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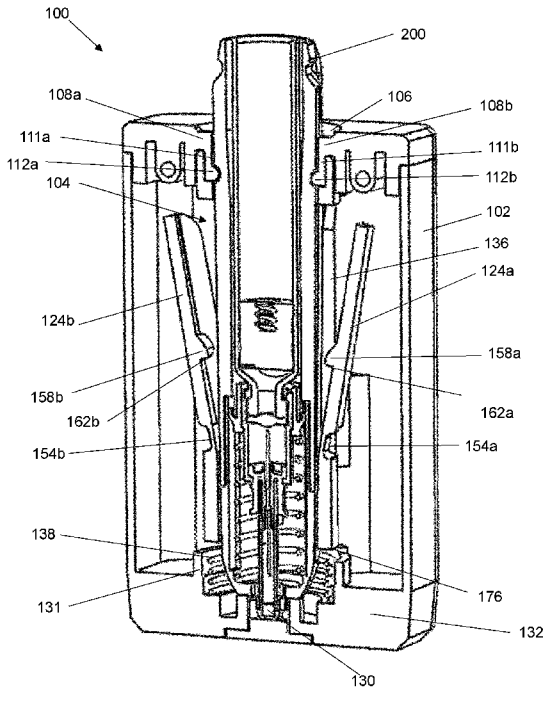


Fig. 2

(57) Abstract: An apparatus (100) for storing, in both an unused and a used state, a cartridge (200) for delivering an injectable medication (204), the cartridge (200) being attachable to and detachable from a drive mechanism (300). The apparatus (100) comprises a receptacle (102) and a latching mechanism (104). The latching mechanism (104) is configured to facilitate unlatching of the cartridge (200) in an unused state upon engagement of a part of the drive mechanism (300) with the receptacle (102) and coupling of the drive mechanism (300) to the cartridge (200); upon removal of the cartridge (200) from the receptacle (102), move to a re-latching configuration; and receive the cartridge (200) in a used state, wherein said re-latching configuration latches the cartridge (200) within the receptacle (102) whilst substantially preventing its further removal by the drive mechanism (300).

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Syringe apparatus

Technical field

The invention relates to an apparatus for storing, in both an unused and a used state, a cartridge for delivering an injectable medication.

Background

Injection devices, in particular auto-injectors, are commonly used to self-administer injections of medicament. Such auto-injectors may comprise a drive mechanism configured to receive or couple to a syringe or cartridge containing an injectable medication. The drive mechanism may then drive a plunger into the syringe or cartridge in order to deliver the medication. Prior to this delivery, the auto-injector may facilitate the insertion of the needle into the injection site.

Injection devices, such as auto-injectors, may be disposable or re-usable. Disposable devices are intended for single use only. A user may use the disposable device once in order to inject the medication into an injection site, and after the medication has been delivered, the device cannot be re-used. As such, the user would need to use a new device for a subsequent injection of medication.

Re-usable devices allow the user to use the same device multiple times, for subsequent medication deliveries. While re-usable devices can be more cost effective, reduce waste and reduce the volume of storage needed, often these devices are more complex to use that disposable devices and require longer set up times in order to prime them for use. This is because before the user can re-use the device, they are typically required to open the device, arm/prime it for re-use, insert a new syringe/cartridge with a new dose of medication into the device, and then close the device.

In contrast, disposable devices are ready-to-use and provided with the syringe or cartridge containing the injectable medication already installed. As such, disposable devices typically only require the user to remove the device from its packaging before

use, and therefore there are fewer steps that the user needs to take in order to use the device.

There exists a need to reduce the complexity of disposable injection devices and reduce the burden placed on the user when re-using disposable devices.

Summary

According to the invention in a first aspect, there is provided an apparatus for storing, in both an unused and a used state, a cartridge for delivering an injectable medication, the cartridge being attachable to and detachable from a drive mechanism, the apparatus comprising: a receptacle; a latching mechanism configured to: facilitate unlatching of the cartridge in an unused state upon direct or indirect engagement of a part of the drive mechanism with the receptacle and coupling of the drive mechanism to the cartridge; upon removal of the cartridge from the receptacle, move to a re-latching configuration; receive the cartridge in a used state, wherein said re-latching configuration latches the cartridge within the receptacle whilst substantially preventing its further removal by the drive mechanism.

Optionally, the latching mechanism is further configured to latch the cartridge within the receptacle in an unused state.

Optionally, the latching mechanism comprises a latching sleeve configured to receive the cartridge therein, and wherein the latching sleeve is moveable within the receptacle between: an unlatching position to facilitate the unlatching of the cartridge, and a re-latching position to re-latch the cartridge within the receptacle in the used state.

Optionally, the latching sleeve is movable between a latching position to latch the cartridge within the receptacle in the unused state, the unlatching position and the re-latching position.

Optionally, engagement of the part of the drive mechanism with the receptacle causes the latching sleeve to move from the latching position to the unlatching position to facilitate unlatching of the cartridge.

Optionally, the engagement of the part of the drive mechanism with the receptacle causes axial movement of the latching sleeve from the latching position to the unlatching position

Optionally, the receptacle comprises a cartridge latch configured to latch the cartridge within the receptacle in the unused state, and wherein the in latching position, the latching sleeve prevents release of the cartridge latch.

Optionally, in the unlatching position, the latching sleeve allows the cartridge latch to be released to allow removal of the cartridge from the receptacle.

Optionally, the cartridge latch comprises a flexible arm comprising a lug configured to be received within a corresponding recess of the cartridge.

Optionally, the cartridge sleeve is configured to prevent deflection of the flexible arm to disengage the lug from the recess of the cartridge in the latching position, and wherein the cartridge sleeve is configured to allow deflection of the flexible arm to disengage the lug from the recess of the cartridge in the unlatching position.

Optionally, the latching sleeve comprises a cartridge locking channel configured to receive the flexible arm therein to prevent deflection of the flexible arm in the latching position, and wherein movement of the latching sleeve to the unlatching position causes the flexible arm to exit the cartridge locking channel to allow deflection of the flexible arm.

Optionally, the latching mechanism further comprises a biasing member.

Optionally, the biasing member is disposed between the latching sleeve and a base of the receptacle.

Optionally, the biasing member is configured to axially bias the latching sleeve into the latching position, and wherein the biasing member is configured to be compressed on engagement of the part of the drive assembly with the receptacle to move the latching sleeve into the unlatching position.

Optionally, the biasing member is configured to apply a rotational biasing force to the latching sleeve to rotate the latching sleeve towards the re-latching position.

Optionally, the receptacle comprises a stop surface configured to engage the latching sleeve to prevent rotation of the latching sleeve when the latching sleeve is in the latching position.

Optionally, movement of the latching sleeve from the latching position to the unlatching position upon engagement of the part of the drive mechanism with the receptacle causes the latching sleeve to disengage from the stop surface and rotate towards the re-latching position under the force of the biasing member.

Optionally, the latching sleeve comprises a deflectable latching arm configured to engage the cartridge in a deflected state to prevent removal of the cartridge from the receptacle, and wherein the latching arm is in the deflected state when the latching sleeve is in the re-latching position.

Optionally, the latching arm comprises a locking feature configured to engage a corresponding locking feature on the cartridge.

Optionally, in the deflected state, the latching arm is deflected into a position such that when the cartridge is received within the receptacle in a used state, the latching arm engages the cartridge to prevent removal of the cartridge.

Optionally, the receptacle comprises a reaction surface, and wherein movement of the latching sleeve towards the re-latching position causes the latching arm to engage the reaction surface and deflect towards the position.

Optionally, the latching arm is deflected into the position upon removal of the cartridge in the unused state from the receptacle.

Optionally, in a non-deflected state, the latching arm is not engaged with the cartridge and does not prevent removal of the cartridge from the receptacle, and wherein the latching arm is in a non-deflected state when the cartridge in the unused state is received within the receptacle.

Optionally, the receptacle further comprises an axial lock and a rotational lock, and wherein the latching sleeve is configured to engage the axial lock and the rotational lock when in the re-latching position such that the latching sleeve is unable to move from the re-latching position on re-engagement of the drive mechanism therewith, and further removal of the cartridge in the used state is prevented.

Optionally, the apparatus further comrises the cartridge.

Optionally, the engagement of the drive mechanism with the receptacle is direct engagement comprising insertion of at least a part of the drive mechanism into the receptacle.

According to the invention in a further aspect, there is provided an assembly comprising: a plurality of apparatus according to any of claims 1 to 26, each of the plurality of apparatus comprising the cartridge received within the receptacle in an unused state, wherein each of the plurality of apparatus are coupled together in series.

According to the invention in a further aspect, there is provided an auto-injector assembly comprising: an apparatus according to any of claims 3 to 26; and the drive mechanism comprising an actuating portion configured to engage the latching sleeve on engagement of the drive mechanism with the receptacle to facilitate movement of the latching sleeve between the unlatching position and the re-latching position.

Optionally, the drive mechanism further comprises a coupling portion comprising coupling features configured to engage corresponding coupling features on the cartridge to couple the cartridge thereto when the portion of the drive mechanism is engaged with the receptacle.

Optionally, the drive mechanism further comprises a collar moveable between a locking configuration in which the collar is operable to retain the coupling features of the coupling portion in engagement with the coupling features of the cartridge, and a release configuration in which the collar is operable to allow the coupling features of the coupling portion to disengage from the coupling features of the cartridge.

Optionally, the collar is movable between the locking configuration and the release configuration on engagement of at least a portion of the drive mechanism with the receptacle.

According to the invention in a further aspect, there is provided a drive mechanism for an auto-injector and for coupling to a cartridge comprising an injectable medication and stored within a receptacle of an apparatus, the drive mechanism configured to couple to the cartridge and to facilitate release of the cartridge from the receptacle on direct or indirect engagement of at least a portion of the drive mechanism with the receptacle, the drive mechanism operable to drive a plunger rod into the cartridge to dispense the injectable medication, the drive mechanism comprising: a coupling portion comprising coupling features configured to engage corresponding coupling features on the cartridge to couple the cartridge thereto; and a collar moveable between a locking configuration in which the collar is operable to retain the coupling features of the coupling portion in engagement with the coupling features of the cartridge, and a release configuration in which the collar is operable to allow the coupling features of the coupling portion to disengage from the coupling features of the cartridge, and wherein movement of the collar between the locking configuration and the release configuration is caused by the direct or indirect engagement of the drive mechanism with the receptacle.

Optionally, the coupling features of the coupling portion comprise a flexible arm comprising a lug configured to be received within a corresponding recess of the cartridge.

Optionally, the collar comprises a locking surface configured to engage the flexible arm when the collar is in the locking configuration to prevent disengagement of the lug from the corresponding recess of the cartridge.

Optionally, the locking surface is configured to abut the flexible arm when the collar is in the locking configuration.

Optionally, the collar is moveable to bring the locking surface into and out of engagement with the flexible arm to move the collar between the locking configuration and the release configuration.

Optionally, the collar is rotatable, and wherein relative rotation between the collar and the coupling portion causes the collar to move between the locking configuration and the release configuration.

Optionally, the collar and the coupling portion comprise corresponding angled surfaces configured to engage to rotate the collar between the locking configuration and the release configuration, and wherein the corresponding angled surfaces are brought into engagement on relative axial movement between the collar and the coupling portion.

Optionally, the relative axial movement between the collar and the coupling portion is facilitated by the direct or indirect engagement of the at least a portion of the drive mechanism with the receptacle.

Optionally, the collar and the coupling portion comprise corresponding angled teeth, and wherein the corresponding angled teeth comprise the corresponding angled surfaces.

Optionally, the collar is axially moveable with respect to the coupling portion, and wherein axial movement of the collar with respect to the coupling portion causes the collar to move between the locking configuration and the release configuration.

Optionally, the drive mechanism further comprises a biasing member configured to bias the collar into the locking configuration.

Optionally, the biasing member is held in a primed state and is releasable to drive the collar towards the locking configuration on the direct or indirect engagement of the portion of the drive mechanism with the receptacle and/or cartridge.

Optionally, one of the coupling portion and the collar comprise a track and the other of the coupling portion and the collar comprise a lug configured to be received within the track.

Optionally, the track comprises a retention portion, and wherein when the lug is received within the retention portion, the biasing member is held in the primed state.

Optionally, the track comprises a release portion, and wherein the lug is moveable within the release portion to allow the biasing member to be released to drive the collar into the locking configuration.

Optionally, the collar is axially and rotatably moveable with respect to the coupling portion to cause movement of the lug within the track, the drive mechanism further comprising an actuating sleeve configured to interact with the receptacle to cause axial and rotatable movement of the collar on the direct or indirect engagement of the drive mechanism with the receptacle.

Optionally, one of the actuating sleeve and the collar comprise a track and the other of the actuating and the collar comprise a protrusion configured to be received within the track.

Optionally, movement of the protrusion within the track causes the axial and rotatable movement of the collar.

Optionally, engagement of the drive mechanism with the receptacle to facilitate release of the cartridge is direct engagement comprising insertion of at least a portion of the drive mechanism within the receptacle.

Brief description of the drawings

Figure 1 shows an exemplary apparatus, cartridge and drive mechanism;
Figure 2 shows a section view of an exemplary apparatus;
Figure 3 shows an exemplary apparatus with a cartridge received therein;
Figure 4 shows an exemplary receptacle;
Figure 5 shows an exemplary latching sleeve;
Figure 6 shows an exemplary cartridge;
Figure 7 shows an exemplary drive assembly;
Figure 8 shows an exemplary apparatus in a first stage of operation;
Figure 9 shows an exemplary apparatus in a further stage of operation;
Figure 10 shows an exemplary apparatus in a first stage of operation;
Figures 11a and 11b show an exemplary apparatus in a second stage of operation;

Figures 12 shows an exemplary apparatus in a third stage of operation;

Figures 13a and 13b show an exemplary apparatus in a fourth stage of operation;

Figure 14a shows an exemplary actuating portion;

Figure 14b shows an exemplary collar;

Figure 15 shows an exemplary drive mechanism in a first stage of operation;

Figure 16 shows an exemplary drive mechanism in a second stage of operation;

Figure 17a shows an exemplary coupling portion;

Figure 17b shows an exemplary collar;

Figure 17c shows an exemplary actuating sleeve;

Figure 18 shows an exemplary drive mechanism;

Figure 19 shows the an exemplary schematic path followed during operation of the exemplary drive mechanism;

Figure 20 shows an exemplary drive mechanism in a stage of operation;

Figure 21 shows an exemplary drive mechanism in a stage of operation;

Figure 22 shows an exemplary drive mechanism in a stage of operation;

Figure 23 shows an exemplary drive mechanism in a stage of operation.

Figure 24 shows an axial cross-sectional view of an activation system of the drive assembly of Figure 7;

Figure 25 shows a partial axial cross-sectional view of the activation system of the drive assembly of Figure 7;

Figure 26 shows an exploded view of components of the activation system of Figures 24 and 25; and

Figures 27 to 30 show the activation system of Figures 24 and 25 in various stages of its operation.

Detailed description

Generally disclosed herein are apparatus for storing a cartridge for delivering an injectable medication. The cartridge may be attachable to a drive mechanism to facilitate injection of the medication within the cartridge into an injection site.

The apparatus may comprise a receptacle within which the cartridge is stored, and a latching mechanism. The latching mechanism is configured to latch the cartridge within the receptacle when the cartridge is in its unused state. The latching mechanism is configured to facilitate unlatching of the cartridge, to allow removal of the cartridge from

the receptacle, when at least part of the drive mechanism is received within the receptacle. The cartridge or a cartridge carrier may also be configured to couple to the drive mechanism when the at least part of the drive mechanism is received within the receptacle. This allows an unused cartridge, containing the medication, to be removed from the receptacle when it is coupled to the drive mechanism to inject medication contained within the cartridge into an injection site.

In exemplary arrangements, the latching mechanism is configured to move into a re-latching configuration upon removal of the cartridge or cartridge carrier from the receptacle. Once a cartridge has been used, a user may reinsert the used cartridge into the receptacle. Because the latching mechanism is in the re-latching configuration, when the used cartridge is received within the receptacle, the latching mechanism latches the cartridge within the receptacle and prevents its further removal by the drive mechanism. Re-insertion of the cartridge into the receptacle may comprise re-insertion of at least a portion of the drive mechanism into the receptacle to facilitate decoupling of the used cartridge from the drive mechanism, so that the drive mechanism may be coupled to further unused cartridges for subsequent drug delivery. The drive mechanism may interact with a further apparatus containing a further cartridge in an unused state to facilitate injection of a further medication.

The skilled person will appreciate that the term latching mechanism is used to encompass any suitable mechanism to selectively retain the cartridge within the receptacle. The latching mechanism may be a mechanical latch, alternatively the latching mechanism may be a bayonet configuration, magnets or any other suitable retention means. Additionally, the latching mechanism may comprise a carrier into which the cartridge is removeably inserted and the receptacle. Interactions between the carrier and the receptacle acting to selectively retain the cartridge carrier and cartridge in the receptacle and release the carrier and cartridge from the receptacle. The cartridge may be removed from the carrier allowing another cartridge to be placed into the carrier before inserting the carrier and cartridge into the receptacle.

The skilled person will further appreciate that the term “latching” is used to encompass retention of the cartridge and/or cartridge carrier within the receptacle, and is not intended to limit to retention using a mechanical latch. The retention of the cartridge and/or cartridge carrier within the receptacle may be achieved using mechanical

latches or alternative retention means, such as a bayonet configuration, magnets or any other suitable retention means as will be appreciated by the skilled person. Similarly, the term "unlatching" is used to encompass any suitable release of the the means by which the cartridge or cartridge carrier is retained in the receptacle, and is not intended to limit to release of a mechanical latch.

Figure 1 shows an exemplary apparatus 100 for storing a cartridge 200 for delivering an injectable medication. The cartridge 200 is attachable to and detachable from a drive mechanism 300 for dispensing the medication to a user.

Figure 2 shows a section view through the apparatus 100. The apparatus 100 comprises a receptacle 102 and a latching mechanism 104.

The receptacle 102 is configured to at least partially receive the cartridge 200 therein. The receptacle 102 may be substantially hollow. The exemplary receptacle 102 shown in Figure 1 is substantially rectangular in shape, however the skilled person will appreciate that other shapes may be used. In exemplary arrangements, a plurality of apparatus 100 may be coupled together in series. Each of the plurality of apparatus 100 may, at least initially, contain a cartridge 200 in an unused state.

The receptacle 102 may comprise an aperture 106. The aperture 106 may be substantially circular. The cartridge 200 may be inserted into the receptacle 102 and removed therefrom via the aperture 106. The receptacle 102 may be dimensioned such that when the cartridge 200 is fully received therein, at least a portion of the cartridge 200 may protrude from the aperture 106 of the receptacle 102, as shown in Figure 2.

The aperture 106 may be of greater dimension than an outer dimension of the cartridge 200. Protrusions 108a, 108b may extend inwardly from a wall 110 of the aperture 106. The protrusions 108a, 108b may be discrete. In the exemplary arrangement shown in Figure 1, two opposed protrusions are depicted, however the skilled person will appreciate that in alternative arrangements, a different number and arrangement of protrusions may be used. The protrusions 108a, 108b may be configured to abut an outer surface of the cartridge 200 when the cartridge 200 is received within the

receptacle 102. That is, the distance between the protrusions 108a, 108b may substantially correspond to the diameter of the cartridge 200.

The aperture 106 may expose a portion of the latching mechanism 104. Since the protrusions 108a, 108b do not extend along the entirety of the wall 110 of the aperture 106, a gap may be formed between the cartridge 200 and the wall 110 of the aperture 106 when the cartridge 200 is received within the aperture 106. This is most easily seen in Figure 3. The gap may expose at least a portion of the latching mechanism 104. As will be explained in more detail below, the drive mechanism 300 may be at least partially inserted into the receptacle 102 through the gap to interact with the latching mechanism 104 to facilitate unlatching of the cartridge 200 from the latching mechanism 104.

The protrusions 108a, 108b may act as keying features such that the aperture 106 comprises a keyed aperture. The keyed aperture may be configured to allow insertion of the drive mechanism 300 therein in discrete orientations only.

The receptacle 102 may comprise a cartridge latch configured to retain the cartridge 200 within the receptacle 102. The cartridge latch may comprise flexible arms 111a, 111b. In the exemplary receptacle 102 depicted in Figures 2 and 4, the flexible arms 111a, 111b are shown extending from the protrusions 108a, 108b. The skilled person will appreciate that in alternative arrangements, the flexible arms 111a, 111b need not extend from the protrusions 108a, 108b. The flexible arms 111a, 111b may be deflectable in a radially outward direction. The flexible arms 111a, 111b comprise lugs 112a, 112b. The lugs 112a, 112b may be configured to engage corresponding retention recesses of the cartridge 200.

The receptacle 102 may comprise at least one latching channel 114 configured to receive a lug of the latching mechanism 104, as will be described in more detail below. The latching channel 114 is visible in Figure 4, which shows a section view through the receptacle 102 of Figures 1-3. For clarity, the receptacle 102 is shown in isolation in Figure 4.

The exemplary receptacle 102 depicted comprises four latching channels 114a-d, each configured to receive a respective lug of the latching mechanism 104. Only two of the

latching channels 114a, 114b are visible in Figure 4, however the skilled person will appreciate that similar latching channels 114c, 114d are present on the section of the receptacle 102 not shown in Figure 4. In alternative arrangements, a different number of latching channels and lugs may be used.

The latching channels 114a-d may each extend partially around the wall 110 of the aperture 106. The latching channels 114a-d may be angularly separated. In the exemplary receptacle 102 depicted in Figure 4, adjacent latching channels 114a-d are angularly separated by 90 degrees.

Each of the latching channels 114a-d may comprise a stop surface 116a-d (only stop surfaces 116a, 116b are visible in Figure 4).

The latching channels 114a-d may comprise an upper surface 118a-d (only upper surface 118a is visible in Figure 4).

The receptacle 102 may comprise a reaction portion. The reaction portion comprises a reaction surface 122 (visible in Figure 4). The reaction surface 122 may be an angled reaction surface. The exemplary receptacle 102 comprises two reaction surfaces 122a, 122b (only one of which is visible in Figure 4). The second reaction surface 122b may be similar to and diametrically opposed to the reaction surface 122a visible in Figure 4. The reaction surfaces 122a, 122b may be configured to interact with latching arms 124a, 124b of the latching mechanism 104 (visible in Figure 2). The reaction surfaces 122a, 122b may be configured to interact with the latching arms 124a, 124b to move the latching arms 124a, 124b towards a re-latching position, as will be explained in more detail below.

The receptacle 102 may comprise retention portions 123a, 123b configured to receive the latching arms 124a, 124b and retain them in the re-latching position, as will be explained in more detail below. The retention portions 123a, 123b may be positioned such that the latching arms 124a, 124b are received therein after the latching arms 124a, 124b interact with the reaction surfaces 122a, 122b. The exemplary receptacle 102 comprises two retention portions 123a, 123b (only retention portion 123a is visible in Figure 4). The second retention portion 123b may be similar to and opposed to the retention portion 123a. The skilled person will appreciate that in alternative

arrangements, a different number of latching arms, reaction surfaces and retention portions may be used.

The receptacle 102 may comprise a stop surface 128 (visible in Figure 11b). The stop surface 128 may be configured to engage a portion of the latching mechanism 104 to prevent rotation of the latching mechanism 104 with respect to the receptacle 102, as will be described in more detail below.

The receptacle 102 may comprise an axial lock. The axial lock is configured to interact with a portion of the latching mechanism 104 to prevent axial movement of the latching mechanism 104 with respect to the receptacle, as will be described in more detail below. The axial lock may comprise a shoulder 129 (visible in Figure 13b). Axial movement of the latching mechanism 104 with respect to the receptacle 102 may be prevented when a portion of the latching mechanism 104 abuts the shoulder 129.

The receptacle 102 may comprise a needle shield grip 130. The needle shield grip 130 is configured to engage a needle shield of the cartridge 200 needle shield grip (as shown in Figure 2).

The receptacle 102 may comprise a biasing member guide 131 configured to receive a biasing member 138, as will be described in more detail below. The biasing member guide 131 may extend from a base 132 of the receptacle 102.

The receptacle 102 may comprise an indicator configured to indicate to the user when a cartridge 200 is received within the receptacle 102 in an unused state and when a cartridge 200 is received within the receptacle 102 in a used state. The indicator may comprise a visual indicator. The receptacle 102 may comprise a window 133 (visible in Figure 4). The window 133 may form part of the indicator configured to indicate to the user whether the receptacle 102 holds an unused cartridge or a user cartridge. For example, a different visual indication may be visible through the window 133 to indicate when a cartridge in an unused state is received within the receptacle 102 to when a cartridge in a used state is received within the receptacle 102. The different visual indication may be provided by a different portion of the latching mechanism 104 being visible through the window 133 when an unused and used cartridge is received within the receptacle 102.

The latching mechanism 104 may comprise a latching sleeve 136 and a biasing member 138. The latching sleeve 136 is shown in isolation in Figure 5. The exemplary latching sleeve 136 is received within the receptacle 102. The latching sleeve 136 is configured to receive the cartridge 200 therein when the cartridge 200 is received within the receptacle 102. At least a portion of the latching sleeve 136 may be received within the aperture 106 of the receptacle 102 (as shown in Figure 2). The latching sleeve 136 may be axially and rotationally moveable with respect to the receptacle 102.

The latching sleeve 136 may be substantially tubular. The latching sleeve 136 may comprise open ends, such that at least part of the cartridge 200 may protrude from either end of the latching sleeve 136 when the cartridge 200 is received therein.

The latching sleeve 136 comprises lugs 140a-d (only lugs 140a-c are visible in Figure 5). The lugs 140a-d protrude radially outwardly from on outer surface of the latching sleeve 136. In the exemplary latching sleeve 136 the lugs 140a-d extend radially outwardly from a first portion 142, which may be an upper portion, of the latching sleeve 136. In exemplary arrangements, the first portion 142 is at least partially received within and is moveable within the aperture 106 of the receptacle 102. The lugs 140a-d may be angularly spaced about latching sleeve 136. In the exemplary latching sleeve 136, the lugs 140a-d are arranged in intervals of 90 degrees about the latching sleeve 136. The skilled person will appreciate that different arrangements may be used.

The lugs 140a-d may be received within the latching channels 114a-d of the receptacle 102. That is, each of the lugs 140a-d may be received within a respective latching channel 114a-d of the receptacle 102. The lugs 140a-d may be movable within the latching channels 114a-d. The lugs 140a-d may comprise stop surfaces 144a-d. The stop surfaces 144a-d may be configured to prevent rotational movement between the latching sleeve 136 and the receptacle 102 when the stop surfaces 144a-d of the lugs 140a-d abut the stop surfaces 116a-d of the respective latching channels 114a-d. As will be described in more detail below, the latching sleeve 136 may be axially moveable with respect to the receptacle 102 to cause the lugs 140a-d to disengage from the latching channels 114a-d to allow rotation of the latching sleeve 136 with respect to the receptacle 102.

The latching sleeve 136 may comprise cartridge locking channels 145a, 145b. The cartridge locking channels 145a, 145b may be configured to receive the flexible arms 111a, 111b of the receptacle 102 therein. The cartridge locking channels 145a, 145b may be configured to prevent outward deflection of the flexible arms 111a, 111b when the flexible arms 111a, 111b are received therein. The exemplary latching sleeve 136 shown in Figure 5 depicts opposed cartridge locking channels 145a, 145b. That is, the cartridge locking channels 145a, 145b are angularly separated by 180 degrees. The first portion 142 may comprise the cartridge locking channels 145a, 145b. The skilled person will appreciate that different arrangements may be used.

