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(56) Documents Cited:
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GB 2414398 A **EP 2364739 A1**
WO 2012/045836 A2 **WO 2009/040605 A1**
WO 2005/070481 A1

(58) Field of Search:
INT CL **A61M**
Other: **EPODOC & WPI; TXTE**

(54) Title of the Invention: **Automatic injection device**
Abstract Title: **Automatic injection device with mechanical interlock which prevents firing until the needle boot is removed**

(57) An automatic injection device 101 has a mechanical interlock preventing actuation of its trigger 105 until removal of its needle boot 111. The interlock may be between a boot remover 104 (such as a cap) and a trigger cover 106, the cover having flexible ridges 109 which are compressed by the boot remover to prevent removal (figure 1). Alternatively, the injection device may comprise a separate syringe housing (203, figure 4) and a firing mechanism housing (202). When the two are joined together a lip (205) on the firing mechanism housing axially displaces a rod (207) residing in the syringe housing which in turn displaces the boot remover (204). Alternatively, a helical track in the rod may engage with a peg on the boot remover to rotate the rod and thereby deactivate a trigger lock (figures 8-13) such as a rotatable arm (405, figure 16). The two housings may be hinged together and held in a folded position by the boot remover 502 such that the device cannot operate until the boot remover is removed.

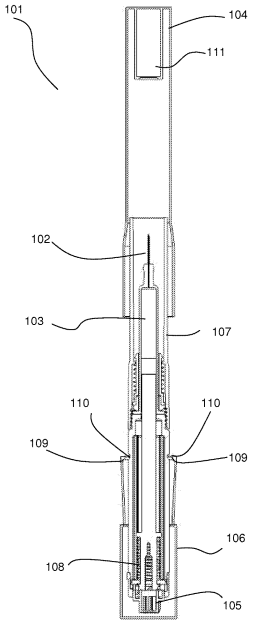

Figure 2

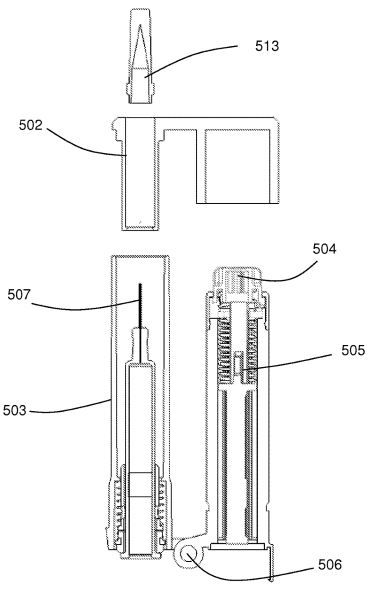

Figure 19

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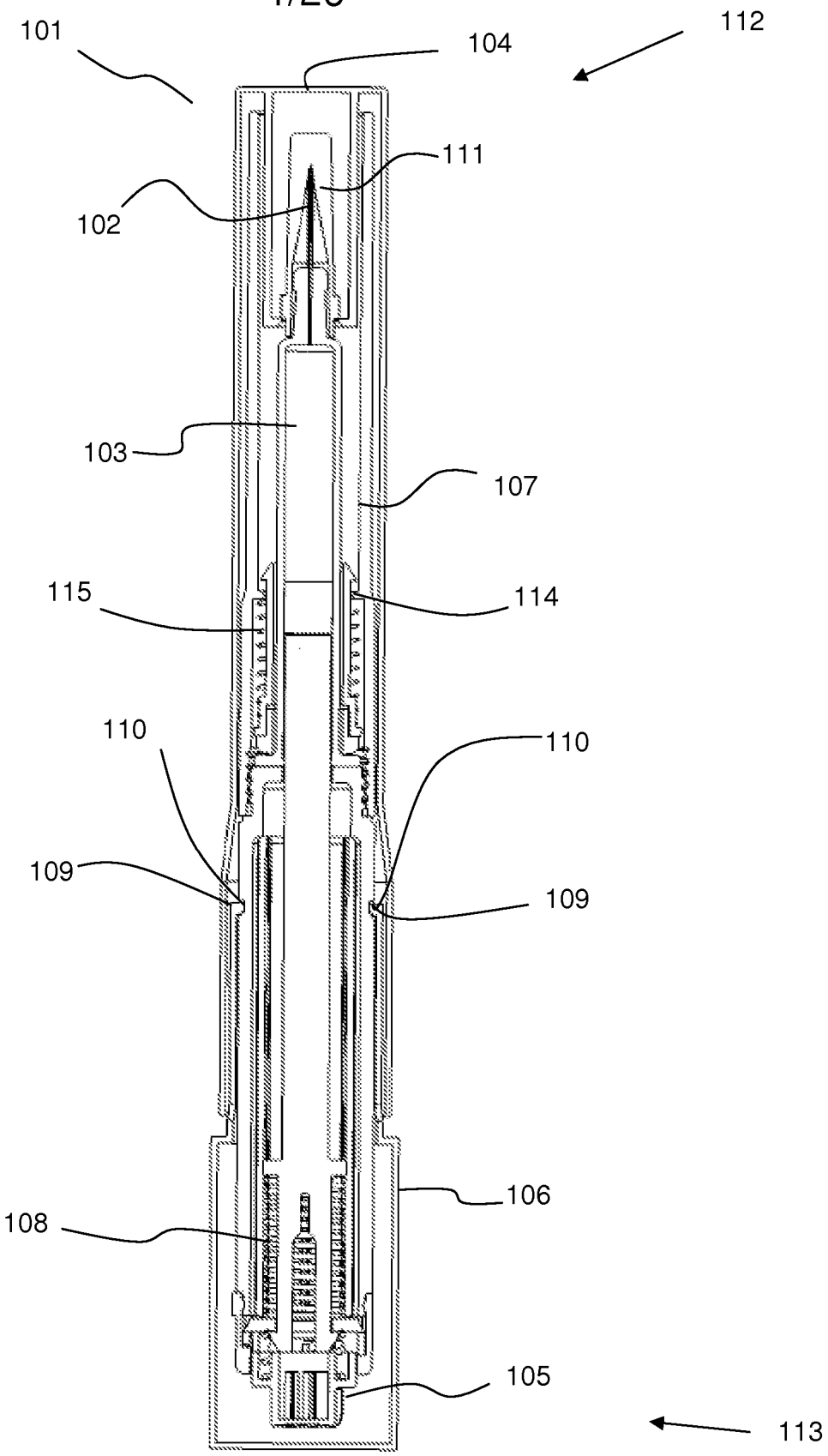
101
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Figure 1

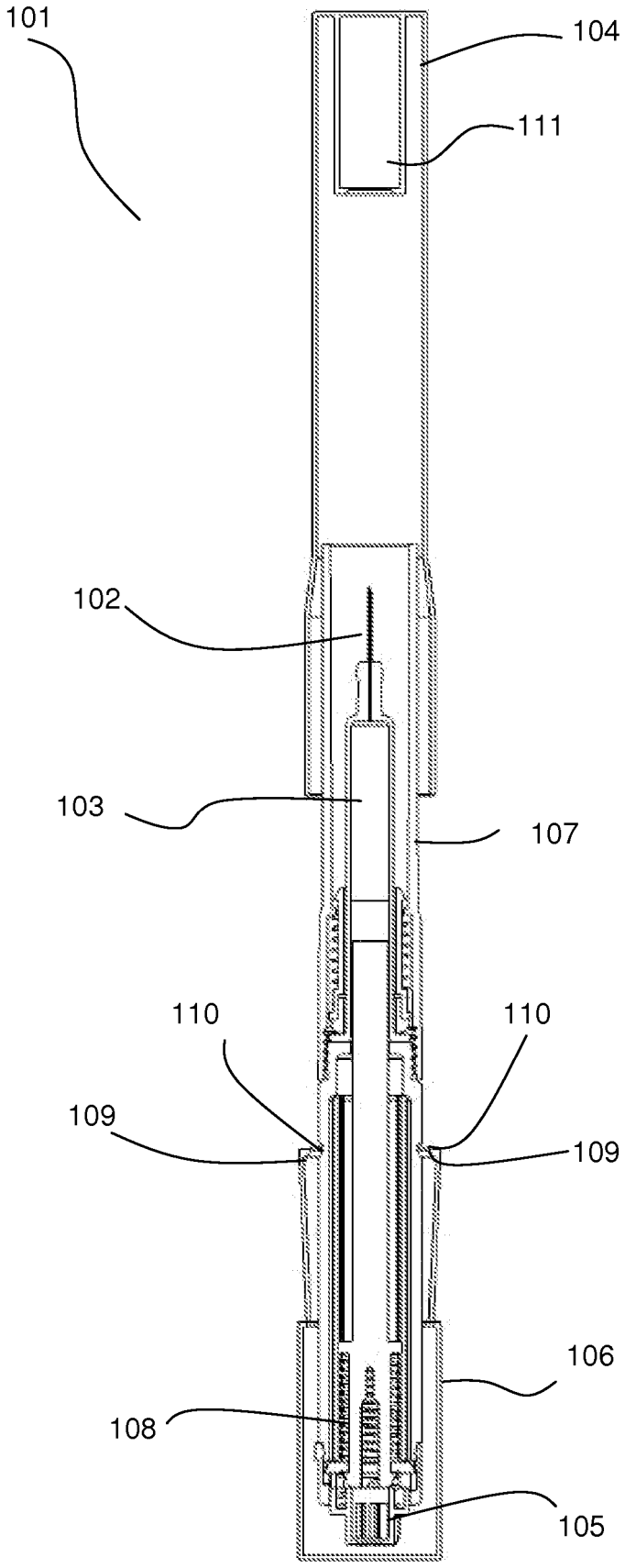
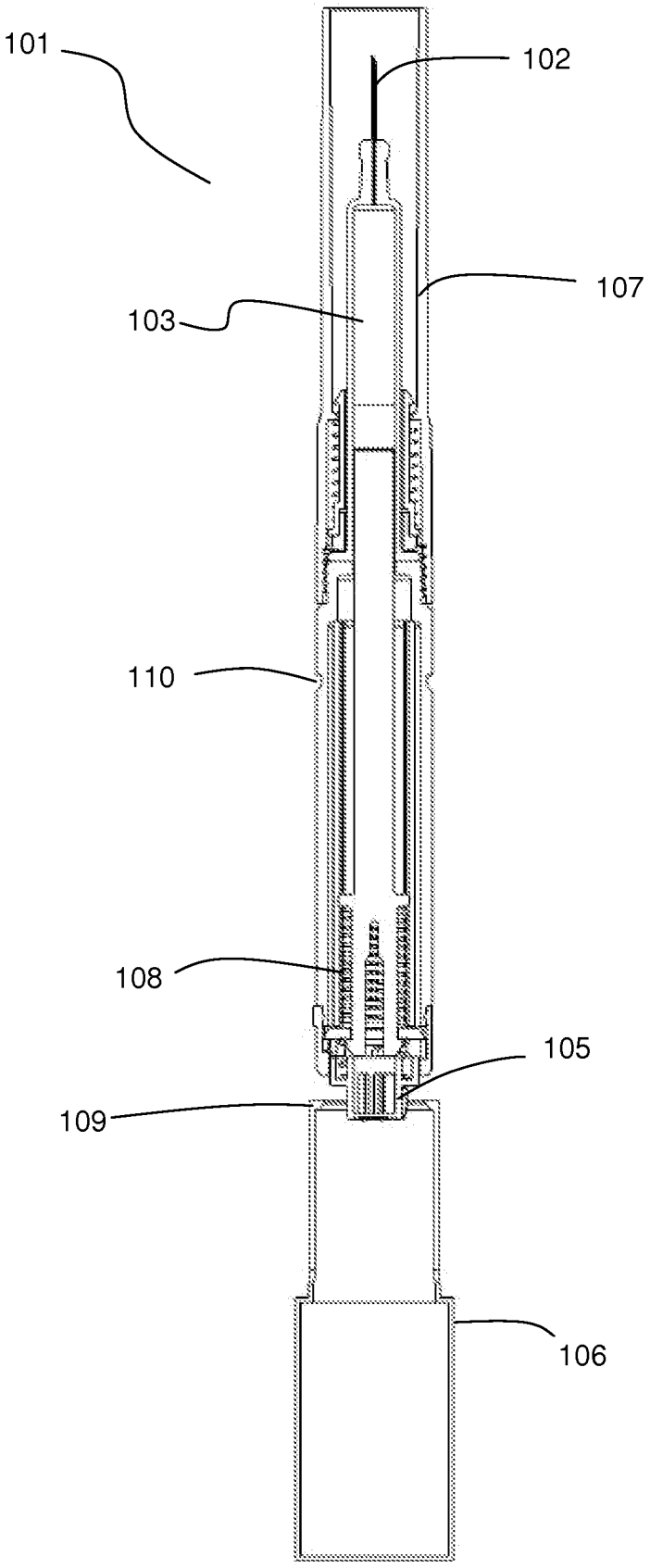


Figure 2



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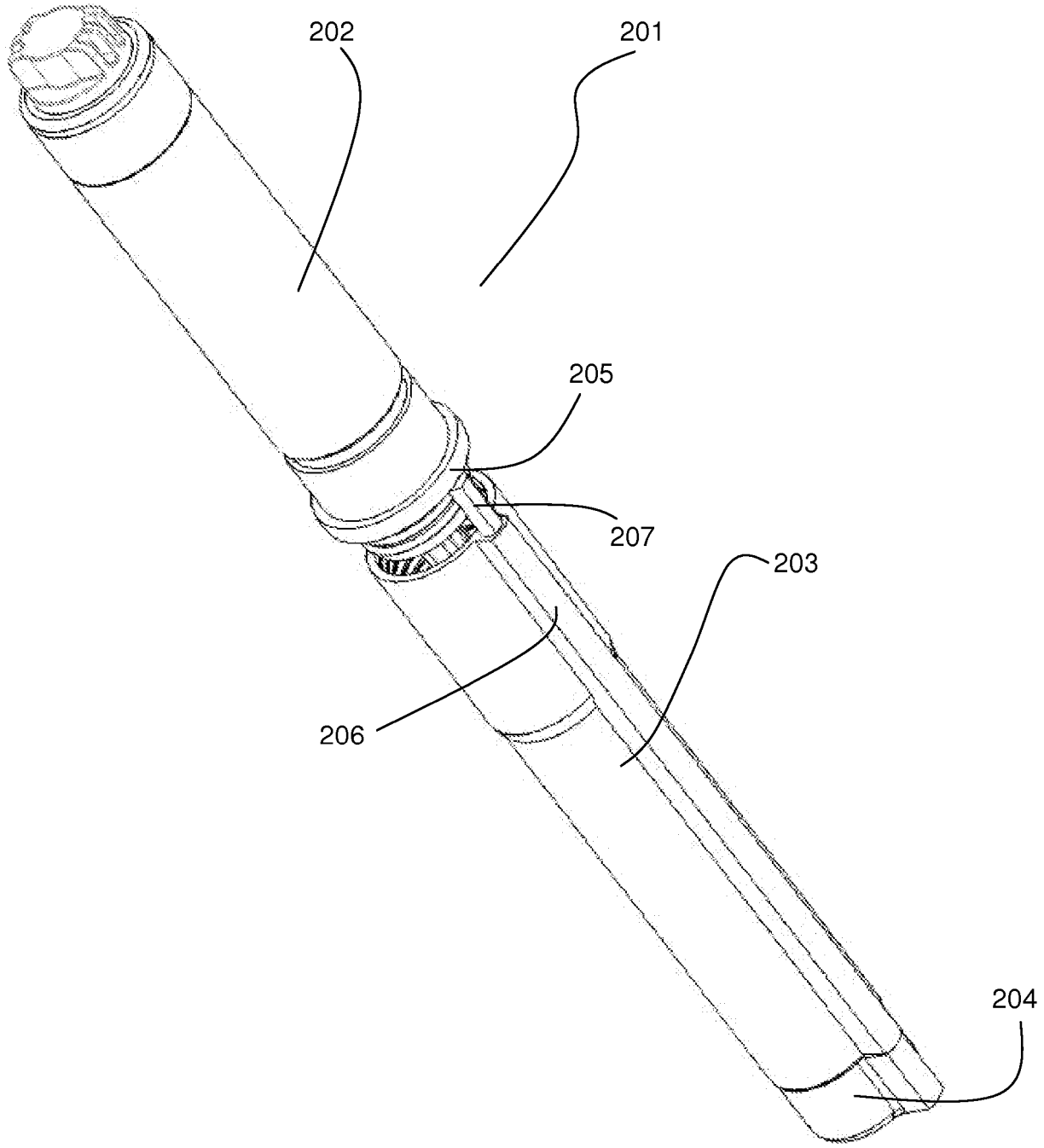

