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(54) Title: AUTOINJECTOR WITH A NEEDLE COVER

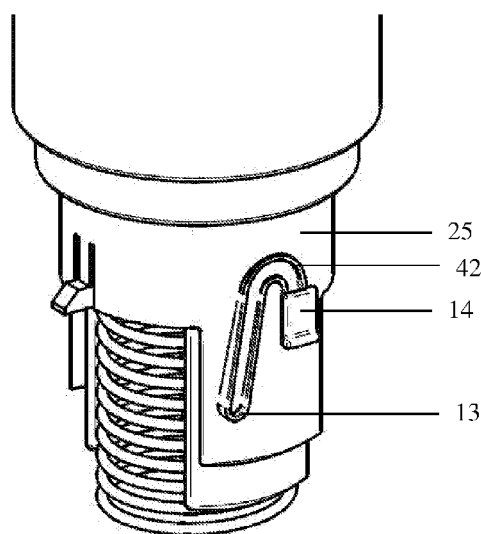


FIGURE 4

(57) **Abstract:** The invention relates to an autoinjector 59 for administering a fluid medicament to a subject comprising: a housing 1 for receiving a cartridge holder; a driver assembly 8; the driver assembly on actuation may move the cartridge 3 forward in the cartridge holder 2; a needle cover 4 may be coupled to the housing wherein the needle cover 4 travels in a linear or translational movement; said needle cover 4 is adapted to protect a needle when the needle cover may be in first locking position 17 and second locking position 18; the linear or translational movement may be achieved by a cam profile 13 and a cam follower 14; the cam profile 13 may be provided on outside surface of housing and the cam follower 14 located between the needle cover 4 and the housing 1; a first biasing member 15; and a second biasing member 16 configured to bias the cartridge 3 and the needle cover 4 respectively; and a safety cap 11 to control the actuation of the autoinjector.



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AUTOINJECTOR WITH A NEEDLE COVER**PRIORITY DOCUMENTS**

- 5 This application claims priority from the Indian provisional patent application Nos. IN 201721006679 (filed on Feb 24, 2017) and IN 201721031188 (filed on Sep 4, 2017), both of which are incorporated herein by reference in their entirety for all purposes.

FIELD OF THE INVENTION

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The application relates to an autoinjector for administering a fluid medicament to a subject.

BACKGROUND OF THE INVENTION

- 15 Autoinjector is used to inject a dose of medicament which may be contained in a container and deliver the medicament through a needle. The container may be a cartridge or a pre filled syringe and the like.

- Many people have 'needle phobia' and are apprehensive of seeing a needle during medicament administration. As a result, people with 'needle phobia' may not regularly administer medicament as prescribed or may improperly administer an injection due to their apprehension.

The following patents disclose autoinjector with needle protection system:

- 25 U.S. 6,767,336 discloses autoinjector with a sharp protector that is manually or automatically deployable.
- U.S. 7,449,012 discloses autoinjector with a needle cover at least partially received within the housing.
- U.S. 6,805,686 discloses autoinjector with extendible needle protector shroud.
- 30 U.S. 8,617,119 discloses a safety device having a tubular support for a needle mount end and a protective shield slidably mounted on the support.

SUMMARY OF THE INVENTION

Some embodiments disclose an autoinjector for a medicament administration comprising: a housing having a proximal portion and a distal portion; a cartridge holder received within the housing; the cartridge holder having a proximal end and a distal end; an opening at the distal end; a cartridge; a plunger; a needle cover, wherein the housing is at least partially received within the needle cover; the autoinjector further comprises a needle cover locking mechanism, wherein the needle cover locking mechanism comprises a cam profile and cam follower, wherein the cam follower of locking mechanism is located between the needle cover and the distal portion of the housing in both first locking position and second locking position.

Some embodiments disclose an autoinjector for a medicament administration comprising: a housing having a proximal portion and a distal portion, a cartridge holder received within the housing; the cartridge holder is having a proximal end and a distal end; an opening at the distal end; a cartridge; the housing is having a first sleeve section and second sleeve section; the first sleeve section is having an inward transverse projections on the inner surface; a plunger; the plunger is having two wings provided on the outer surface; a needle cover, wherein the housing is at least partially received within the needle cover; the auto injector further comprises a needle cover locking mechanism; wherein the needle cover locking mechanism comprises a cam profile, a cam follower; wherein the cam follower of the locking mechanism is located between the needle cover and the second sleeve section of the housing in both first locking position and second locking position; wherein the distal surfaces of the wings of the plunger engage the surface of the inward transverse stopping projections of the housing at the end of the medicament administration.

Some of the examples disclose the proximal portion of the housing; wherein the housing is having a first sleeve section; a first shoulder at the distal end of the first sleeve section; a second sleeve section extends distally from the first shoulder in the distal portion.