The latching sleeve 136 may further comprise release channels 146a, 146b. The release channels 146a, 146b may be configured to receive the flexible arms 111a, 111b of the receptacle 102 therein. The release channels may allow outward deflection of the flexible arms 111a, 111b when the flexible arms 111a, 111b are received therein. In the exemplary arrangement shown in Figure 5, the release channels 146a, 146b are of greater dimension than the cartridge locking channels 145a, 145b. As such, when the flexible arms 111a, 111b are received within the release channels 146a, 146b, there is a clearance volume within which the flexible arms 111a, 111b are able to deflect outwardly. The release channels 146a, 146b are opposed (i.e. angularly separated by 180 degrees). In the exemplary latching sleeve 136, each of the release channels 146a, 146b are angularly separated from each of the cartridge locking channels 145a, 145b by 90 degrees. The first portion 142 may comprise the release channels 146a, 146b. The skilled person will appreciate that different arrangements may be used.

The latching sleeve 136 may comprise an actuation surface 147. The actuation surface 147 may be configured to interact with the drive mechanism 300. In the exemplary apparatus 100, the actuation surface 147 is exposed by the aperture 106 such that insertion of at least a portion of the drive mechanism 300 into the aperture 106 of the receptacle 102 causes interaction between the drive mechanism 300 and the actuation surface 147. The actuation surface 147 may comprise an upper surface of the latching sleeve 136. In the exemplary latching sleeve 136, the first portion 142 comprises the actuation surface 147.

In exemplary arrangements, the first portion 142 is received within the aperture 106 of the receptacle 102. The first portion 142 may be located between the cartridge 200 and the wall 110 of the aperture 106 of the receptacle 102, when the cartridge 200 is received within the receptacle 102. The actuation surface 147 may be exposed by the gap between the wall 110 of the aperture 106 and the cartridge 200 (see Figure 3).

The latching sleeve 136 may comprise the latching arms 124a, 124b. The latching arms 124a, 124b may be deflectable. The latching arms 124a, 124b may splay outwards in a non-deflected state, as shown in Figure 5.

The latching sleeve 136 may comprise a main body 150. The main body 150 may comprise openings 152a, 152b. The main body 150 may be substantially tubular. The latching arms 124a, 124b may extend from the main body 150 at an angle relative to the main body 150. That is, the latching arms 124a, 124b may extend outwardly at an angle with respect to walls of the main body 150 such that the latching arms 124a, 124b extend beyond a periphery of the main body 150. In exemplary arrangements, the angle may be less than 90 degrees, for example the angle may be substantially 10 degrees, 20 degrees or 30 degrees. The latching arms 124a, 124b may be deflectable radially inwardly (i.e. in a direction towards the main body 150). Inward radial deflection of the latching arms 124a, 124b causes the latching arms 124a, 124b to be received within the openings 152a, 152b in the main body 150. When the latching arms 124a, 124b are deflected radially inwardly and received in the openings 152a, 152b, the latching arms 124a, 124b may be aligned with walls of the main body 150 of the latching sleeve 136. That is, the latching arms 124a, 124b may not extend beyond the periphery of the main body 150.

The latching arms 124a, 124b may be coupled to the main body 150 of the latching sleeve 136 by hinges 154a, 154b (only hinge 154b is visible in Figure 5). Deflection of the latching arms 124a, 124b inwards, may comprise rotation of the latching arms 124a, 124b about the respective hinges 154a, 154b. Rotation of the latching arms 124a, 124b about the hinges 154a, 154b may reduce the angle between the latching arms 124a, 124b and the main body 150. The hinges 154a, 154b may be living hinges. That is, the hinges 154a, 154b may comprise an area of reduced dimension (such as reduced thickness), such the angle between the main body 150 and the latching arms 124a, 124b can be changed by bending the area of reduced dimension. The skilled

person will appreciate that in alternative arrangements, alternative hinges may be used. Further alternative arrangements may not comprise hinges, and the latching arms may be deflectable due to their resiliency.

The latching arms 124a, 124b may comprise locking features. The locking features are configured to interact with corresponding locking features on the cartridge 200 to resist movement of the cartridge 200 relative to the latching sleeve 136. The locking features of the latching arms 124a, 124b may be configured to interact with the corresponding locking features on the cartridge 200 when the latching arms 124a, 124b are deflected inwardly.

In the exemplary arrangement depicted in Figure 5, the locking features comprise lugs 158a, 158b (only lug 158a is visible in Figure 5). The lugs 158a, 158b extend radially inwardly from the locking arms 124a, 124b. The lugs 158a, 158b may be configured to provide a snap fit with the corresponding locking features of the cartridge 200. The lugs 158a, 158b may comprise stop surfaces 162a, 162b. The stop surfaces 162a, 162b may be configured to interact with the locking features of the cartridge 200 to prevent axial movement of the cartridge 200 with respect to the latching sleeve 136. In exemplary arrangements, the stop surfaces 162a, 162b of the lugs 158a, 158b may be configured to abut corresponding stop surfaces of the cartridge 200 to prevent axial movement of the cartridge 200 relative to the latching sleeve 136.

The exemplary latching sleeve 136 comprises a stop 166. The stop 166 may be configured to interact with the receptacle 102 to limit rotational and/or axial movement of the latching sleeve 136 with respect to the receptacle 102. The stop 166 may comprise a protrusion. The protrusion may extend radially outwardly from the latching sleeve 136. The stop 166 may comprise a rotation limitation surface 168. The stop 166 may comprise an axial limitation surface 170. The rotation limitation surface 168 may be perpendicular to the axial limitation surface 170. In the exemplary latching sleeve 136 shown in Figure 5, the stop 166 is substantially rectangular. In the exemplary arrangement shown in Figure 5, the main body 150 comprises the stop 166. The stop 166 may be located on a lower portion of the main body 150.

The exemplary latching mechanism 104 of the apparatus 100 may comprise the biasing member 138 (visible in Figure 2). The exemplary biasing member 138 is

disposed between the receptacle 102 and the latching sleeve 136. The biasing member 138 may be configured to apply a biasing force to the latching sleeve 136. The biasing member 138 may be configured to apply both a rotational biasing force and an axial biasing force to the latching sleeve 136. For example, the biasing member 138 may comprise a torsion spring configured to apply a rotational biasing force, and the torsion spring may also be compressible and extendible to apply an axial biasing force. The biasing member 138 may be compressible. The biasing member may comprise a spring, for example a coil spring.

The biasing member 138 may be disposed between the base 132 of the receptacle 102 and the latching sleeve 136. In the exemplary arrangement shown in Figure 2, the biasing member is disposed between the base 132 of the receptacle 102 and a lower end 176 of the latching sleeve 136. The biasing member 138 may be configured to bias the latching member 136 away from the base 132 of the receptacle 102. In other words, the biasing member 138 may be configured to bias the latching member 136 in a direction out of the receptacle 102 (e.g. towards the aperture 106 of the receptacle 102). In exemplary arrangements, the biasing member 138 may be configured to rotationally bias the latching sleeve 136 in a direction to bring the stop 166 of the latching sleeve towards the stop surface 128 of the receptacle 102. In the exemplary arrangement shown, the biasing member 138 therefore biases the latching sleeve 136 to rotate in an anti-clockwise direction.

The biasing member 138 may surround at least a portion of the cartridge 200 when the cartridge 200 is fully received within the receptacle 102.

Figures 6a and 6b show an exemplary cartridge 200. Figure 6a shows a perspective view of the exemplary cartridge 200 while Figure 6b shows a section view of the exemplary cartridge 200. The cartridge 200 in Figures 6a and 6b is shown in an unused state, i.e. prior to injection of the medication contained therein.

The exemplary cartridge 200 comprises a cartridge housing 202. The cartridge housing 202 may be substantially cylindrical. An injectable medication 204 may be received within the cartridge housing 202. The injectable medication 204 may be contained within a barrel or container 206. The barrel or container 206 may comprise a needle 208 to allow injection of the medication 204 into an injection site. The needle

208 may allow injection of the medication from the barrel 206 directly. Alternatively, the barrel or container 206 may comprise a septum arrangement (as shown in Figure 6b) with a separate needle arrangement arranged to pierce the septum before medication delivery. A bung 207 may be received within the barrel 206 and configured to be driven forwards to expel the medication 204 from the barrel 206 and through the needle 208.

A needle shield 210 may enclose the needle 208. The needle shield 210 may be removable to expose the needle 208.

The cartridge 200 may comprise coupling features 212a, 212b. The coupling features 212a, 212b may be configured to engage with corresponding coupling features on the drive mechanism 300 to couple the cartridge 200 thereto. The exemplary coupling features 212a, 212b comprise detents/recesses configured to receive corresponding lugs of the drive mechanism 300. However, the skilled person will appreciate that alternative coupling features may be used. In the exemplary cartridge 200, the cartridge housing 202 comprises the coupling features 212a, 212b.

The cartridge 200 may comprise retention features configured to retain the cartridge 200 within the receptacle before use of the cartridge 200 to inject the medication 204. The retention features may comprise retention recesses 213a, 213b. The retention recesses 213a, 213b may be configured to receive the lugs 112a, 112b of the flexible arms 111a, 111b of the receptacle 102 therein.

The cartridge 200 may comprise locking features. The locking features of the cartridge 200 may interact with the locking features of the latching sleeve 136 to prevent withdrawal of the cartridge 200 from the latching sleeve 136. In exemplary arrangements, the locking features of the cartridge 200 may interact with the locking features of the latching sleeve 136 to prevent withdrawal of a used cartridge 200 once it has been reinserted into the receptacle 102 following injection of the medication 204.

The locking features of the cartridge 200 may comprise recesses 214a, 214b configured to engage the lugs 158a, 158b on the locking arms 124a, 124b of the latching sleeve 136 (only recess 214a is visible in Figure 6a). In the exemplary cartridge 200, the recesses comprise windows. The recesses 214a, 214b may

comprise stop surfaces 216a, 216b configured to abut the stop surfaces 162a, 162b of the lugs 158a, 158b of the latching sleeve 136 to prevent withdrawal of the cartridge 200 from the latching sleeve 136.

Figures 7a and 7b show an exemplary drive mechanism 300. The drive mechanism 300 may be configured to couple to the cartridge 200 for injecting the medication contained in the cartridge 200 into an injection site. The drive mechanism 300 may comprise drive means and a plunger rod. The plunger rod may engage the bung 207 of the cartridge 200. The drive means may be configured to drive the plunger rod forwards, such that the bung 207 is driven forwards within the barrel 206 and the medication 204 is injected into the injection site via the needle 208. A detailed description of the actuation system of the drive mechanism 300 is provided below. The skilled person will appreciate that there are many implementations and arrangements that may be used for driving a plunger rod to expel a medication.

The drive mechanism 300 may comprise a housing 303. The housing 303 may be configured to receive at least a portion of the cartridge 200 therein. The exemplary housing 303 comprises an aperture which may receive the cartridge 200 therein. The drive mechanism 300 may comprise an actuating portion 304, which may form part of the housing 303 of the drive mechanism 300. The actuating portion 304 may be configured to be received within the receptacle 102 to engage the actuation surface 147 of the latching sleeve 136.

The actuating portion 304 may comprise channels 306a, 306b. Only channel 306b is visible in Figure 7a, but the skilled person will appreciate that the channel 306a is similar but opposed. The channels 306a, 306b may be configured to receive the protrusions 108a, 108b of the receptacle 102, when the actuating portion 304 is inserted into the receptacle 102. The protrusions 108a, 108b may be configured to travel within the channels 306a, 306b.

The drive mechanism 300 may comprise a coupling portion 307. The coupling portion may be rotatably fixed with respect to the housing 303. The coupling portion 307 may also be axially fixed with respect to the housing 303. The coupling portion 307 may comprise coupling features configured to engage with the coupling features 212a, 212b of the cartridge 200 to couple the cartridge 200 and the drive mechanism 300.

In the exemplary arrangement shown in Figure 7b, the coupling features comprise arms 310a, 310b. The arms 310a, 310b comprise lugs 312a, 312b configured to engage the detents/recesses of the coupling features 212a, 212b of the cartridge 200. The arms 310 may be deflectable. Only arm 310b and lug 312b is visible in Figure 7b, but the skilled person will appreciate that the arm 310a and the lug 312a are similar but opposed.

The drive mechanism 300 may comprise a collar 316. The collar 316 may be axially and rotatably moveable with respect to the coupling portion 307. The collar 316 may be configured, in a locking configuration, to retain the coupling features of the drive mechanism 300 in engagement with the coupling features 212a, 212b of the cartridge 200 to couple the drive mechanism 300 and the cartridge 200. The collar 316 may be configured, in a release configuration, to allow the coupling features of the drive mechanism 300 to disengage from the coupling features 212a, 212b of the cartridge 200 to decouple to the drive mechanism 300 and the cartridge 200. The collar 316 may be moveable between the locking configuration and the release configuration.

The collar 316 may at least partially receive the arms 310a, 310b of the coupling portion 307 therein. The collar 316 may comprise locking surfaces 320a, 320b. The collar 316 may comprise apertures 322a, 322b. In the locking configuration, the locking surfaces 320a, 320b may be aligned with the arms 310a, 310b, to prevent outward deflection of the arms 310a, 310b. In the release configuration, the apertures 322a, 322b may be aligned with the arms 310a, 310b to allow outward deflection of the arms 310a, 310b (i.e. into the volume provided by the apertures 322a, 322b). The collar 316 may be rotatable to move the locking surfaces 320a, 320b and the apertures 322a, 322b into and out of alignment with the arms 310a, 310b. In the exemplary arrangement shown in Figure 7b, the collar 316 comprises a series of locking surfaces 320n separated by a series of apertures 322n, such that rotation of the collar 316 sequentially aligns the arms 310a, 310b with a first locking surface, and then a first aperture, and then a second locking surface etc.

The exemplary collar 316 comprises teeth 326 configured to engage corresponding teeth 328 of the coupling portion 307. The teeth 326, 328 may be angled teeth, with each tooth of the angled teeth 326, 328 comprising an angled surface 330. Each tooth

of the teeth 326, 328 may further comprise a stop surface 332. The teeth 326, 328 may engage to cause relative rotation between the collar 316 and the coupling portion 307. The relative rotation may move the locking surfaces 320a, 320b and the apertures 322a, 322b into and out of alignment with the arms 310a, 310b. The skilled person will appreciate that alternative rotation mechanisms may be used.

A biasing member 333 may be disposed between the collar 316 and the coupling portion 307 to bias the collar 316 forwards within the housing 303 of the drive mechanism 300. As such, the biasing member 333 biases the teeth 326 of the collar 316 and the teeth 328 of the coupling portion 307 away from each other. The biasing member may comprise a compression spring, which may be compressed to engage the teeth 326, 328.

The collar 316 may be axially moveable with respect to the housing 302 and the coupling portion 307. The collar 316 may comprise a reaction surface 338 configured to interact with the receptacle 102. The reaction surface 338 may interact with, for example abut, the protrusions 108a, 108b of the receptacle 102 when the drive mechanism 300 is inserted into the receptacle 102. The collar 316 may extend at least partially into the actuating portion 304 such that the protrusions 108a, 108b may engage the collar 316 when the protrusions 108a, 108b are received within the channels 306a, 306b of the actuating portion 304.

Operation of the apparatus 100 will now be described with reference to Figures 1-13b.

The apparatus 100 may store a cartridge 200 in an unused state. That is, the apparatus 100 may store the cartridge 200 comprising the injectable medication 204 before the cartridge 200 is coupled to the drive mechanism 300 to dispense the medication 204. In exemplary arrangements, a plurality of apparatus 100 storing unused cartridges 200 may be provided. The plurality of apparatus 100 may be connected in series.

Figure 8 shows the apparatus 100 storing a cartridge 200 in the unused state. The cartridge 200 is received within the receptacle 102. A portion of the cartridge 200 protrudes from the receptacle 102. In the exemplary arrangement shown in Figure 8,

the portion of the cartridge 200 comprising the coupling features 212a, 212b protrudes from the receptacle 102.

The cartridge 200 may be latched/retained within the receptacle 102 in the unused state.

Figure 8 shows the latching sleeve 136 in a latching position. In the latching position, the cartridge 200 is latched within the receptacle 102 by the engagement of the lugs 112a, 112b of the flexible arms 111a, 111b of the receptacle 102, with the retention recesses 213a, 213b of the cartridge 200. The flexible arms 111a, 111b of the receptacle 102 are received within the cartridge locking channels 145a, 145b and so the flexible arms 111a, 111b are prevented from deflecting radially outwardly by their abutment with walls of the cartridge locking channels 145a, 145b. As such, the lugs 112a, 112b of the flexible arms 111a, 111b are retained within the retention recesses 213a, 213b of the cartridge 200, and therefore the cartridge 200 is latched within the receptacle 102.

As shown in Figure 8, when the latching sleeve 136 is in the latching position, the latching arms 124a, 124b are in their non-deflected state (that is, they are splayed outwardly). The latching arms 124a, 124b are therefore not in engagement with the cartridge 200. Specifically, the lugs 158a, 158b of the latching arms 124a, 124b are not in engagement with the recesses 214a, 214b of the cartridge 200. The latching arms 124a, 124b therefore do not resist withdrawal of the cartridge 200 from the receptacle 102.

The biasing member 138 is held in a primed state between the base 132 of the receptacle and the latching sleeve 136. As such, the biasing member 138 applies an axial and rotational force to the latching sleeve 136. At this stage, rotation of the latching sleeve 136 is prevented by the interaction between the lugs 140a-d of the latching sleeve 136 and the latching channels 114a-d of the receptacle 102. The lugs 140a-d of the latching sleeve 136 are received within the latching channels 114a-d of the receptacle 102 and abut the stop surfaces 116a-d of the latching channels 114a-d

to prevent rotation of the latching sleeve 136 under the force of the biasing member 138.

Axial movement of the latching sleeve 136, under the force of the biasing member 138, is prevented by the interaction between the lugs 140a-d of the latching sleeve 136 and the latching channels 114a-d of the receptacle 102. The lugs 140a-d may abut the upper surfaces 118a-d of the latching channels 114a-d to prevent axial movement of the latching sleeve under the force of the biasing member 138.

The latching mechanism 104 of the apparatus 100 is configured to facilitate removal of the unused cartridge 200 from the receptacle 102 and coupling of the unused cartridge 200 to the drive mechanism 300 on insertion of at least part of the drive mechanism 300 within the receptacle. The user may, for example, wish to remove the unused cartridge 200 from the receptacle 102 for use with the drive mechanism 300 to inject the medication 204 into an injection site. In exemplary arrangements, the latching sleeve 136 may move from the latching position to the unlatching position to allow removal of the cartridge 200 from the receptacle 102, once the cartridge 200 has coupled to the drive mechanism 300. Coupling of the cartridge 200 and the drive mechanism 300 will firstly be described below, and then the process of the latching sleeve 136 moving from the latching position to the unlatching position will be described (however the skilled person will appreciate that these processes may take place simultaneously).

Coupling of the drive mechanism 300 to the cartridge 200 may comprise placing the drive mechanism 300 over the cartridge 200, such that the portion of the cartridge 200 that protrudes from the receptacle 102 is received within the drive mechanism 300. The drive mechanism 300 may be moved along the length of the cartridge 200, such that more of the cartridge 200 is received therein, until the coupling features of the drive mechanism 300 engage the coupling features 212a, 212b of the cartridge 200, as will be described in more detail below.

Coupling of the drive mechanism 300 to the cartridge 200 may comprise insertion of at least a part of the drive mechanism 300 into the receptacle 102. The user may continue to move the drive mechanism 300 towards the receptacle 102 (and along the length of the cartridge 200 received therein) until the actuating portion 304 of the drive

mechanism 300 is received within the aperture 106 of the receptacle 102. The protrusions 108a, 108b of the receptacle 102 and the channels 306a, 306b of the actuating portion 304 may act as keying features to ensure that the drive mechanism 300 is inserted into the receptacle 102 in the correct orientation. Specifically, in an orientation that aligns the coupling features 212a, 212b of the cartridge 200 with the coupling features of the drive mechanism 300.

The actuating portion 304 of the drive mechanism 300 may therefore be inserted into the aperture 106 of the receptacle 102 such that the protrusions 108a, 108b of the receptacle 102 are received within the channels 306a, 306b of the actuating portion 304. Further movement of the drive mechanism 300 into the receptacle 102, causes the protrusions 108a, 108b of the receptacle 102 to travel within the channels 306a, 306b of the actuating portion 304 of the drive mechanism 300.

Insertion of the drive mechanism 300 into the receptacle 102 causes the protrusions 108a, 108b of the receptacle 102 to engage with the reaction surface 338 of the collar 316 of the drive mechanism 300. As the drive mechanism 300 is pushed further into the receptacle 102, the collar 316 is therefore moved axially rearwards within the housing 303 of the drive mechanism 300. The rearward movement of the collar 316 within the housing 303 causes the biasing member 333 disposed between the collar 316 and the coupling portion 307 to be compressed.

As described above, the coupling portion 307 is axially fixed with respect to the housing 303 of the drive mechanism 300, and so the collar 316 moves rearwards with respect to the coupling portion 307. Rearward movement of the collar 316 with respect to the coupling portion 306 moves the angled teeth 326 of the collar 316 towards the angled teeth 328 of the coupling portion 307. That is, rearward movement of the collar 316 with respect to the coupling portion 307 may compress the biasing member 333 disposed between the collar 316 and the coupling portion 307 to allow the teeth 326 of the collar 316 to move towards the teeth of the coupling portion 307.

The collar 316 may initially be in the release configuration such that the arms 310a, 310b of the coupling portion 307 are deflectable outwardly. That is, the apertures 322a, 322b of the collar 316 may be aligned with the arms 310a, 310b to allow the arms 310a, 310b to be deflected outwardly into the apertures 322a, 322b. As more of

the cartridge 200 is received within the drive mechanism 300, the lugs 312a, 312b of the arms 310a, 310b of the coupling portion 307 engage the cartridge 200 and the arms 310a, 310b are deflected outwardly. This is because the cartridge 200 is of slightly larger dimension that the distance between the lugs 312a, 312b. The lugs 312a, 312b ride over an outer surface of the cartridge 200 until the lugs 312a, 312b reach the recesses of the cartridge 200. At this point, the arms 310 will return to their non-deflected state, and the lugs 312a, 312b will be received within and engage the recesses of the cartridge 200.

Further rearward movement of the collar 316 with respect to the coupling portion 307 after the lugs 312a, 312b engage the recesses of the cartridge 200 causes the collar 316 to move into the locking configuration. In the locking configuration, the locking surfaces 320a, 320b of the collar 316 abut the arms 310a, 310b to retain the lugs 312a, 312b within the recesses of the cartridge 200.

The collar 316 is moved into the locking configuration due to the interaction between the teeth 326 of the collar 316 with the teeth 328 of the coupling portion 307. The rearward movement of the collar 316 with respect to the coupling portion 307 brings the angled surface of the teeth 326 of the collar 316 into engagement with the angled surface of the teeth 328 of the coupling portion 307. Further rearward movement of the collar 316 causes the respective angled surfaces to ride over each other, and the collar 316 to rotate with respect to the coupling portion 307. The coupling portion 307 does not rotate, since it is rotationally fixed with respect to the housing 303 of the drive mechanism 300. The collar 316 rotates until the respective stop surfaces of the teeth 326, 328 of the collar 316 and the coupling portion 307 abut, at which point further rotation is prevented. At this point, the locking surfaces 320a, 320b have been brought into alignment with the arms 310a, 310b to prevent outward deflection of the arms 310a, 310b, and therefore the collar 316 is in the locking configuration. Furthermore, the teeth 326, 328 are meshed together and so further rearward movement of the collar 316 with respect to the housing 303 and the coupling portion 307 is prevented. At this stage the cartridge 200 is coupled to the drive mechanism 300. This is shown in Figure 9.

Movement of the latching sleeve 136 from the latching position (described above in respect of Figure 8) into the unlatching position and the re-latching position will now be

described with reference to Figures 10-13b. As mentioned, movement of the latching sleeve between these positions may coincide with the coupling process for coupling the cartridge 200 and the drive mechanism 300, described above.

Figure 10 shows the latching sleeve 136 in the latching position before the driving mechanism 300 is inserted into the receptacle 102. Figure 10 omits the cartridge 200 for clarity and to aid the reader in viewing the features of the latching sleeve 136 and the receptacle 102 at this stage of use, however the skilled person will understand that in the state shown in Figure 10 the cartridge 200 would be located within the receptacle 102 in an unused state. A detailed description of the latching position is given above in respect of Figure 8, and is not repeated here.

When a user wishes to withdraw the cartridge 200 from the receptacle 102, for example for injection of the medication 204 contained within the cartridge 200, the user may facilitate unlatching of the cartridge 200 from the receptacle 102 by inserting at least a portion of the drive mechanism 300 into the receptacle 102 (as described above, this insertion may also facilitate coupling of the cartridge 200 to the drive mechanism 300). Insertion of the portion of the drive mechanism 300 may facilitate movement of the latching sleeve 136 from the latching position to the unlatching position, in which the cartridge 200 may be removed from the receptacle 102.

As the drive mechanism 300 is inserted into the receptacle 102, the actuating portion 304 of the drive mechanism 300 may engage the actuation surface 147 of the latching sleeve 136. In exemplary arrangements, the actuating portion 304 is received within the gap between the cartridge 200 and the wall 110 of the aperture 106 in the receptacle 102 and travels therein until it engages the actuation surface 147 of the latching sleeve 136. Further insertion of the drive mechanism 300 into the receptacle 102 after engagement of the actuating portion 304 with the actuation surface 147 of the latching sleeve 136 causes the latching sleeve 136 to be pushed axially downwards, towards the base 132 of the receptacle 102, as demonstrated by the arrow in Figure 10. This causes the biasing member 138 to be compressed.

The axial movement of the latching sleeve 136 towards the base 132 of the receptacle 102 causes the flexible arms 111a, 111b of the receptacle 102 to exit the cartridge locking channels 145a, 145b of the latching sleeve 136. As such, at this stage, the

flexible arms 111a, 111b are free to deflect outwards to disengage the lugs 112a, 112b from the retention recesses 213a, 213b of the cartridge 200 to allow removal of the cartridge 200 from the receptacle 102, as will be described in more detail below. As such, the latching sleeve 136 is in an unlatching position in which the cartridge 200 may be unlatched from the receptacle 102.

The axial movement of the latching sleeve 136 toward the base 132 of the receptacle 102 causes the lugs 140a-d of the latching sleeve 136 to disengage from the latching channels 114a-d of the receptacle 102. As such, the latching sleeve 136 is free to rotate under the rotational force exerted on it by the biasing member 138. This rotation moves the latching sleeve 136 towards the re-latching position.

Rotation of the latching sleeve 136 under the force of the biasing member 138 causes the latching arms 124a, 124b to interact with the reaction surfaces 122a, 122b. The interaction between the latching arms 124a, 124b and the reaction surfaces 122a, 122b causes the latching arms to be deflected inwardly, as shown in Figure 11a. Specifically, the latching arms 124a, 124b ride over the reaction surfaces 122a, 122b of the receptacle 102 and the latching arms 124a, 124b are deflected inwardly.

The latching sleeve 136 rotates under the force of the biasing member 138 until the stop 166 of the latching sleeve 136 engages the stop surface 128 of the receptacle 102, as shown in Figures 11a and 11b. Figures 11a and 11b show the latching sleeve 136 in the same position within the receptacle 102, however the section view taken in Figure 11b is at 90 degrees to the section view taken in Figure 11a, in order to more clearly show the stop feature 166 of the latching sleeve 136 and its engagement with the stop surface 128 of the receptacle 102. Note that Figures 11a and 11b omit the cartridge 200 for clarity and to aid the reader in viewing the features of the latching sleeve 136 and the receptacle at different stages of use, however the skilled person will understand that in the states shown in Figures 11a and 11b, the cartridge 200 would still be located within the receptacle 102. The latching sleeve 136 rotates until the rotation limitation surface 168 of the stop 166 engages the stop surface 128 of the receptacle 102. The latching arms 124a, 124b may not be fully deflected inwardly at this stage. That is, the latching sleeve 136 has not fully reached the re-latching position at this stage. As such, the lugs 158a, 158b are not in engagement with the cartridge 200 and do not act to retain the cartridge 200 within the latching sleeve 136.

Movement of the latching sleeve 136 into the position shown in Figures 11a and 11b, and described above, may substantially coincide with the point at which the cartridge 200 couples to the drive mechanism 300.