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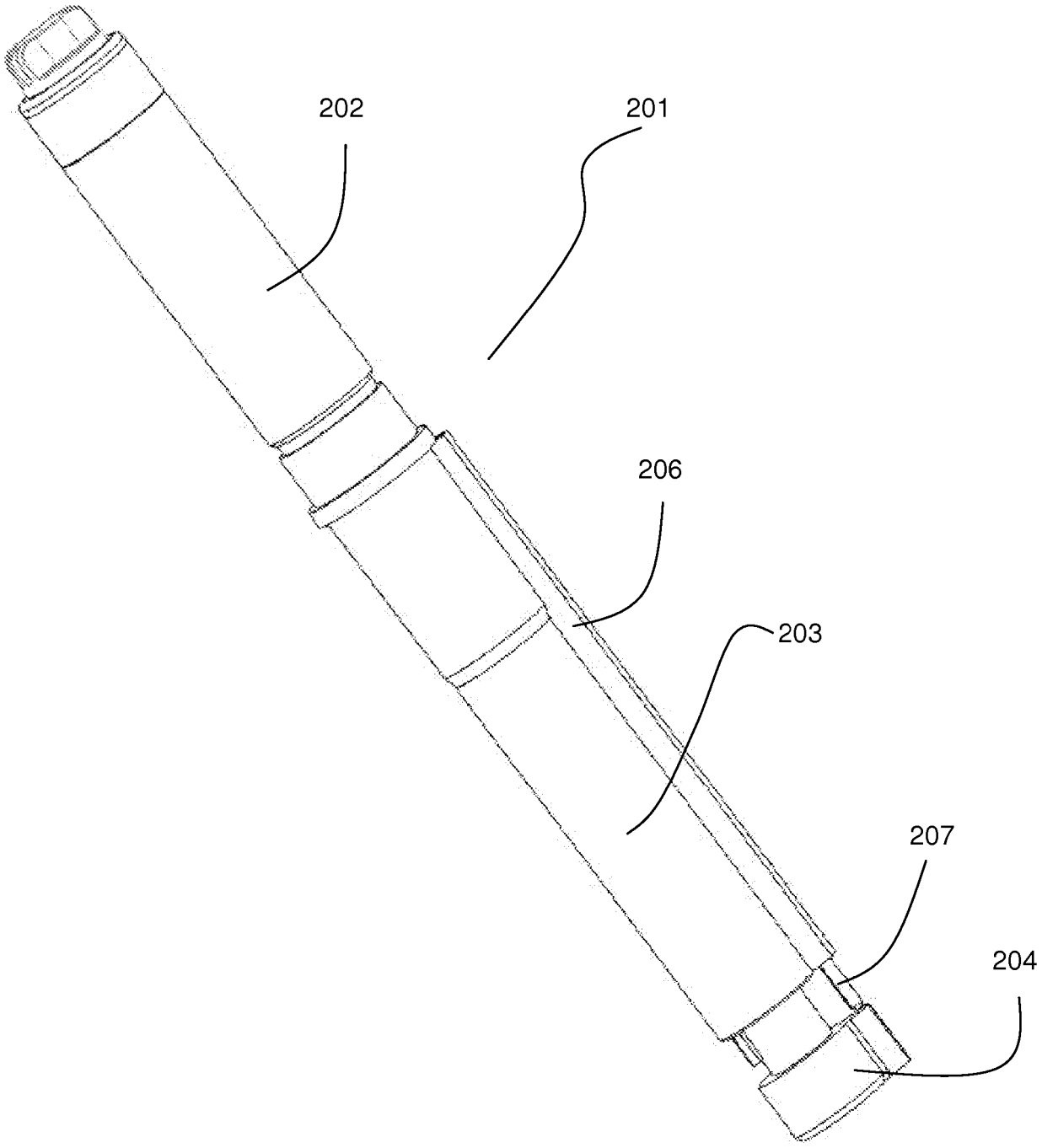

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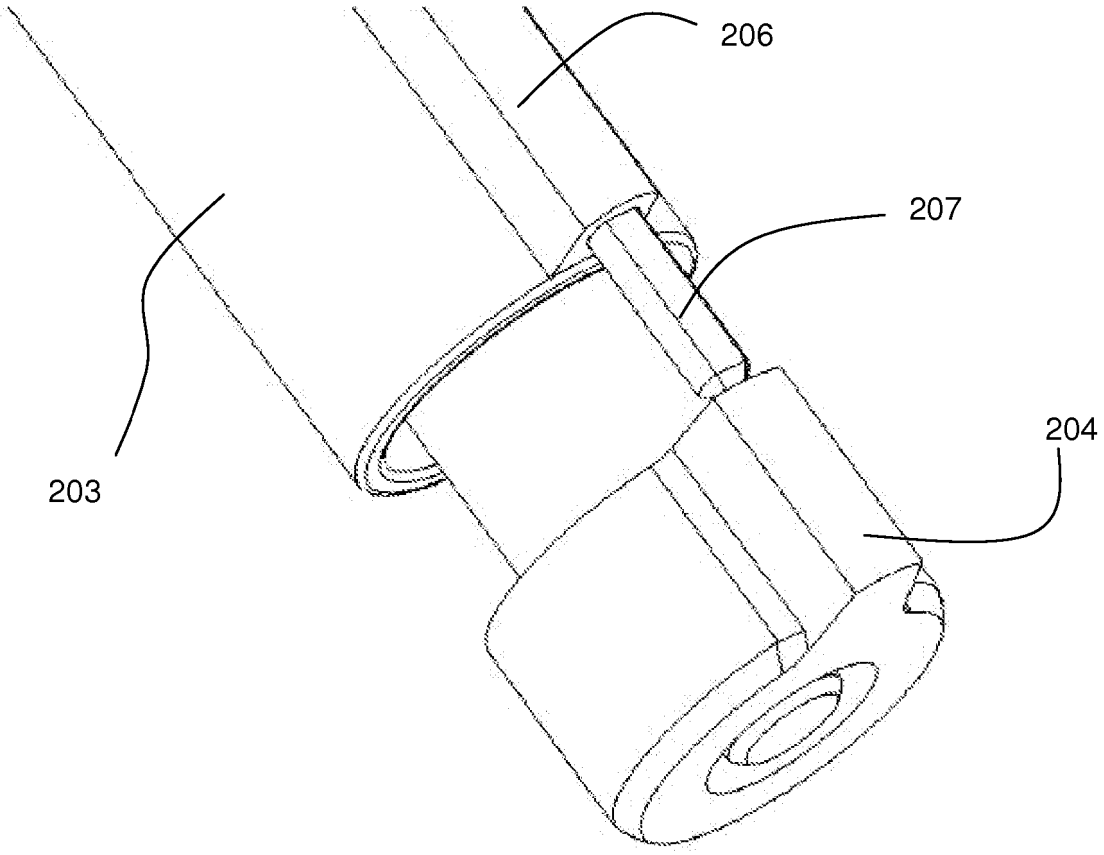

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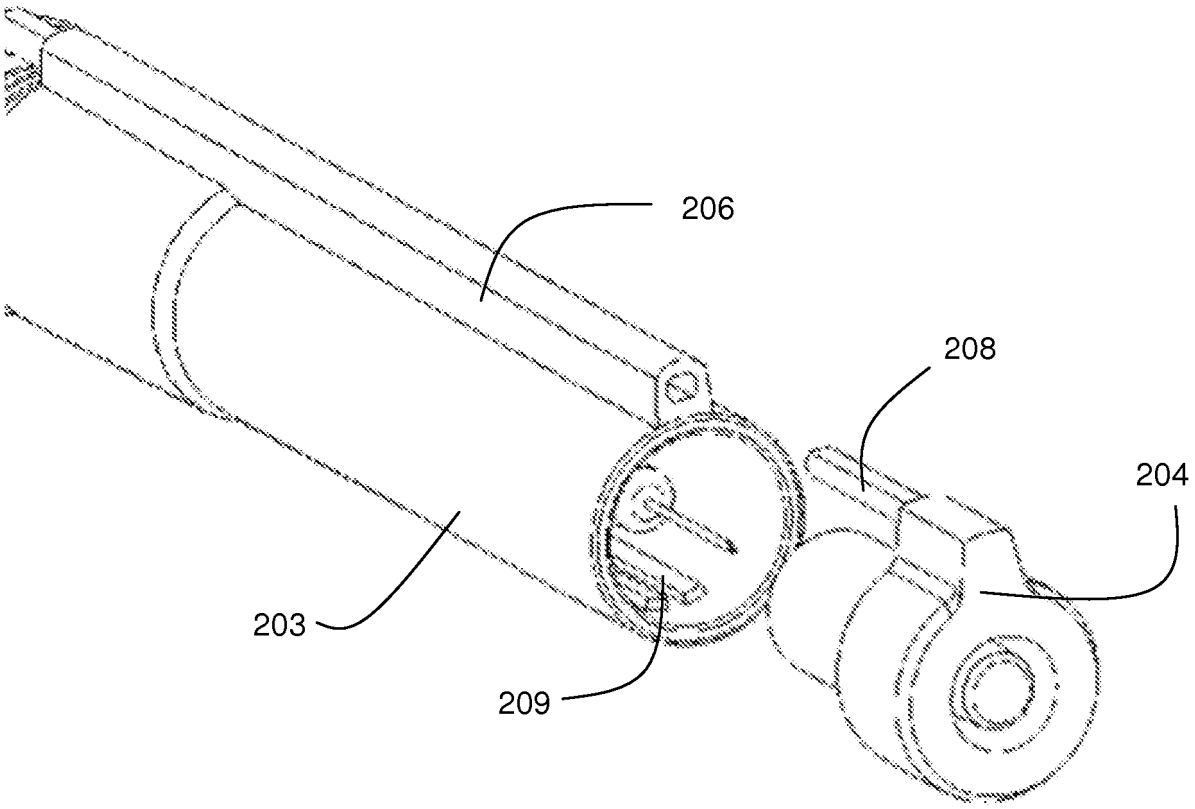

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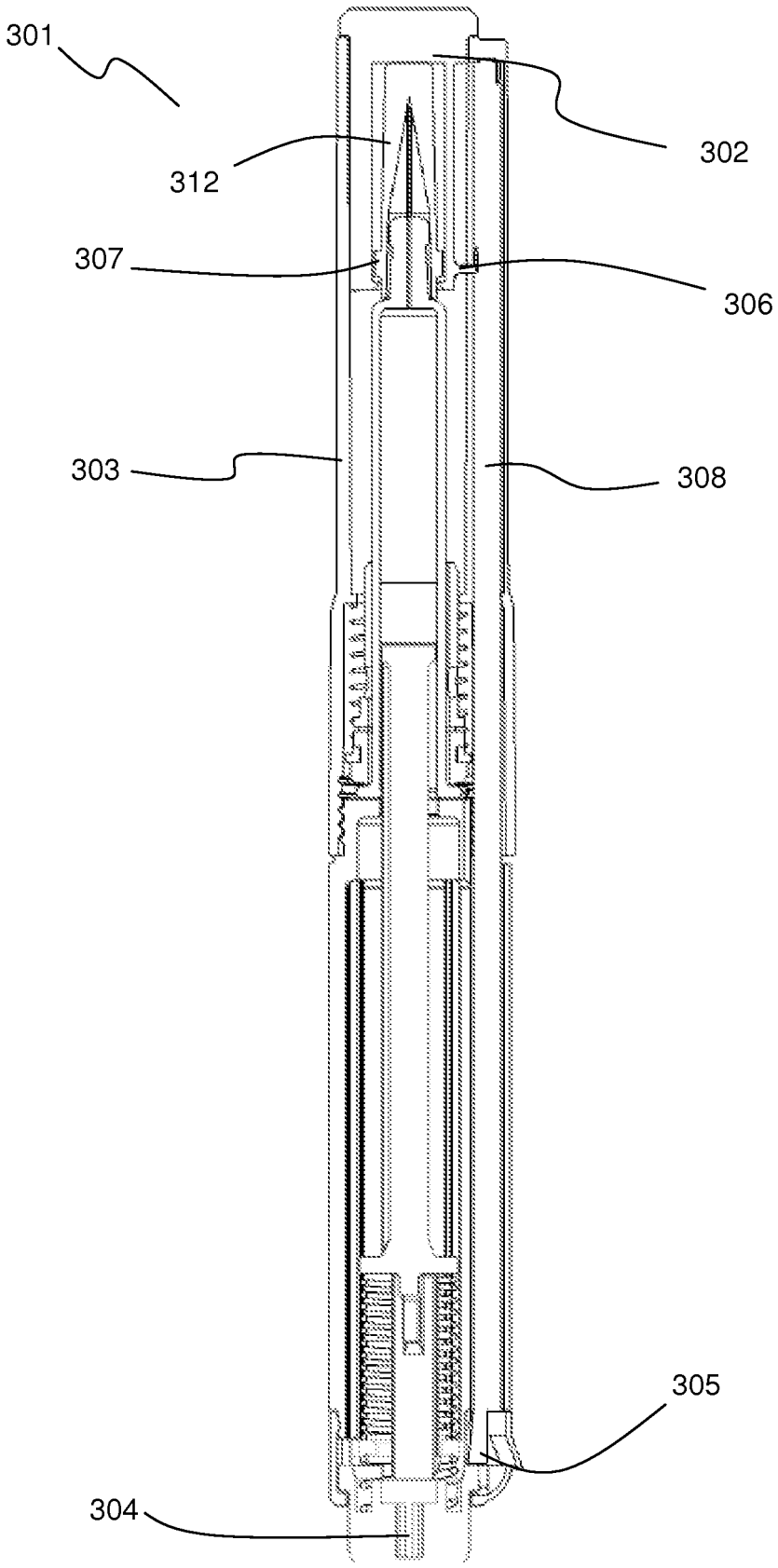