Some of the examples disclose a cartridge holder; wherein the cartridge holder is having slots provided on the proximal portion of the cartridge holder; openings are provided on the outer surface of the cartridge holder.

Some of the examples disclose the cam profile which comprises an angled contour surface in the proximal portion and cylindrical contour surface in the distal portion.

5 Some of the examples disclose the cam follower which comprises a cam follower protrusion on the distal portion; a cam follower button on the proximal portion; and a cam follower body extending between them.

Some of the examples disclose the autoinjector comprising the medicament selected from epinephrine or dihydroergotamine.

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BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a longitudinal view of an autoinjector with a needle cover in the first locking position with structural details in a cross sectional view;

15 FIGURE 2 is a longitudinal view of an autoinjector with a needle cover in the first locking position during safety cap removal with structural details in a cross sectional view;

FIGURE 3 is a longitudinal view of an autoinjector with a needle cover in the second locking position with structural details in a cross sectional view;

20 FIGURE 4 is a side schematic view of distal end of housing with needle cover through the interaction between the cam profile and the cam follower in the first locking position;

FIGURE 5 is a side schematic view of distal end of housing with needle cover through the interaction between the cam profile and the cam follower when the needle cover is pressed on to an injection surface;

FIGURE 6 is a side exploded view of the cam follower and cam profile on the housing;

25 FIGURE 7 is a longitudinal view and bottom view of an autoinjector with a needle cover in the first locking position with structural details in a cross sectional view along line x-x;

FIGURE 8A shows side exploded view of the cam follower and cam profile on the fourth sleeve section of housing; FIGURE 8B; shows the exploded view of projections on fourth sleeve section;

30 FIGURE 9 is an exploded view of another embodiment of an autoinjector;

FIGURE 10 is a longitudinal view and bottom view of an autoinjector with a needle cover in the first locking position with structural details in a cross sectional view;

FIGURE 11A shows perspective view of needle cover top and needle cover bottom;

FIGURE 11B shows front view of cam follower; FIGURE 11C; shows cross-sectional view of position of the cam follower on the second sleeve section of the housing after actuation and before needle cover extension;

FIGURE 12 shows a perspective view of the housing;

5 FIGURE 13 shows perspective view of the cartridge holder of the auto injector;

FIGURE 14 shows the position of the cam follower on the housing of an auto injector after needle cover extension;

FIGURE 15 shows a schematic view of cam profile on the housing;

FIGURE 16 shows a perspective view of the plunger;

10 FIGURE 17 shows a side view of the autoinjector with safety cap in place;

FIGURE 18 shows a perspective view of the autoinjector with safety cap removed;

FIGURE 19 shows a sectional view of the autoinjector with needle exposed from the needle cover bottom before medicament administration;

15 FIGURE 20 shows a sectional view of the autoinjector with needle exposed from the needle cover bottom after medicament administration;

FIGURE 21 shows a sectional view of the autoinjector with needle cover top and needle cover bottom in extended position protecting the exposed needle after medicament administration.

20 DETAILED DESCRIPTION OF THE INVENTION

The invention relates to an autoinjector for administering a fluid medicament to a subject.

25 As used herein, the proximal end of a component or component in an assembled autoinjector or the assembled autoinjector is the end that may correspond towards safety cap end. Distal end of a component or component in an assembled autoinjector or the assembled autoinjector may be the end that may correspond to the delivery end or towards the needle cover.

30 As used herein, the rearward end of a component or component in an assembled autoinjector or the assembled autoinjector is the end that may correspond towards safety cap end. Forward end of a component or component in an assembled autoinjector or the assembled autoinjector may be the end that may correspond to the delivery end or towards the needle cover.

As already described above a need was felt for an autoinjector with an improved needle protection system that may be easily used by a subject.

5 It may be advantageous if the needle is in a safe location before and after the use to prevent accidental injury or contamination.

Usually, the autoinjector with a needle protection system may include a needle cover to move towards the injection end over the needle once the injection of the medicament is completed. The movement of the needle cover with respect to the needle may often be triggered by a
10 spring in an automatic way when the autoinjector is withdrawn from the injection site. In general, the needle cover may be locked in its "after use" position to a locking system.