At this stage, the user may withdraw the drive mechanism 300 from the receptacle 102. The cartridge 200 is coupled to the drive mechanism 300 and so the cartridge 200 is withdrawn from the receptacle 102. The user may pull the drive mechanism 300 away from the receptacle 102, and because the cartridge 200 is coupled to the drive mechanism 300, the cartridge 200 is pulled out of the receptacle 102. Specifically, the cartridge 200 is pulled out of the latching sleeve 136. As described above, the flexible arms 111a, 111b of the receptacle 102 have exited the cartridge locking channels 145a, 145b of the latching sleeve 136, and therefore the flexible arms 111a, 111b are free to deflect outwardly. As shown in Figure 12, as the cartridge 200 is withdrawn from the receptacle 102, the lugs 112a, 112b of the flexible arms 111a, 111b are deflected outwards to disengage from the retention recesses 213a, 213b of the cartridge 200. The flexible arms 111a, 111b remain deflected outwards as the cartridge 200 is withdrawn from the latching sleeve 136 and the lugs 112a, 112b ride over the surface of the cartridge 200 until the cartridge 200 is fully withdrawn from the receptacle 102. As shown in Figure 12, the needle shield 210 is retained within the receptacle 102 due to its engagement with the needle shield grip 130. As such, the cartridge 200 is withdrawn from the receptacle 102 in a ready-to-use state.

Withdrawal of the drive mechanism 300 from the receptacle 102 causes the collar 316 to move forward relative to the coupling portion 307 under the force of the biasing member 333 disposed therebetween. The collar 316 is in a rotationally different position to its initial rotational position before the drive mechanism 300 was inserted into the receptacle. That is, the collar has been rotated into the locking configuration and remains in the locking configuration, retaining the lugs 312a, 312b within the recesses of the cartridge 200 on forward movement under the force of the biasing member. The teeth 326, 328 of the collar 316 and the coupling portion 328 therefore act as a camming mechanism such that subsequent rearward movement of the collar 316 with respect to the coupling portion 307 causes each of the teeth 326 of the collar 316 to engage with adjacent teeth 328 of the coupling portion (that is, teeth adjacent to those that were engaged on the previous rearward movement of the collar 316). As

will be described in more detail below, this allows the collar 316 to be rotated into the release configuration to allow the cartridge 200 to be decoupled from the drive mechanism 300 on subsequent engagement of the teeth 326, 328 of the collar 316 and the coupling portion 307.

As the cartridge 200 is withdrawn from the receptacle 102, the latching sleeve 136 moves into the re-latching configuration. The re-latching position is shown in Figures 13a and 13b. Figures 13a and 13b show the latching sleeve 136 in the same position (i.e. in the re-latching position) within the receptacle 102, however the section view taken in Figure 13b is at 90 degrees to the section view taken in Figure 13a, in order to more clearly show the stop feature 166 of the latching sleeve 136.

The latching sleeve 136 moves into the re-latching position because as the drive mechanism 300 is withdrawn from the receptacle 102, there is no longer a force applied to the latching sleeve 136 to compress the biasing member 138. As such, the biasing member 138 expands, to push the latching sleeve 136 axially away from the base 132 of the receptacle 102. The latching sleeve 136 moves axially, until the lugs 140a-d enter the latching channels 114a-d. The skilled person will appreciate that since the latching sleeve 136 has rotated (by approximately 90 degrees in this exemplary arrangement) from its initial position, the lugs 140a-d enter a latching channel 114a-d different from and adjacent to the latching channel 114a-d in which they were initially received.

The axial movement of the latching sleeve 136 also causes the flexible arms 111a, 111b of the receptacle 102 to be received within the cartridge release channels 146a, 146b. As described above, the release channels 146a, 146b are angularly separated from the cartridge locking channels 145a, 145b by 90 degrees. Since the latching sleeve 136 has rotated (by approximately 90 degrees in this exemplary arrangement) from its initial position, the flexible arms 111a, 111b of the receptacle 102 are therefore received within the release channels 146a, 146b on axial movement of the latching sleeve 136 following removal of the cartridge 200, rather than being re-received within the cartridge locking channels 145a, 145b.

The axial movement of the latching sleeve also causes the stop 166 of the latching sleeve 136 to disengage from the stop surface 128 of the receptacle 102. The latching sleeve 136 is therefore free to rotate under the force of the biasing member 138.

The continued rotation of the latching sleeve 136 causes the latching arms 124a, 124b to interact with the reaction surfaces 122a, 122b to deflect fully inwards into the re-latching position. The continued rotation of the latching sleeve 136 may cause the latching arms 124a, 124b to be received within the retention portions 123a, 123b of the receptacle such that the latching arms are retained in the re-latching position.

The rotation of the latching sleeve 136 causes the stop 166 to engage the axial lock of the receptacle 102. Specifically, the stop 166 may abut the shoulder 129 of the receptacle 102, as shown in Figure 13b.

The latching sleeve 136 may continue to rotate under the force of the biasing member 138 until the lugs 140a-d engage with the stop surfaces 116a-d of the latching channels 114a. The lugs 140a-d may be in engagement with the upper surfaces 118a-d of the latching channels 114a-d. At this stage, the latching sleeve 136 is in the re-latching configuration, as shown in Figures 13a and 13b. In the re-latching configuration, the latching arms 124a, 124b are deflected fully inwardly and are in the re-latching position. The stop 166 of the latching sleeve 136 may be in engagement with the axial lock to prevent axial movement of the latching sleeve 136 towards the base 132 of the receptacle 102. Further rotation of the latching sleeve 136 is prevented by the engagement of the lugs 140a-d with the stop surfaces 116a-d. The latching sleeve 136 has rotated by substantially 90 degrees from its initial position.

The apparatus 100 may be configured to receive a used cartridge therein when the latching sleeve 136 is in the re-latching configuration and prevent removal of the used cartridge. This prevents the user coupling a used cartridge to the drive mechanism 300.

Once the cartridge 200 has been used to inject the medication, the cartridge 200 may be reinserted into the receptacle 102. Re-insertion of the cartridge 200 within the receptacle 102 causes the flexible arms 111a, 111b of the receptacle 102 to deflect outwards into the clearance volume provided by the release channels 146a, 146b of

the latching sleeve 136. As the cartridge 200 is further inserted into the receptacle 102, the lugs 112a, 112b of the flexible arms 111a, 111b of the receptacle 102 ride over the surface of the cartridge 200. The lugs 112a, 112b may ride over the surface of the cartridge 200 until they are brought into engagement with the retention recesses 213a, 213b of the cartridge 200 and received therein.

Re-insertion of the cartridge 200 into the receptacle 102 may comprise reinsertion of the cartridge 102 into the latching sleeve 136. The used cartridge 200 may be inserted into the latching sleeve 136 until the lugs 158a, 158b of the latching arms 124a, 124b engage the stop surfaces 216a, 216b of the cartridge 200. The lugs 158a, 158b of the latching arms 124a, 124b engage the stop surfaces 216a, 216b of the cartridge 200 to provide a snap fit. The snap fit acts to retain the cartridge 200 within the receptacle 102.

Re-insertion of the cartridge 200 within the receptacle 102 may facilitate decoupling of the drive mechanism 300 from the cartridge 200. Re-insertion of the cartridge 200 within the receptacle comprises re-insertion of at least a portion of the drive mechanism 300 within the receptacle 102. This causes the collar 316 to be moved back to the release configuration to allow the arms 310a, 310b of the coupling portion 307 to be deflected outwardly, and allow decoupling of the used cartridge 200 from the drive mechanism 300.

The collar 316 is moved back into the release configuration by engagement of the protrusions 108a, 108b of the receptacle 102 with the reaction surface 338 of the collar 316 of the drive mechanism 300 on re-insertion of the drive mechanism 300 into the receptacle 102. This causes the collar 316 to move rearward with respect to the coupling portion 307, similarly to as described above. The rearward movement of the collar 316 with respect to the coupling portion 307 brings the angled surface of the teeth 326 of the collar 316 into engagement with the angled surface of the teeth 328 of the coupling portion 307. Further rearward movement of the collar 316 causes the respective angled surfaces to ride over each other, and the collar 316 to rotate with respect to the coupling portion 307. The coupling portion 307 does not rotate, since it is rotationally fixed with respect to the housing 303 of the drive mechanism 300. The collar 316 rotates until the respective stop surfaces of the teeth 326, 328 of the collar 316 and the coupling portion 307 abut, at which point further rotation is prevented. At

this point, the apertures 322a, 322b of the collar 316 have been brought into alignment with the arms 310a, 310b of the coupling portion 307 and therefore the collar 316 is in the release configuration. The arms 310a, 310b are therefore free to deflect outwardly to disengage the lugs 312a, 312b from the recesses of the cartridge 200 and allow the drive mechanism 300 to decouple from the used cartridge 200.

The user is unable to remove the used cartridge 200 from the receptacle 102 by inserting the drive mechanism 300 into the receptacle 102 as described above in respect of the unused cartridge. This is because the latching sleeve 136 is both axially and rotationally fixed in position with respect to the receptacle 102. As described above, the latching sleeve 136 is rotationally fixed relative to the receptacle due to the engagement of the lugs 140a-d of the latching sleeve 136 with the stop surfaces 116a-d of the receptacle 102, and axially fixed in position with respect to the receptacle 102 due to the engagement of the stop 166 of the latching sleeve 136 with the axial lock of the receptacle 102. The latching sleeve 136 is therefore unable to be moved from the re-latching position, in which the arms 124a, 124b of the latching sleeve 136 are engaged with the cartridge 200 to retain the cartridge 200 therein.

Even if the user re-inserts the drive mechanism 300 into the receptacle 102, while the latching mechanism 104 is in the re-latching configuration, the user will be unable to push the latching sleeve 136 towards the base 132 of the receptacle 102 because the stop 166 of the latching sleeve 136 abuts the shoulder 129 of the receptacle 102. Therefore the user is unable to compress the biasing member 138 and disengage the lugs 140a-d of the latching sleeve 136 from the latching channels 136 to allow rotation of the latching sleeve 136 out of the re-latching position. That is, the latching sleeve 136 cannot be rotated into a position in which the latching arms 124a, 124b splay outwardly to release the cartridge 200.

In further exemplary arrangements, the drive mechanism 300 may comprise an RFID reader or RFID tag configured to communicate with an RFID reader or RFID tag on the cartridge 200 and/or the receptacle 102. The RFID reader/tag on the drive mechanism 300 may be positioned such that when the part of the drive mechanism 300 is inserted into the receptacle 102 to couple the cartridge 200 to the drive mechanism 300, the RFID reader/tag of the drive mechanism is placed within proximity of the RFID tag/reader on the cartridge 200 or the receptacle 102. Within proximity encompasses a

distance sufficiently close to allow short range telecommunications signals to be transmitted between the RFID tag/reader of the drive mechanism 300 and the RFID tag/reader of the cartridge 200 or the receptacle 102. The RFID tag/reader of the drive mechanism 300 may communicate with the RFID tag/reader of the cartridge 200 or the receptacle 102 to obtain data indicative of the medication batch stored within the cartridge 200. The drive assembly 300 may further comprise a memory configured to store the data indicative of the medication batch. The data may be subsequently transmitted to a further device, for example, using Bluetooth communications.

Figures 14a, 14b, 15 and 16 show an alternative drive mechanism 400. The drive mechanism 400 may be similar to the drive mechanism 300 described above, except that the coupling mechanism (i.e. the mechanism by which the drive mechanism 400 couples to and decouples from the cartridge 200) may be different. Many of the features of the drive mechanism 400 are similar to those described above in respect of the drive mechanism 300 of Figures 7a and 7b. As such, a description of these features is not given again here and corresponding reference numerals are used to identify them in Figures 14a, 14b, 15 and 16. Thus, 404 is the actuating portion, 406a, 406b are the channels, 407 is the coupling portion, 410a, 410b are the arms, 412a, 412b are the lugs, 416 is the collar, and 420a, 420b are locking surfaces.

Figures 14a and 14b show the exemplary actuating portion 404 and the exemplary collar 416 of the drive mechanism 400 respectively in isolation.

As shown in Figure 14a, the actuating portion 404 comprises the channels 406a, 406b. Only channel 406b is visible in Figure 15a, but the skilled person will appreciate that the channel 406a is similar but opposed.

The actuating portion 404 may comprise angled teeth 428. The angled teeth 428 may be configured to engage corresponding angled teeth 426 on the collar 416, as will be described in more detail below. Each tooth of the angled teeth 428 may comprise an angled surface 430n (only a single angled surface 430n of a single tooth is labelled on Figure 14a). Each tooth of the angled teeth 428 may comprise a stop surface 432n (only a single stop surface 432n of a single tooth is labelled on Figure 14a).

The actuating portion 404 may be axially and rotatably fixed with respect to the housing of the drive mechanism 400.

The collar 416 may be at least partially telescopically received within the actuating portion 404, as shown in Figure 15. The collar 416 may be axially and rotatably movable with respect to the actuation portion 404.

Figure 14b shows an exemplary collar 416 of the drive mechanism 400. The collar 416 may be axially and rotatably movable with respect to the coupling portion 407. The collar 416 may be configured, in a locking configuration, to retain the coupling features of the drive mechanism 400 in engagement with the coupling features 212a, 212b of the cartridge 200 to couple the drive mechanism 400 and the cartridge 200. The collar 416 may be configured, in a release configuration, to allow the coupling features of the drive mechanism 400 to disengage from the coupling features 212a, 212b of the cartridge 200 to decouple to the drive mechanism 400 and the cartridge 200. The collar 416 may be moveable between the locking configuration and the release configuration.

The coupling portion 407 may be at least partially telescopically received within the collar 416. In the exemplary drive mechanism 400, the arms 410a, 410b of the coupling portion 407 may be received within the collar 416.

As shown in Figure 14b, the collar 416 comprises locking surfaces 420a, 420b and release channels 422a, 422b. In the exemplary collar 416, the locking surfaces 420a, 420b and the release channels 422a, 422b are located on an inner surface of the collar 416. In the locking configuration, the locking surfaces 420a, 420b may be aligned with the arms 410a, 410b, to prevent outward deflection of the arms 410a, 410b. That is, the locking surfaces 420a, 420b may abut the arms 410a, 410b respectively to prevent outward deflection of the arms 410a, 410b. In the release configuration, the release channels 422a, 422b may be aligned with the arms 410a, 410b. The release channels 422a, 422b may comprise a clearance volume to allow outward deflection of the arms 410a, 410b (i.e. deflection into the clearance volume).

The collar 416 may be rotatable with respect to the coupling portion 407 to move the locking surfaces 420a, 420b and the release channels 422a, 422b into and out of

alignment with the arms 310a, 310b. In the exemplary arrangement shown in Figure 14b, the collar 416 comprises a series of locking surfaces 420 separated by a series of release channels 422, such that rotation of the collar 416 sequentially aligns the arms 410a, 410b with a first locking surface, and then a first release channel, and then a second locking surface, and then a second release channel etc.

The collar 416 may comprise angled teeth 426 configured to interact with the angled teeth 428 of the actuating portion 404. Similarly to the angled teeth of the actuating portion 404, each tooth of the angled teeth 426 of the collar 416 comprise an angled surface 430n (only a single angled surface 430n of a single tooth is labelled on Figure 14b) and a stop surface 432n (only a single stop surface 432n of a single tooth is labelled on Figure 14b).

The collar 416 comprises a reaction surface configured to interact with the receptacle 102. The exemplary collar 416 comprises a plurality of reaction surfaces 438a-n. The plurality of reaction surface 438a-n may comprise at least one pair of opposed reaction surfaces 438a, 438b. Only reaction surface 438a of the opposed reaction surfaces 438a, 438b is visible in Figure 14b. The reaction surfaces 438a-n may comprise an angled reaction surface configured to interact with the receptacle to facilitate rotation of the collar 416 with respect to the coupling portion 407.

Coupling of the drive mechanism 400 to the cartridge 200 on insertion of the drive mechanism 400 into the receptacle 102 will be explained with respect to Figures 14a and 14b, 15 and 16. The skilled person will understand that the drive mechanism 400 may facilitate latching, unlatching and re-latching of the cartridge 200 to the receptacle similarly to as described above in respect of the drive mechanism 300, and this process is not repeated here.

Figure 15 shows a portion of the exemplary drive mechanism 400 before insertion into the receptacle 102. For clarity, the housing of the drive mechanism 400 is not shown, and a portion of the actuating portion 404 has been cut away to show features of the collar 416 received within the actuation portion 404.

As shown in Figure 15, a biasing member 433 is disposed between the collar 416 and the coupling portion 407. The biasing member 433 comprises a compression spring.

The biasing member 433 biases the collar 416 axially forward with respect to the housing of the drive mechanism 400. In particular, the biasing member 433 biases the angled teeth 426 of the collar 416 into engagement with the angled teeth 428 of the actuating portion 404. As shown in Figure 15, the angled teeth 426 of the collar 416 and the angled teeth 428 of the actuating portion 404 are meshed together. The angled surfaces of each of the teeth 426 of the collar 416 abut the corresponding angled surfaces of each of the teeth 428 of the actuating portion 404. The stop surfaces of each of the teeth 426 of the collar 416 abut the corresponding stop surfaces of each of the teeth 428 of the actuation portion 404. The abutment of the respective stop surfaces of the teeth 426, 428 of the collar 416 and the actuating portion 404 prevents rotation of the collar 416 in a first direction (in the exemplary arrangement shown in Figure 15, rotation of the collar 416 in an anti-clockwise direction is prevented).

When the user wishes to couple the cartridge 200 and the drive mechanism 400, the user may insert the drive mechanism 400 into the receptacle 102, as described above in respect of the drive mechanism 300.

The collar 416 may initially be in the release configuration such that the arms 410a, 410b of the coupling portion 407 are deflectable outwardly. That is, the release channels 422a, 422b of the collar 416 may be aligned with the arms 410a, 410b to allow the arms 410a, 410b to be deflected outwardly into the clearance volume of the release channels 422a, 422b. This allows the arms 410a, 410b to deflect outwardly and ride along the cartridge until the lugs 412a, 412b reach the recesses 212a, 212b of the cartridge 200 and engage them to couple the cartridge 200 to the drive mechanism 400.

Insertion of the drive mechanism 400 into the receptacle 102 causes the protrusions 108a, 108b of the receptacle 102 to travel within the channels 406a, 406b of the actuating portion 404 to engage with the opposed reaction surface 438a, 438b of the collar 416.

In exemplary arrangements, the protrusions 108a, 108b of the receptacle 102 may comprise corresponding angled reaction surfaces that engage the angled reaction surfaces 438a, 438b of the collar 416. Engagement of the opposed angled reaction

surfaces 438a, 438b of the collar 416 and the angled reaction surfaces of the protrusions 108a, 108b may act to rotate the collar 416 with respect to the coupling portion 407, as the collar 416 is moved axially with respect to the protrusions 108a, 108b. However, rotation of the collar 416 is prevented at this stage due to the abutment of the stop surfaces of the meshed teeth 426, 428 of the collar 416 and the actuating portion 404.

As the drive mechanism 400 is pushed further into the receptacle 102, the collar 416 is moved axially rearwards within the housing of the drive mechanism 400. The rearward movement of the collar 416 within the housing causes the biasing member 433 disposed between the collar 416 and the coupling portion 407 to be compressed, as shown in Figure 16.

As described above, the coupling portion 407 and the actuating portion 404 are axially fixed with respect to the housing of the drive mechanism 400, and so the collar 416 moves rearwards with respect to the coupling portion 407 and the actuating portion 404. Rearward movement of the collar 416 with respect to the coupling portion 406 moves the angled teeth 426 of the collar 416 out of engagement with the angled teeth 428 of the actuating portion 404, as shown in Figure 16. That is, rearward movement of the collar 416 with respect to the coupling portion 407 may compress the biasing member 433 disposed between the collar 416 and the coupling portion 407 to allow the teeth 426 of the collar 416 to disengage from the teeth 428 of the actuating portion 404.

The collar 416 continues to move rearwards with respect to the actuating portion 404, until the stop surfaces of the teeth 426 of the collar 416 disengage from the stop surfaces of the teeth 428 of the coupling portion 407. At this point, there is nothing stopping the collar 416 from rotating with respect to the coupling portion 407. As such, as the user continued to move the drive assembly 400 into the receptacle 102, the angled reaction surfaces 438a, 438b of the collar 416 travel along the angled reaction surfaces of the protrusions 108a, 108b of the receptacle 102, causing the collar 416 to rotate.

The collar 416 may rotate into the locking configuration. That is, the collar 416 rotates until the locking surfaces 420a, 420b of the collar 416 abut the arms 410a, 410b of the coupling portion 407 to retain the lugs 412a, 412b within the recesses of the cartridge

200. Engagement of the locking surfaces 420a, 420b with the arms 410a, 410b prevents outward deflection of the arms 310a, 310b, and therefore prevents disengagement of the lugs 412a, 412b from the recesses of the cartridge 200.

Withdrawal of the drive mechanism 400 from the receptacle 102 causes the collar 416 to move forward relative to the coupling portion 407 under the force of the biasing member 433 disposed therebetween. The collar 416 is in a rotationally different position to its initial rotational position before the drive mechanism 400 was inserted into the receptacle. That is, the collar has been rotated from the release configuration and into the locking configuration and remains in the locking configuration, retaining the lugs 412a, 412b within the recesses of the cartridge 200 on forward movement of the collar 416 under the force of the biasing member. This brings the teeth 426 of the collar back into engagement with the teeth 428 of the actuating portion 404. The teeth 426 of the collar 416 re-mesh with the teeth 426 of the actuating portion 404. The skilled person will appreciate that each of the teeth 426 of the collar 416 engage with adjacent teeth of the actuating portion 404 (that is, teeth adjacent to those that were engaged before the drive mechanism 400 was inserted into the receptacle 102). Abutment of the respective stop surfaces of the teeth 426 of the collar and the teeth 428 of the actuating portion 404 prevents rotation of the collar 416 out of the locking configuration. As such, the cartridge 200 is coupled to the drive mechanism 400.

When the user wishes to decouple the cartridge 200 from the drive mechanism 400 (for example after use of the cartridge 200 to inject a medication), the user may reinsert the cartridge 200 into the receptacle 102. The process mentioned above may be repeated, however this time the collar 316 is rotated from the locking configuration to the release configuration, and therefore the cartridge 200 may be decoupled from the drive mechanism 400.

Figures 17 to 23 show a further alternative drive mechanism 500. The drive mechanism 500 may be similar to the drive mechanism 300 described above, except that the coupling mechanism (i.e. the mechanism by which the drive mechanism 500 couples to and decouples from the cartridge 200) may be different. Many of the features of the drive mechanism 500 are similar to those described above in respect of the drive mechanism 300 of Figures 7a and 7b. As such, a description of these features is not given again here and corresponding reference numerals are used to

identify them in Figures 17 to 23. Thus, 504 is the actuating portion, 506a, 506b are channels, 507 is the coupling portion, 510a, 510b are the arms, 512a, 512b are the lugs, 516 is the collar, and 520 is the locking surface.

Figure 17a shows an exemplary coupling portion 507 of the drive mechanism 500. The coupling portion 507 may be rotatably and axially fixed with respect to the housing of the drive mechanism 500.

The coupling portion 507 comprises the arms 510a, 510b. The arms 510a, 510b each comprise a lug 512a, 512b respectively.

The coupling portion 507 comprises a track 570. The exemplary coupling portion 507 comprises three angularly separated tracks (only one track is visible in Figure 17a), however substantially any number of tracks may be used. The description below is related to a single track 570, however the skilled person will appreciate that similar features/operation will apply to the other tracks in arrangements comprising a plurality of tracks.

The track 570 may be configured to receive a lug of the collar 516 therein, as will be described in more detail below. The track 570 may be substantially square in shape.

The track 570 comprises a retention portion 572. The retention portion 572 may be substantially v-shaped. The lug may be received within the retention portion in an initial position.

The track 570 may further comprise a release portion 576. At least a portion of the release portion 576 may comprise a vertical track. The track 570 may further comprise a latching portion 577. The latching portion may comprise an angled track. The track 570 may comprise a seat 578. The seat 578 may be located at the end of the latching portion 577.

The track 570 may comprise a return portion 579. At least a portion of the return portion 576 may comprise a vertical track.

The retention portion 572, the release portion 576, the latching portion 577 and the return portion 578 may form a substantially square/rectangular track. The retention

portion 572 may be substantially parallel to and opposed to the latching portion 577 (that is, form opposed sidewalls of the square/rectangle). The release portion 576 may be substantially parallel to and opposed to the return portion 579 (that is, form opposed sidewalls of the square/rectangle).

Figure 17b shows an exemplary collar 516 of the drive mechanism 500. The collar 516 may be substantially tubular. At least a portion of the coupling portion 507 may be telescopically received within the collar 516. Similarly to the collars 316, 416 described above, the collar 516 may be axially and rotatably moveable with respect to the coupling portion 507. The collar 516 may be configured, in a locking configuration, to retain the coupling features of the drive mechanism 500 in engagement with the coupling features 212a, 212b of the cartridge 200 to couple the drive mechanism 500 and the cartridge 200. The collar 516 may be configured, in a release configuration, to allow the coupling features of the drive mechanism 500 to disengage from the coupling features 212a, 212b of the cartridge 200 to decouple the drive mechanism 500 and the cartridge 200. The collar 516 may be moveable between the locking configuration and the release configuration.

The collar 516 may at least partially receive the arms 510a, 510b of the coupling portion 507 therein in the locking configuration. The collar 516 may comprise a locking surface 520. In the exemplary collar 516, the locking surface 520 comprises an inner wall of the collar 516. In the locking configuration, at least a portion of the arms 510a, 510b of the coupling portion 507 may abut the locking surface 520. The locking surface 520 therefore prevents outward deflection of the arms 510a, 510b of the coupling portion.

The collar 516 may comprise lugs 580a-c. The lugs 580a-c may protrude radially inwards from an inner surface of the collar 516. The lugs 580a-c may be received in respective tracks 570 of the coupling portion 507. As described above, the exemplary coupling portion 507 comprises three tracks, and so in the exemplary arrangement show, each of the three lugs 580a-c are received in a respective track. The lugs 580a-c may be configured to travel within the respective tracks 570 of the coupling portion 507.

The collar 516 may comprise protrusions 582a, 582b. The protrusions 582a, 582b may extend radially outwards from an outer surface of the collar 516. The protrusions 582a, 582b may be received within a track of an actuating sleeve 584, as described below.

Figure 17c shows an actuating sleeve 584. The actuating sleeve 584 may be substantially tubular. At least a portion of the collar 516 and the coupling portion 507 may be received within the actuating sleeve 584. In exemplary arrangements, the collar 516 may be located between the coupling portion 507 and the actuating sleeve 584. The actuating sleeve may be axially moveable with respect to the housing of the drive mechanism 500, but not rotatably fixed with respect to the housing of the drive mechanism 500.

The actuating sleeve 584 may comprise a reaction surface 586 configured to interact with the receptacle 102. The reaction surface 538 may interact with, for example abut, the protrusions 108a, 108b of the receptacle 102 when the drive mechanism 500 is inserted into the receptacle 102. The collar 516 may extend at least partially into the actuating portion 504 such that the protrusions 108a, 108b may engage the collar 516 when the protrusions 108a, 108b are received within the channels 506a, 506b of the actuating portion 504.

The actuating sleeve 584 may comprise tracks 586a, 586b configured to receive respective protrusions 582a, 582b of the collar 516. The tracks 586a, 586b may each comprise an angled portion 588a, 588b. The tracks 586a, 586b may comprise a vertical portion 590a, 590b. The angled portions 588a, 588b may be connected to the respective vertical portions 590a, 590b such that the protrusions 582a, 582b may travel therebetween.

Operation of the coupling mechanism of the drive mechanism 500 will now be described with reference to Figures 18 to 23. The skilled person will understand that the drive mechanism 500 may facilitate latching, unlatching and re-latching of the cartridge 200 to the receptacle similarly to as described above in respect of the drive mechanism 300, and this process is not repeated here.

Figure 18 shows a portion of the exemplary drive mechanism 500 before insertion into the receptacle 102.