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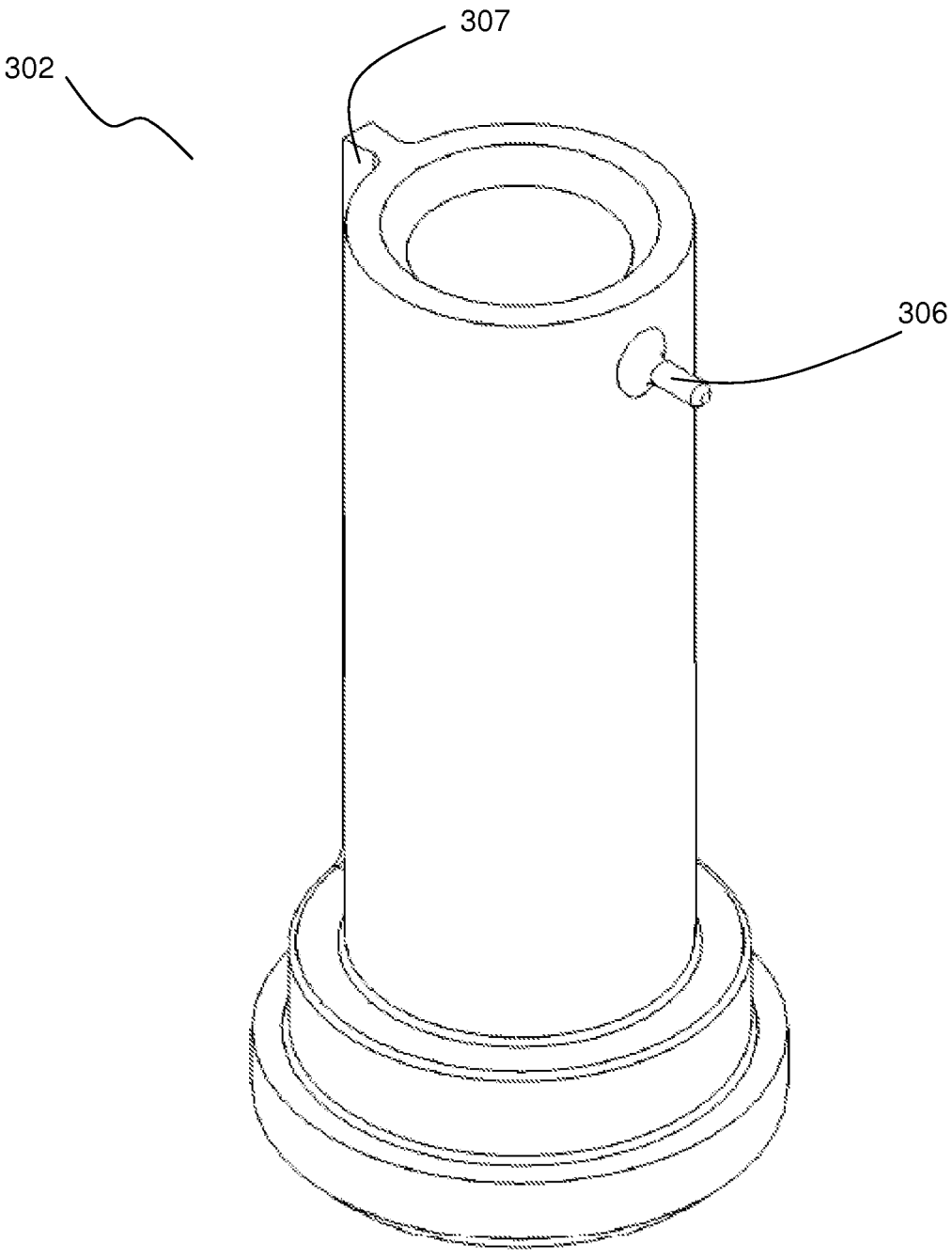

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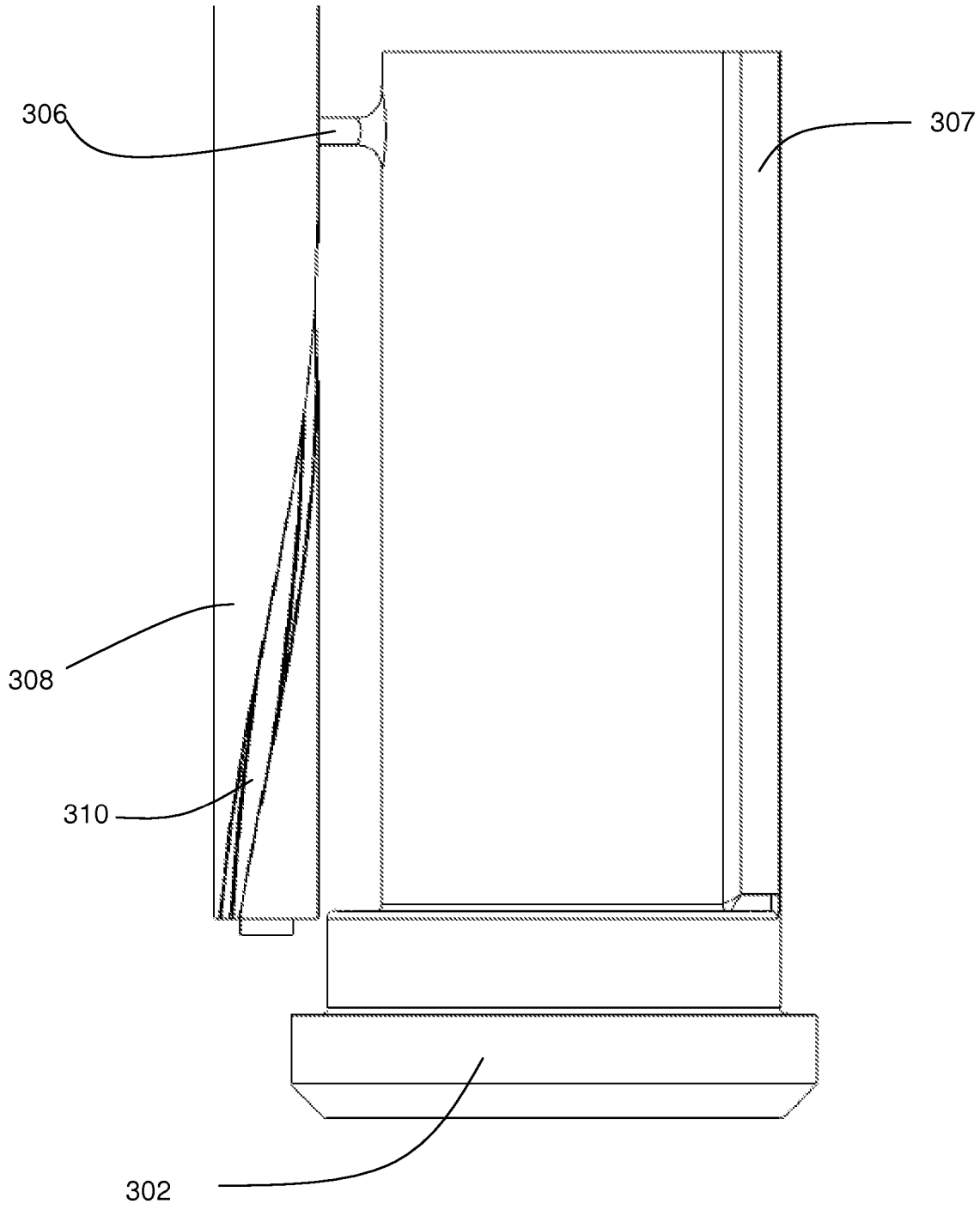

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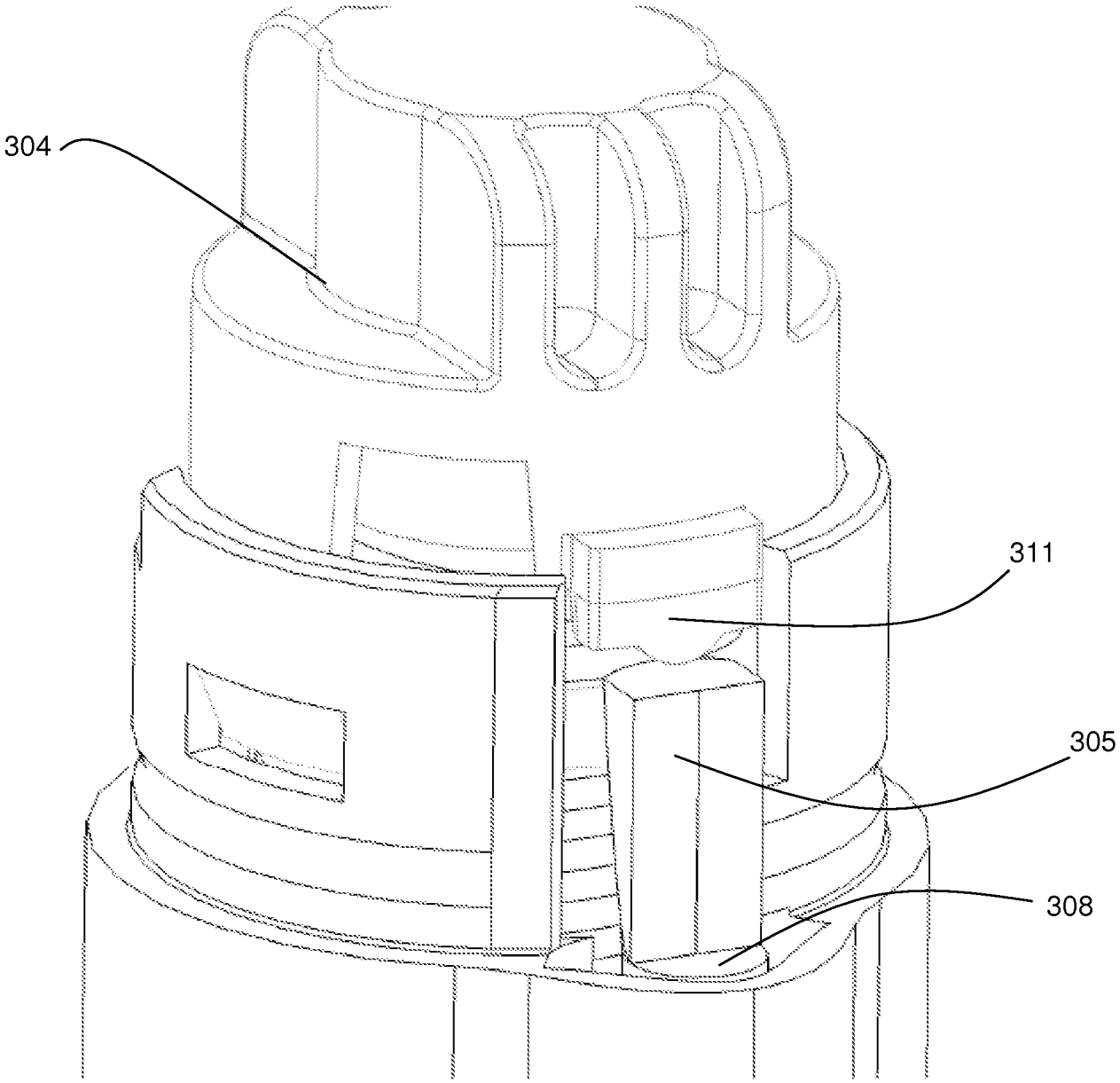

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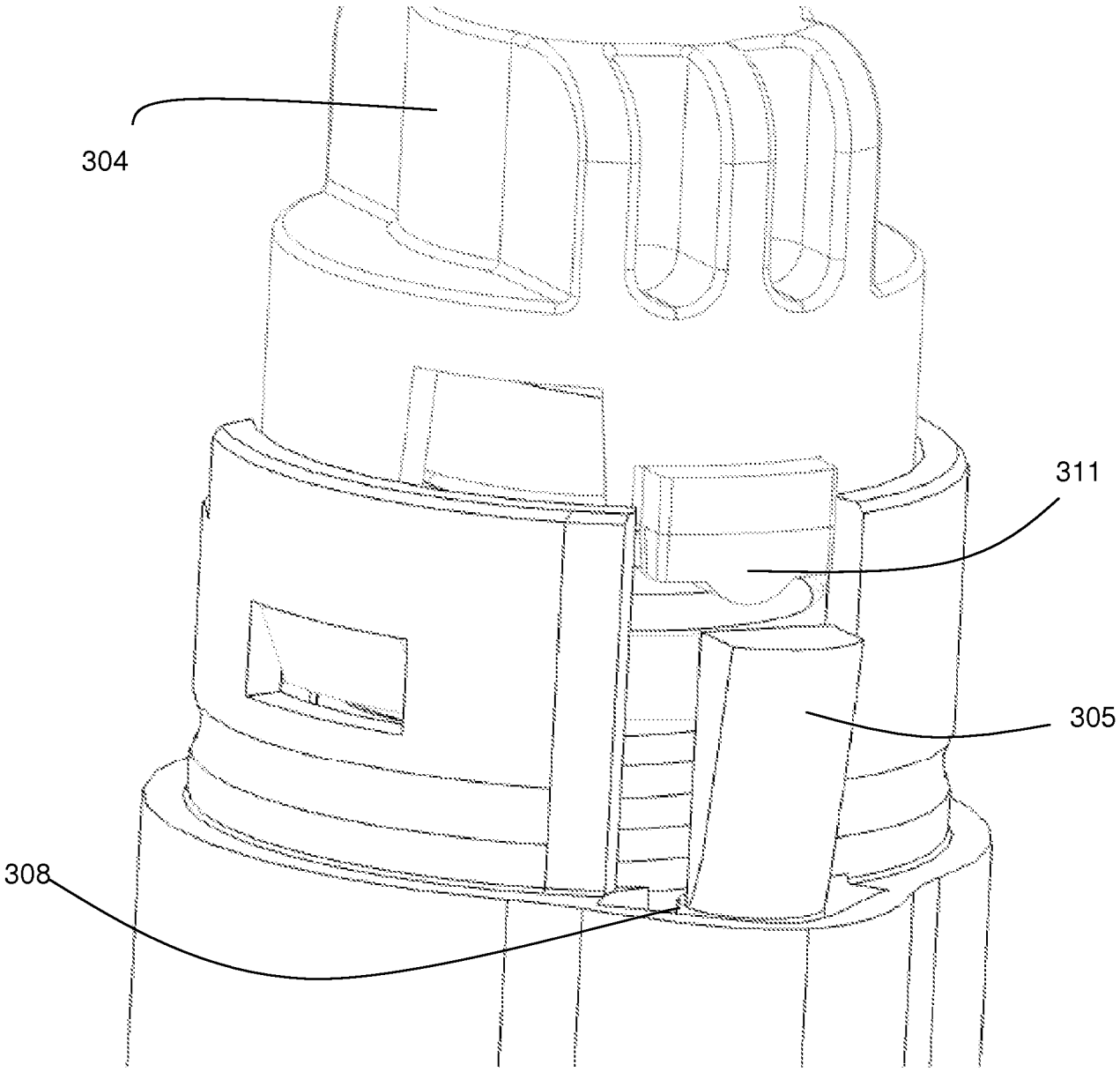