Referring to **FIGURES 1-3**, one embodiment discloses an autoinjector **59** comprising: a housing **1** having a proximal portion and a distal portion; a cartridge holder **2** received within
15 the housing **1**; the cartridge holder **2** having a proximal end **29** and a distal end **29a**; a cartridge **3** received within the cartridge holder **2**; a needle **5** fixed to the distal end of the cartridge **3**; a driver assembly **8** comprises a collet **9** and a collapsible lock **10**; and a needle cover **4**, wherein the housing **1** is at least partially received within the needle cover **4**, wherein the needle cover **4** comprises a groove **45** on the inner surface of needle cover **4**; a first
20 locking position **17** and a second locking position **18**; a safety cap **11**, said safety cap **11** controls the actuation of the driver assembly **8**; a first biasing member **15**, said biasing member configured to bias the driver assembly **8**; a second biasing member **16**, said second biasing member **16** configured to bias the needle cover **4**; a driver assembly **8** configured to move from a proximal portion of the housing **1** to urge the first biasing member **15** upon the
25 removal of safety cap **11** and thereby move the cartridge **3** towards the distal end in the cartridge holder **2** to project the needle **5** beyond the needle cover **4**; a locking mechanism **60** for locking the needle cover **4** to the housing **1** in first locking position **17** and in second locking position **18**; wherein the locking mechanism **60** comprises a cam profile **13**, a cam follower **14**; the cam follower **14** of locking mechanism **60** is located between the needle
30 cover **4** and the housing **1** in both first locking position **17** and second locking position **18**. The cam profile **13** may be provided in diametrically opposite directions on outer surface of the housing **1**; similarly cam follower **14** may be provided in diametrically opposite directions and located between the needle cover **4** and the housing **1**.

The autoinjector has possible advantages over the injectors already known in the art. The most possible advantages are amongst; the locking mechanism for locking of linearly moveable needle cover **4** both before and after medicament administration may be achieved by a cam follower **14** which is operably associated both with needle cover **4** and the housing **1**, a stationary component.

There may be inconsistencies in medicament delivery and malfunctioning of autoinjector wherein if the component of a locking mechanism for locking of linearly moveable needle cover involves two or more moveable components. In the needle cover locking mechanism of the autoinjector **59**, no locking tooth is employed. The cam follower **14** of the locking mechanism of the autoinjector does not interact with three moveable components e.g. needle cover, cartridge container and cartridge. The cam follower **14** interacts with the housing **1** and needle cover **4**.

The details of various embodiments of the autoinjector **59** are described in the following paragraphs. In this regard, reference can also be made to the some of the embodiments depicted in **FIGURES 1-6**.

An angled contour surface **41** of the cam profile **13** comprises a frustum of a cone surface **42** in the proximal portion and a cylindrical or rectangular contour surface **42a** running from proximal to distal portion. The advantage of this is that the distal portion of the frustum of a cone surface **42** facilitates locking of needle cover **4** before medicament administration e.g. in the first locking position and the distal portion of cylindrical or rectangular contour surface **42a** facilitates locking of needle cover **4** after medicament administration e.g. second locking position. Since housing surface on which cam profile surfaces (**41**, **42**, **42a**) are provided in a stationary housing component helps in avoiding malfunctioning of device. The length of the frustum of a cone surface **42** is such that it ensures the desired extension of the needle **5** on actuation of the autoinjector **59** by pressing needle cover **4** on to the patient body.

It is preferred that the cam follower **14** comprises a cam follower protrusion **40** on the distal portion; a cam follower button **38** on the proximal portion; and a cam follower body **39** extending between them. This is advantageous because the cam follower button **38** and cam follower body **39** which constitute significant surface area of the cam follower **14** establishes

firm linkage with cam profile **13** provided on the outer surface on the distal portion of the housing **1**, a stationary component.

Some of the embodiments disclose the protrusion **40** of the cam follower **14** mates with
5 groove **45** provided on opposite surfaces shown in **FIGURE 1** and **FIGURE 3** on the inner
surface of the needle cover **4** both in the first locking position **17** and the second locking
position **18**. The advantage thereof is that the protrusion **40** provided over the cam follower
14 establishes operable connection to corresponding groove **45** provide better stability
between the needle cover **4** and housing surface **26**. The protrusion **40** may extend around
10 80% to 100% of the width of the cam follower body **39**.

The cam follower button **38** of the cam follower **14** mates with the distal portion of angled
contour surface **44** of the cam profile **13** in the first locking position **17**. This has the
favourable effect that that there is no relative movement between the two components e.g.
15 housing surface **26** which is stationary and needle cover **4** which is a moveable component.
Further one sub component e.g. cam follower button **38** that establishes linkage with a
surface of a stationary component e.g. the housing **1**.

The cam follower button **38** of the cam follower **14** engages with distal portion cylindrical
20 contour surface **48a** of the cam profile **13** in the second locking position **18**. This is
particularly advantageous in view of the fact that cam follower button **38** continues its travel
on a stationary component housing **1** ensures precise covering of needle cover **4** after
medicament administration.