As shown in Figure 18, a biasing member 533 is disposed between the collar 516 and the coupling portion 507. The biasing member 533 comprises a compression spring. The biasing member 533 biases the collar 516 axially forward with respect to the housing of the drive mechanism 500. In particular, the biasing member 533 biases collar 516 axially forward with respect to the coupling portion 507. Before insertion of the drive mechanism 500 into the receptacle 102, the biasing member 533 is held in a primed state. The lugs 580a-c of the collar 516 are received within the respective retention portions 572 of the respective tracks 570 of the coupling portion 507. Since the coupling portion 507 is axially fixed with respect to the housing of the drive mechanism 500, the collar 516 is unable to move forward within the housing under the force of the biasing member 533 when the lugs 580a-c are received within the retention portions 572 of the respective tracks 570.

The receipt of the lugs 580a-c of the collar 516 within the respective retention portions 572 of the tracks 570 of the coupling portion 507 is schematically shown in Figure 19 in position “A”. Figure 19 schematically shows the travel of the lugs 580a-c of the collar 516 within the tracks 570 of the coupling portion 507 (from position “A” to “F”), during operation of the drive mechanism 500.

As shown in Figure 18, the drive mechanism 500 comprises a further biasing member 592. The biasing member 592 biases the actuating sleeve 584 forward with respect to the housing of the drive mechanism 500, and therefore forward with respect to the coupling portion 507. The biasing member 592 is disposed between a surface of the actuating sleeve 584 and a surface of the housing of the drive mechanism 500.

When the drive mechanism 500 is in the position shown in Figure 18, before insertion of the drive mechanism 500 into the receptacle 102, the collar 516 is in the release configuration. Figure 20 is a section view through the drive mechanism 500, when the drive mechanism is in the pre-use configuration as shown in Figure 18. As shown in Figure 20, the collar 516 does not surround the arms 510a, 510b of the coupling portion 507, and the locking surface 520 of the collar is not in abutment with the arms 510a, 510b of the coupling portion 507. There exists a volume between the coupling portion 507 and the actuating sleeve 584 into which the arms 510a, 510b may deflect.

When the user wishes to couple the cartridge 200 and the drive mechanism 500, the user may insert the drive mechanism 500 into the receptacle 102, as described above in respect of the drive mechanism 300.

Since the collar 516 is in the release configuration, when the drive mechanism 500 is placed over the cartridge 200 on insertion of the drive mechanism 500 into the receptacle 102, the arms 510a, 510b deflect outwardly and ride along the cartridge until the lugs 512a, 512b of the arms 510a, 510b reach the recesses of the cartridge 200 and engage them to couple the cartridge 200 to the drive mechanism 500.

Insertion of the drive mechanism 500 into the receptacle 102 causes the protrusions 108a, 108b of the receptacle 102 to engage with the reaction surface 586 of the actuating sleeve 584. As the drive mechanism 500 is pushed further into the receptacle 102, the actuating sleeve 584 is moved axially rearwards. This causes the biasing member 592 to compress (i.e. the biasing member that biases the actuating sleeve 584 forward).

Movement of the actuating sleeve 584 rearwards, causes the protrusions 582a, 582b of the collar 516 to travel within the tracks 586a, 586b of the actuating sleeve 584. Specifically, the protrusions 582a, 582b travel within the angled portions 588a, 588b of the respective tracks 586a, 586b. Since the actuating sleeve 584 is rotatably fixed within the housing of the drive mechanism 500, travel of the protrusions 582a, 582b of the collar 516 within the angled portions 588a, 588b of the respective tracks 586a, 586b of the actuating sleeve 584 causes the collar 516 to rotate. The collar 516 is also moved axially rearwards. This moves the lugs 580a-c of the collar 516 within the track 570 of the coupling portion 507 from the retention portion 572 to the position “B” shown in Figure 19. In this position, the lugs 580a-c are aligned with the release portions 576 of the respective tracks 570.

Furthermore, the protrusions 582a, 582b of the collar 516 have moved along the angled portions 588a, 588b of the respective tracks 586a, 586b of the actuating sleeve 584 and are aligned with the vertical portions 590a, 590b of the tracks 586a, 586b of the actuating sleeve 584.

In this position, the collar 516 is free to move axially forward under the force of the biasing member 533. Movement of the collar 516 axially forwards causes the protrusions 582a, 582b of the collar 516 to move within the vertical portions 590a, 590b of the tracks 586a, 586b of the actuating sleeve 584. This moves the collar 516 axially forward with respect to the actuating sleeve 584. The collar 516 moves axially forwards until the protrusions 582a, 582b of the collar 516 reach the end of the vertical portions 590a, 590b of the tracks 586a, 586b of the actuating sleeve 584.

Movement of the collar 516 axially forwards causes the lugs 580a-c of the collar 516 to move within the release portions 576 of the tracks 570 of the coupling portion towards position "C" as shown in Figure 19. The collar 516 therefore moves axially forwards with respect to the coupling portion 507 until the lugs 580a-c of the collar reach the end of the release portions 576. This causes the collar 516 to move towards the locking configuration. The collar 516 moves axially forwards with respect to the coupling portion 507 along the length of the arms 510a, 510b to move the locking surface 520 into engagement with the arms 510a, 510b. In the exemplary arrangement shown, moving the collar 516 into the locking configuration comprises moving the collar 516 into a position such that it surrounds at least a portion of the length of the arms 510a, 510b. The locking surface 520 of the collar 516 is brought into abutment with at least a portion of the arms 510a, 510b and therefore the arms 510a, 510b are prevented from deflecting outwards. This prevents the lugs 512a, 512b of the arms 510a, 510b of the coupling portion 507 from disengaging the recesses 212a, 212b of the cartridge 200. As such, the collar 516 retains the coupling portion 507 in engagement with the cartridge 200 to couple the cartridge 200 and the driving mechanism 500.

Figure 21 shows the position of the collar 516 relative to the coupling portion 507 when the when the lugs 580a-c of the collar 516 are in position "C" as shown in Figure 19. As can be seen in Figure 21, in this position, the collar 516 does not fully surround the entire length of the arms 510a, 510b of the coupling portion 507. That is, a portion of the arms 510a, 510b extends beyond a lower surface of the collar 516. Enough of the arms 510a, 510b are in contact with the locking surface 520 to prevent outward deflection of the arms 510a, 510b however.

Withdrawal of the drive mechanism 500 from the receptacle 102 causes the actuating sleeve 584 to move forward under the force of the biasing member 592. The actuating sleeve 584 moves axially forwards relative to the collar 516.

As discussed above, prior to withdrawal of the drive mechanism 500 from the receptacle, the protrusions 582a, 582b are located at the end of the vertical portions 590a, 590b of the tracks 586a, 586b of the actuating sleeve 584. The movement of the actuating sleeve 584 axially forwards relative to the collar 516 causes the protrusions 582a, 582b of the collar 516 to move rearward within the vertical portions 590a, 590b of the tracks 586a, 586b of the actuating sleeve 584. Continued forward axial movement of the actuating sleeve 584 causes the protrusions 582a, 582b to contact the angled surface of the angled portion 588a, 588b of the tracks 586a, 586b. Since the actuating sleeve is rotationally fixed with respect to the housing of the drive mechanism 500, continued forward axial movement of the actuating sleeve 584 after the protrusions 582a, 582b enter the angled portion 588a, 588b of the tracks 586a, 586b and travel therein causes the collar 516 to rotate. The skilled person will appreciate that because the protrusions 582a, 582b are travelling along the angled portion 588a, 588b of the tracks 586a, 586b in an opposed direction to when the actuating sleeve 584 was move rearwards (as described above), the collar 516 rotates in the opposite direction to the rotational direction on rearward movement of the actuating sleeve 584.

The rotation of the collar 516 causes the lugs 580a-c of the collar 516 to enter the latching portion 577 of the track 570 and travel therein. The latching portion 577 is angled, and so travel of the lugs 580a-c of the collar 516 within the latching portion 577 causes axial movement of the collar 516 forwards with respect to the coupling portion 507 as well as relative rotational movement between the collar 516 and the coupling portion 507 (and the collar 516 and the actuating sleeve 584). This axial movement causes the collar 516 to move further forwards along the length of the arms 510a, 510b to the position shown in Figure 22. As such, more of the length of the arms 510a, 510b is surrounded by the collar 516 as compared to the position depicted in Figure 21.

The collar 516 rotates and moves axially forwards with respect to the coupling portion 507 and the actuating sleeve 584 until the lugs 580a-c of the collar 516 to reach the end of the latching portion 577 of the track 570 of the coupling portion 507. The position of the lugs 580a-c of the collar 516 at the end of the latching portion 577 is

shown in position “E” in Figure 19. The lugs 580a-c may be received in respective seats 578 of the tracks 570. In exemplary arrangements, the latching portion 577 of the track 570 may comprise a ramp 594 and the lugs 580a-c of the collar 516 may be required to travel over the ramp in order to reach the seat 578 and be retained therein. In this position, the lugs 580a-c are aligned with the respective return portions 579 of the track 570.

When the lugs 580a-c of the collar 516 are in position “E”, as shown in Figure 19, the collar 516 is in the locking configuration and the lugs 512a, 512b of the arms 510a, 510b of the coupling portion 507 are held in engagement with the corresponding recesses of the cartridge 200 to couple the cartridge 200 to the driving mechanism 500.

When the user wishes to decouple the cartridge 200 from the drive mechanism 500 (for example after use of the cartridge 200 to inject a medication), the user may reinsert the cartridge 200 into the receptacle 102. To reinsert the cartridge 200 into the receptacle 102, the user may need to insert the drive mechanism 500 into the receptacle 102.

Insertion of the drive mechanism 500 into the receptacle 102 causes the protrusions 108a, 108b of the receptacle 102 to engage with the reaction surface 586 of the actuating sleeve 584. As the drive mechanism 500 is pushed further into the receptacle 102, the actuating sleeve 584 is moved axially rearwards, similarly to as described above. This causes the biasing member 592 to compress (i.e. the biasing member that biases the actuating sleeve 584 forward).

Movement of the actuating sleeve 584 rearwards causes movement of the collar 516 rearwards with respect to the coupling portion 507. This is because the protrusions 582a, 582b of the collar 516 to travel within the tracks 586a, 586b of the actuating sleeve 584. Specifically, the protrusions 582a, 582b travel within the angled portions 588a, 588b of the respective tracks 586a, 586b to the end of the angled portions 588a, 588b. Once the protrusions reach the end of the angled portions 588a, 588b of the respective tracks 586a, 586b, further rearward movement of the actuating sleeve 584 causes axial rearward movement of the collar 516.

Movement of the protrusions 582a, 582b travel within the angled portions 588a, 588b of the respective tracks 586a, 586b imparts a rotational force on the collar 516 in a

direction that would act to move the lugs 580a-c back into the latching portion 577 of the track 570. Rotation of the collar 516 to move the lugs 580a-c back into the latching portion 577 of the track 570 is prevented by the ramp within the latching portion 577 however and the lugs 580a-c are kept in alignment with the respective return portions 579 of the track 570.

Rearward movement of the collar 516 with respect to the coupling portion 507 causes the lugs 580a-c to move within the respective return portions 579 of the tracks 570 until they reach position “F” shown in Figure 19. This causes the collar 516 to return to the release position, as shown in Figure 23. In this position, the locking surface 520 of the collar 516 is no longer in abutment with the arms 510a, 510b of the coupling portion 507. As such, the arms 510a, 510b are free to deflect outwards to disengage the lugs 512a, 512b from the recesses 212a, 212b of the cartridge 200. This allows the drive mechanism 500 and the cartridge 200 to decouple.

When the user once again withdraws the drive mechanism 500 from the receptacle 102 (after decoupling the cartridge 200 from the drive mechanism 500), the actuating sleeve 584 moves forwards under the force of the biasing member 592. The lugs 580a-c of the collar 516 move back into the respective retention portions 572 of the tracks 570. As such, the drive mechanism 500 may be used to couple to a subsequent cartridge 200 full of an injectable medication using the same process as described above.

The above apparatus 100 therefore provides a simplified way to assemble a disposable auto-injector. In order to attach a cartridge 200 to a re-usable auto-injector drive mechanism 300, the user simply needs to push the drive mechanism 300 into the apparatus 100 to couple the cartridge 200 thereto. To decouple the cartridge 200 from the re-usable auto-injector drive mechanism 300 after the medication has been injected, the user simply needs to again, push the drive mechanism 300 into the apparatus 100, and the apparatus facilitates decoupling of the cartridge 200 from the drive mechanism 300 and retention of the cartridge 200 therein. As such, the user is required to take far fewer steps to assemble the auto-injector device that typically required by known devices.

Figures 24 and 25 provide an axial cross-sectional view and a partial cross-sectional view of an actuation system 600 of the drive mechanism 300 (shown in Figures 7a and 7b), whilst Figure 26 shows an exploded view of the actuation system. The system 600 is located within an outer housing of the drive mechanism, where the drive mechanism includes a battery and connectors for electrically connecting the battery to electrical components of the system. Reference herein to a "proximal end" and a "distal end" of the system and its components are intended to refer, respectively, to the end closest to a user's skin in use and furthest from the user's skin in use.

The system 600 comprises a housing 601 defining a first chamber 602 within which an electric motor 603 is located. The electric motor is arranged to be driven by power supplied from the battery. Although not shown in the drawings, the system (and drive mechanism) comprise switching means for allowing a user to activate the motor and thereby facilitate needle insertion and medication delivery. The system further comprises a plunger rod 604 which, in use, engages a bung 207 of an attached cartridge 200 (extracted from the cartridge magazine as described above). The plunger rod is generally cylindrical, having a screw thread 605 provided around its outer surface. The plunger rod 604 is located within a passage 606 extending axially through a generally cylindrical drive shaft 607, where the screw thread 605 on the plunger rod engages with a corresponding screw thread 608 provided on the surface of the passage 606 extending through the drive shaft.

An upper end (as viewed in the Figures) of the drive shaft 607 is in turn received within a generally cylindrical inner insertion collar 609 whilst the inner insertion collar 609 is located with a generally cylindrical outer insertion collar 610. Of note here is that a slot 623 is defined at the upper end of the outer insertion collar and extends circumferentially over a region or 5 to 10 degrees. The slot receives a feature 624 projecting outwardly from the inner insertion collar 609, where the circumferential extent of the feature 624 is significantly less than that of the slot 623.

The inner insertion collars 609,610 are configured such the inner collar extends above the outer collar to an extent, whilst the outer insertion collar extends below the inner insertion collar to a similar extent. [The mechanism coupling the drive shaft 607, inner insertion collar 609 and outer insertion collar 610 is described in detail below.] The inner insertion collar 609 is rotatably mounted within the housing 601 by way of an

appropriate bearing or bearings 611 (not described here in detail). Teeth formed around a circumferentially extending surface at the top of the outer insertion collar 610, above the top of the outer insertion collar, provide an output gear 612. An input gear 613 is secured to a driven motor shaft 614 for rotation therewith. An intermediate gear 615 is coupled between the input and output gears such that rotation of the input gear 613 by the driven motor shaft 614 causes rotation of the output gear 612 and therefore rotation of the inner insertion collar 609.

Figure 27 illustrates the actuation system absent the outer insertion collar 610 from which it can be seen that the inner insertion collar 609 defines a helical slot 615 that passes through the collar. The helical slot 615 is open at its lower end. The outer insertion collar 610 defines on its inner surface a helical track 616 with the same pitch as the helical slot 615 defined by the inner insertion collar. A pair of shaped teeth 616a,b, only one of which is visible in Figure 27, are provided on an outer surface of the drive shaft 607 and are spaced apart, e.g. by 180 degrees, on a helical path that corresponds in pitch to that of the helical slot 612 and helical track 613. The teeth may be shaped to follow the helical path along their lengths. In a ready to use state, the inner and outer insertion collars are rotationally aligned such that the helical slot 612 and the helical track 613 are also aligned, whilst the teeth 616a,b project through the helical slot and are located within the helical track. In this ready to use state, the teeth 616a,b are at the upper end of the helical slot and track, i.e. the drive shaft 607, by means of the teeth, is screwed all of the way to the top of the insertion collars. The plunger rod 604 is also screwed all of the way rearward into the drive shaft 607, such that the mechanism comprising the insertion collars, drive shaft and plunger rod is in a fully contracted or compressed state.

Also shown in the Figures is a drive collar 617 that comprises a ring-shaped base 618 defining a passage therethrough and a pair of flexible legs 619a,b extending radially upwardly from the base. An end of the plunger rod 604 that projects outwardly from the drive shaft extends through the base to project from the base 618 to a small extent (in the ready to use state). A pair of tracks 625a,b extend coaxially along the outer surface of the plunger rod, with the tracks being spaced by 180 degrees. The tracks are engaged by cooperating features 626a,b provided on the inside of the base 618 of the drive collar 617, such that the features prevent relative rotation of the plunger rod and the drive collar whilst not, by themselves, inhibiting relative axial movement.

A first ball catch 620 or similar resilient feature is provided at the end of the plunger rod 604, within the base 618, and is received with a corresponding key (not visible in the Figures) defined on an inner surface of the base. These features resist rotation of the plunger within the drive shaft until a force applied between the two components exceeds some threshold. The flexible legs 619a,b extend upwardly and are compressed between the drive shaft 607 and the system housing 601, such that a pair of inwardly directed fingers 621a,b, extending from respective legs, are received within and retained by a recess 622 extending circumferentially around a central region of the drive shaft 607. The fingers 621a,b also have radially outwardly directed features that engage respective co-axial tracks 628a,b extending down an inner surface of the housing 601. This arrangement prevents rotation of the drive collar 617 within the housing whilst allowing the drive collar to slide axially within the housing. The plunger rod 604 is provided with a second ball catch 627 at its upper end which, in the ready-to-use state, is held inwardly by the inner surface of the drive shaft.

As has been described above, the housing of the actuation system comprises coupling features 308a, 308b configured to engage with the coupling features 212a, 212b of the cartridge 200 to couple the cartridge 200 and the drive mechanism 300 including the actuation system 600.

The operating sequence of the actuation system is as follows:

a. The user depresses a button to actuate the electric motor 603. This causes the inner insertion collar 609 to rotate, which in turn rotates the outer insertion collar 610. At this stage, the engagement of the piston rod 604 with the drive collar 617, via the first ball catch 620, prevents the piston rod and therefore the drive shaft 607 from rotating. The drive shaft, and with it the piston rod and the drive collar, are therefore moved axially down the housing. During this phase of operation, the drive collar 617 acts against the top of the cartridge 200, pushing the cartridge and attached needle 208 through the cartridge housing 202, the end of which is pressed against the user's skin.

b. After a certain relative axial movement of the insertion collars and the drive shaft, the teeth 616a,b provided on the drive shaft exit from the lower end of the helical slot 615 defined by the inner insertion collar. The teeth remain engaged with the helical track 616 defined in the outer insertion collar although the lowermost tooth will now

have arrived at the end of the track. This is the position illustrated in Figure 28 (again, absent the outer insertion collar).

c. At this stage, the teeth 616a,b no longer prevent relative rotation of the inner and outer insertion collars, and the inner insertion collar now rotates around the outer collar until the feature 624 has travelled to the opposite end of the slot 623, at which point the inner and outer collars are once again rotationally coupled. It will be appreciated that the helical slot in the inner insertion collar is no longer aligned with the helical track in the outer insertion collar. As such, any subsequent counter-rotation of the drive shaft with respect to the insertion collars will not result in the teeth 616a,b re-entering the helical slot /track.

d. Rotation of the inner insertion collar, and with it the outer insertion collar, continues. It will be appreciated that the teeth 616a,b are now at the end of the helical track defined in the outer insertion collar, abutting against the end wall of the track.

e. As has already been noted, during needle insertion, the drive collar, plunger rod and drive shaft have all been prevented from rotating within the housing. At the end of needle insertion, the cartridge 200 is prevented from further movement forward within the cartridge housing 202, with the base 618 of the drive collar 617 being pressed firmly against the end of the cartridge. A significant rotational force is now being exerted on the drive shaft by the outer insertion collar. As the plunger rod is still being prevented from rotating by virtue of its splined engagement with the drive collar, the only option for the plunger rod is for it to be screwed out of the drive shaft. This happens after the resistance presented by the first ball catch is overcome.

f. Continued rotation of the drive shaft causes the plunger rod to push the bung 207 through the cartridge to eject medication through the needle. Figure 29 illustrates the state of the device as the plunger rod approaches the end of its delivery stroke.

g. At the end of the delivery stroke of the plunger rod 604, the second ball catch 627, provided at an upper end of the plunger rod, exits the central passage in the drive shaft 607 and pops out. This state is illustrated in Figure 30.

h. At this point, injection of the medication from the cartridge is complete and the plunger rod is unable to move forwards. This is detected by a microprocessor of the device as a current spike. The microprocessor is coded to make the motor dwell for a set period of time (about 2 to 3 seconds), then rotate the motor in the reverse direction. This reverse rotation initially rotates only the inner insertion collar 609 until the feature 623 provided on the inner insertion collar arrives at the other end of the slot 623

provided on the outer insertion collar. This brings the helical slot 615 and helical track 616 into alignment and both insertion collars now rotate together.

i. The reaction force exerted on the plunger rod 604 by the cartridge bung and retraction spring exert a rearward force on the drive shaft 607 via the second ball catch 627 which inhibits relative rotation of the plunger rod and the drive shaft. Rotation of the insertion collars therefore screws the insertion rod, and with it the plunger rod, rearwards into the device. At the same time the needle is withdrawn from the patients skin.

j. When the drive shaft reaches the back of the inner insertion collar, the drive shaft will then rotate with the insertion collars. As the plunger rod cannot rotate, it is screwed fully back into the drive shaft and the mechanism is fully reset.

The skilled person will be able to envisage other apparatus and drive mechanisms and features thereof without departing from the scope of the appended claims. In particular, it is noted that one or more features included in one or more drawings may be integrated into apparatus and/or drive mechanisms shown in other drawings, as will be appreciated by the skilled person.

CLAIMS:

1. An apparatus for selectively retaining a cartridge for delivering an injectable medication, the cartridge being attachable to and detachable from a drive mechanism, the apparatus comprising:

a receptacle;

a latching mechanism configured to:

facilitate unlatching of the cartridge upon direct or indirect engagement of a part of the drive mechanism with the receptacle and coupling of the drive mechanism to the cartridge;

upon removal of the cartridge from the receptacle, move to a re-latching configuration;

re-receive the cartridge, wherein said re-latching configuration latches the cartridge within the receptacle whilst substantially preventing its further removal by the drive mechanism.

2. An apparatus according to claim 1, wherein the latching mechanism is further configured to retain the cartridge within the receptacle in an unused state prior to the drive mechanism engaging the cartridge.

3. An apparatus according to claim 1 or 2, wherein the latching mechanism comprises a latching sleeve configured to receive the cartridge therein, and wherein the latching sleeve is moveable within the receptacle between:

an unlatching position to facilitate the unlatching of the cartridge, and

a re-latching position to re-latch the cartridge within the receptacle in the used state.

4. An apparatus according to claim 3, wherein the latching sleeve is movable between a latching position to latch the cartridge within the receptacle in the unused state, the unlatching position and the re-latching position.

5. An apparatus according to claim 4, wherein engagement of the part of the drive mechanism with the receptacle causes the latching sleeve to move from the latching position to the unlatching position to facilitate unlatching of the cartridge.

6. An apparatus according to claim 5, wherein the engagement of the part of the drive mechanism with the receptacle causes axial movement of the latching sleeve from the latching position to the unlatching position

7. An apparatus according to claim 5 or 6, wherein the receptacle comprises a cartridge latch configured to latch the cartridge within the receptacle in the unused state, and wherein the in latching position, the latching sleeve prevents release of the cartridge latch.

8. An apparatus according to claim 7, wherein in the unlatching position, the latching sleeve allows the cartridge latch to be released to allow removal of the cartridge from the receptacle.

9. An apparatus according to claim 7 or 8, wherein the cartridge latch comprises a flexible arm comprising a lug configured to be received within a corresponding recess of the cartridge.

10. An apparatus according to claim 9, when dependent on claim 6, wherein the cartridge sleeve is configured to prevent deflection of the flexible arm to disengage the lug from the recess of the cartridge in the latching position, and wherein the cartridge sleeve is configured to allow deflection of the flexible arm to disengage the lug from the recess of the cartridge in the unlatching position.

11. An apparatus according to claim 10, wherein the latching sleeve comprises a cartridge locking channel configured to receive the flexible arm therein to prevent deflection of the flexible arm in the latching position, and wherein movement of the latching sleeve to the unlatching position causes the flexible arm to exit the cartridge locking channel to allow deflection of the flexible arm.

12. An apparatus according to any of claims 2 to 11, wherein the latching mechanism further comprises a biasing member.

13. An apparatus according to claim 12, wherein the biasing member is disposed between the latching sleeve and a base of the receptacle.

14. An apparatus according to claim 13, wherein the biasing member is configured to axially bias the latching sleeve into the latching position, and wherein the biasing member is configured to be compressed on engagement of the part of the drive assembly with the receptacle to move the latching sleeve into the unlatching position.

15. An apparatus according to any of claims 12 to 14, wherein the biasing member is configured to apply a rotational biasing force to the latching sleeve to rotate the latching sleeve towards the re-latching position.

16. An apparatus according to claim 15, wherein the receptacle comprises a stop surface configured to engage the latching sleeve to prevent rotation of the latching sleeve when the latching sleeve is in the latching position.

17. An apparatus according to claim 16, wherein movement of the latching sleeve from the latching position to the unlatching position upon engagement of the part of the drive mechanism with the receptacle causes the latching sleeve to disengage from the stop surface and rotate towards the re-latching position under the force of the biasing member.

18. An apparatus according to any of claims 15 to 17, wherein the latching sleeve comprises a deflectable latching arm configured to engage the cartridge in a deflected state to prevent removal of the cartridge from the receptacle, and wherein the latching arm is in the deflected state when the latching sleeve is in the re-latching position.

19. An apparatus according to claim 18, wherein the latching arm comprises a locking feature configured to engage a corresponding locking feature on the cartridge.

20. An apparatus according to claim 18 or 19, wherein in the deflected state, the latching arm is deflected into a position such that when the cartridge is received within the receptacle in a used state, the latching arm engages the cartridge to prevent removal of the cartridge.

21. An apparatus according to claim 20, wherein the receptacle comprises a reaction surface, and wherein movement of the latching sleeve towards the re-latching

position causes the latching arm to engage the reaction surface and deflect towards the position.

22. An apparatus according to claim 20 or 21, wherein the latching arm is deflected into the position upon removal of the cartridge in the unused state from the receptacle.

23. An apparatus according to claim 21 or 22, wherein in a non-deflected state, the latching arm is not engaged with the cartridge and does not prevent removal of the cartridge from the receptacle, and wherein the latching arm is in a non-deflected state when the cartridge in the unused state is received within the receptacle.

24. An apparatus according to any of claims 2 to 23, wherein the receptacle further comprises an axial lock and a rotational lock, and wherein the latching sleeve is configured to engage the axial lock and the rotational lock when in the re-latching position such that the latching sleeve is unable to move from the re-latching position on re-engagement of the drive mechanism therewith, and further removal of the cartridge in the used state is prevented.

25. An apparatus according to any preceding claim, further comprising the cartridge.

26. An apparatus according to any preceding claim, wherein the engagement of the drive mechanism with the receptacle is direct engagement comprising insertion of at least a part of the drive mechanism into the receptacle.

27. An assembly comprising:

a plurality of apparatus according to any of claims 1 to 26, each of the plurality of apparatus comprising the cartridge received within the receptacle in an unused state,

wherein each of the plurality of apparatus are coupled together in series.

28. An auto-injector assembly comprising:

an apparatus according to any of claims 3 to 26; and

the drive mechanism comprising an actuating portion configured to engage the latching sleeve on engagement of the drive mechanism with the receptacle to facilitate

movement of the latching sleeve between the unlatching position and the re-latching position.