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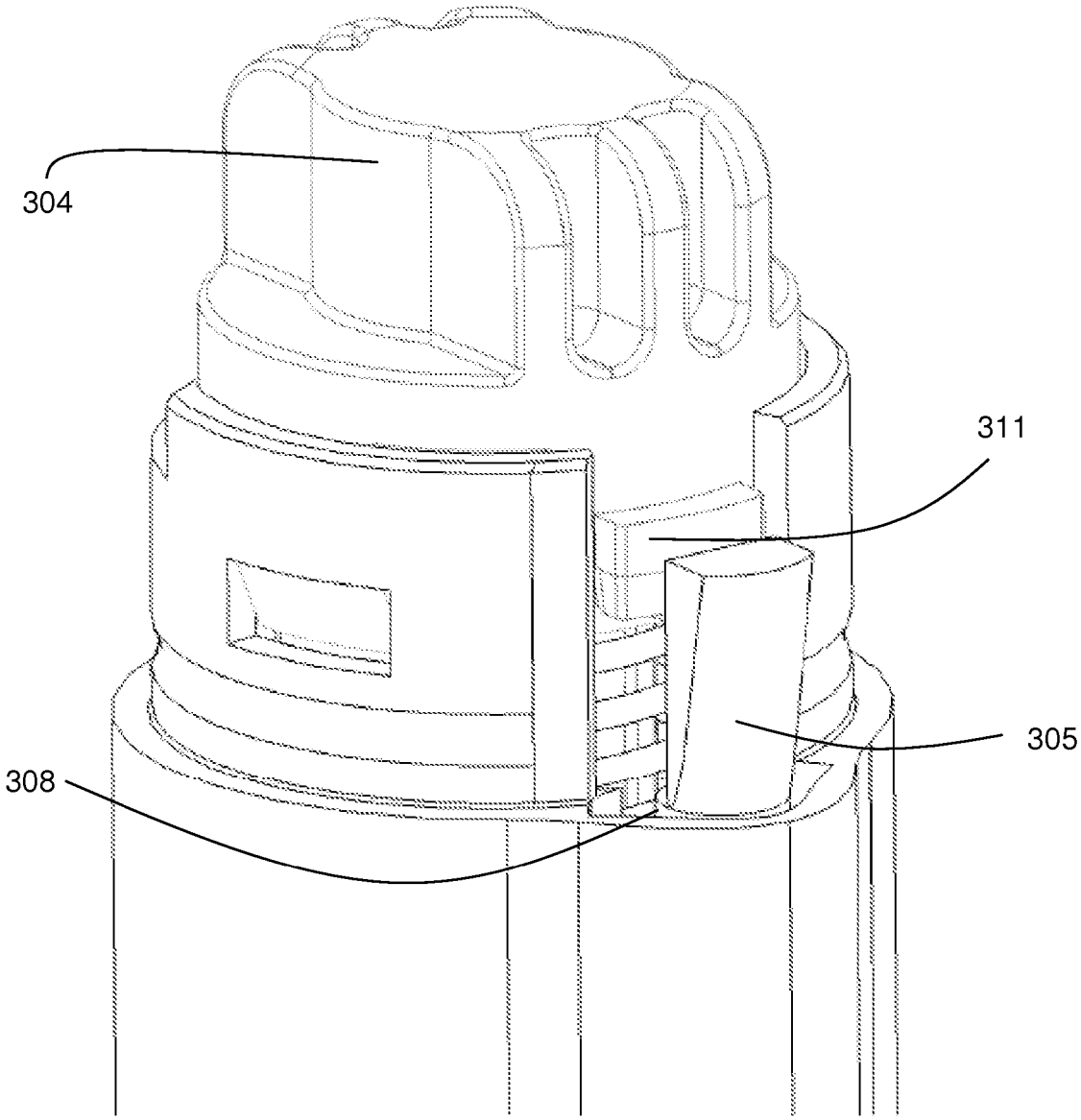

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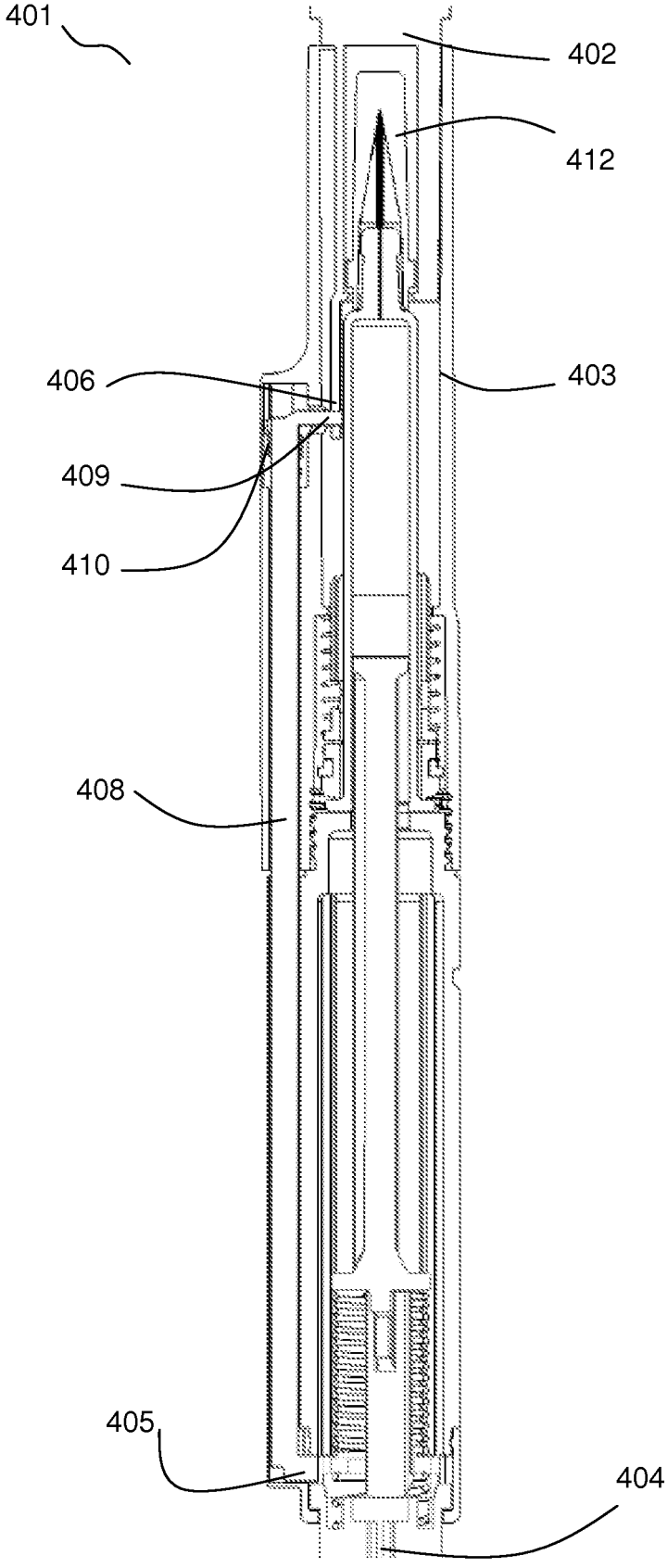

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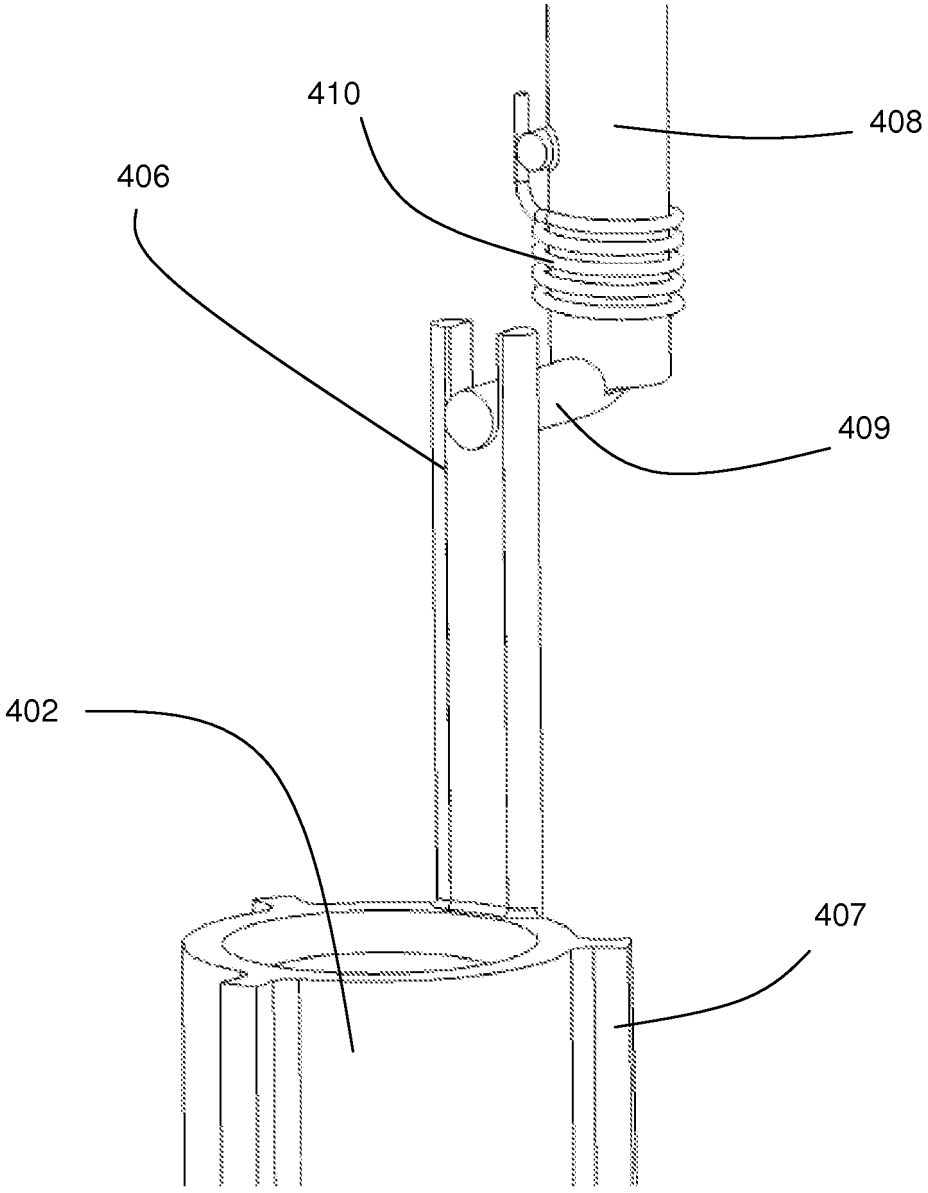

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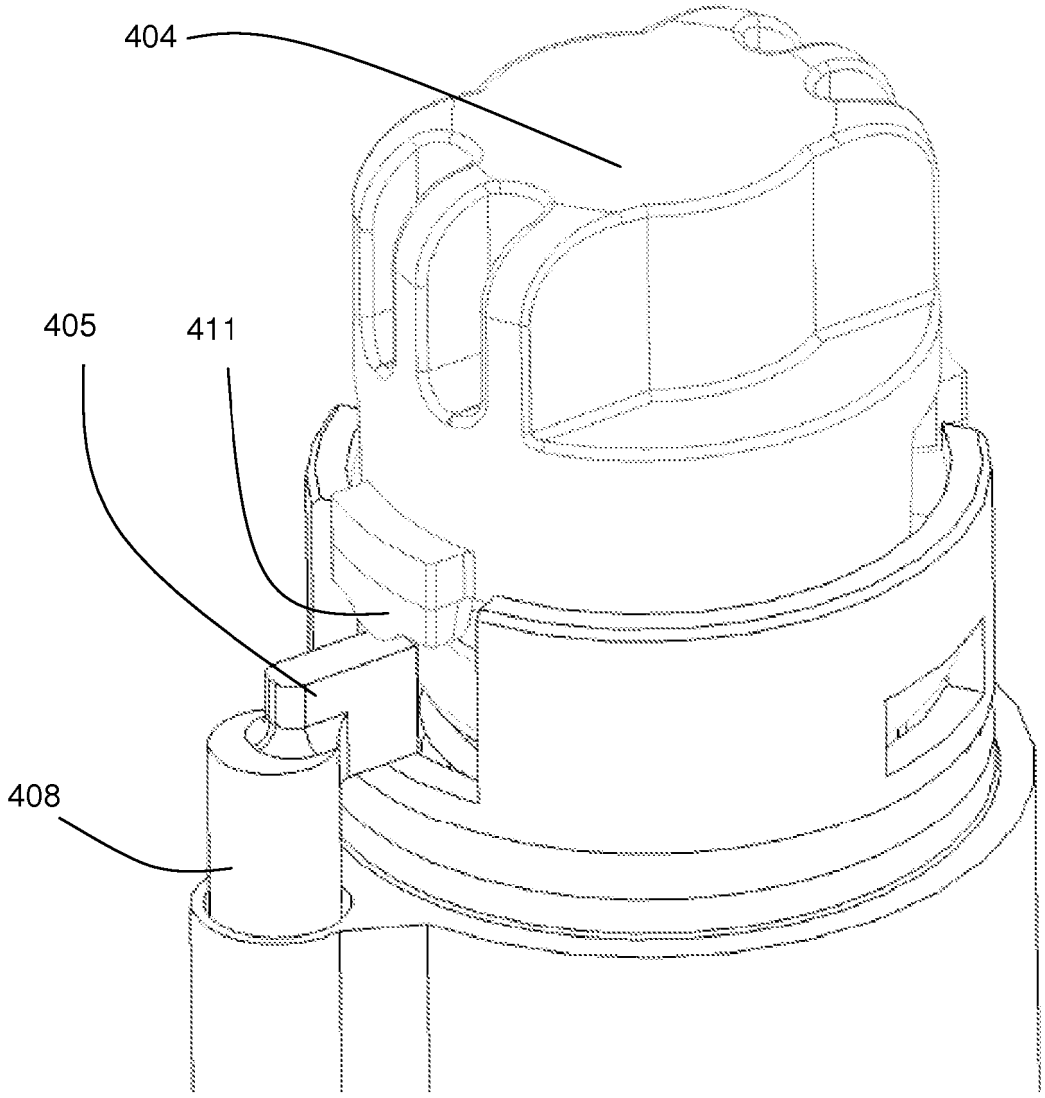

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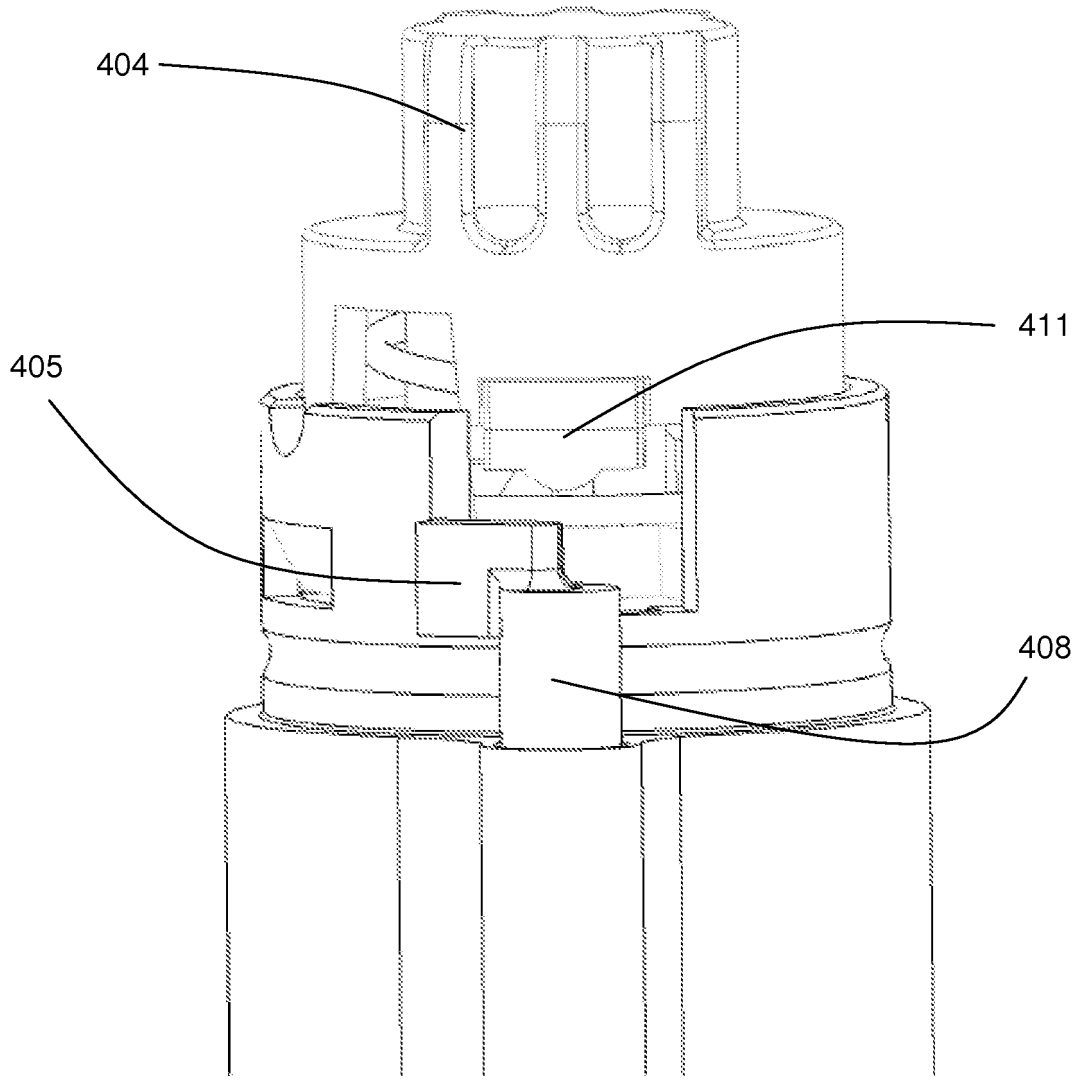