25 Referring to **FIGURES 1-3**, the housing may be of cylindrical, oval or elliptical shape. The
housing **1** may be of such a length that it may accommodate the cartridge holder **2** in distal
portion of the housing **1**; the proximal portion of the housing **1** may receive the driver
assembly **8**. The driver assembly **8** may comprise a collet **9**, a top cover **21**, a first biasing
member **15**, a collapsible lock **10**, a plunger **19** and a stopper **20**. The collet **9** may be
30 cylindrical in shape having a central aperture **27** at its proximal end to form a hole and an out
turned flange **28** at the distal end. The collet **9** may have a cylindrical section **28a** extending
from proximal portion to distal portion. The flange **28** of the collet may establish contact with
proximal end surface **29** of the cartridge holder **2** when the driver assembly **8** may be inserted
in the housing **1**. There may be a transverse portion **33** at the proximal end of the collet **9**.

A cartridge holder **2** may be received within the housing **1**. The cartridge holder **2** having proximal and distal portions, the distal portion having a reduced conical portion **2a** whose distal end having an opening **30** therein; further, cartridge holder **2** may comprise a outer tubular sleeve **6** extending circumferentially along the longitudinal axis from the conical portion **2a** in the distal direction; the outer tubular sleeve **6** may be cylindrical structure emerging from a flange **2b** like structure protruding out from the proximal portion of the conical section longitudinally; the distal end of the outer tubular sleeve **6** may be coupled to the proximal end **4a** of tubular structure that may extend from the inner surface of the transverse portion of the needle cover **4**.

Further referring to **FIGURES 1-3**, collapsible lock **10** may fit within the collet **9**; said collapsible lock **10** may comprise longitudinal blades **31** extending radially outward from a common longitudinal axis in the proximal portion. There may be four to six longitudinal blades **31**. The higher number of longitudinal blades **31** may offer better operating stability. The proximal portion of the longitudinal blades **31** have shoulder **32** extending outwardly; the distal end of the shoulder **32** may establish contact with the distal end transverse surface **33** of the proximal end of collet **9**. The collapsible lock **10** proximal body portion **34** may fit within inner diameter of first biasing member **15**. The proximal body portion of collapsible lock **10** towards proximal end may have cut out portion on its underside to thus form elongated fingers terminating in frusto-conical detent **56** sloping rearwardly.

Referring **FIGURE 2**, the needle cover **4** may be a cylindrical, oval or elliptical part with a first sleeve section **35**, a second sleeve section **36** at the proximal end and a frusto conical base **37** at distal end; the second sleeve section **36** may be located in between frusto conical base **37** and first sleeve section **35**. The first sleeve section **35** of the needle cover **4** may have an internal circumference that may be slightly larger than the external circumference of the housing **1** which facilitates the travelling of needle cover **4** on the outer surface of housing **1** towards proximal direction when pressed on to the injection site.. The second sleeve section **36** of the needle cover **4** may have an internal circumference that may be slightly larger than the external circumference of the second sleeve section **25** of the housing **1** to allow the second sleeve section **25** of the housing **1** to pass through internal circumference of the second sleeve section **36**. In a preferred embodiment, the housing **1** is at least partially received within needle cover **4**.

The locking of the needle cover **4** in a first locking position **17** and a second locking position **18** with respect to the housing **1** may be attained by a locking mechanism **60**. The locking mechanism **60** may comprise a cam profile **13** on the outer surface of the housing **1** and a
5 cam follower **14**. Further details of cam profile **13** and cam follower **14** are provided herein.

The needle cover **4** may be mounted on to the distal portion of housing **1**. The needle cover has a linear movement both during the actuation and needle cover extension after medicament administration. A cam profile **13** may be provided on the outer surface of sleeve
10 section **25** of the housing **1**. The cam follower **14** may be located radially between the cam profile **13** and groove **45** of the inner portion of the needle cover **4**. Referring to **FIGURE 6**, the cam follower **14** may comprise a cam follower protrusion **40** in the distal portion, a cam follower body **39** extending towards proximal portion and a cam follower button **38** in the proximal portion. The cam follower protrusion **40** and cam follower button **38** may be located
15 on opposite surfaces of the cam follower body **39**. The shape of the cam follower protrusion **40** of the cam follower **14** may be cylindrical, conical, square, rectangular, trapezoid and the like. The shape of the cam follower button **38** of the cam follower **13** may be cylindrical, conical, square, rectangular, trapezoid and the like.

20 In some of the embodiments, the translational movement of cam follower **14** may be considered as a combination of both linear and rotational movement corresponding to movement traced by the cam follower on cam surface.

Referring to **FIGURE 6**, the cam profile **13** provided on the outer surface of second sleeve
25 section **25** of the housing **1** on its distal portion may be described as follows. An angled contour surface **41** of the cam profile **13** may have a frustum of a cone contour surface **42** in the proximal portion and cylindrical or rectangular contour surface **42a** towards the distal portion as shown in **FIGURE 4**, **FIGURE 5**, and **FIGURE 6**. Cam profile **13** may be a groove **43** in the housing **1** to facilitate engagement or interaction of cam follower button **38**,
30 on to housing **1**. It could also be that cam profile **13** may be a protrusion on the housing to facilitate engagement or interaction of cam follower button **38**, on to housing **1**. The engagement or interaction may be by snap fit, a butt joint, a bayonet coupling, welding or other known methods of attachment.