29. An auto-injector assembly according to claim 28, wherein the drive mechanism further comprises a coupling portion comprising coupling features configured to engage corresponding coupling features on the cartridge to couple the cartridge thereto when the portion of the drive mechanism is engaged with the receptacle.

30. An auto-injector assembly according to claim 29, wherein the drive mechanism further comprises a collar moveable between a locking configuration in which the collar is operable to retain the coupling features of the coupling portion in engagement with the coupling features of the cartridge, and a release configuration in which the collar is operable to allow the coupling features of the coupling portion to disengage from the coupling features of the cartridge.

31. An auto-injector assembly according to claim 30, wherein the collar is movable between the locking configuration and the release configuration on engagement of at least a portion of the drive mechanism with the receptacle.

32. A drive mechanism for an auto-injector and for coupling to a cartridge comprising an injectable medication and stored within a receptacle of an apparatus, the drive mechanism configured to couple to the cartridge and to facilitate release of the cartridge from the receptacle on direct or indirect engagement of at least a portion of the drive mechanism with the receptacle, the drive mechanism operable to drive a plunger rod into the cartridge to dispense the injectable medication, the drive mechanism comprising:

a coupling portion comprising coupling features configured to engage corresponding coupling features on the cartridge to couple the cartridge thereto; and

a collar moveable between a locking configuration in which the collar is operable to retain the coupling features of the coupling portion in engagement with the coupling features of the cartridge, and a release configuration in which the collar is operable to allow the coupling features of the coupling portion to disengage from the coupling features of the cartridge, and

wherein movement of the collar between the locking configuration and the release configuration is caused by the direct or indirect engagement of the drive mechanism with the receptacle.

33. A drive mechanism according to claim 32, wherein the coupling features of the coupling portion comprise a flexible arm comprising a lug configured to be received within a corresponding recess of the cartridge.

34. A drive mechanism according to claim 33, wherein the collar comprises a locking surface configured to engage the flexible arm when the collar is in the locking configuration to prevent disengagement of the lug from the corresponding recess of the cartridge.

35. A drive mechanism according to claim 34, wherein the locking surface is configured to abut the flexible arm when the collar is in the locking configuration.

36. A drive mechanism according to claim 34 or 35, wherein the collar is moveable to bring the locking surface into and out of engagement with the flexible arm to move the collar between the locking configuration and the release configuration.

37. A drive mechanism according to any of claims 32 to 36, wherein the collar is rotatable, and wherein relative rotation between the collar and the coupling portion causes the collar to move between the locking configuration and the release configuration.

38. A drive mechanism according to claim 37, wherein the collar and the coupling portion comprise corresponding angled surfaces configured to engage to rotate the collar between the locking configuration and the release configuration, and wherein the corresponding angled surfaces are brought into engagement on relative axial movement between the collar and the coupling portion.

39. A drive mechanism according to claim 38, wherein the relative axial movement between the collar and the coupling portion is facilitated by the direct or indirect engagement of the at least a portion of the drive mechanism with the receptacle.

40. A drive mechanism according to claim 38 or 39, wherein the collar and the coupling portion comprise corresponding angled teeth, and wherein the corresponding angled teeth comprise the corresponding angled surfaces.

41. A drive mechanism according to any of claims 32 to 36, wherein the collar is axially moveable with respect to the coupling portion, and wherein axial movement of the collar with respect to the coupling portion causes the collar to move between the locking configuration and the release configuration.

42. A drive mechanism according to claim 41, further comprising a biasing member configured to bias the collar into the locking configuration.

43. A drive mechanism according to claim 42, wherein the biasing member is held in a primed state and is releasable to drive the collar towards the locking configuration on the direct or indirect engagement of the portion of the drive mechanism with the receptacle and/or cartridge.

44. A drive mechanism according to claim 43, wherein one of the coupling portion and the collar comprise a track and the other of the coupling portion and the collar comprise a lug configured to be received within the track.

45. A drive mechanism according to claim 44, wherein the track comprises a retention portion, and wherein when the lug is received within the retention portion, the biasing member is held in the primed state.

46. A drive mechanism according to claim 45, wherein the track comprises a release portion, and wherein the lug is moveable within the release portion to allow the biasing member to be released to drive the collar into the locking configuration.

47. A drive mechanism according to any of claims 44 to 46, wherein the collar is axially and rotatably moveable with respect to the coupling portion to cause movement of the lug within the track, the drive mechanism further comprising an actuating sleeve configured to interact with the receptacle to cause axial and rotatable movement of the collar on the direct or indirect engagement of the drive mechanism with the receptacle.

48. A drive mechanism according to claim 47, wherein one of the actuating sleeve and the collar comprise a track and the other of the actuating and the collar comprise a protrusion configured to be received within the track.

49. A drive mechanism according to claim 48, wherein movement of the protrusion within the track causes the axial and rotatable movement of the collar.

50. A drive mechanism according to any of claims 32 to 49, wherein engagement of the drive mechanism with the receptacle to facilitate release of the cartridge is direct engagement comprising insertion of at least a portion of the drive mechanism within the receptacle.

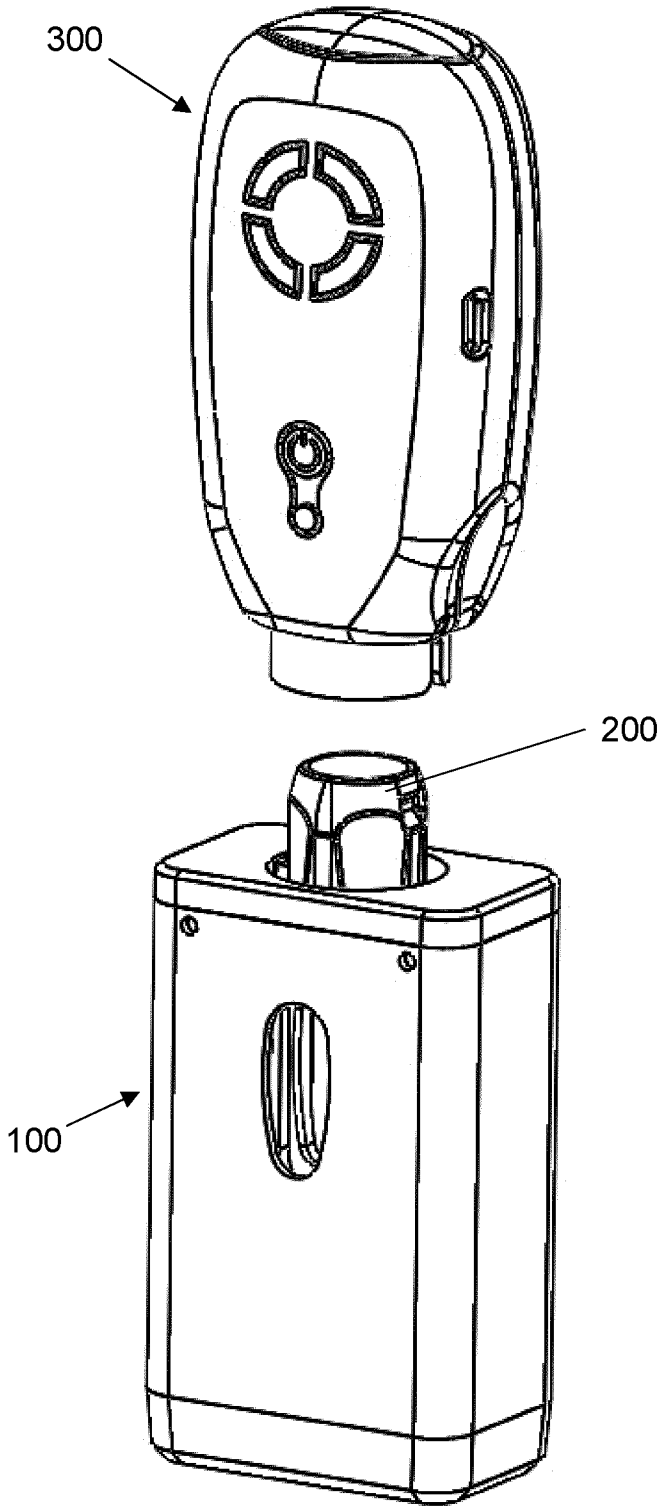


Fig. 1

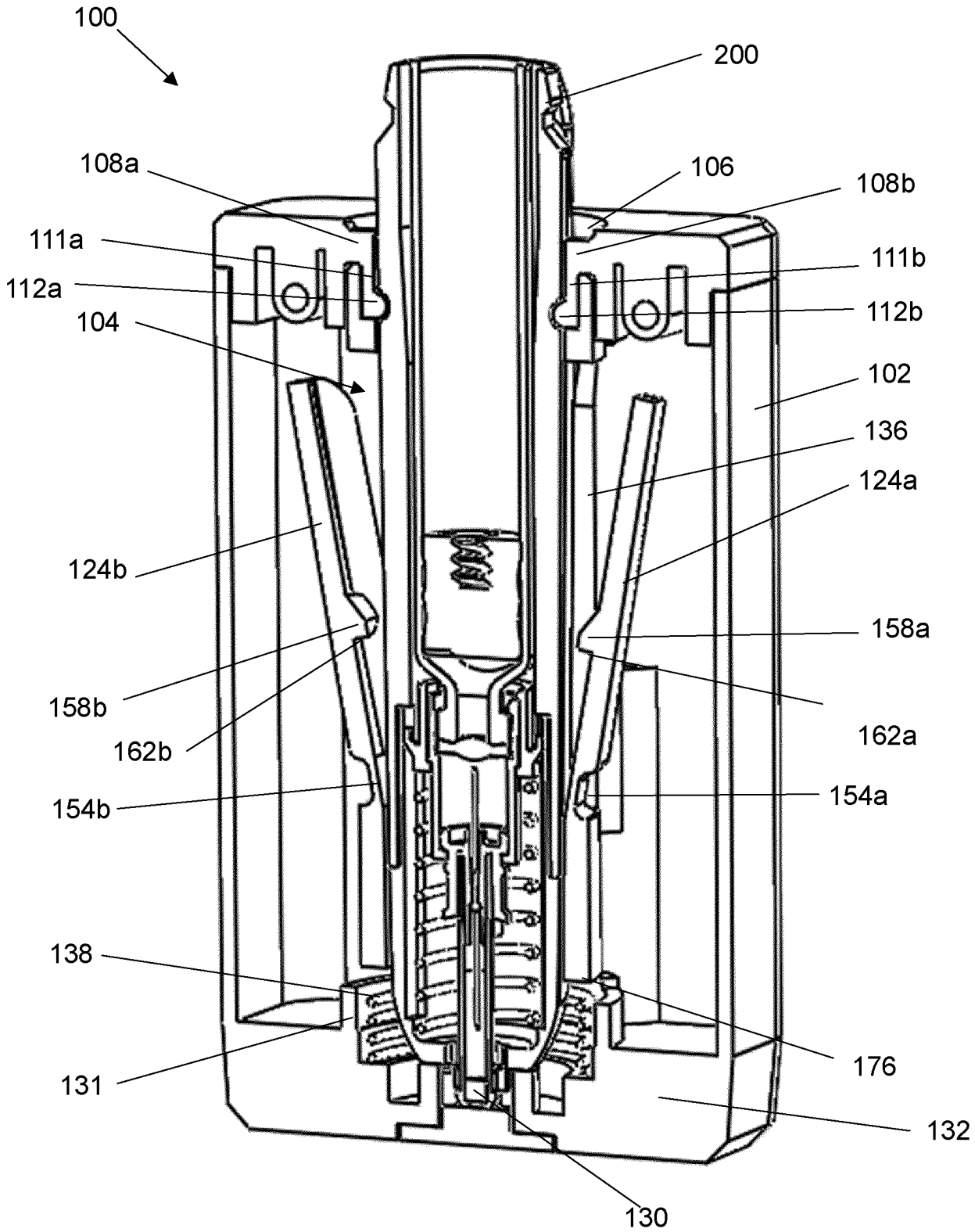

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108b
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112b
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Fig. 2

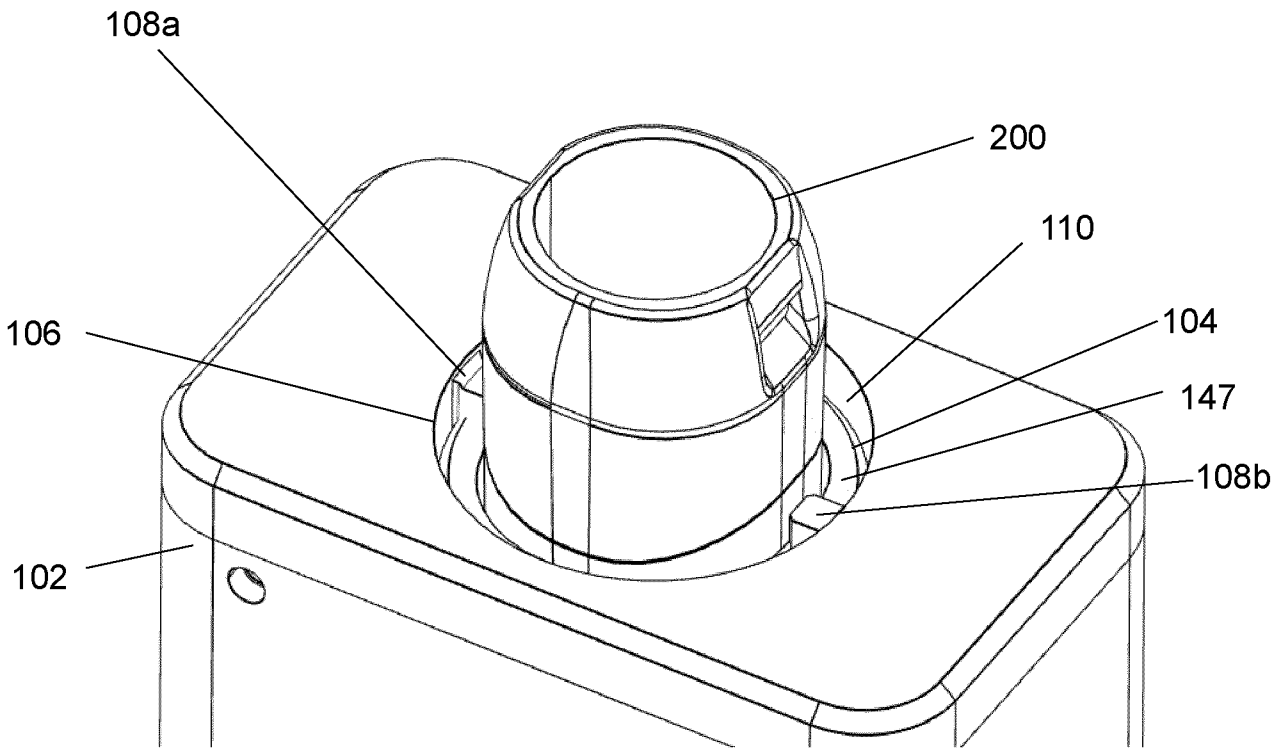


Fig. 3

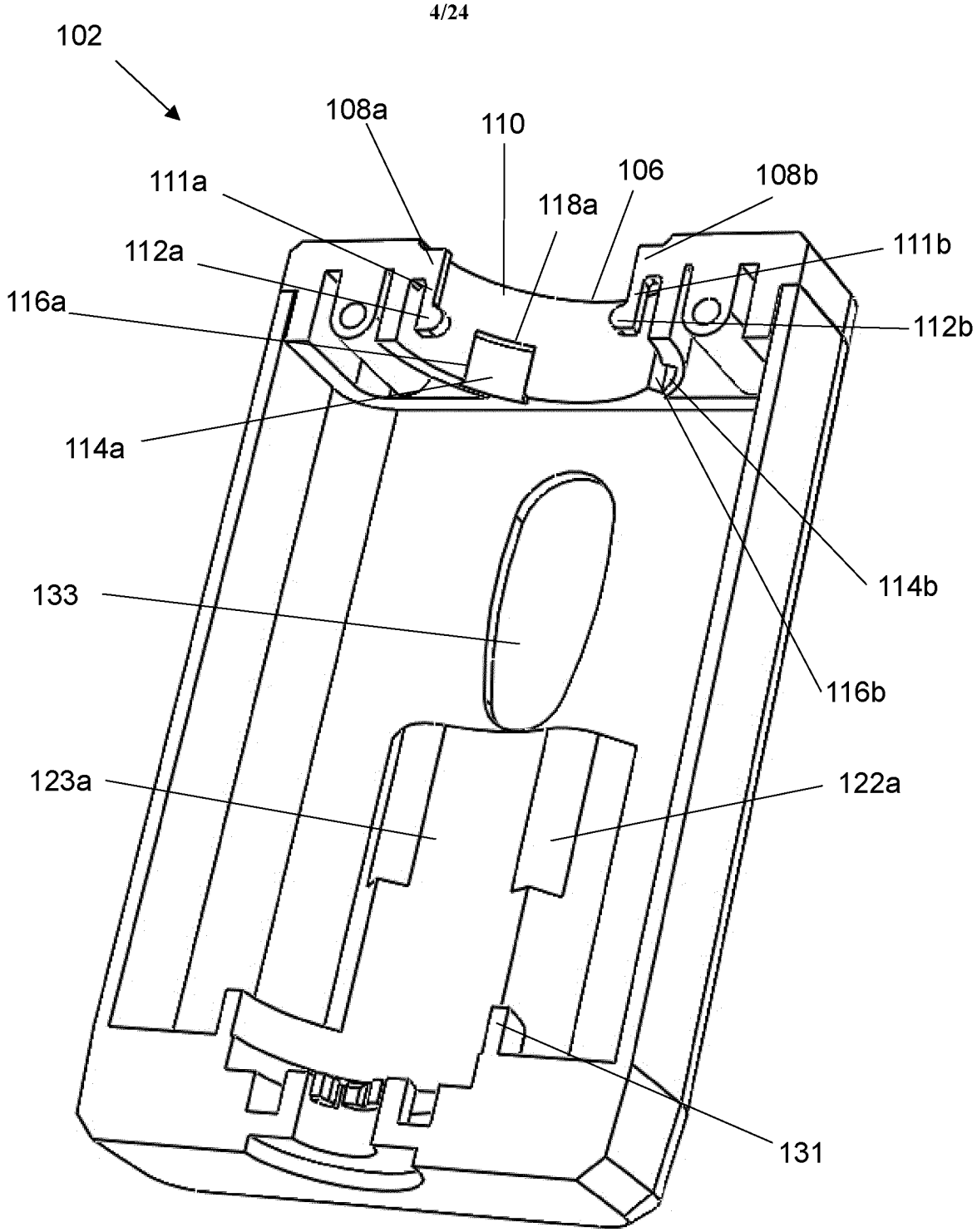

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108a
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111a
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108b
118a
112a
111b
116a
112b
114a
114b
133
116b
123a
122a
131

Fig. 4

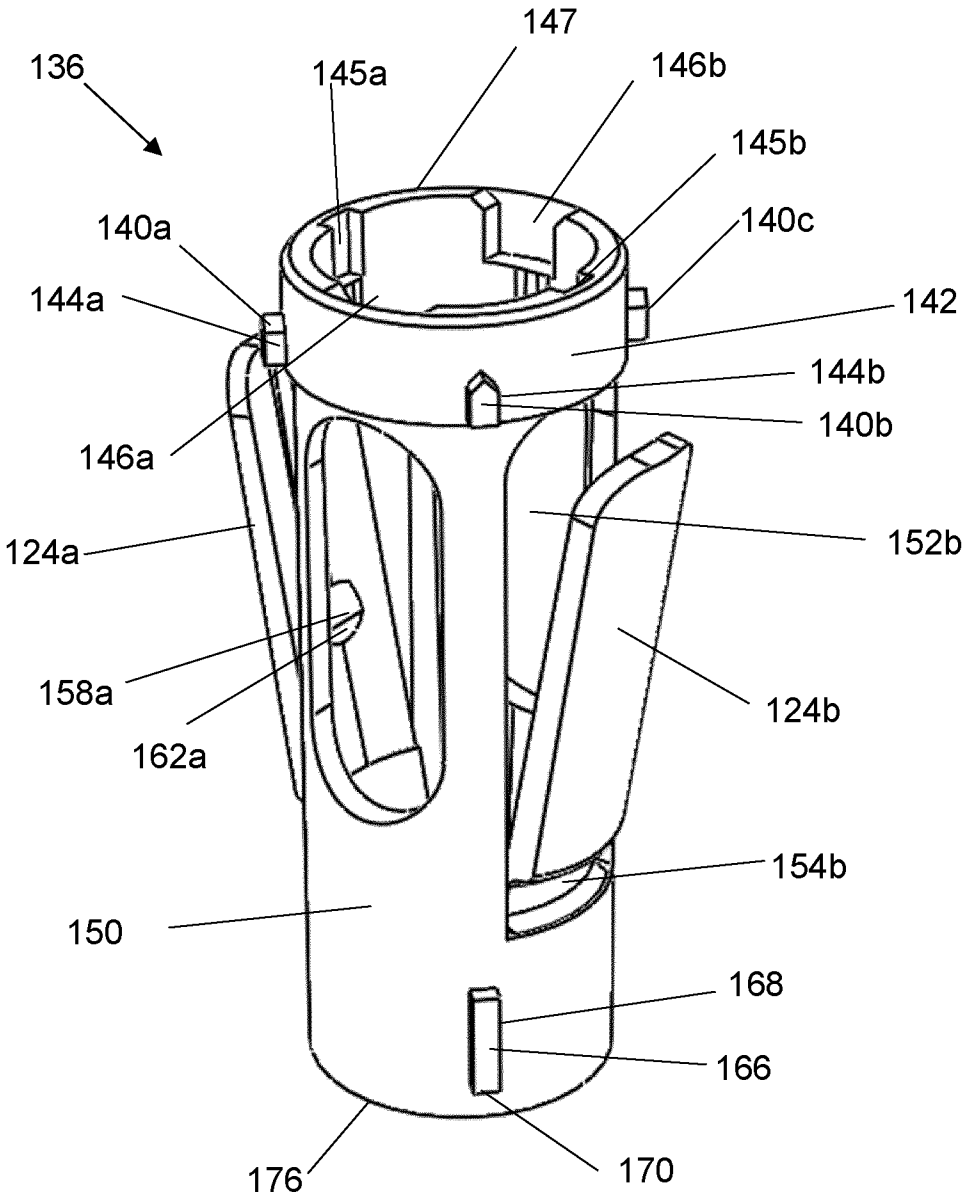

136
147
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146b
145b
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140c
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144b
140b
146a
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158a
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162a
154b
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176
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Fig. 5

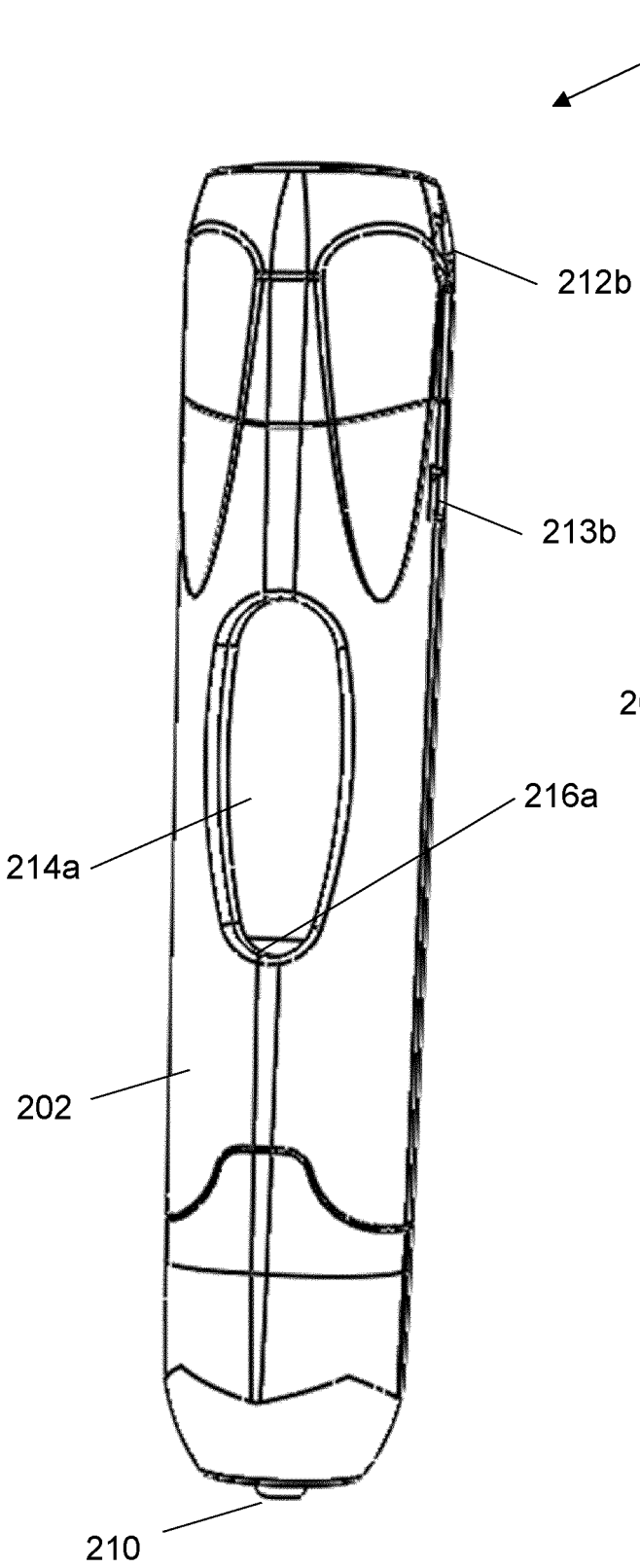

212b
213b
214a
216a
202
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Fig. 6a

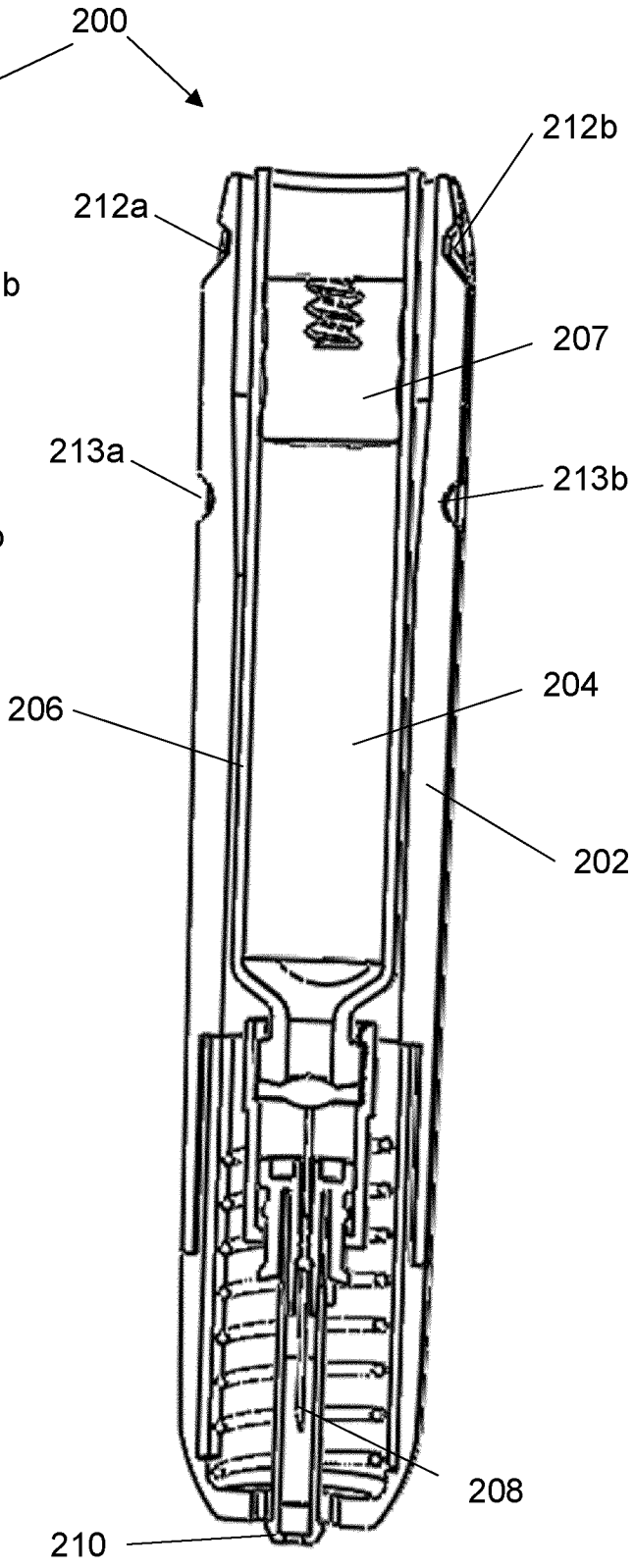

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212b
212a
207
213a
213b
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204
202
208
210