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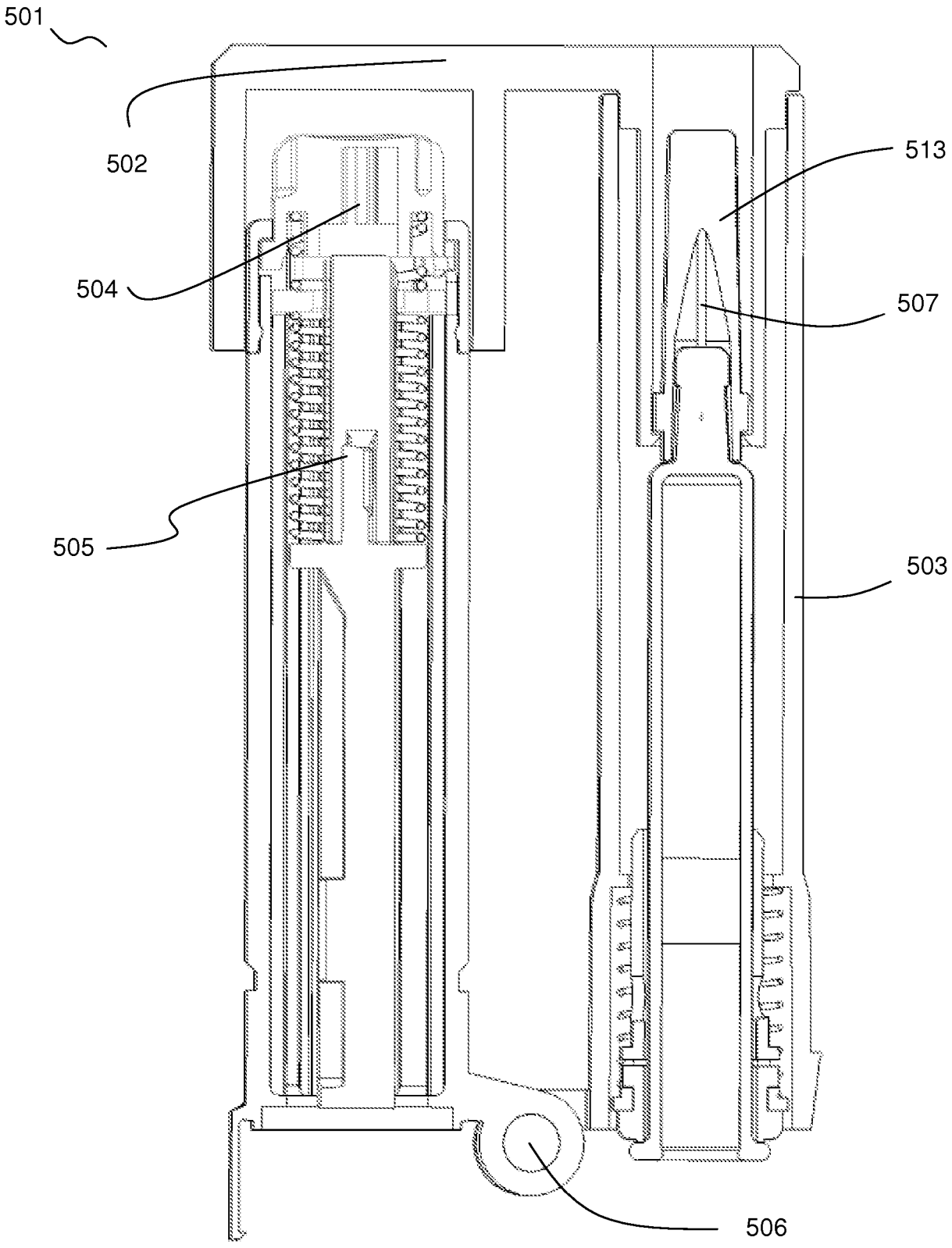

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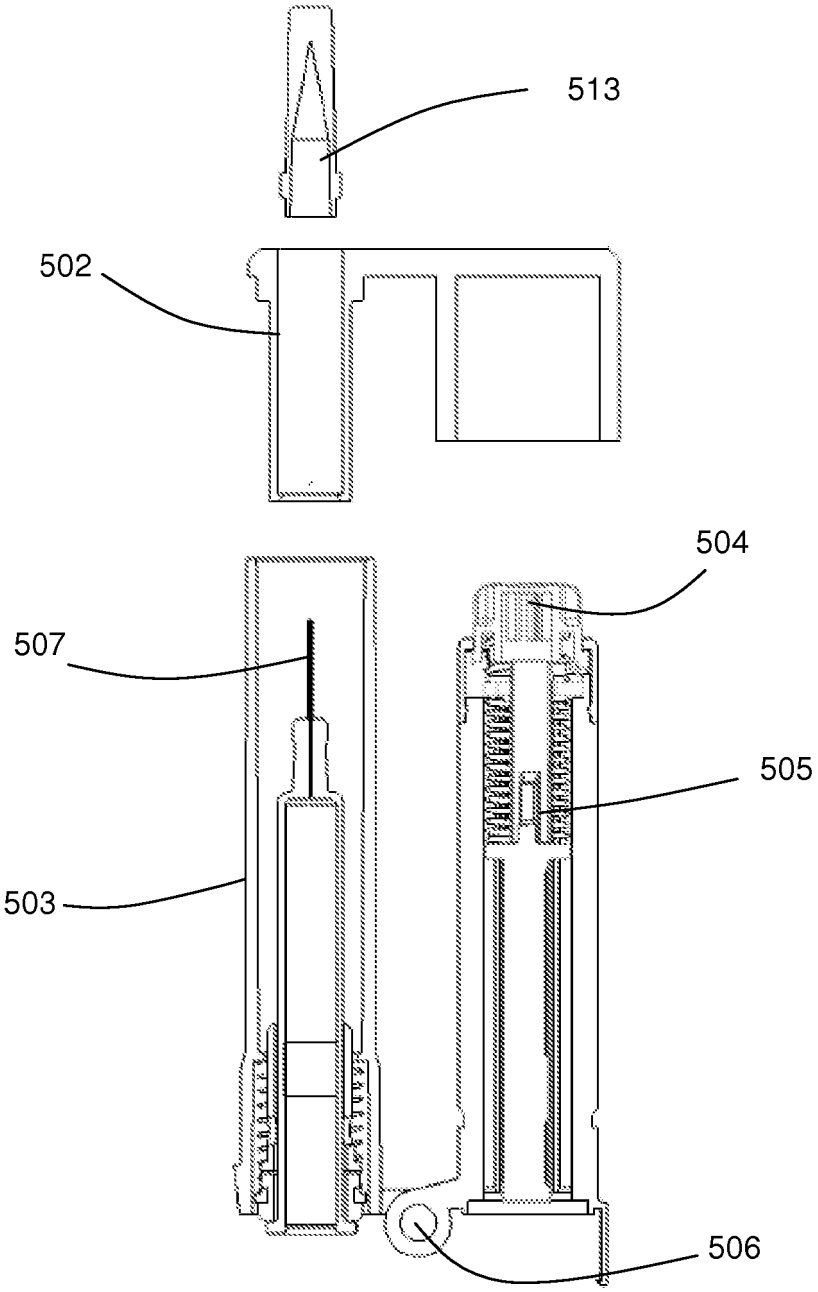

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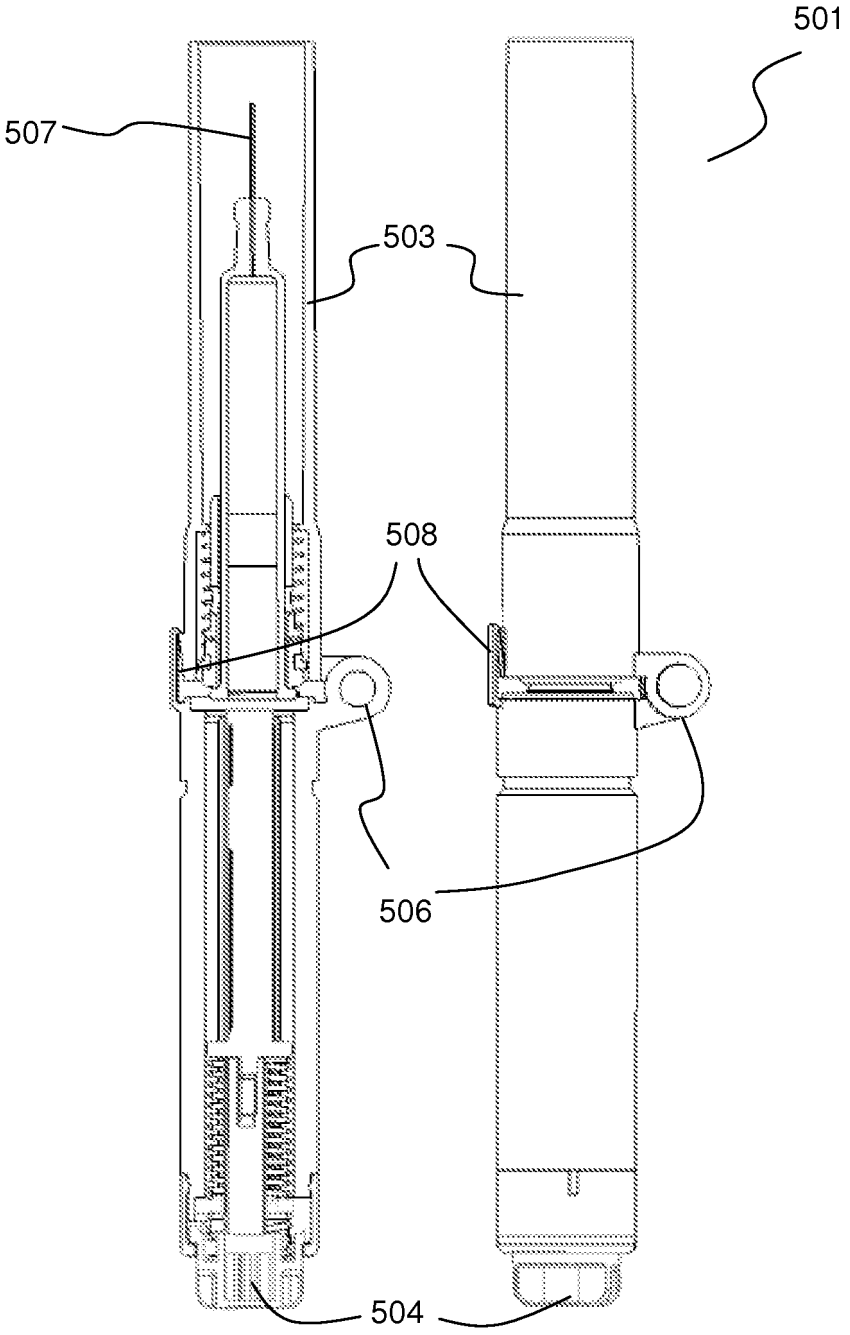

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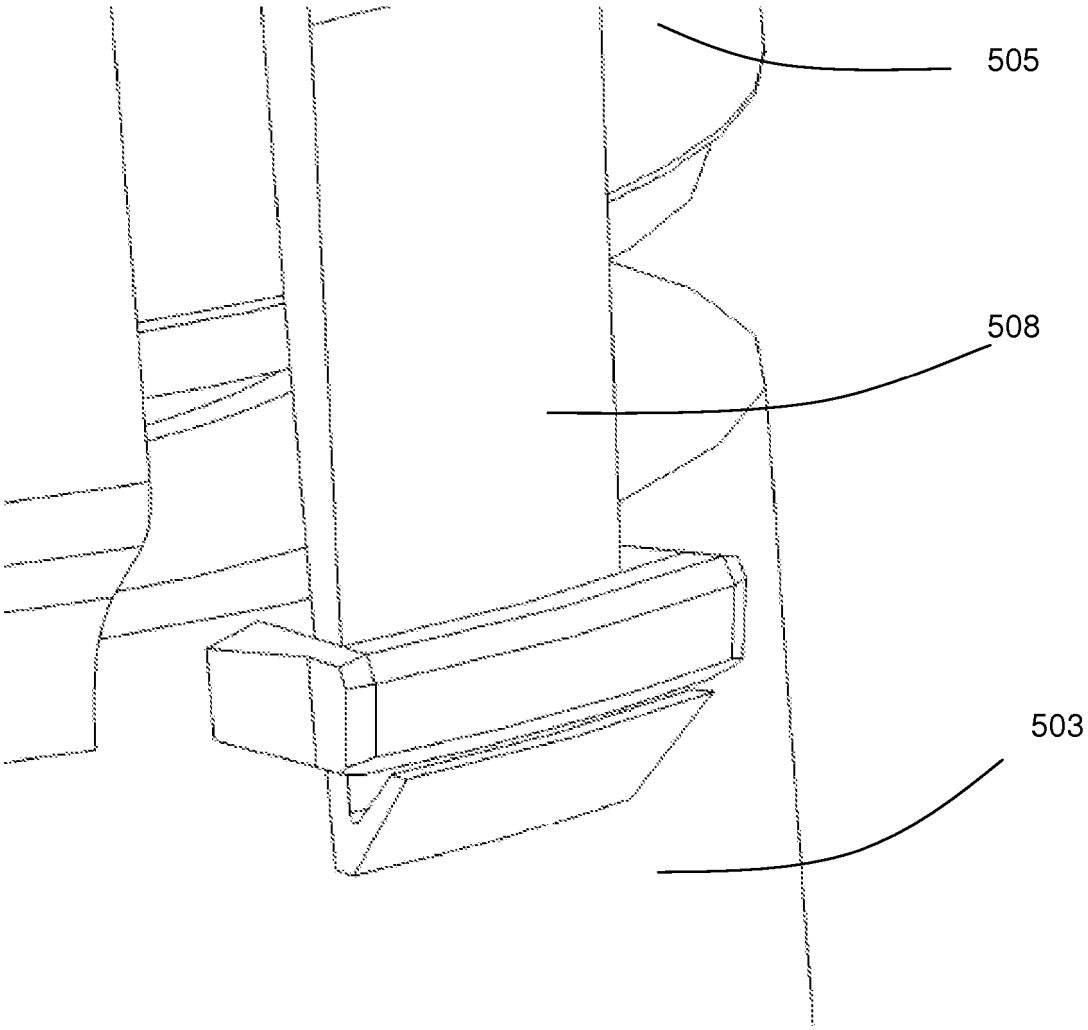