As shown in **FIGURE 1**, on the inner surface of the second sleeve section **36** of the needle cover **4**, a groove **45** may be provided in the transverse direction radially. The groove **45** may be provided on opposing surfaces on the inner surface of the second sleeve section **36** of the needle cover **4**. The cam follower protrusion **40** may be engaged or interaction with the
5 needle cover groove **45**. The interaction may be by snap fit, a butt joint, a bayonet coupling, welding or other known methods of attachment.

The cam follower **14** may maintain the first locking position **17** with the cam profile **13** provided on the housing **1** by the engagement or interaction of cam follower button **38** to the
10 distal portion angled contour surface of **44** of the frustum of a cone contour surface **42**. The pressing of needle cover **4** flat portion **46** against the injection site, causes the cam follower button **38** of the cam follower **14** to move in the frustum of a cone contour surface **42** translationally along the cam profile **13** on the housing **1** in the initial position and may reach the proximal portion of angled contour surface **47**. The needle cover **4** interacts with
15 protrusion **40** of cam follower **14** via groove **45**. The proximal force is at least partially transferred to the cam follower **14**. In response to the proximal force, the cam follower **14** moves proximally in the cam profile **13**. The needle cover **4** may have only linear movement toward the housing **1**. At the end of the actuation, the cam follower button **38** movement may stop, when the proximal surface of cam follower button **38** mates with proximal end of
20 surface of the proximal portion of angled contour surface **41**. The traverse distance of cam follower **14** through cam profile angled contour surface **41** from the distal portion angled contour surface of **44** of the frustum of a cone contour surface **42** to the proximal portion of angled contour surface **47** of the frustum of cone surface **42** may correspond to exposed length of the needle **5**.

Referring to **FIGURES 1-3**, safety cap **11** may comprise top cylindrical, elliptical or oval shaped sleeve sized to fit over the end portion of the proximal end of housing **1**. A safety pin **12** may extend distally from the centre of the cap **11** into the opening formed by inner ends of the collapsible lock **10** fingers to thereby prevent inward movement.

Referring to **FIGURES 1-3**, a first biasing member **15** may be positioned between the transverse portion of the collet **9** and the collapsible lock **10** and configured to bias the driver assembly **8**. The proximal end of the first biasing member **15** may bias the inside surface of the proximal end of the collet **9**. The distal end of the first biasing member **15** may bias the

proximal portion of the distal end of the collapsible lock **10**. The second biasing member **16** may be positioned between the outer tubular sleeve **6** of the cartridge holder **2** and the transverse portion of the needle cover **4**. The proximal end of the second biasing member **16** may be configured to bias the proximal end of outer sleeve **6** of the cartridge holder **2** and the distal end of the second biasing member **16** may bias proximal end of the transverse surface of the needle cover **4**.

Referring to **FIGURES 1-3**, a top cover **21** may be fitted in the proximal end of the housing **1**. The fitting of top cover **21** into the housing may be by any of the following methods. The top cover **21** may be cylindrical, elliptical or oval shape comprising two to four outward projections **50** provided on the outer surfaces **53** diagonally opposite or located perpendicularly to the top cover **21** towards the proximal portion. There may be provided plurality of corresponding grooves **51** towards the proximal portion on the inner surface of the housing **1** so as to allow mating of the projections **50** with the grooves **51**. Additionally, the top cover **21** outer diameter may be slightly lower than the inner diameter of the housing **1** to have a snap fit on the outer surface cylindrical or oval shape of the housing **1**. Snap fit may ensure the interaction or engagement between the top cover **21** and the housing **1** may be firm. The top cover **21** inner sleeve projections **54** may be of higher diameter than the collet **9**. The shape of sleeve projections **54** may be of cylindrical, oval or elliptical shape emerging from the inner surface of the top cover **54**. The top cover inner cylindrical projection **54**, oval or elliptical shape may be integrally molded or welded or screwed attachment to inside surface of the top cover **21** top surface **57**. The collet **9** may be fitted inside top cover **21** inner sleeve projections **54**. The inner sleeve projection **54** may be cylindrical, oval or elliptical shape. Extending from distal end **55** of the top cover **21** inner portion of the top surface of the top cover **57** may be a frusto-conical cam surface **58** sized and shaped to cooperate with frusto-conical detents **56** to during actuation of the autoinjector **59**.