Fig. 6b

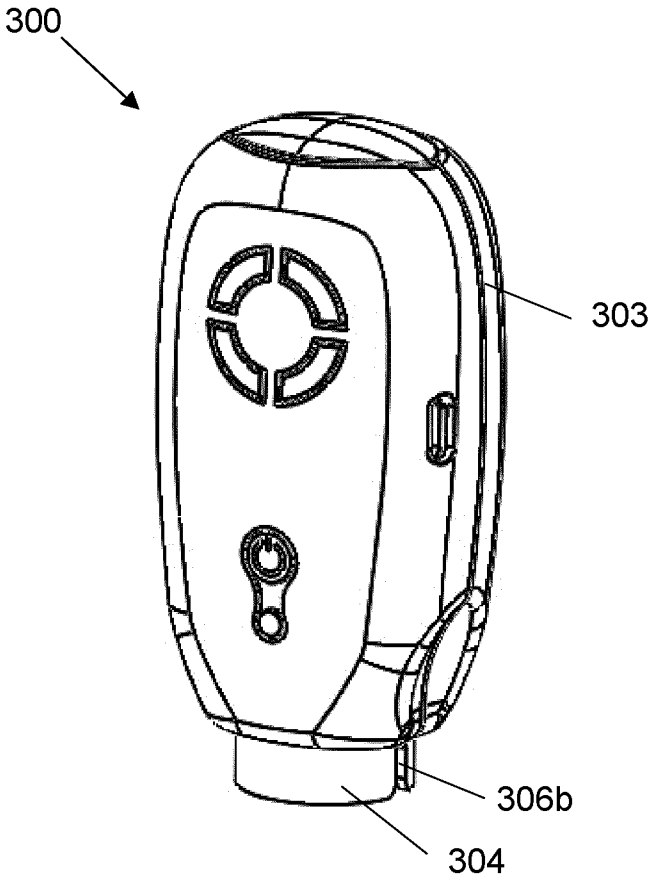

300
303
306b
304

Fig. 7a

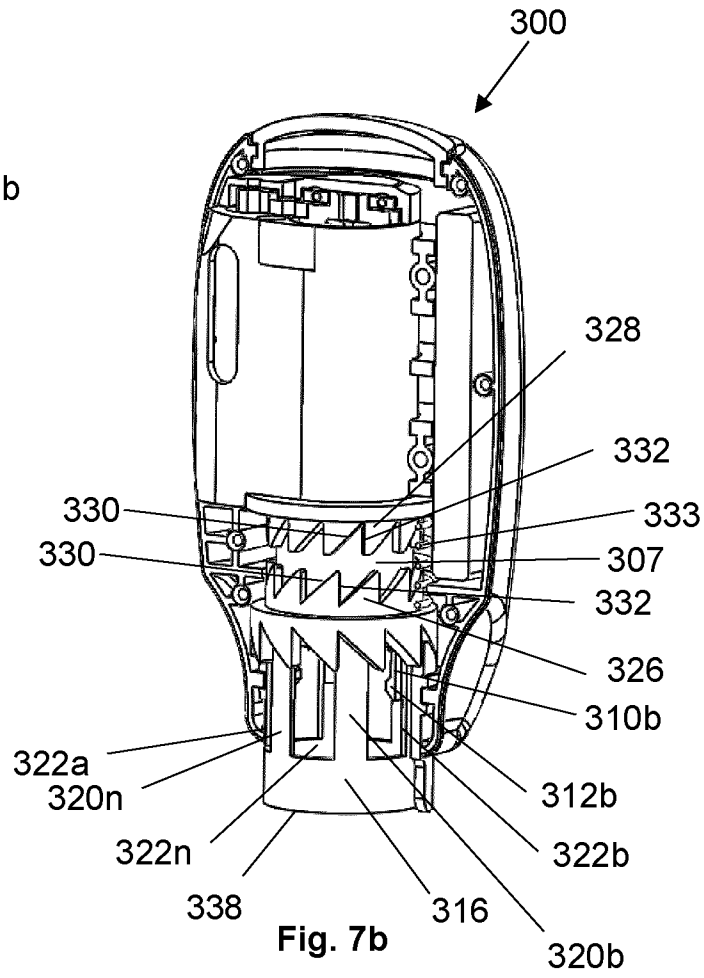

300
328
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333
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307
332
326
310b
322a
320n
312b
322b
322n
338
316
320b

Fig. 7b

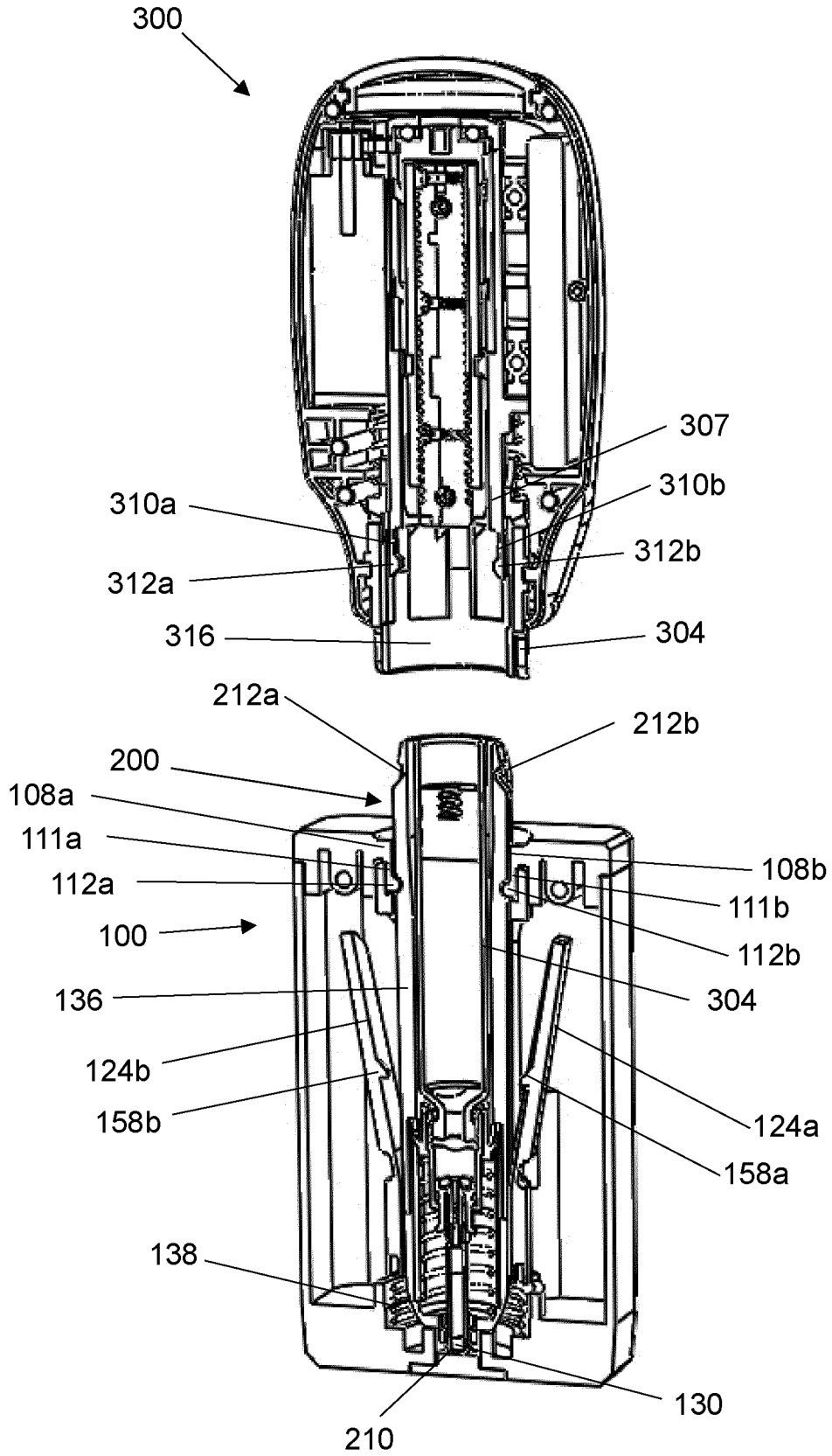

300
307
310b
310a
312b
312a
316
304
212a
212b
200
108a
111a
108b
112a
111b
100
112b
304
136
124b
158b
124a
158a
138
130
210

Fig. 8

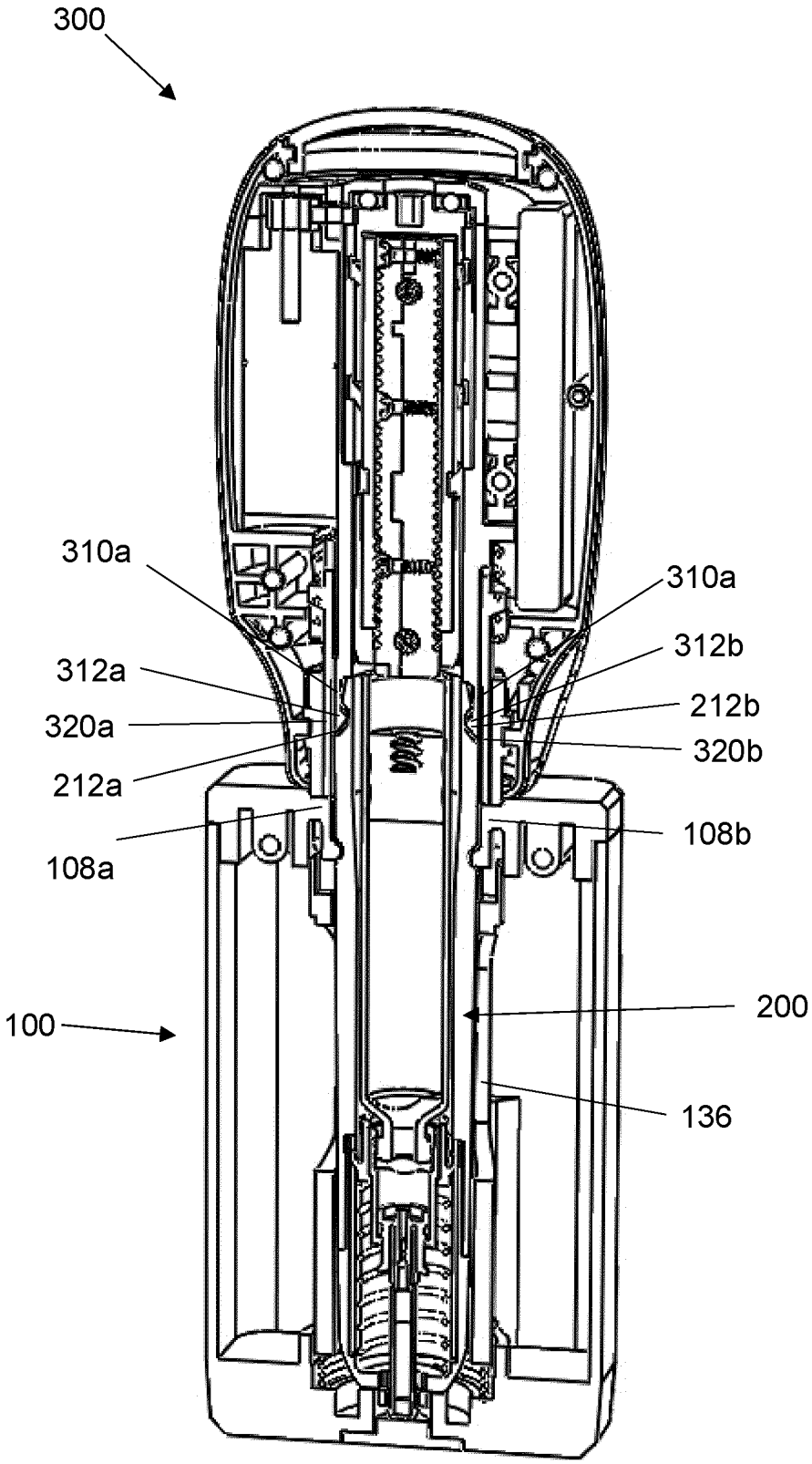

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312b
312a
212b
320a
320b
212a
108b
108a
200
100
136