Figure 21

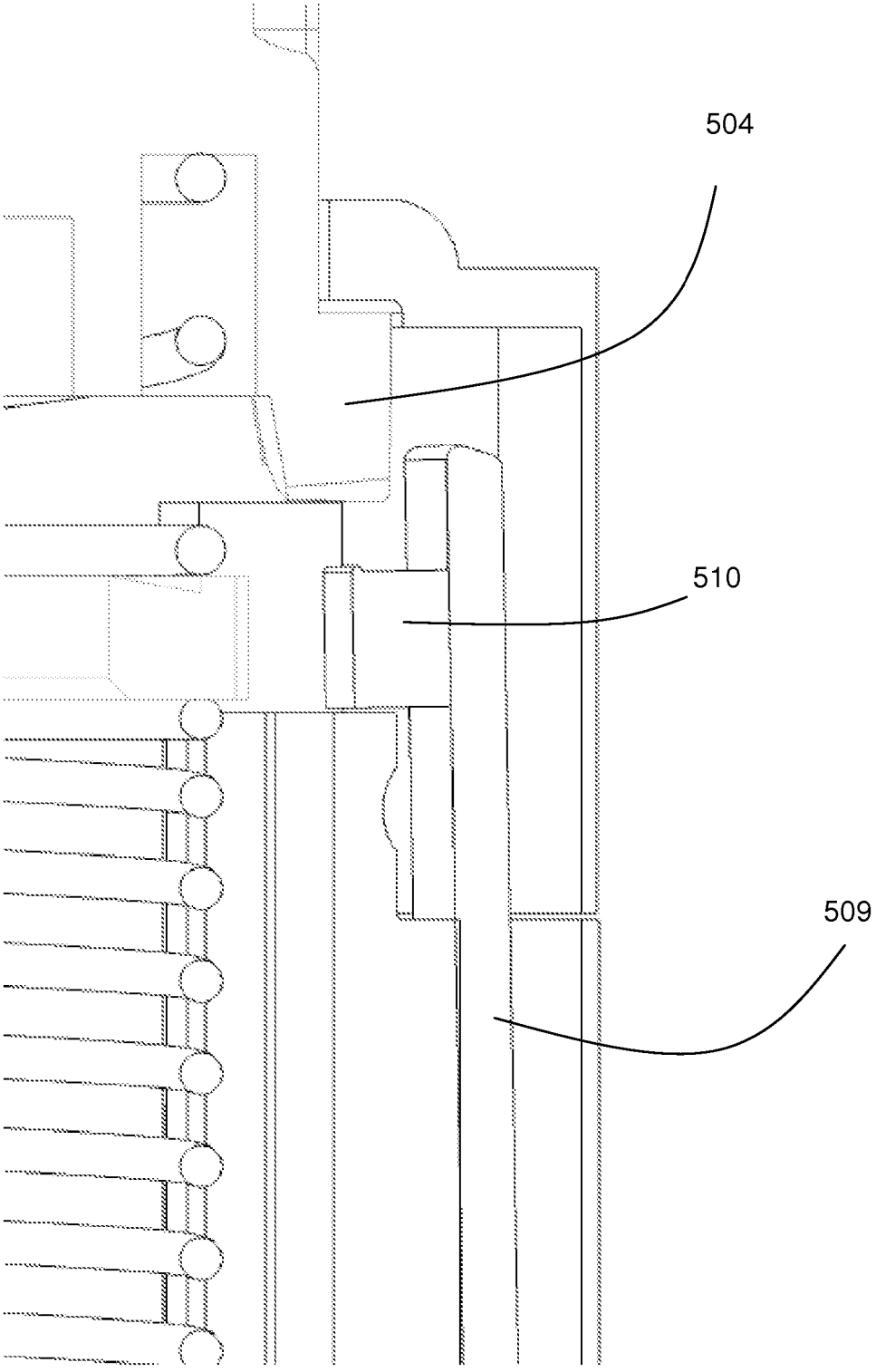
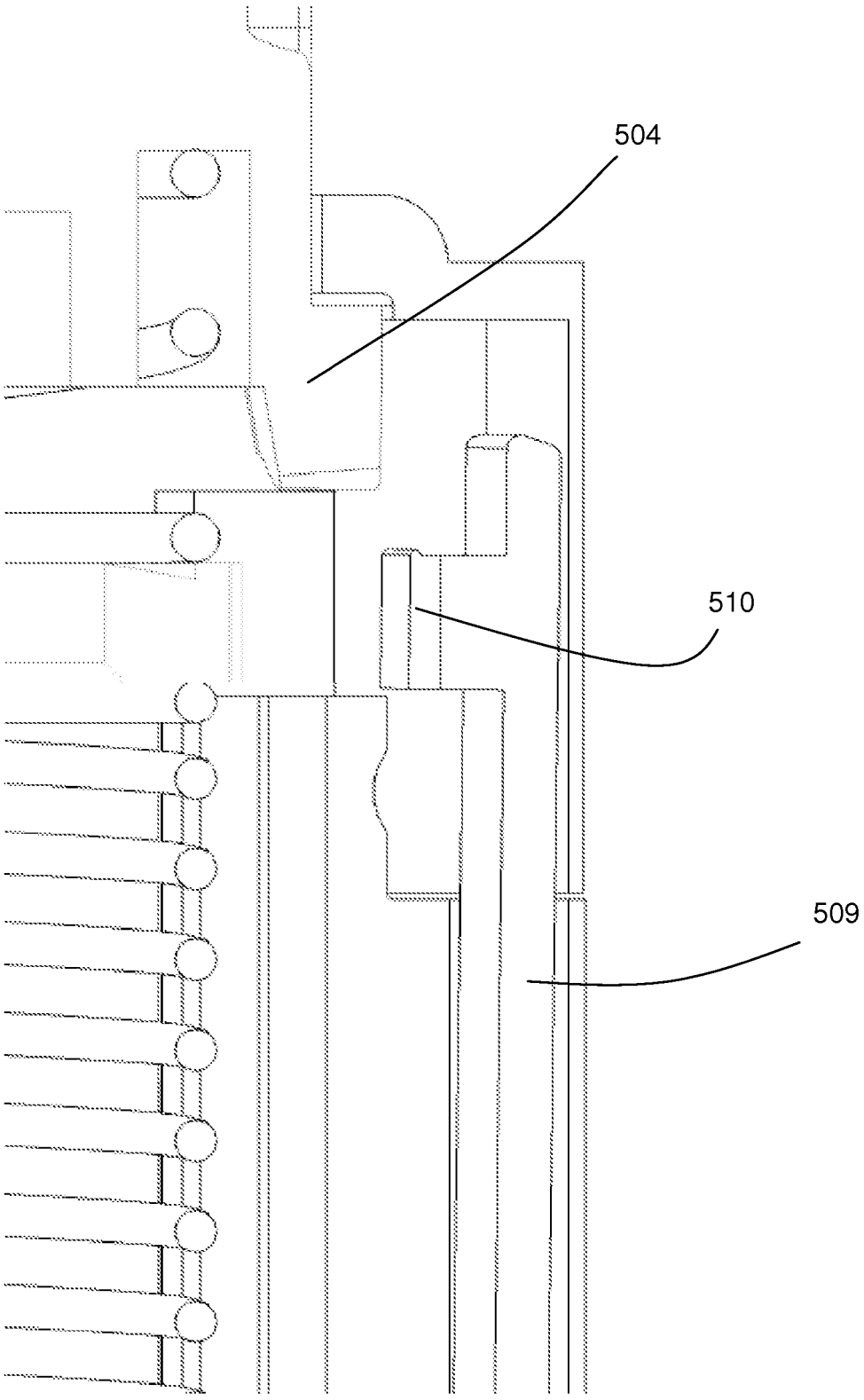


Figure 22



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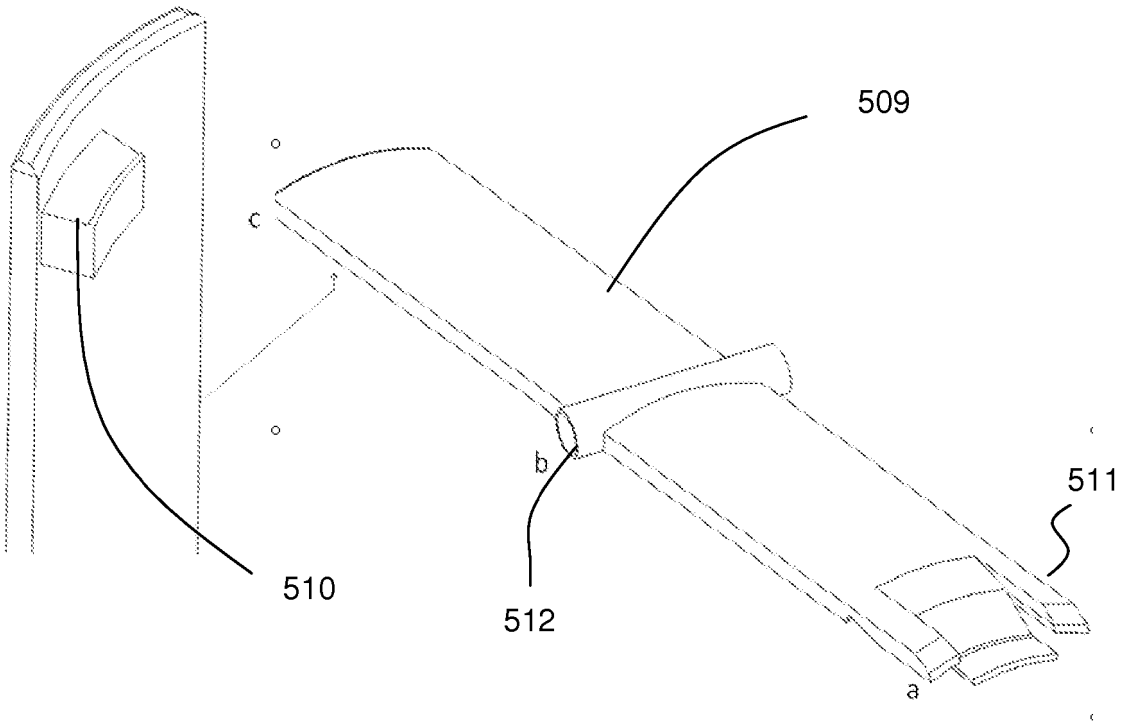

Figure 24

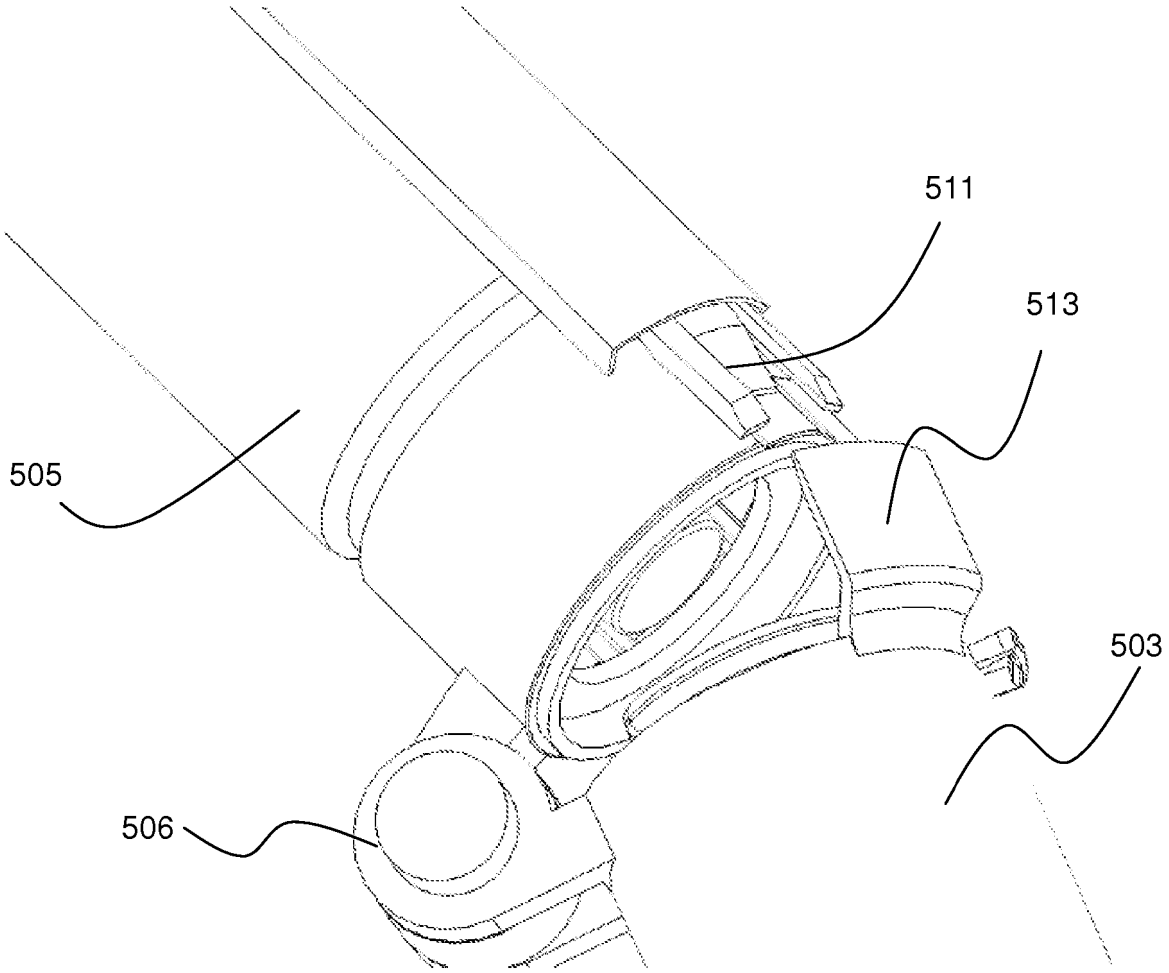

Figure 25

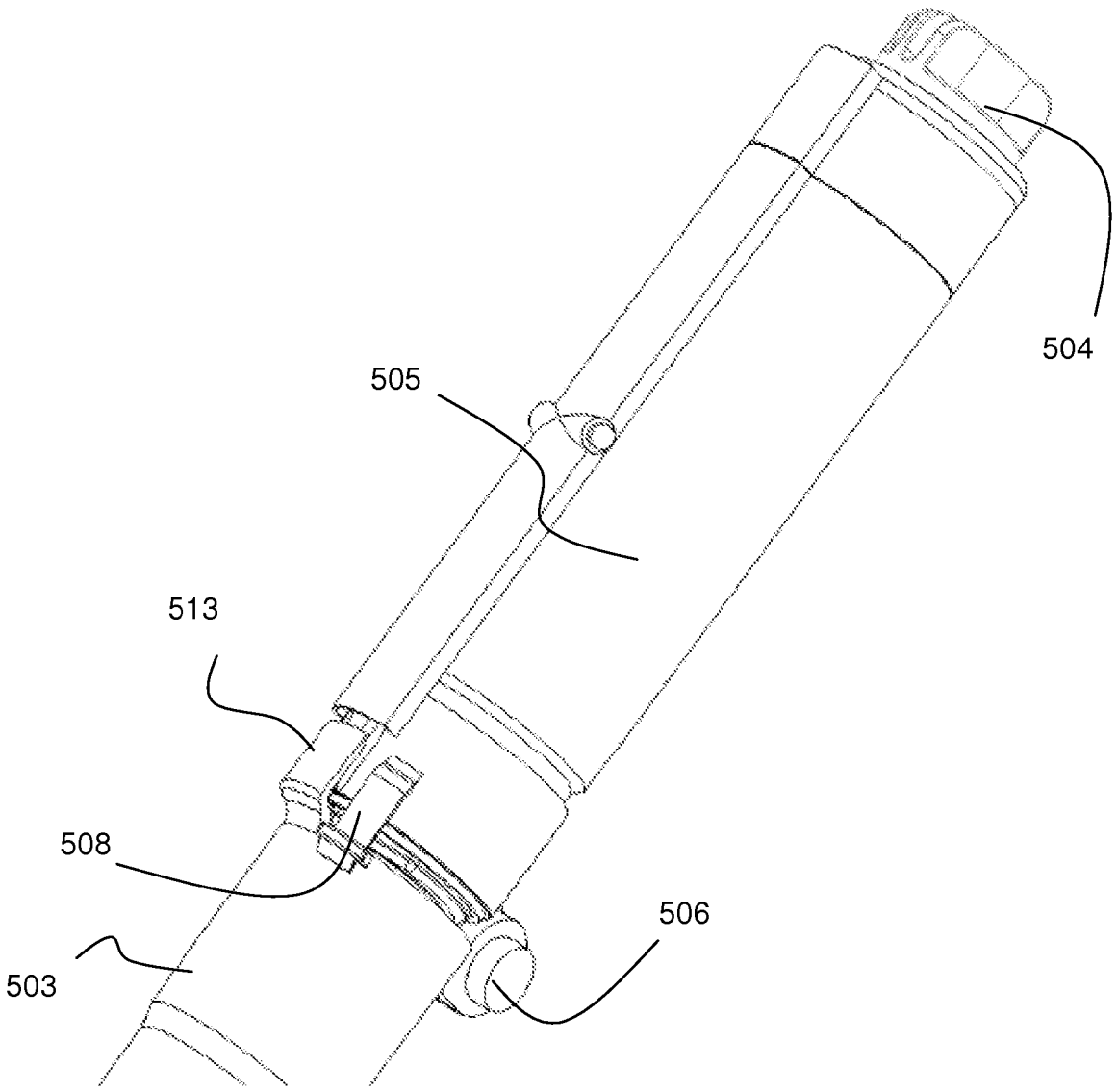

Figure 26

AUTOMATIC INJECTION DEVICE

TECHNICAL FIELD

The present invention relates to an automatic injection device for delivering a dose of medicine to a user from a medicine containing syringe.