To inject the medicament, as shown in **FIGURE 2**, the safety cap **11** of the autoinjector **59** has to be removed. Upon the removal of safety cap **11**, the driver assembly **8** may be of the autoinjector **59** device may be ready for use. The needle cover **4** may be pressed against injection site. The needle cover **4** may move towards the housing **1** and then may push the cartridge holder **2** in the proximal direction. This movement is due to the abutment of the cartridge holder **2** and the collet **9** described below. Since the proximal end surface **29** of cartridge holder **2** may have a simple butt joint with the collet distal flange **28** of the collet **9**,

the collet **9** may move in proximal direction. Since the distal end of the shoulder **32** of collapsible lock **10** may have contact with the distal end transverse surface **33** of the proximal end of collet **9**, the collet may move proximally. Movement of collet **9** in proximal direction may move frusto-conical detents **56** of collapsible lock **10** towards frusto-conical cam surface **58** of the top cover **21**. This movement may unlock the collet **9** and collapsible lock **10**. The interaction between the tapered surfaces of the blades **31** and the tapered surface of the cam surface **58** causes blades **31** to move radially inward to the point that the blades **31** can fit through the central aperture **27**. Once the blades **31** slide proximally through the central aperture **27**, there are no forces countering the first biasing member, so the collet **9** and the collapsible lock **10** are unlocked. The unlocking of collet **9** and collapsible lock **10** may initiate the first biasing member **15** to expand and thereby move the cartridge **3** towards the distal end in the cartridge holder **2** to project the needle **5** beyond the needle cover, and then to a forward position to deliver a dose through the needle **5** at the injection site. Once the medicament is injected and upon removal of autoinjector **59** from the injection site, the needle cover **4** may move from the first locking position **17** to the second locking position **18** along the cam profile **13** and may cover the extended needle. The cam follower button **38** may traverse either on the frustum of a cone contour surface **42** or cylindrical or rectangular contour surface **42a** of the cam profile **13** from the proximal portion to the distal portion due to the energy released by the second biasing member **16**. The mating of the distal end of cam follower body **39** with the distal portion of either a frustum of a cone contour surface **48** or distal portion of cylindrical contour surface **48a** may ensure no further movement of the needle cover **4** occurs. In **FIGURE 6** the cylindrical contour surface **48a** on the cam profile **13** is shown.

There may be two diametrically opposite projections **88**, **88a** provided on the second sleeve section **25** towards the distal end as shown in **FIGURE 6**. While the projection **88** is shown in the **FIGURE 6** the projection **88a** is not shown. Fool proof locking of the needle cover **4** may be achieved by the abutment of projections **88**, **88a** provided on the second sleeve section **25** towards the distal end with the diametrically opposite grooves **87a**, **87b** (not shown in any of the **FIGURES 1** to **6**) provided on the inner surface of the needle cover **4** due to the force of the relaxation of the second biasing member **16**. This ensures the cam profile **14** does not move back on the cam profile **13** of the housing **1**.

Referring to **FIGURE 1**, needle sheath **7** may be positioned over the needle **5** such that the open end of the sheath **7** may fit around needle and may abut the shoulder formed by hub portions.

- 5 When the needle **5** fully extended as shown in **FIGURE 3**, the needle sheath **7** may be compressed the greatest amount hence the largest reactionary force may exist in the compressed needle sheath **7** in such position. The needle sheath **7** is positioned over the needle **7** such that the open end of the sheath fits over and around the needle **5**. The length of the sheath **7** is such that its closed end is slightly beyond or spaced from the end of needle **5**.
- 10 The cartridge **3** moves forward whereby the needle sheath **7** is compressed the most between the cartridge holder **2** and the needle cover **4**. The stored energy released by the relaxation of the first biasing member **15** to drive the needle **5** and cartridge **3** during medicament dispensing operation may be transmitted to the needle cover **4** and the needle sheath **5** is compressed between the cartridge **3** and the needle cover **4**. When the cartridge **3** completed
- 15 its travel under the force of first biasing member **15**, the forward movement of stopper **20** towards the distal end may commence under the action of driver assembly **8** to dispense the medicament.

- Some embodiments of an auto injector **59** may be described with reference to **FIGURE 7** and
- 20 **FIGURE 8** as follows. The auto injector **59** of **FIGURE 7** comprises a housing **1**, a cartridge holder **2**, a top cover **21**, a safety cap **11**, a collet **9**, a first biasing member **15** associated with cartridge movement and medicament administration, a second biasing member **16** associated with needle cover locking mechanism **60** during the operation and medicament administration, needle cover **4** comprising a needle cover top **64**, a needle cover bottom **65**, a
- 25 plunger **19** provided with two oppositely located wings **68**, **68a** (not shown in figure) towards the distal portion, an indicator sleeve **69** a cartridge **3** and a needle sheath **7** over the needle **5**.