Fig. 9

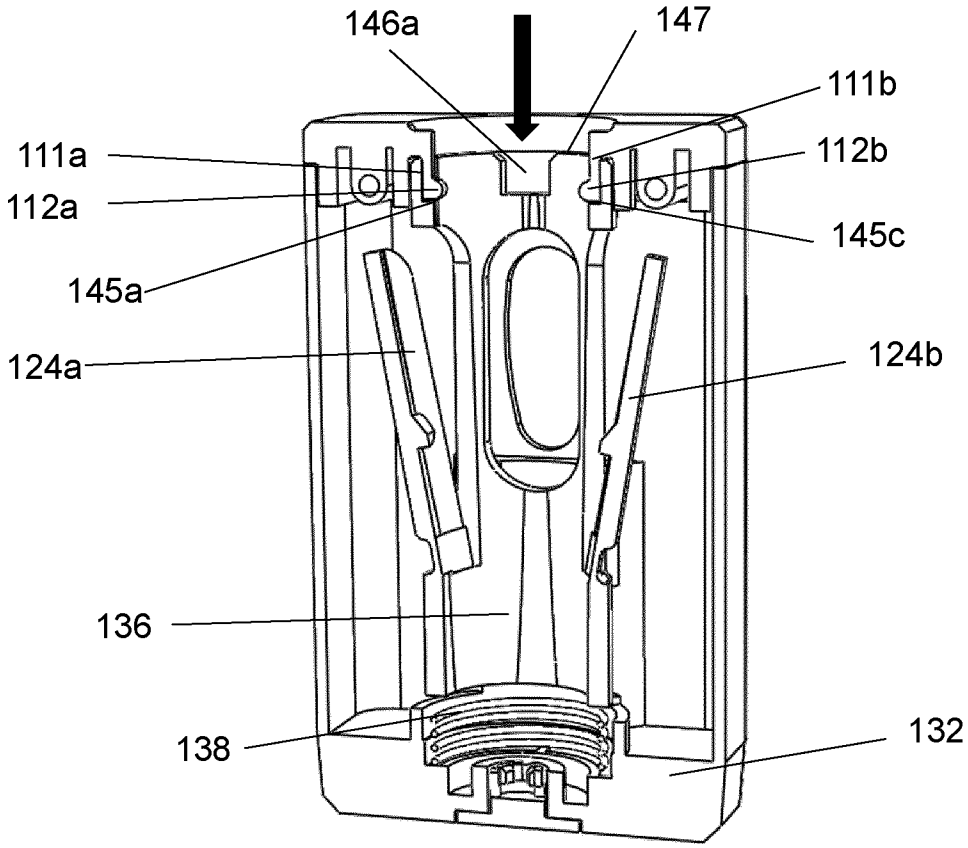


Fig. 10

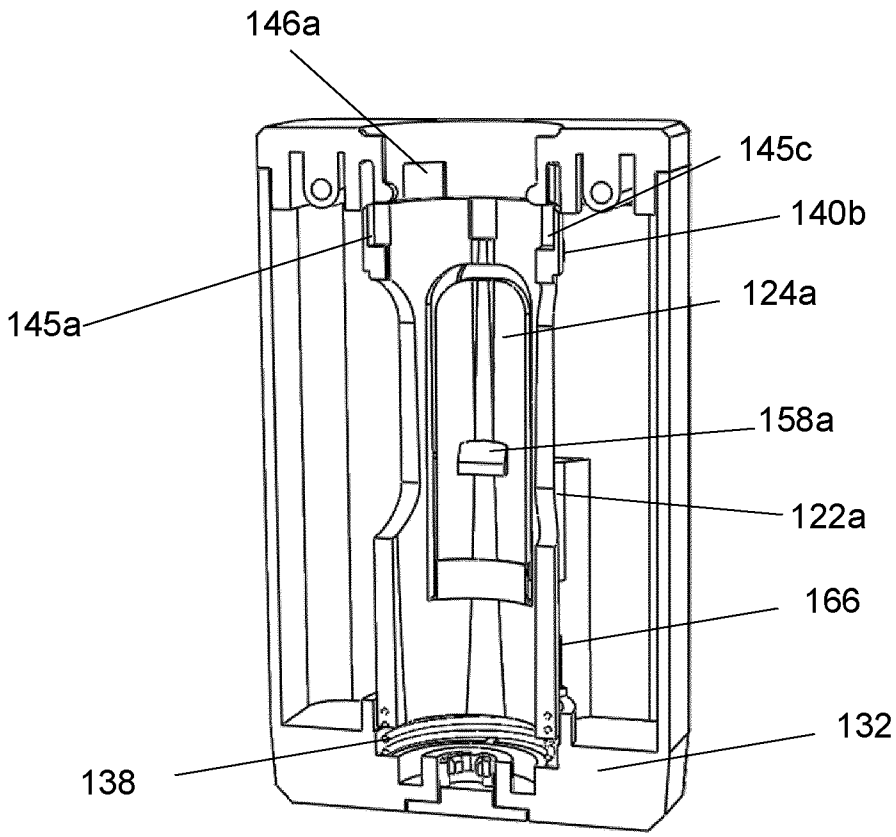


Fig. 11a

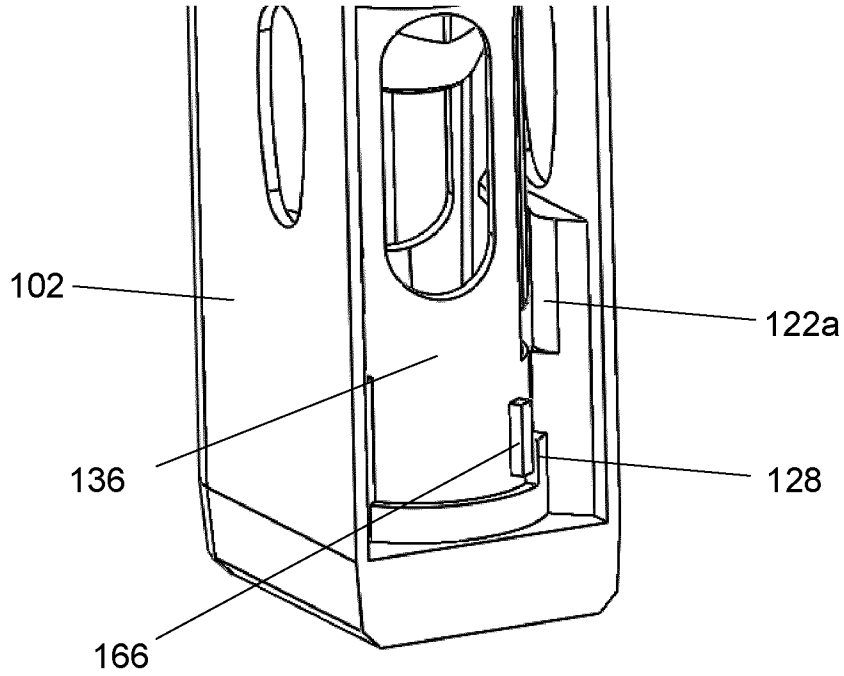


Fig. 11b

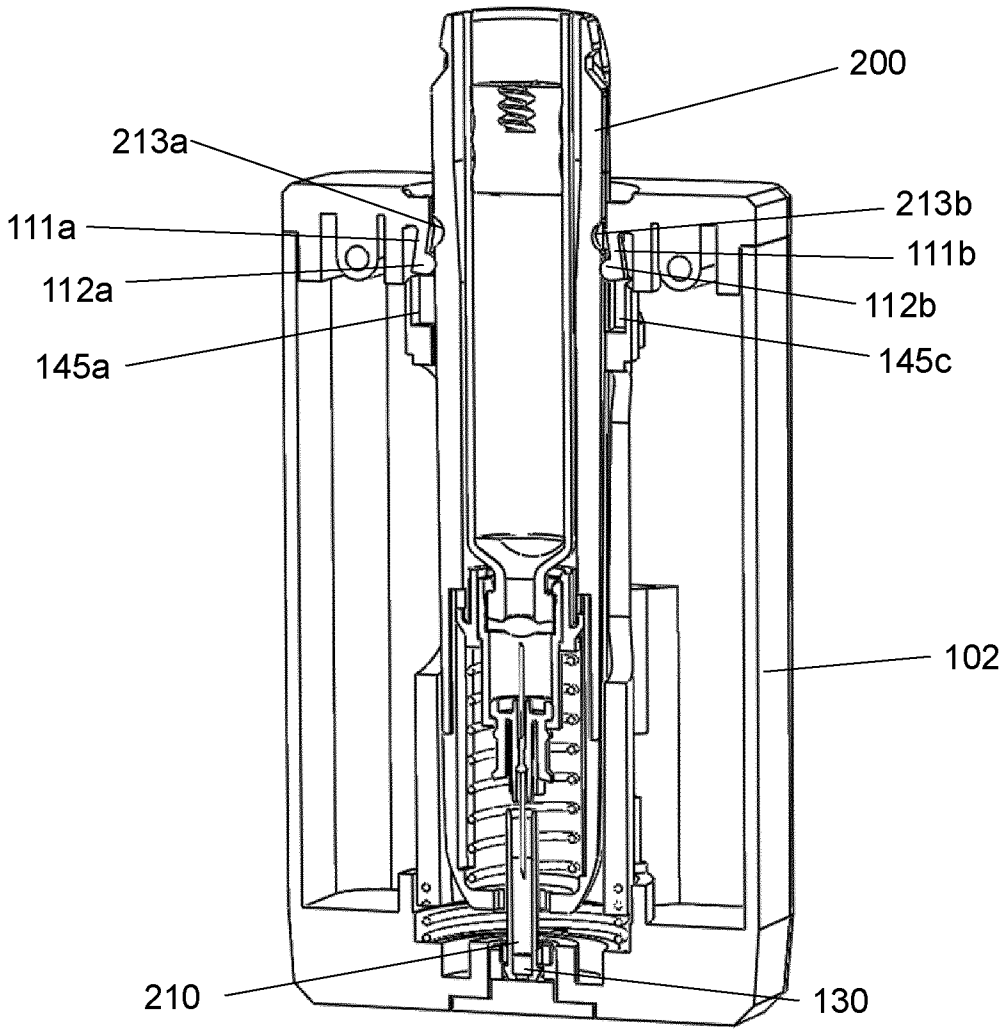


Fig. 12

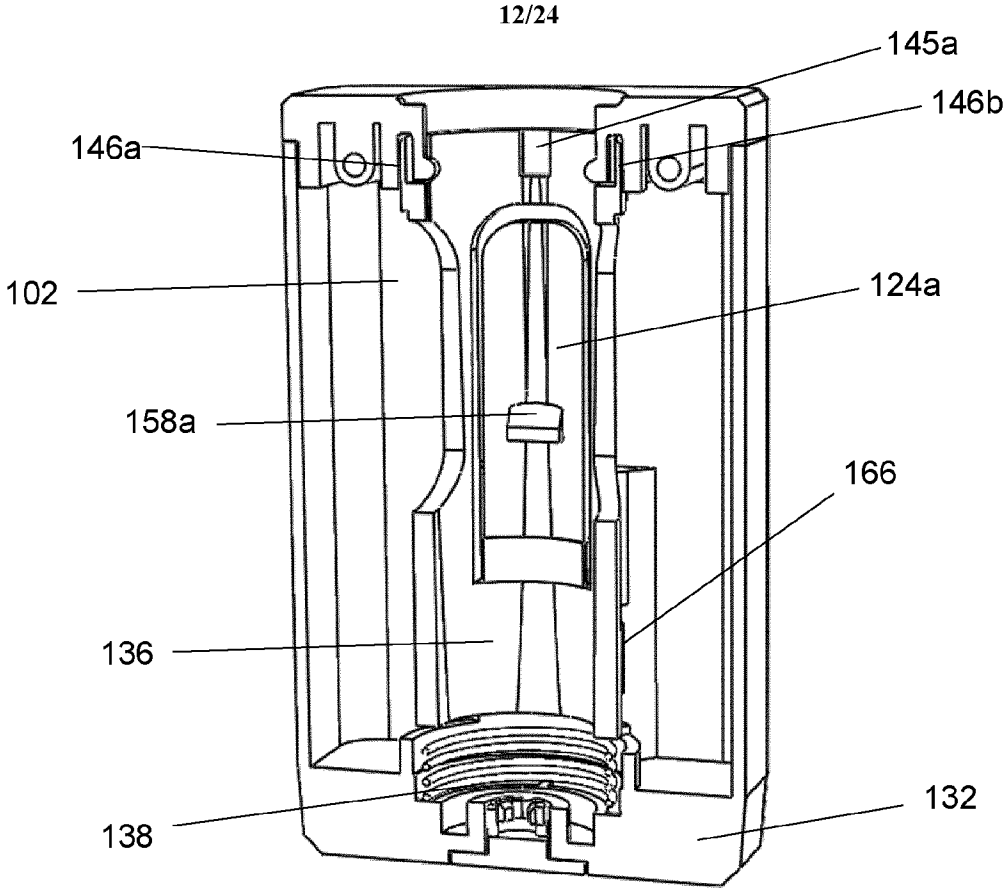


Fig. 13a

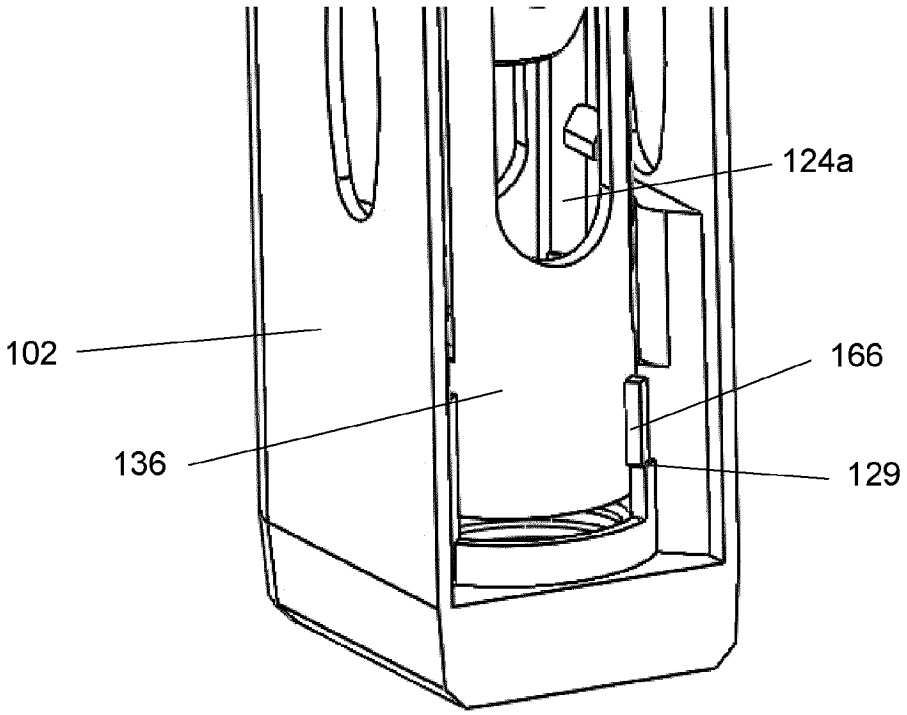


Fig. 13b

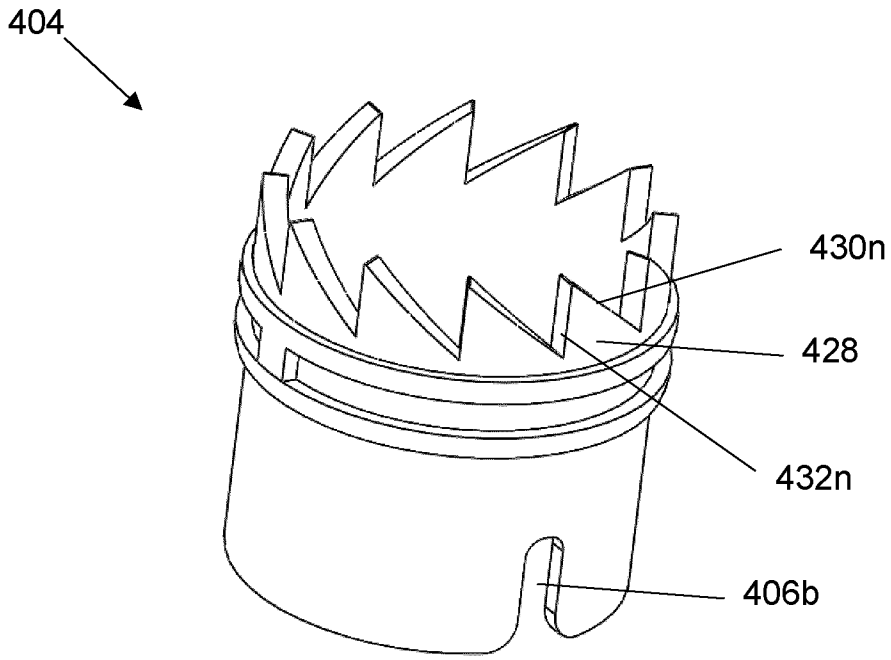


Fig. 14a

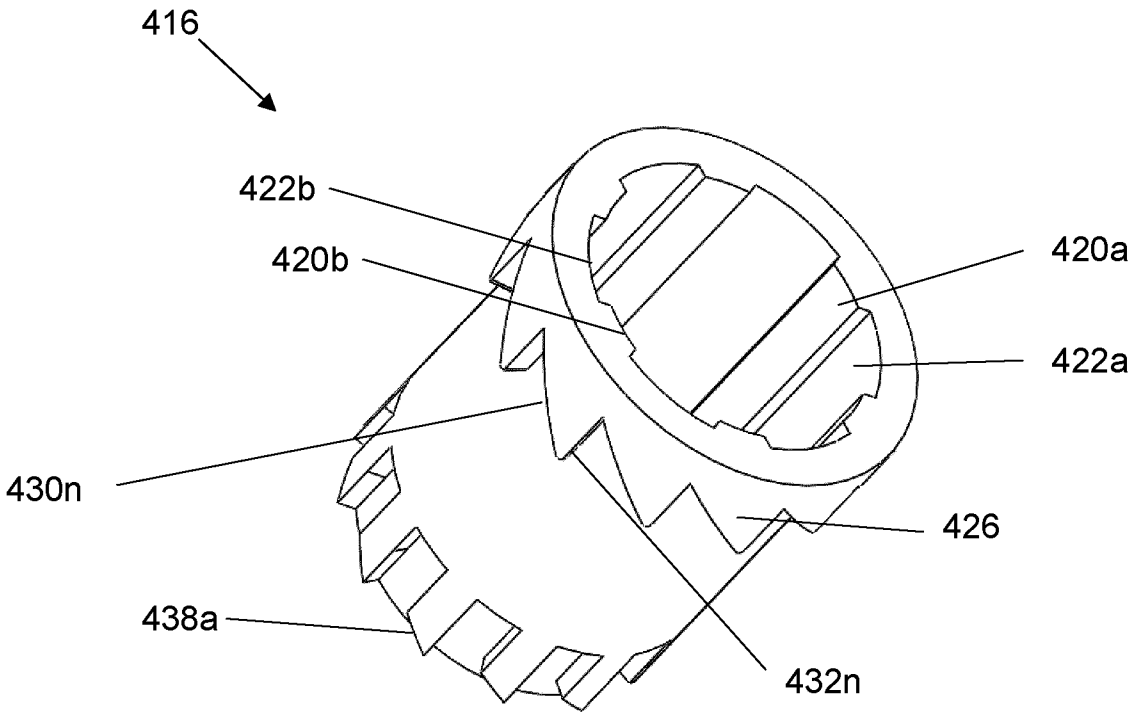


Fig. 14b

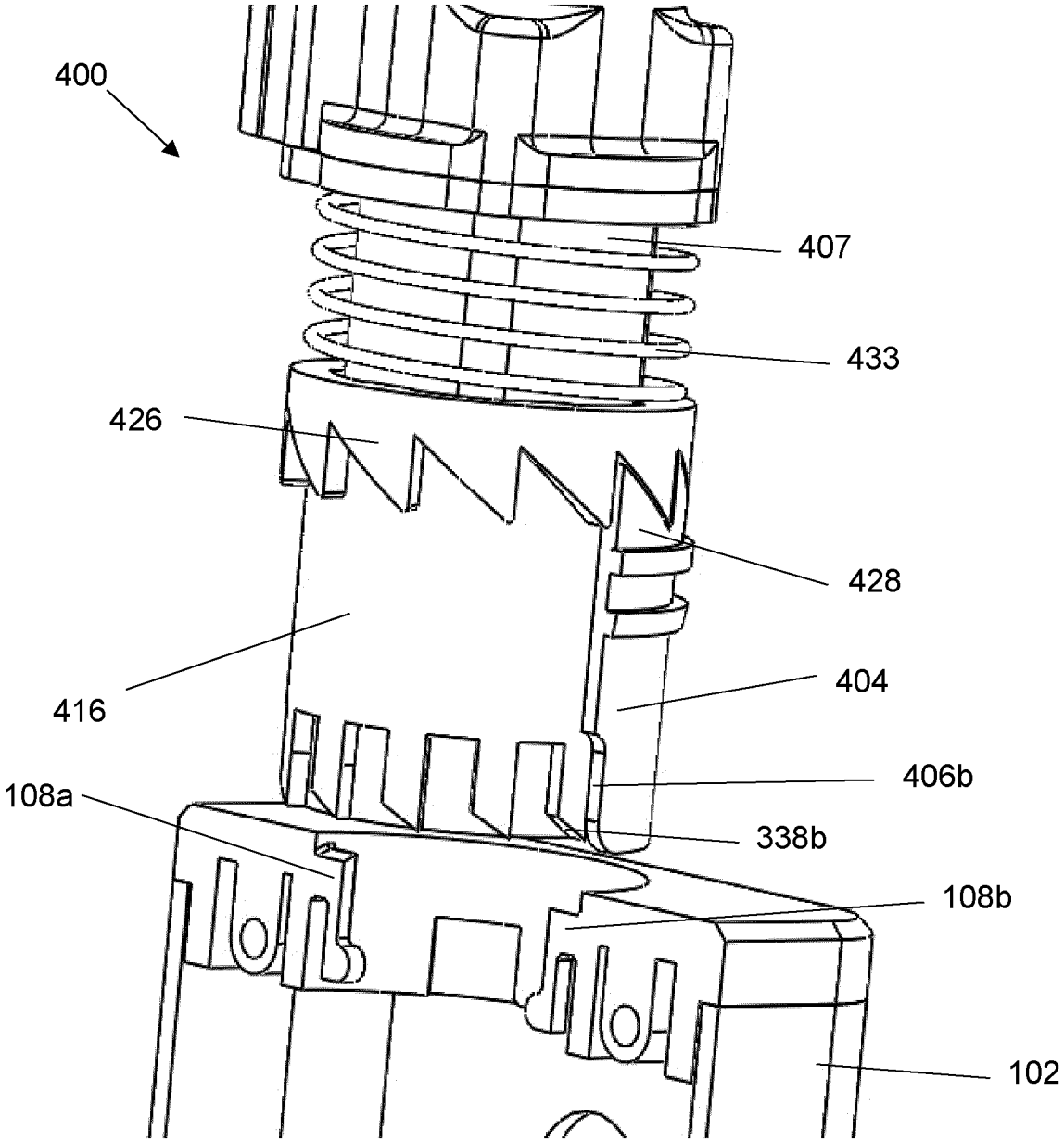


Fig. 15

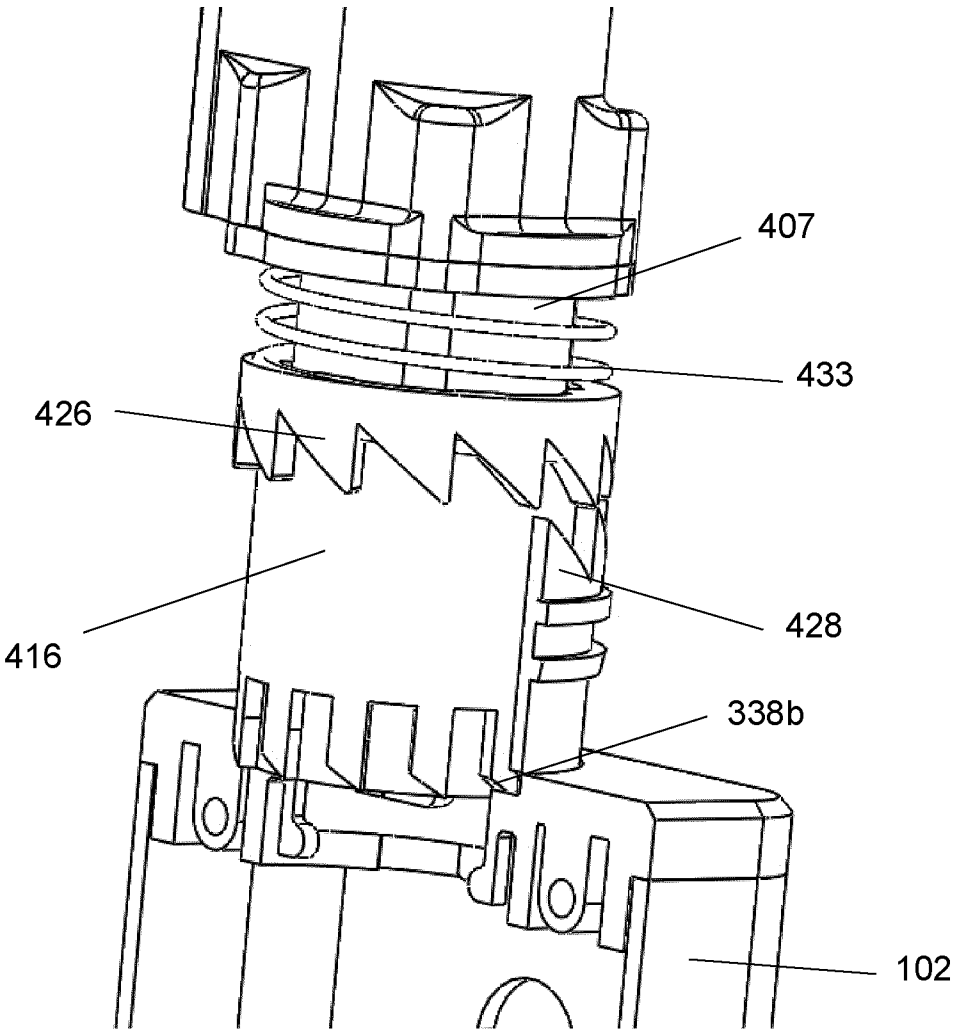


Fig. 16

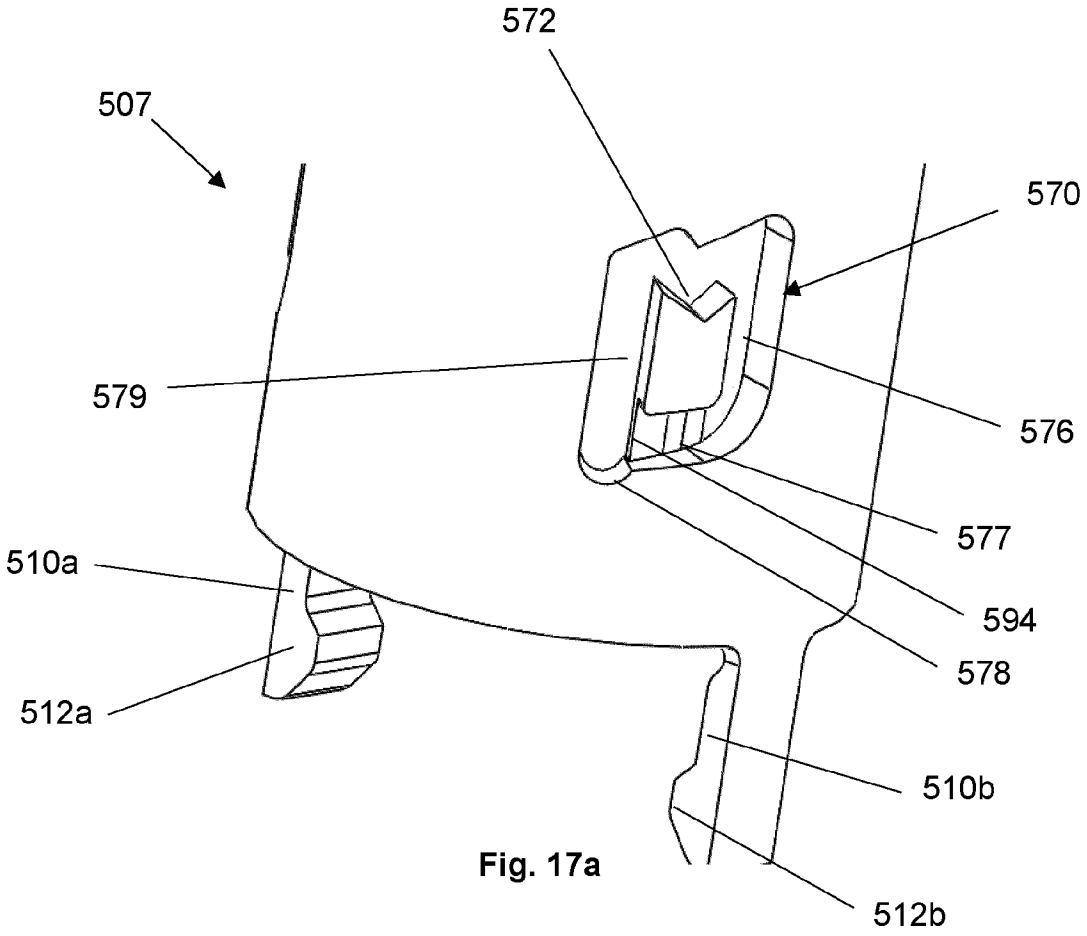


Fig. 17a

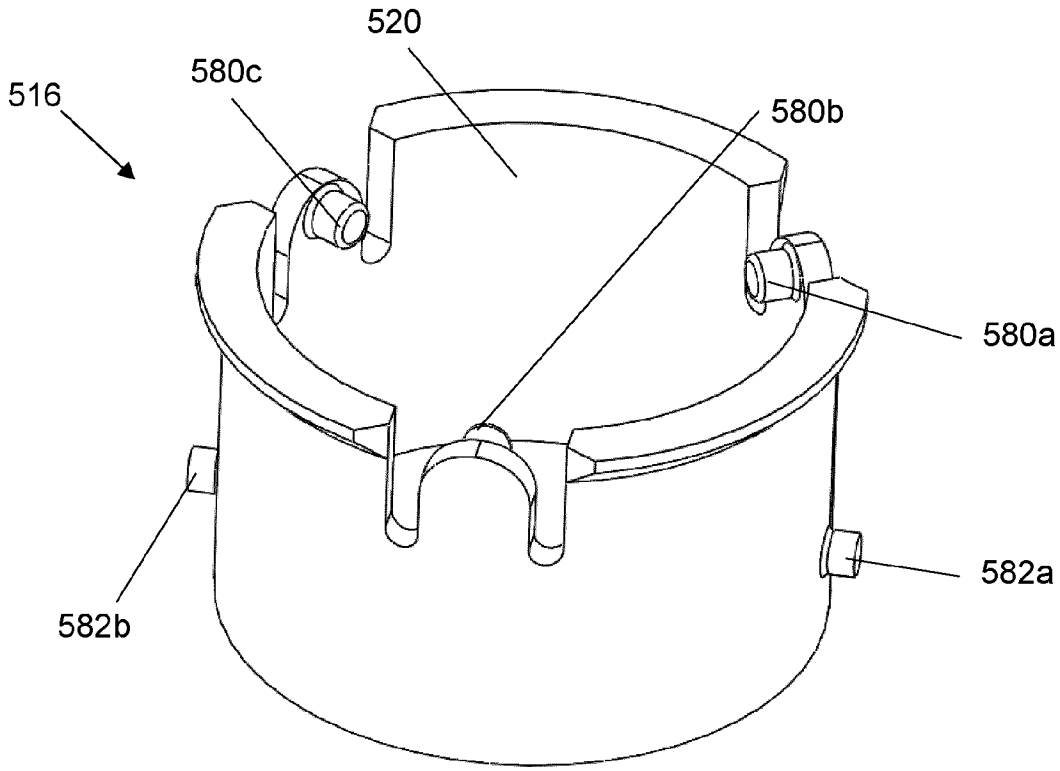


Fig. 17b

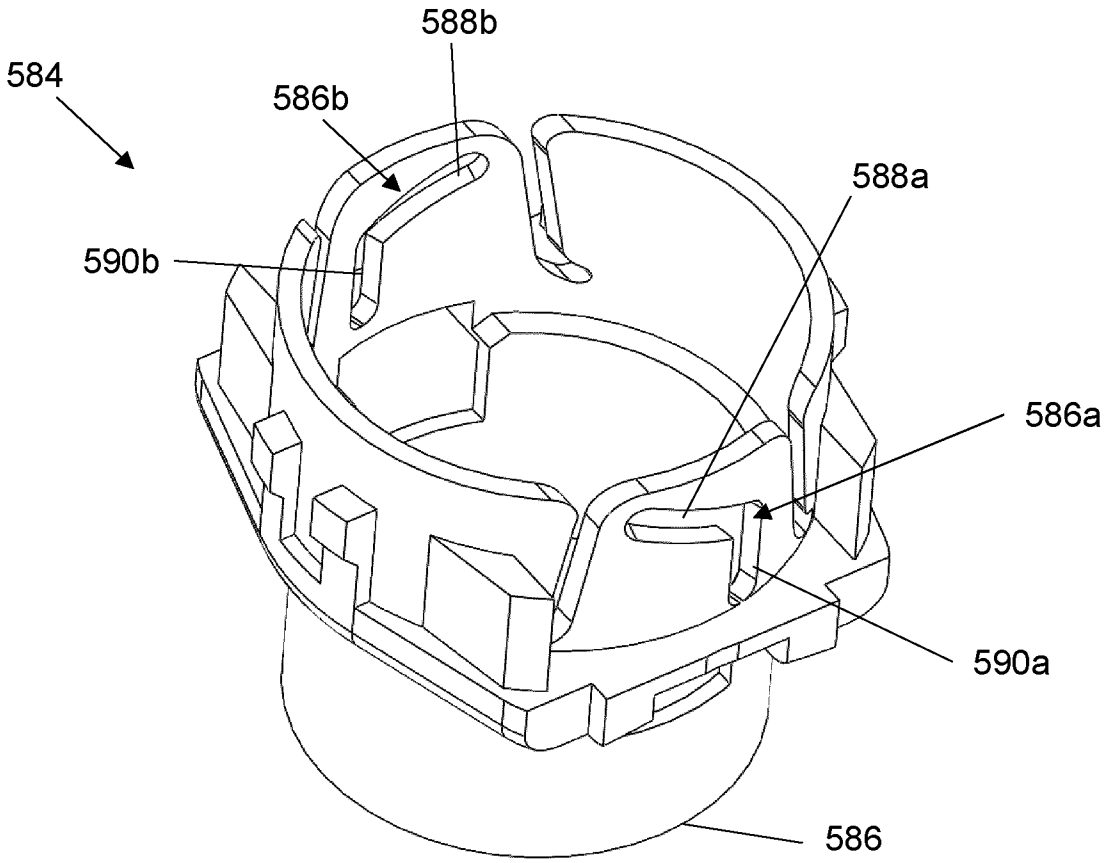


Fig. 17c

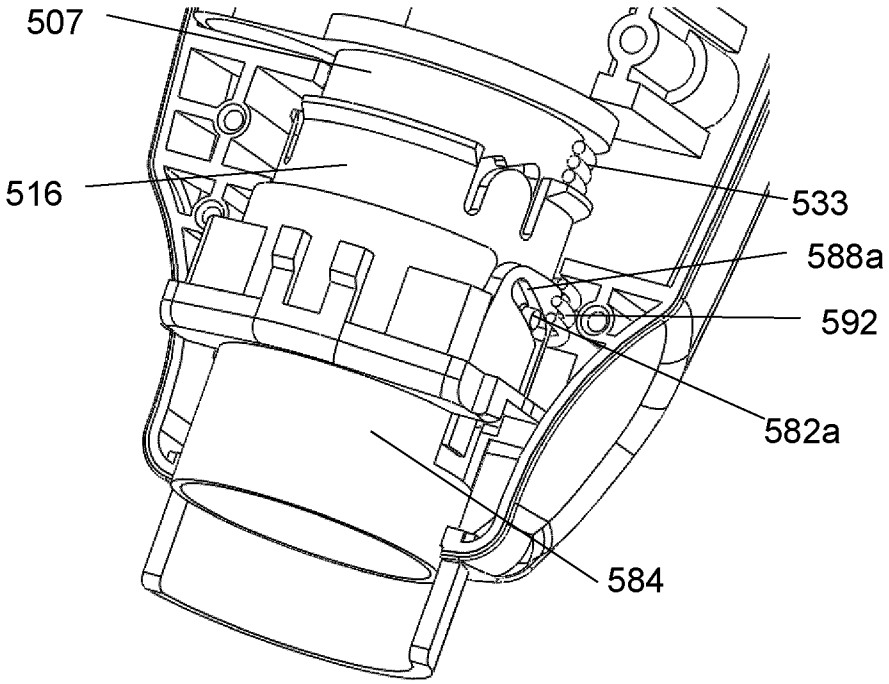


Fig. 18

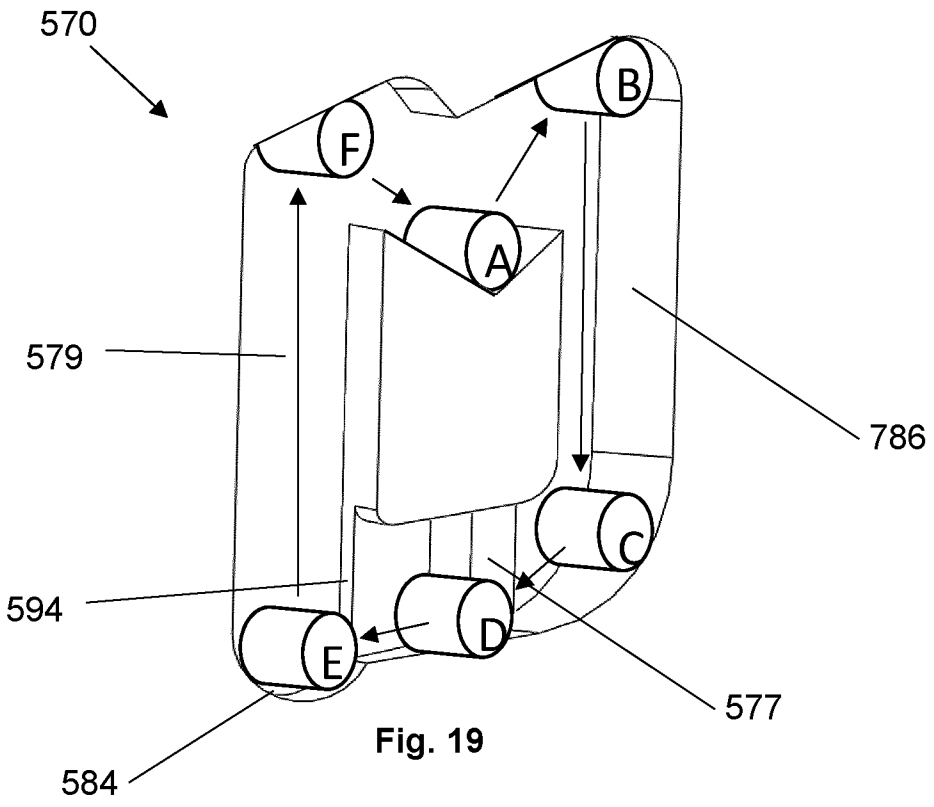


Fig. 19

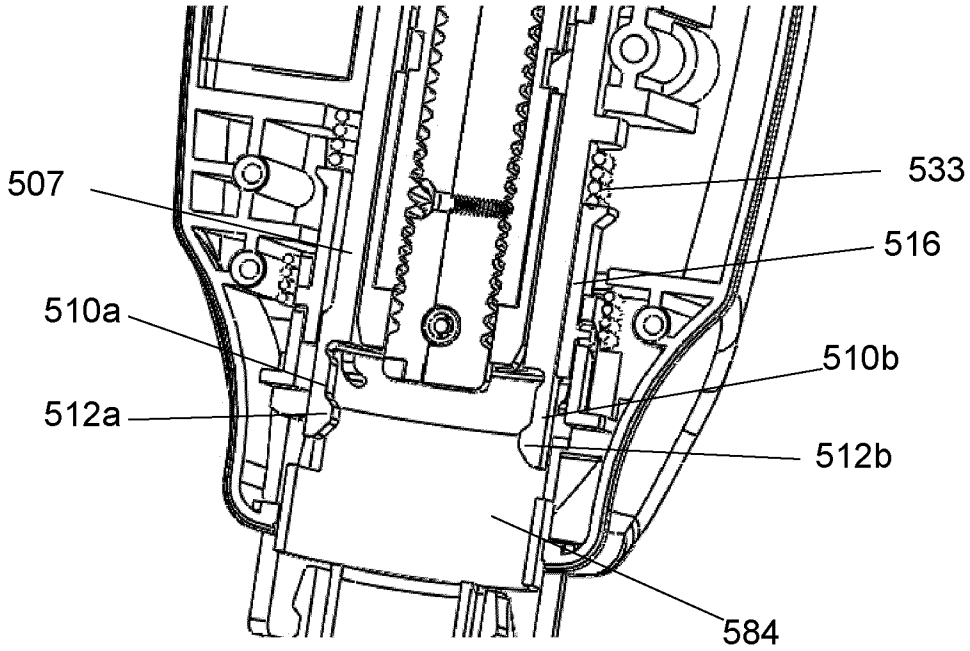

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533
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510a
510b
512a
512b
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Fig. 20