BACKGROUND

Automatic injection devices are routinely used in the medical field to deliver a measured dose of medicine to a user. Due to their user friendly design, they can be safely used by patients for self-administration, although in some circumstances they may be used by trained personnel.

A typical automatic injection device comprises several parts which may include; a syringe containing medicine, a needle fixed to the end of the syringe, a firing mechanism including a spring (or possibly other drive means such as an electric motor or gas drive means), and a trigger. The spring may be preloaded, or may be set using a dose setting mechanism such as a dial. The firing mechanism is activated by the trigger and forces the medicine through the needle and into the user. A mechanical lock may be provided to prevent the trigger from being accidentally pressed. This could be, for example, simply a catch that must be moved out of the way in order to access the trigger.

Single use, disposable automatic injection devices are delivered to end users in an assembled state, with a medicine syringe contained within the device housing and a needle fixed to the end of the syringe. In order to ensure sterility of the needle, the projecting end of the needle is contained within an rubber or elastomer “boot”. Typically, the boot forms an interference fit around the narrowed end portion of the syringe body. The tip of the needle may penetrate the end of the boot. In the case of re-useable automatic injection devices, an end user must typically open the housing and press a new single-use syringe into position. The single-use syringe will have a needle and boot already in place.

The injection device may also comprise a boot remover to allow the end user to easily and safely remove the boot and thereby expose the needle. Typically, the boot remover is fitted around or inside the proximal end of the device prior to insertion of the syringe into the housing. When the syringe is pressed into the housing, the boot protecting the needle is captured by the boot remover, i.e. snaps into place within the boot remover. A needle shield may be further provided around the needle, such that the needle remains protected even after the boot has been removed. This is relevant to so-called "auto-injectors" which, in addition to driving the medicine through the needle, perform an initial step of inserting the needle through the skin using the force provided by the injection spring (or possible a secondary spring).

When a single use automatic injection device is to be used, a user should first remove the boot remover and boot to expose the needle. NB. the needle remains surrounded by the needle shield at least in the case of an auto-injector. The user will then release the mechanical lock, such that the trigger can be pressed. The user can then place the auto-injector against the surface of the skin and press the trigger to push the needle through the skin and force the medicine through the needle. In the case of an auto-injector, a carriage and carriage-return spring may cause the needle to be returned to a position within the needle shield.

A problem with single use automatic injection devices occurs when a user forgets to first remove the boot, and, instead, operates the trigger with the boot still in place. This is particularly likely in the case of an auto-injector, where the needle and boot are not readily visible. If the boot is not removed before firing, no drug is delivered to the user. Furthermore, since the medicine will now be under pressure, there is a risk that the user may inadvertently empty the syringe contents into the air if, when realising their error, they subsequently remove the boot.

A user may not have an abundance of medicine and so waste may be a serious issue. Waste may also be undesirable due to cost implications: some medicines can be extremely expensive. Therefore, there exists a need to provide an automatic injection device that overcomes the problem of a device being fired prior to removal of a boot.

SUMMARY

It is an object of the present invention to provide an automatic injection device that cannot be fired prior to removal of a boot.

According to an aspect of the present invention there is provided an automatic injection device for delivering a dose from a medicine containing syringe. The automatic injection device comprises a housing for containing the syringe, a force applicator for applying a force to eject medicine from the syringe, a trigger coupled to the force applicator for releasing the force applicator to cause an injection, a boot covering a needle attached to the syringe to protect and maintain sterility of the needle, and a mechanical interlock. The mechanical interlock prevents actuation of the trigger prior to removal of the boot. When the boot is removed, the mechanical interlock allows for actuation of the trigger.

The present invention overcomes problems associated with current automatic injection devices, where a user can accidentally fire the automatic injection device with the boot still in place. This can result in wasted medicine, which may be expensive to replace. The present invention overcomes this by providing a mechanical interlock, such that an automatic injection device cannot be fired prior to removal of the boot.

As an option the automatic injection device comprises a boot remover for removing the boot. The boot remover may be formed integrally with the boot. Alternatively the boot and boot remover are formed as separate discrete components, and configured such that the boot is locked into the boot remover upon insertion of the syringe into the housing.

In a first embodiment of the present invention, the mechanical interlock comprises a boot remover, wherein the boot remover is configured such that removal of the boot remover from the housing both removes the boot from the needle and facilitates access to the trigger. As an option the mechanical interlock comprises a cover attached to a distal end of the housing. The cover is locked in place when the boot remover is attached to the housing, and is removable from the housing to expose the trigger only after removal of the boot remover and boot. As another option the cover is coupled to the distal end of the housing by one or more flexible latches. When the boot remover has been removed, the latches may be disengaged and the cover removed. The boot

remover may extend to cover the flexible latches when the boot remover is attached to the housing.

In a second embodiment of the present invention, the housing comprises a first part for containing the syringe and a second part for attachment to the first part by a user. The mechanical interlock is configured to remove the boot upon coupling together of the first and second parts. As an option the trigger is provided on the second part. The first and second parts may be coupled together by relative axial motion of the parts, for example, by engaging complimentary screw threads formed on the first and second parts. The mechanical interlock may comprise a rod coupled to the first part of the housing and slideable relative thereto in an axial direction. The rod has a distal end that engages with the second part in order to axially displace the rod upon coupling together of the first and second parts. The rod has a proximal end that is coupled to the boot in order to remove the boot. As an option, the rod is coupled to the boot by way of the boot remover. As an option, the first part of the housing defines a channel within which the rod is slideably mounted. As an option the boot remover may comprise a peg that protrudes into the channel for engaging with the rod upon coupling together of the first and second parts in order to push the boot remover off of the housing. Alternatively, the housing comprises a spring coupled to the rod in order to return the proximal end of the rod into the channel upon disconnection of the first and second parts.

In a third embodiment of the present invention, the mechanical interlock comprises a rod coupled to the boot remover and a trigger lock engaging with the trigger and with said rod. The mechanical interlock is configured such that removal of the boot results in rotation of the rod thereby releasing the trigger lock. The rod may have a helical track extending axially therealong and a peg is provided on the boot remover to engage with said track such that the rotation of the rod is caused by the axial motion of the peg as the boot remover is removed. As an option the boot remover may comprise a key and the housing may comprise an axially extending track. The key and axially extending track are arranged such that the key engages with the axially extending track to prevent rotation of the boot remover prior to removal of the boot remover.

In a fourth embodiment of the present invention, the mechanical interlock comprises a rod coupled to the boot remover and a trigger lock engaging with the trigger and with

said rod. The mechanical interlock is configured such that removal of the boot results in rotation of the rod thereby releasing the trigger lock. A torsion spring is coupled between the rod and the hosing to provide a rotational bias to the rod. A latch is provided on the boot remover to prevent rotation of the rod until the boot remover has been removed. As an option the rod comprises a pin for engaging with the latch. As an option the boot remover may comprise a key and the housing may comprise an axially extending track. The key and axially extending track are arranged such that the key engages with the axially extending track to prevent rotation of the boot remover prior to removal of the boot remover.

In a fifth embodiment of the present invention, the housing comprises a first part for containing the syringe and a second part for attachment to the first part by the user. The mechanical interlock is provided by the boot remover such that, when attached to the first and second parts, the boot remover holds the first and second parts in a non-useable configuration and removal of the boot remover allows the first and second parts to be brought together into a useable configuration. As an option, there is provided a hinge that rotatably couples the first and second parts together. The mechanical interlock may further comprise a trigger lock for preventing actuation of the trigger when the device is in the non-useable configuration whilst allowing actuation of the trigger when the device is in the useable configuration. The trigger lock may comprise an elongate plate mounted to the first part by a pivot axle. There may be a biasing mechanism acting on the plate such that, when in the non-usable configuration, the plate prevents actuation of the trigger. When the device is brought together into a useable configuration, the plate is rotated about said axle to free the trigger.

BRIEF DESCRIPTION OF DRAWINGS

Figure 1 shows a cross-section through an auto-injector according to a first embodiment;

Figure 2 shows a cross-section through the auto-injector of Figure 1 with a boot remover partially removed;

Figure 3 shows a cross-section through the auto-injector of Figure 1 with a trigger cover partially removed;

Figure 4 shows a perspective view of an auto-injector according to a second embodiment;

Figure 5 shows a perspective view of the auto-injector of Figure 4 with a boot remover partially removed;

Figure 6 shows a close up perspective view of a proximal end of the auto-injector of Figure 4;

Figure 7 shows a further close up perspective view of a proximal end of the auto-injector of Figure 4 with boot remover removed;

Figure 8 shows a cross-section through an auto-injector according to a third embodiment;

Figure 9 shows a perspective view of a boot remover according to an option of the third embodiment;

Figure 10 shows a side view of the boot remover of the third embodiment engaging with a rod;

Figure 11 shows a close up perspective view of the distal end of the auto-injector of Figure 8;

Figure 12 shows a further close up perspective view of the distal end of the auto-injector of Figure 8;

Figure 13 shows a further close up perspective view of the distal end of the auto-injector of Figure 8;

Figure 14 shows a cross-section through an auto-injector according to a fourth embodiment;

Figure 15 shows a perspective view of a boot remover engaging with a rod according an example of the fourth embodiment;

Figure 16 shows up perspective view of the distal end of the auto-injector of Figure 14;

Figure 17 shows a side view of the distal end of the auto-injector of Figure 14;

Figure 18 shows a cross-section through an auto-injector according to a fifth embodiment;

Figure 19 shows a cross-section through the auto-injector of Figure 18, with a boot remover removed;

Figure 20 shows a cross-section through the auto-injector of Figure 18, and a side view of said auto-injector;

Figure 21 shows a perspective view of a latch according to an option of the fifth embodiment;

Figure 22 shows a cross-section view of a trigger lock according to an option of the fifth embodiment;

Figure 23 shows a cross-section view of a trigger lock according to an option of the fifth embodiment in a different configuration;

Figure 24 shows a perspective view of a trigger lock according to an option of the fifth embodiment;

Figure 25 shows a close up perspective view of the auto-injector of Figure 18; and

Figure 26 shows a perspective view of the auto-injector of Figure 18.

DETAILED DESCRIPTION

Embodiments to be described aim to provide an automatic injection device that cannot be fired until a boot protecting the syringe needle has been removed. The aim is to prevent the problem of wasted medicine and user frustration that may otherwise occur. Embodiments are described in the context of an auto-injector, that is an automatic injection device that has a spring or springs that not only drives the injection of medicine, but also pushes the needle into the patient's skin. Such a device is referred to as an auto-injector. However, the skilled person will appreciate that the approach may also be applied to automatic injection devices that only drive medicine delivery and do not push the needle into the skin.

With reference to Figures 1 to 3, there will now be described a first embodiment, referred to here as the "enclosed button auto-injector". To assist with an understanding of this and further embodiments described below it is helpful to define a "proximal" end of the auto-injector as being the end that is closest to the patient's skin when in use, and a "distal" end as being the end furthest from the patient's skin.

Figure 1 shows a cross-sectional view of an enclosed button auto-injector 101 comprising a needle 102, syringe 103, boot remover 104, boot 111, trigger 105, trigger cover 106, and housing 107. The auto-injector has a proximal end 112 and a distal end 113. The housing 107 houses the needle 102 for piercing a user's skin, and the syringe 103 for containing medicine. Activation of the trigger 105 actuates a firing mechanism 108. The firing mechanism 108 drives the needle into the skin, and forces the medicine through the needle and into the user. Although not described in detail, the device also includes a carriage 114 and carriage return spring 115 within which the syringe 103 is mounted.

To prevent the user from accidentally activating the trigger 105, the trigger cover 106 is removably attached to the housing 107 such that it covers the trigger 105. This provides a physical barrier that prevents the user from accidentally activating the trigger 105. Any suitable mechanical interlock for preventing activation of the trigger 105, such as a trigger lock, may be used instead of the trigger cover 106. When the user wishes to use the enclosed button auto-injector 101, he or she must first remove the trigger cover 106 in order to access the trigger 105.

The trigger cover 106 may be secured to the housing 107 by any suitable connection type. For example, in Figures 1 and 2 the trigger cover 106 has ridges 109 for slotting into shoulders 110 formed in the housing 107.

The boot 111 is arranged to prevent contamination of the needle 102. The boot remover 104 is connected to the boot, and facilitates removal of the boot. The boot remover 104 extends over the outer surface of the housing 107 and over the ridges 109 of the trigger cover 106. By doing so, the boot remover 104 prevents any lateral displacement of ridges 109, and therefore prevents the ridges 109 from being moved out of the shoulders 110, preventing removal of the trigger cover 106. The boot remover 104 may provide support to the ridges 109, holding them in place within the shoulders 110.

Figure 2 shows the boot remover 104 partially removed from the housing 107, no longer preventing the ridges 109 from lateral movement. The ridges 109 are pre-stressed and splay outwardly upon removal of the boot remover 104 to disengage from the shoulders 110. In an alternative configuration, the ridges may by displaced outwardly by a separate biasing mechanism, e.g. a spring. Figure 3 shows the boot remover 104 totally removed from the device 101, and the trigger cover 106 partially removed. As a result, the trigger 105 is now exposed.

This arrangement forces a user to perform the step of removing the boot 111 using the boot remover 104 before pressing the trigger 105. By doing so, accidentally activating the enclosed button auto-injector 101 while the boot 111 is still in place is not possible.

This example is but one of many ways in which the boot remover 104 can prevent removal of the trigger cover 106. For example, the boot remover 104 may act as an

interlock to a button, where the button may be used to facilitate removal of the trigger cover 106.

With reference to Figures 4 to 7, there will now be described a second embodiment, referred to here as the "embedded rod auto-injector".

