 of needle shield 302 against a surface (e.g., an arm of a patient, a cap of a vial/bottle), needle shield 302 moves in the same downward direction, thereby compressing spring 604 as shown in **Figure 10**. **Figure 11** shows a locking mechanism 1100 of needle-based device 100 in accordance with the embodiments of **Figures 6 and 7**, but as a variant thereof. Here, in one or more embodiments, locking mechanism 1100 may include a lock button 1102 (analogous to lock button 708) on needle shield 302; however, here, lock button 1102 may have a hook 1104 thereon configured to get between coils 1106 of spring 604 and lock thereonto (e.g., by catching spring wire(s)), as shown in **Figure 11**; for the aforementioned purpose, needle shield may have a groove 1108 on an outer wall thereof through which hook 1104 passes to lock into coils 1106 of spring 604. This increases the lock force compared to the lock force in the embodiment of **Figure 7**, where lock button 708 engages with external cap 702 instead.

[0049] As discussed above, other possible embodiments include lock button 708 being a separate element that engages with needle shield 302 or both with needle shield 302 and spring 604. **Figure 12** shows an external lock button 1202 (e.g., part of locking mechanism 1200) that is configured to engage both with a groove 1204 on needle shield 302 (e.g., by way of a hook 1208 on external lock button 1202) and coils 1106 (e.g., through groove 1108 by way of another hook 1206 on external lock button 1202) of spring 604. Again, the embodiment context of external lock button 1202 is similar to that of **Figure 6**. In one or more embodiments, spring 604 discussed above may be a separate element or integrated with needle mount 112 discussed above or needle shield 302. In one or more embodiments, spring 604 may be a metal spring or molded spring. In one or more embodiments, needle shield 302 across all embodiments, along with other elements such as needle mount 112 and spring

604, may be sold as a safety mechanism distinct from a syringe or another form of needle-based device 100.

[0050] **Figure 13** shows the embodiment of **Figure 6**, but with a longer needle mount 112. Here, needle mount 112 may be longer such that ring 602 may be formed thereon instead of barrel 104. Thus, needle 116 with needle mount 112 and needle shield 302 may be sold as a separate safety mechanism 1300 distinct from needle based device 100. It should be noted that the manual embodiment of **Figure 3** also can include the lock mechanisms (e.g., those of **Figure 7** and **Figures 11-12** (without catching wires of spring 604 as spring 604 does not exist in the embodiment of **Figure 3**); it is easy to envision the embodiment of **Figure 7** without spring 604) discussed herein. All reasonable variations are within the scope of the exemplary embodiments discussed herein. Also, it should be noted that mechanisms of injection of a fluid into a body of a mammal and extraction of a fluid from a vial/bottle/body of the mammal are known to one skilled in the art, especially with regard to needle-based device 100. Detail discussion and illustration thereof are, therefore, skipped for the sake of convenience and clarity.

[0051] Although the present embodiments have been described with reference to specific example embodiments, it will be evident that various modifications and changes may be made to these embodiments without departing from the broader spirit and scope of the various embodiments. Accordingly, the specification and drawings are to be regarded in an illustrative rather than a restrictive sense.