- FIGURE 7** discloses an auto injector **59** for a medicament administration that comprises: a housing **1** having a proximal portion and a distal portion, said proximal portion of housing is
- 30 having a first sleeve section **22**, a first shoulder **23** at the distal end of the first sleeve section **22**, a second sleeve section **25** extends distally from the first shoulder **23** in the distal portion, a second shoulder **24** at the distal end of the second sleeve section **25**, a third sleeve section **26** extends distally from the second shoulder **24**, a third shoulder **62** at the distal end of the third sleeve section **26**, a fourth sleeve section **61** extends distally from the distal end of the

third shoulder **62**; a cartridge holder **2** is received within the housing **1**; cartridge holder **2** is having a proximal end and a distal end; the cartridge holder **2** having an opening at the distal end; a cartridge **3**; a plunger **19**; a needle **5** fixed to the distal end of the cartridge **3**; a needle cover **4**, wherein the housing **1** is at least partially received within the needle cover **4**; the auto injector **59** further comprises a needle cover locking mechanism **60**; and the needle cover locking mechanism **60** comprises a cam profile **13**; a cam follower **14**; the cam follower **14** of locking mechanism **60** is located between the needle cover **4** and the fourth sleeve section **61** of the housing **1** in both first locking position **17** and second locking position **18**. The cam profile **13** may be provided in diametrically opposite directions on outer surface of the housing **1**; similarly cam follower **14** may be provided in diametrically opposite directions and located between the needle cover **4** and the housing **1**.

The needle cover may comprise a needle cover top **64** and needle cover bottom **65**; cam follower **14** of the needle cover locking mechanism **60** and the position of the cam follower **14** on the fourth sleeve section **61** of the housing in some of the embodiments of an auto injector is shown in **FIGURE 7** and **FIGURE 8**.

Referring **FIGURE 7**, the first sleeve section **22** of the housing **1** may be having an inward transverse projection **70b**, **70a** extending from the inner surface **71** of the housing.

Referring **FIGURE 7**, the fourth sleeve section **61** of the housing **1** may have the following configuration. A shoulder **72** may extend internally from the distal portion of the fourth sleeve section **61** in the transverse direction. Further from the inner surface **73** of the shoulder **72**, there may be two or more protrusions extend in the transverse direction towards the proximal portion. In some of the embodiments as shown in **FIGURE 7**, there are four protrusions **74**, **74a**, **74b** and **74c** extending in the transverse direction.

Furthermore, structural changes may be carried out on both the cartridge holder **2** and the housing **1**. In the initial position the medicament may be visible through the windows on the outer surface of the housing **1** and the openings on the cartridge holder **2**. The working of the autoinjector **59** involves removal of safety cap, actuation on the body surface of the patient and removal of the autoinjector from the body surface accompanied by the needle cover extension as explained in the some of the embodiments of **FIGURES 1 to 6**.

FIGURE 8 is a side exploded view of locking mechanism **60** comprising the cam follower **14** and cam profile **13** provided on the fourth sleeve section **61** of housing. Referring **FIGURE 8**, cam follower **14** may comprise a cam follower protrusion **40** in the distal portion, a cam follower body **39** extending towards proximal portion and a cam follower button **38** in the proximal portion. The cam follower protrusion **40** and cam follower button **38** may be located on opposite surfaces of the cam follower body **39**. The shape of the cam follower protrusion **40** and cam follower button **38** may be cylindrical, conical, square, rectangular, trapezoid and the like.

The cam profile **13** may be provided on the outer surface of fourth sleeve section **61** on the distal portion of the housing **1**. An angled contour **41** surface of the cam profile **13** may be in the proximal portion a frustum of a cone contour **42** (not shown in **FIGURE 8**) or cylindrical or rectangular contour **42a** towards the distal portion. The distal portion contour surface **42a** shown in **FIGURE 8** may be a cylindrical one. Cam profile **13** may be formed out as a groove **43** in the housing to facilitate interaction or engagement of cam follower button **38**, on to the housing **1**. In some embodiment, the cam profile **13** may be formed out as a protrusion on the fourth sleeve section **61** of the housing **1** with a void space defining the boundaries of the protrusion to facilitate an interaction of cam follower button **38** into the void space (not shown in the **FIGURE 8**). The interaction may be by snap fit, a bayonet coupling or other methods of attachment that may facilitate free movement of the cam follower button **38**. Further the protrusion **40** of the cam follower **14** may mate with groove **45** (not shown in the **FIGURE 8**) on the inner surface of the needle cover **4** both in the first locking position **17** and the second locking position **18**. It may be considered that groove **45** on the inner surface of the needle cover **4** traverses both in the needle cover top **64** and the needle cover bottom **65**. The advantage thereof may be that the protrusion **40** provided over the width of the cam follower **14** component may establish effective operable connection to the corresponding groove **45** provide better stability between the needle cover **4** and the fourth sleeve section **61** of the housing.