Figure 4 illustrates an embedded pin or rod auto-injector 201, comprising a firing mechanism housing 202, a syringe housing 203 containing a syringe, needle and boot (not shown), and a boot remover 204. Initially, the firing mechanism housing 202 is separate from the syringe housing 203, and therefore actuation of the firing mechanism within the firing mechanism housing 202 will not actuate the injection. On assembly of the embedded rod auto-injector 201, a lip 205 on the firing mechanism housing 202 displaces a rod 207 residing in a channel 206 in the syringe housing 203. Assembly may be achieved by screwing the firing mechanism housing 202 into the syringe housing 203.

Figure 5 shows the firing mechanism housing 202 fully engaged with the syringe housing 203. The lip 205 has displaced the rod 207, which has in turn displaced the boot remover 204, removing it from the syringe housing 203. As a result, the boot will be removed before the auto-injector 201 can be actuated. Figure 6 shows a close up view of the rod 207 displacing the boot remover 204.

The boot remover 204 may have a peg 208 that protrudes into the channel 206 for engaging with the rod, shown in Figure 7. This arrangement ensures that the boot remover 204 can be displaced and ejected without subsequent protrusion of the rod 207, which may otherwise lead to an obstruction when administering an injection. Figure 7 also shows a track 209 running along the inner surface of the syringe housing 203, for receiving a ridge (not shown) formed on the boot remover 204, ensuring proper alignment of the boot remover 204.

The embedded rod auto-injector 201 may comprise a spring located within the syringe housing 203 that acts to push the rod 207 backwards (toward firing mechanism housing 202) in order to ensure that the rod 207 returns from the protruding position upon disassembly. This is relevant in particular to a re-useable device.

With reference to Figures 8 to 13, there will now be described a third embodiment, referred to here as the "helical linkage auto-injector ".

Figure 8 shows a cross-section of a helical linkage auto-injector 301, comprising a boot remover 302, boot 312, housing 303, trigger 304 and trigger lock 305.

The boot remover 302 has a radially projecting peg 306 and a key 307. The housing 303 has an axial track (not shown) for receiving the key 307, and is arranged to prevent rotation of the boot remover 302 while the key 307 is engaged with the axial track. Any number of ways can be used to prevent rotation of the boot remover 302 while it is attached to the helical linkage auto-injector 301. The use of a key 307 and axial track is just one of many possible alternatives.

The housing 303 contains a rod 308 with a helical track 310 (not shown in Figure 8) running around its circumference. The helical track 310 is arranged to receive the peg 306. Note that when the peg 306 is engaged with the helical track 310, the connection between the peg 306 and helical track 310 may be sufficient to prevent rotational movement of the boot remover 302. The key 307 and axial track may then not be required. At one end of the rod 308 there is a trigger lock 305 for preventing actuation of the trigger 304. The trigger lock 305 features is shaped such that, in one orientation of the rod 308 and trigger lock 305, the trigger 304 cannot be activated, but, when the rod and trigger lock are rotated 180 degrees, the trigger 304 can be activated. The shape may be a stepped shape for example. Figure 9 shows a perspective view of the boot remover 302, showing the peg 306 and a key 307, whilst Figure 10 shows the peg 306 engaging with the helical track 310 on the rod 308.

Figure 11 shows a close up view of the trigger 304 and trigger lock 305. The trigger 304 has a lip 311 that abuts the trigger lock 305, and prevents downward motion of the trigger 304. When the boot 312 is removed using the boot remover 302, the axial motion of the peg 306 causes the rod 308 to rotate due to the interaction between the peg 306 and helical track 310. The trigger lock 305, being connected to the rod 308, also rotates.

Figure 12 shows a close up view of the trigger 304 and trigger lock 305 after the boot remover 302 has been removed. The trigger lock 305 no longer blocks the path of the

lip 311, allowing the trigger 304 to be freely pushed downwards, activating the auto-injector. Figure 13 shows the trigger 304 following actuation.

The helical linkage auto-injector 301 cannot be fired while the boot remover 302 is still in place. As the boot remover 302, along with the boot 312, is removed, the trigger lock 305 is disengaged. A user can then press the trigger 304 and activate the auto-injector 301.

With reference to Figures 14 to 17, there will now be described a fourth embodiment, referred to here as the "spring loaded lock auto-injector".

Figure 14 shows a cross sectional view of a spring loaded lock auto-injector 401, comprising a boot remover 402, boot 412, housing 403, trigger 404 and trigger lock 405. The boot remover 402 has a latch 406 and one or more keys 407 (not shown). The housing has one or more a linear, axially extending tracks (not shown) for engaging with the keys 405. This arrangement restricts rotation of the boot remover 402 prior to removal. Any number of ways can be used to prevent rotation of the boot remover 402 while attached to the spring loaded lock auto-injector 401.

The housing 403 contains a rod 408 with a pin 409 for engaging with the latch 406. The housing 403 also contains a torsion spring 410 that connects to the rod 408, providing a torque to the rod 408 when the rod is rotationally displaced from a given orientation. At one end of the rod 408 there is a trigger lock 405 for preventing actuation of the trigger 404. The trigger lock 405 is shaped such that, in one orientation, the trigger 404 cannot be activated, but, when the trigger lock 405 is rotated by 180 degrees, the trigger 404 can be activated. This may be facilitated by a stepped feature formed in the trigger lock 405. In the auto-injector's unarmed state, the rod is rotationally displaced such that a torque is applied to the rod 408 by the torsion spring 410, the rod 408 being held in place by the pin 409 being engaged with the latch 406. A perspective view of the latch and pin is shown in Figure 15.

Figure 16 shows close up view of the trigger 404 and trigger lock 405 in an unarmed position. The trigger 404 has a lip 411 that abuts the trigger lock 405, preventing downward motion of the trigger 404.

When the boot remover 402 is removed, the pin 409 disengages with the latch 406, allowing the rod 408 and trigger lock 405 to rotate due to the torque applied by the torque spring 410. When the rod 408 and trigger lock 405 reach their final position, the trigger lock 405 no longer prevents the trigger 404 from being pressed.

Figure 17 shows a close up of the trigger 404 and trigger lock 405 in an armed position. It will be apparent that rotation of the rod 408 has caused the trigger lock 405 to be rotated such that it no longer blocks the path of the lip 411, allowing the trigger 404 to be freely pushed downwards, activating the auto-injector 401.

The trigger lock in the helical linkage auto-injector and the spring loaded lock auto-injector have been described as having a trigger lock (305; 405) that is arranged to abut the trigger, preventing axial motion of the trigger (304; 404). It is noted that other trigger prevention mechanisms may be used instead. For example, the trigger lock may be a cover that prevents access to the trigger, wherein rotation of the rod causes the cover to move to into a position such that it does not prevent access to the trigger.

With reference to Figures 18 to 26, there will now be described a fifth embodiment, referred to here as the “hinged auto-injector ”. Figure 18 shows a cross sectional view of such a hinged auto-injector 501, comprising a boot remover 502, boot 514, syringe housing 503, trigger 504, firing mechanism housing 505, hinge 506 and needle 507. When folded, the hinged auto-injector 501 is in an unarmed position, with the boot remover 502 covering both the trigger 504 and the needle 507. In order to use the hinged auto-injector 501, the boot remover 502 must first be removed. The hinged auto-injector 501 can then be unfolded into a firing position.

Figure 19 shows the hinged auto-injector 501 with the boot remover 502 and boot 513 removed, but still in the folded configuration. Figure 20 shows the hinged auto-injector 501 unfolded, as both a cross-section and in plan. A latch 508 may be used to lock the hinged auto-injector 501 in the unfolded position.

Figure 21 shows a close up view of the latch 508. Note that the latch 508 may reside on either the firing mechanism 505 or the housing 503. Other suitable mechanisms for locking the hinged auto-injector 501 in position will be readily apparent.

The hinged auto-injector 501 may further comprise a mechanism that prevents actuation of the trigger 504 before the hinged auto-injector 501 has been fully unfolded. An example of such a mechanical interlock comprises a trigger lock comprising an elongate plate 509, shown in Figure 22. The elongate plate 509 features a boss 510 for preventing downward motion of the trigger 504: Figure 22 illustrates the "locked" position. The elongate plate 509, upon unfolding of the auto-injector, is caused to pivot about a central pivot axis from a position in which downward motion of the trigger 504 is prevented into one in which downward motion of the trigger is possible. Figure 23 shows the elongate plate 509 in an unlocked position after unfolding of the device.

The elongate plate 509 is shown in more detail in Figure 24. A front end of the trigger lock features an angled face 511 that acts as a spring and holds the elongate plate 509 in a locked position. The elongate plate 509 is mounted on a central pivot axle 512. As shown in Figure 25, interaction with a second latch 513 on the housing 503 causes the angled face 511 to be pressed into the firing mechanism housing 505. This action causes the elongate plate 509 to pivot about the pivot axle 506, causing the boss 510 to move clear of the path of the trigger 504. Figure 26 shows the hinged auto-injector 501 in a locked position, with the elongate plate 509 disengaged, and the latch 508 engaged.

It will be appreciated by the person of skill in the art that various modifications may be made to the above described embodiments without departing from the scope of the present invention.

CLAIMS:

1. An automatic injection device for delivering a dose from a medicine containing syringe and comprising:

a housing for containing the syringe;

a force applicator for applying a force to eject medicine from the syringe;

a trigger coupled to the force applicator for releasing the force applicator to cause an injection;

a boot covering a needle attached to the syringe to protect and maintain sterility of the needle; and

a mechanical interlock for preventing actuation of the trigger prior to removal of the boot and for allowing actuation following removal of the boot.

2. An automatic injection device according to claim 1 and comprising a boot remover for removing the boot.

3. An automatic injection device according to claim 2, wherein the boot remover is formed integrally with the boot.

4. An automatic injection device according to claim 2, wherein the boot and boot remover are formed as separate discrete components, and configured such that the boot is locked into the boot remover upon insertion of the syringe into the housing.

5. An automatic injection device according to any one of claims 2 to 4, wherein said mechanical interlock comprises said boot remover, the boot remover being configured such that removal of the boot remover from the housing both removes the boot from the needle and facilitates access to the trigger.

6. An automatic injection device according to claim 5, the mechanical interlock comprising a cover attached to a distal end of the housing, the cover being locked in place when the boot remover is attached to the housing, and being removable from the housing to expose the trigger only after removal of the boot remover and boot.

7. An automatic injection device according to claim 6, wherein the cover is coupled to the distal end of the housing by one or more flexible latches, removal of said boot remover allowing disengagement of the latches and removal of the cover.

8. An automatic injection device according to claim 7, wherein said boot remover extends to cover said flexible latches when the boot remover is attached to the housing.

9. An automatic injection device according to any one of claims 1 to 4, the housing comprising a first part for containing said syringe and a second part for attachment to the first part by a user, said mechanical interlock being configured to remove the boot upon coupling together of the first and second parts.

10. An automatic injection device according to claim 9, wherein the trigger is provided on said second part.

11. An automatic injection device according to claim 9 or 10, wherein the first and second parts are coupled together by relative axial motion of the parts, e.g. by engaging complimentary screw threads formed on the first and second parts.

12. An automatic injection device according to claim 11, the mechanical interlock comprising:

a rod coupled to the first part of the housing and slideable relative thereto in an axial direction, a distal end of the rod being engagable by said second part in order to axially displace the rod upon coupling together of the first and second parts, and a proximal end of the rod being coupled to the boot in order to remove the boot.

13. An automatic injection device according to claim 12 when appended to claim 2, wherein the rod is coupled to the boot by way of the boot remover.

14 An automatic injection device according to claims 12 or 13, wherein the first part of the housing defines a channel within which the rod is slideably mounted.

15. An automatic injection device according to claim 14 when appended to claim 2, wherein the boot remover comprising a peg that protrudes into the channel for

engaging with the rod upon coupling together of the first and second parts in order to push the boot remover off of the housing.

16. An automatic injection device according to any one of claims 12 to 14, the housing comprises a spring coupled to the rod in order to return the proximal end of the rod into the channel upon disconnection of the first and second parts.

17. An automatic injection device according to any one of claims 2 to 4, the mechanical interlock comprising a rod coupled to the boot remover and a trigger lock engaging with the trigger and with said rod, the mechanical interlock being configured such that removal of the boot results in rotation of the rod thereby releasing the trigger lock.

18. An automatic injection device according to claim 17, wherein the rod has a helical track extending axially therealong and a peg is provided on the boot remover to engage with said track such that the rotation of the rod is caused by the axial motion of the peg as the boot remover is removed.

19. An automatic injection device according to claim 17 or 18, wherein the boot remover comprises a key and the housing comprises an axially extending track, and the key and axially extending track being arranged such that the key engages with the axially extending track to prevent rotation of the boot remover prior to removal of the boot remover.

20. An automatic injection device according to claim 17 and comprising a torsion spring coupled between the rod and the hosing to provide a rotational bias to the rod, and a latch provided on the boot remover to prevent rotation of the rod until the boot remover has been removed.

21 An automatic injection device according to claim 20, wherein the rod comprises a pin for engaging with the latch.

22. An automatic injection device according to claim 20 or 21, wherein the boot remover comprises a key and the housing comprises an axially extending track, the key and axially extending track being arranged such the key engages with the axially

extending track to prevent rotation of the boot remover prior to removal of the boot remover.

23. An automatic injection device according to any one of claims 1 to 4, the housing comprising a first part for containing said syringe and a second part for attachment to the first part by the user, the mechanical interlock being provided by said boot remover such that, when attached to the first and second parts, the boot remover holds the first and second parts in a non-useable configuration and removal of the boot remover allows the first and second parts to be brought together into a useable configuration.

24. An automatic injection device according to claim 23, comprising a hinge rotatably coupling the first and second parts together.

25. An automatic injection device according to claim 23 or 24, wherein the mechanical interlock comprises a trigger lock for preventing actuation of the trigger when the device is in the non-useable configuration whilst allowing actuation of the trigger when the device is in the useable configuration.

26. An automatic injection device according to claim 25, wherein said trigger lock comprises an elongate plate mounted to said first part by a pivot axle and a biasing mechanism acting on the plate such that, when in the non-usable configuration, the plate prevents actuation of the trigger and, when the device is brought together into a useable configuration, the plate is rotated about said axle to free the trigger.

Application No:	GB1303472.3	**Examiner:**	Andrew Hughes
Claims searched:	1-26	**Date of search:**	19 July 2013

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1,2,5	WO 2005/070481 A1 (MEDICAL HOUSE PLC) especially figures 9-11 and 18-21 and lines 5-7 of page 6, lines 4-19 of page 16, the paragraph spanning pages 17 & 18, and line 27 of page 19 to line 26 of page 21
X	1,2,5	GB 2467637 A (MEDICAL HOUSE PLC) whole document, noting lines 9-12 of page 9
X	1,2,4	EP 2364739 A1 (SANOFI-AVENTIS DEUTSCHLAND GMBH) particularly paragraphs 31-36, 47 & 51
X	1,2	GB 2414398 A (CILAG AG INTERNATIONAL) especially lines 12-26 of page 8
X	1,2	GB 2451665 A (CILAG GMBH INTERNATIONAL) particularly pages 2, 3, 7 & 8
X	1,2	WO 2012/045836 A2 (SANOFI-AVENTIS DEUTSCHLAND GMBH) particularly lines 11-20 of page 11
X	1,2	WO 2009/040605 A1 (BECTON DICKINSON FRANCE) particularly lines 11 & 12 of page 5, and line 19 of page 7 to line 11 of page 8

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
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Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^{X} :

Worldwide search of patent documents classified in the following areas of the IPC

A61M

The following online and other databases have been used in the preparation of this search report

EPODOC & WPI; TXTE

International Classification:

Subclass	Subgroup	Valid From
A61M	0005/20	01/01/2006
A61M	0005/20	01/01/2006