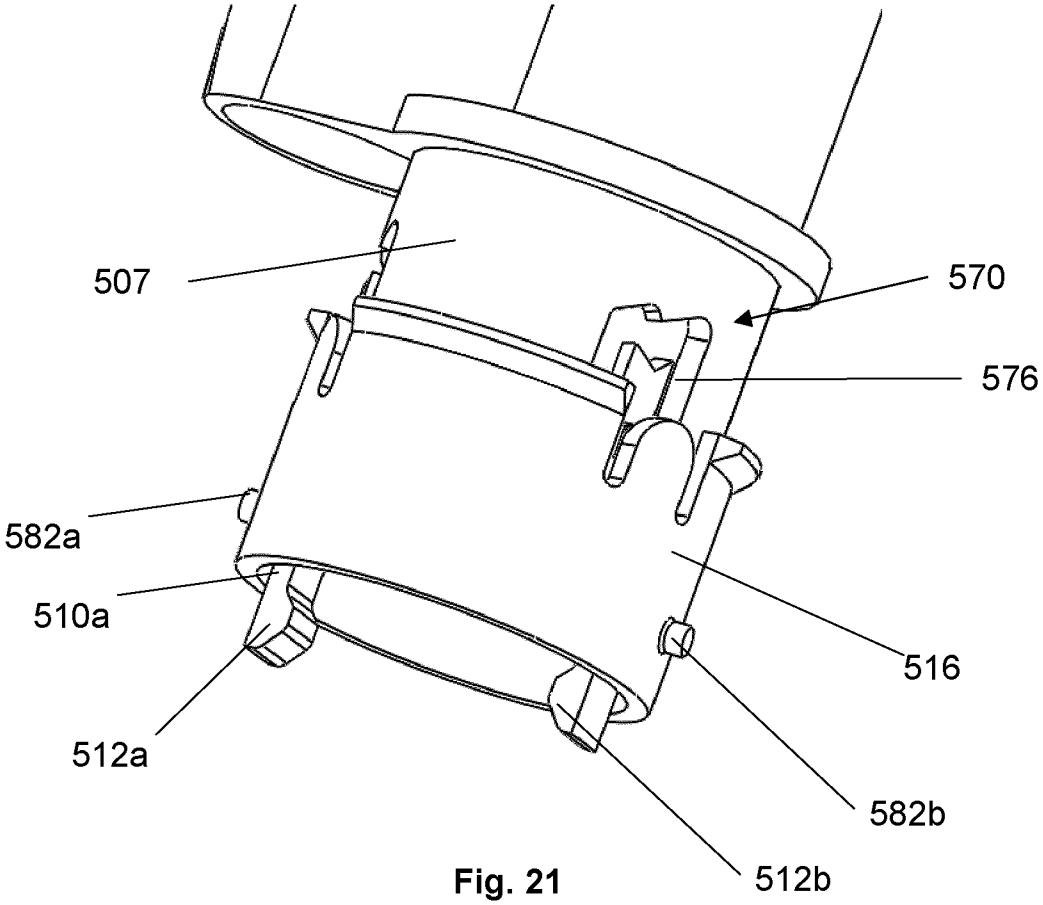

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516
512a
582b
512b

Fig. 21

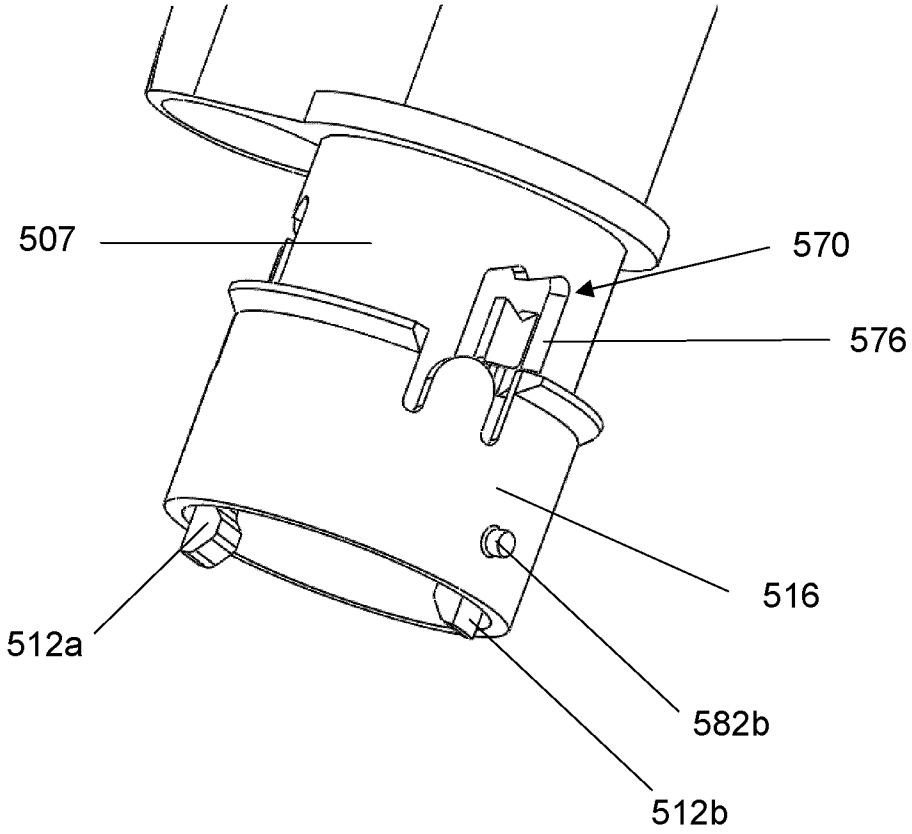

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512a
582b
512b

Fig. 22

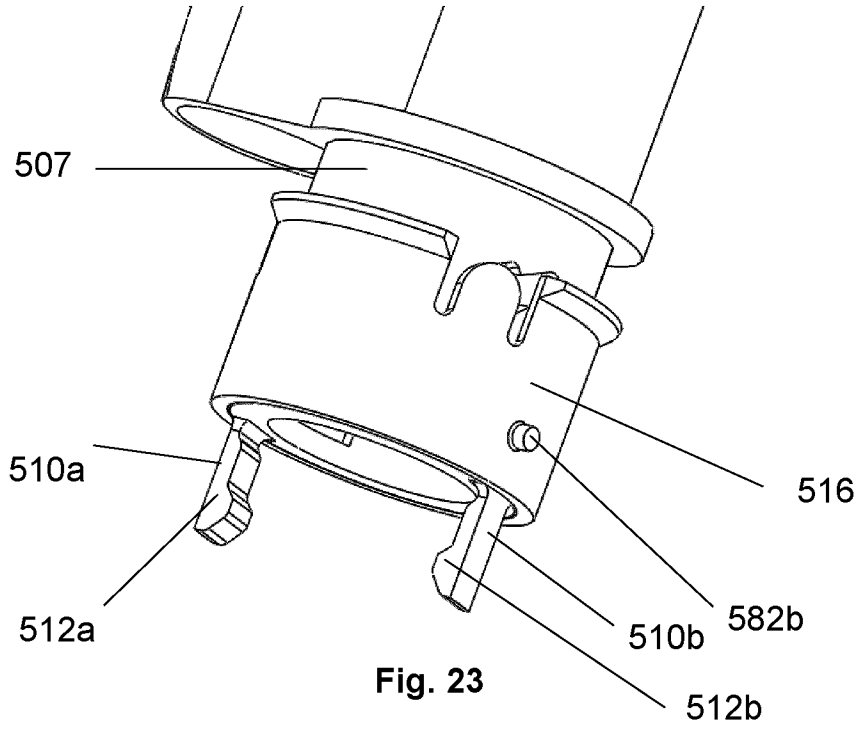

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582b
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512b

Fig. 23

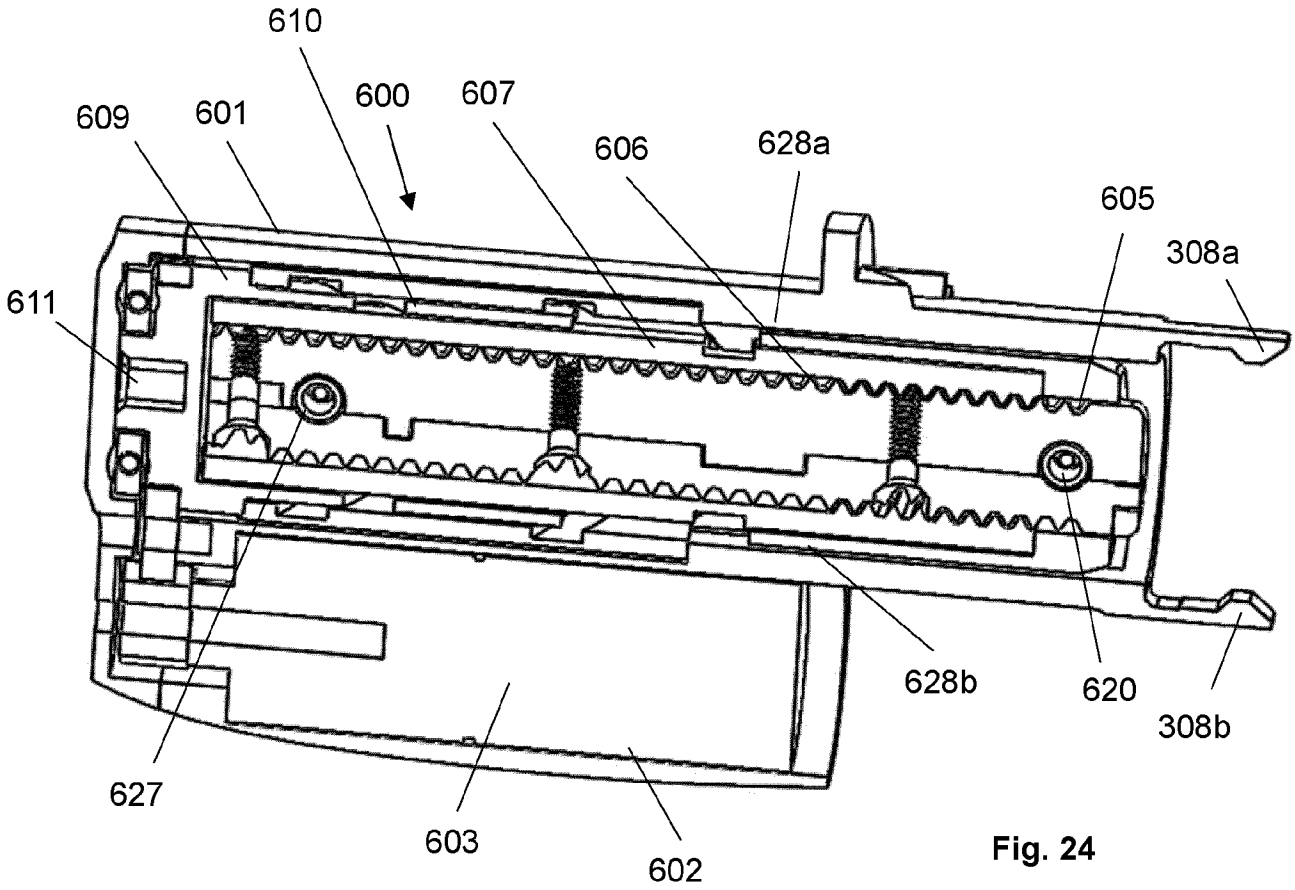

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602

Fig. 24

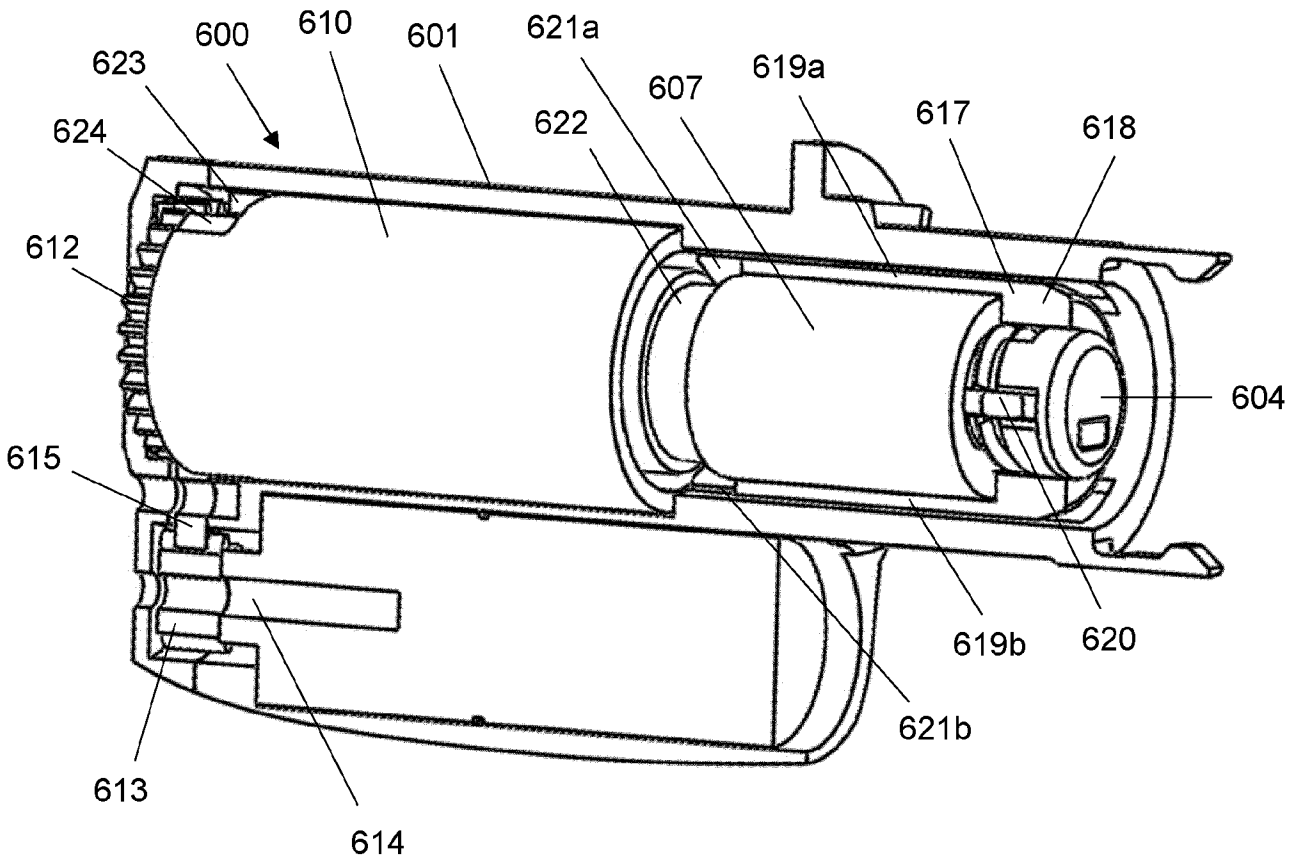

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613
614

Fig. 25

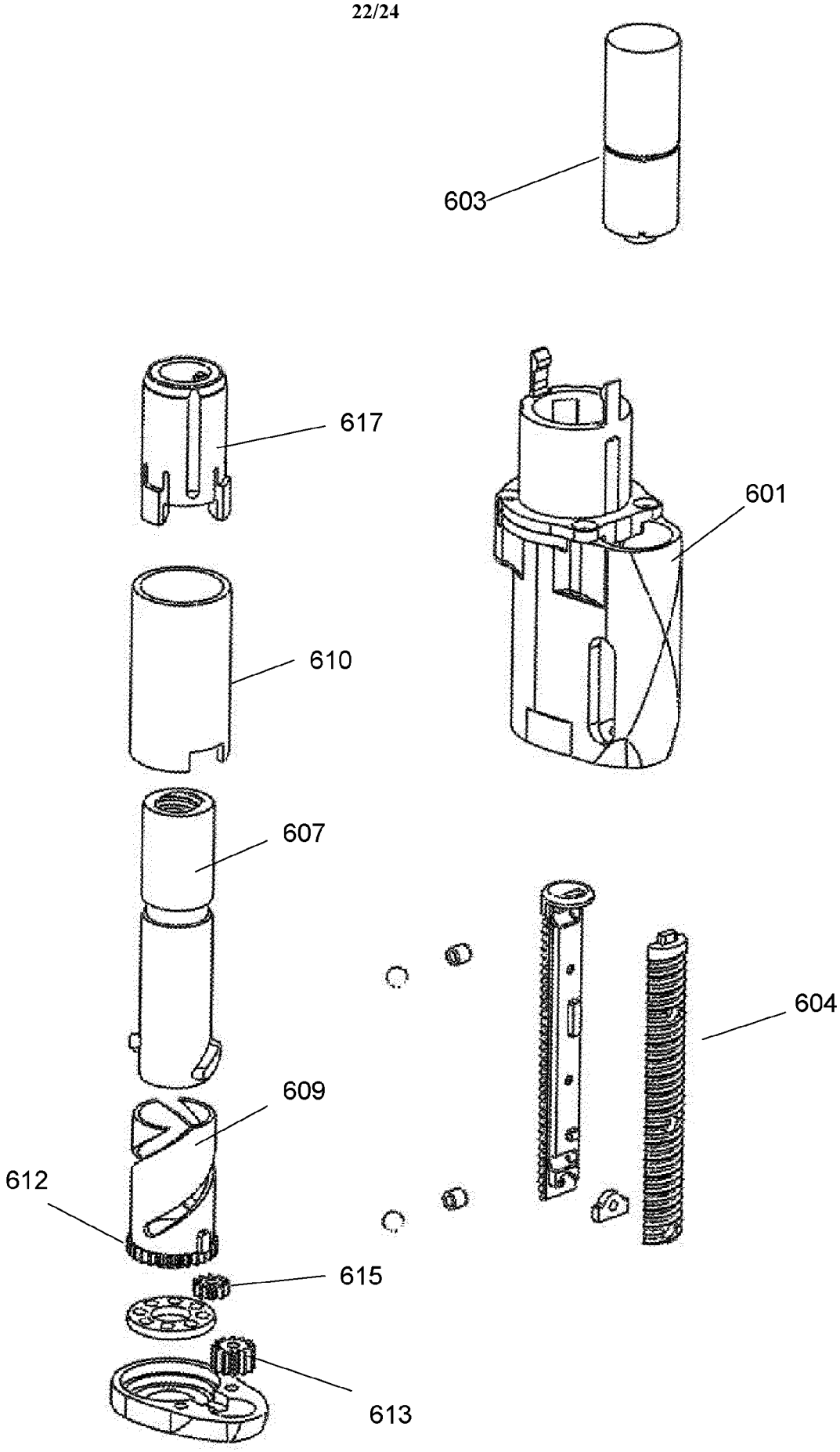


Fig. 26

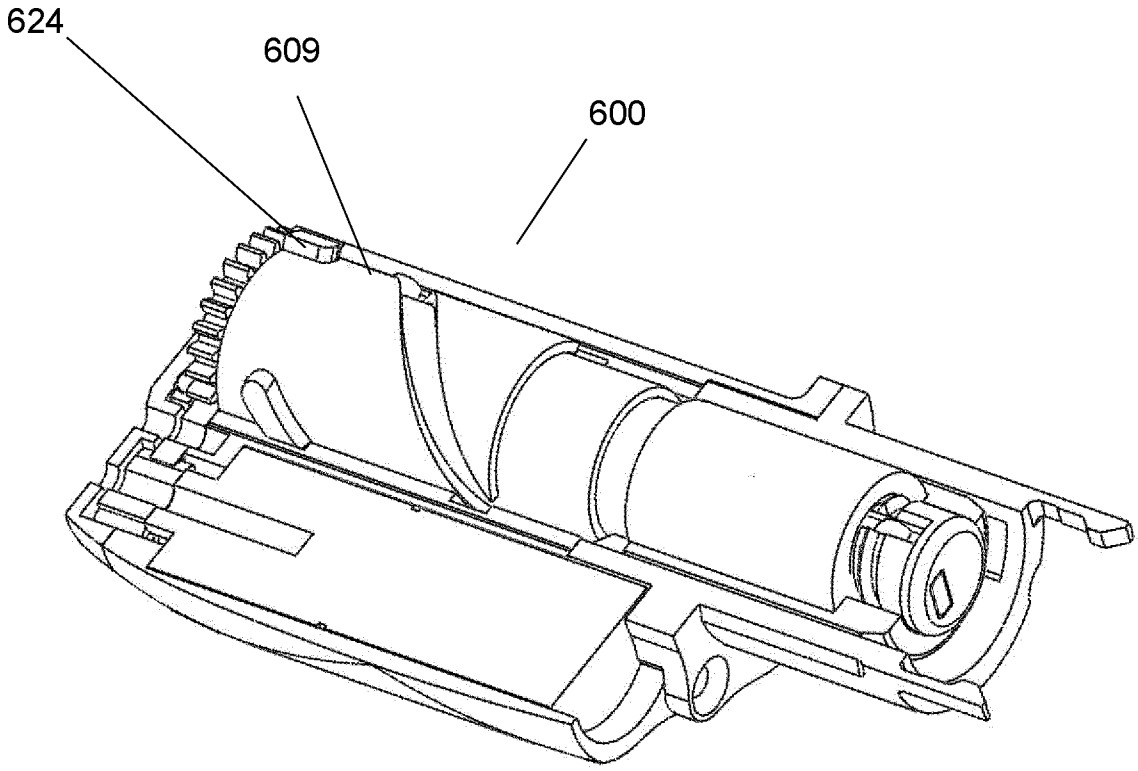


Fig. 27

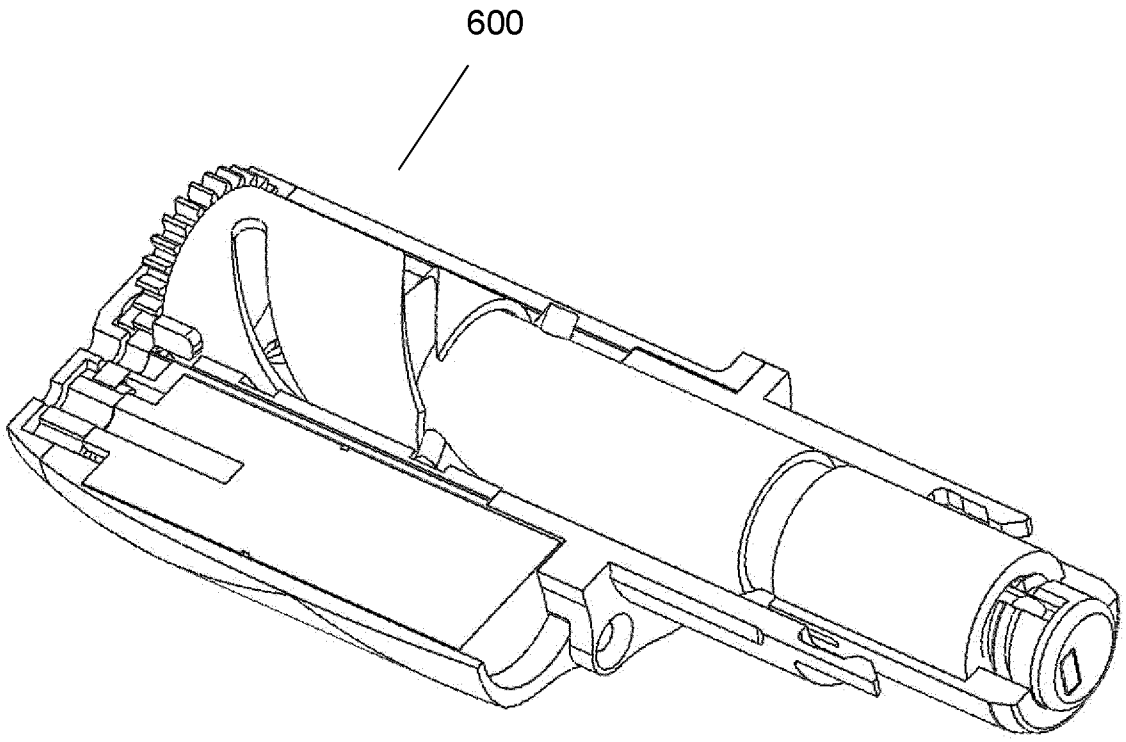


Fig. 28

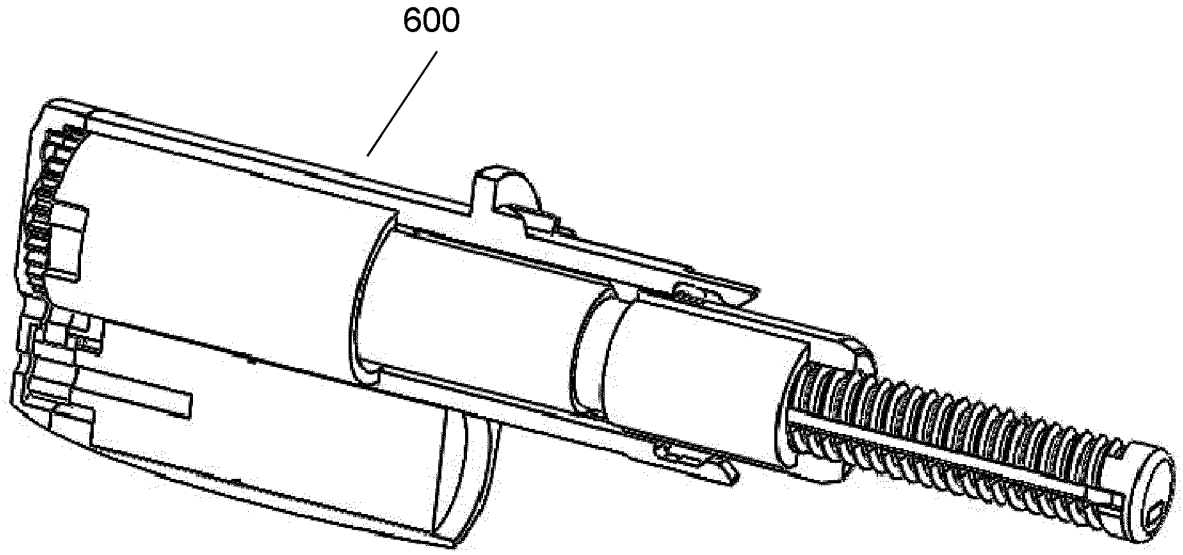


Fig. 29

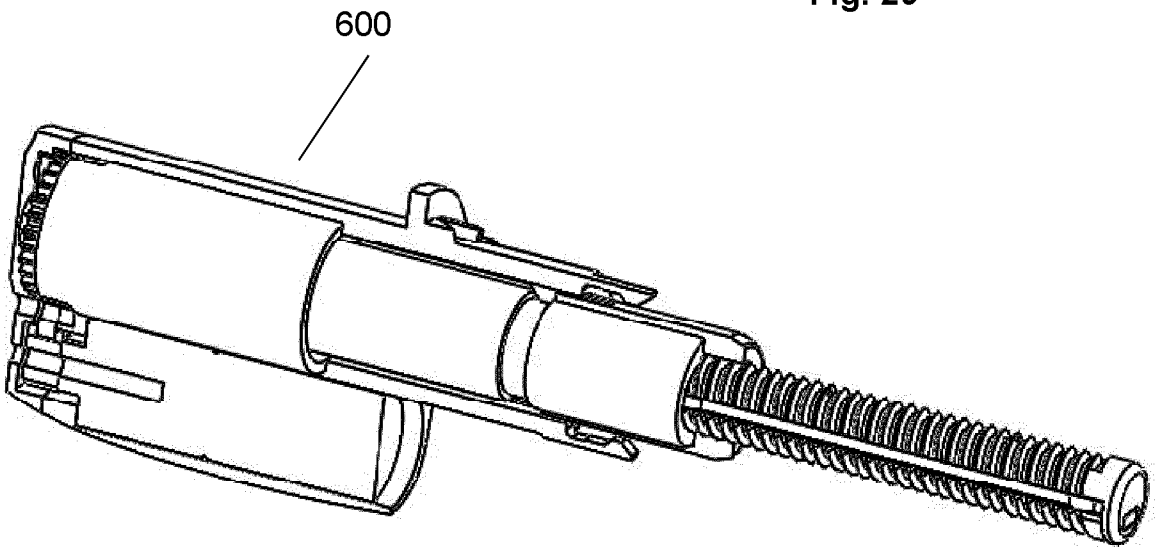


Fig. 30

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2023/076618

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61M5/50
ADD. A61M5/24 A61M5/31 A61M5/315

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A61M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	US 2020/238014 A1 (STEVENS KEVIN [US] ET AL) 30 July 2020 (2020-07-30) paragraphs [0064], [0077], [0083] - [0092] figures 6,13B	1,2,12, 26 3-11, 13-25, 27-50
A	WO 2022/150332 A1 (LILLY CO ELI [US]) 14 July 2022 (2022-07-14) paragraph [0060] figures 11-13	1-50
A	US 2021/038817 A1 (CARLSSON DANIEL [SE] ET AL) 11 February 2021 (2021-02-11) paragraph [0063] figures 6A-F	1-50

-/--

[x] Further documents are listed in the continuation of Box C.

[x] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
15 December 2023	04/01/2024

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Walther, Manuel

1

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2023/076618

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2012/088206 A1 (TANAKA FUMIO [JP] ET AL) 12 April 2012 (2012-04-12) paragraph [0026] figures 2,4	1-50

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2023/076618

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