Some embodiments of an auto injector **59** may be described with reference to **FIGURE 8** to **FIGURE 21** as follows. **FIGURE 9** gives an exploded view of some of the embodiments of an auto injector **59**. The auto injector comprises a housing **1**, a cartridge holder **2**, a top cover **21**, a safety cap **11**, a collet **9**, a first biasing member **15** associated with cartridge movement and medicament administration, a second biasing member **16** associated with needle cover

locking mechanism **60** during the operation and medicament administration, needle cover **4** comprising a needle cover top **64**, a needle cover bottom **65**, a plunger **19** provided with two oppositely located wings **68**, **68a** towards the distal portion on its outer surface, a cartridge **3** and a needle sheath **7** over the needle **5**.

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Some of the embodiments of an autoinjector **59** comprises a driver assembly **8**; a first biasing member **15**; a second biasing member **16**; a safety cap **11**; and a top cover **21**; the first biasing member **15** configured to bias the driver assembly **8**; the drive assembly **8** comprises a collet **9** and a collapsible lock **10** of the plunger **19**.

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FIGURE 10 and **FIGURE 11** discloses an auto injector **59** for a medicament administration that comprises: a housing **1** having a proximal portion and a distal portion, said proximal portion of housing is having a first sleeve section **22**, a first shoulder **23** at the distal end of the first sleeve section **22**, a second sleeve section **25** extends distally from the first shoulder **23** towards the distal portion of housing **1**; a cartridge holder **2** received within the housing **1**; the cartridge holder **2** is having a proximal end and a distal end; the cartridge holder **2** having an opening at the distal end; a cartridge **3**; a plunger **19**; a needle **5** fixed to the distal end of the cartridge **3**; a needle cover **4**, wherein the housing **1** is at least partially received within the needle cover **4**; the auto injector further comprises a needle cover locking mechanism **60**; and the needle cover locking mechanism comprises a cam profile **13**, and a cam follower **14**; the cam follower **14** of locking mechanism **60** is located between the needle cover **4** and the second sleeve section **25** of the housing **1** in both first locking position **17** and second locking position **18**. The cam profile **13** may be provided in diametrically opposite directions on outer surface of the housing **1**; similarly cam follower **14** may be provided in diametrically opposite directions and located between the needle cover **4** and the housing **1**.

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The auto injector **59** for a medicament administration comprises a needle cover locking mechanism **60**. **FIGURE 11A** shows perspective view of needle cover top **64** and needle cover bottom **65**; **FIGURE 11B** shows front view of cam follower **14**; **FIGURE 11C** shows sectional view of position of the cam follower **14** on the second sleeve section **25** of the housing **1** after actuation and before needle cover extension; Referring to **FIGURE 11B** and **FIGURE 11C**, the needle cover **4** of the locking mechanism **60** may comprise a cam profile **13** and a cam follower **14**. The cam follower **14** of the locking mechanism **60** may be located between the needle cover **4** and the second sleeve section **25** of the housing **1** in both the first

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locking position **17** and the second locking position **18**. The needle cover **4** may be of cylindrical, oval or elliptical shape. The needle cover **4** may be considered to be made up of a proximal portion needle cover top **64** and a distal portion needle cover bottom **65**. There may be provided a plurality of projections **66a** on the needle cover top **64** towards the distal portion. The projections **66a** may be over the entire circumference. There may be ribs **67a** provided over the inner surface of the needle cover bottom **65** towards the proximal portion. The outer surface of the plurality of projections **66a** can be slightly smaller than the inner surface of the proximal portion of the needle cover bottom **65** as to make a firm snap fit between the needle cover top **64** and needle cover bottom **65**. Further the distal end of the plurality of projections **66a** abut the proximal end of the ribs **67a** to indicate that both needle cover top **64** and needle cover bottom **65** have firmly snapped up. Alternatively, the needle cover top **64** and needle cover bottom **65** may be ultrasonically welded. There may be a needle cover groove **45** that runs on the inner surfaces of both needle cover top **64** and needle cover bottom **65** and positioned in an aligned manner. The purpose of the needle cover groove **45** may be to provide a path for the cam follower protrusion **40** of the cam follower **14** to traverse both during the actuation and medicament administration.

FIGURE 12 shows a perspective view of the housing. Referring **FIGURE 12**, the housing **1** may comprise a proximal portion and a distal portion. The proximal portion of the housing **1** may have a first sleeve section **22**. A first shoulder **23** may be formed at the distal end of the first sleeve section **22**. The first shoulder **23** may be due to reduced diameter of the housing **1** extending in the inward direction. A second sleeve section **25** may extend in the distal direction from the end of the first shoulder **23**. The housing **1** of **FIGURE 12** may be of cylindrical, oval or elliptical shape. The first sleeve section **22** at the proximal end is having end surface to receive the safety cap **4** and the distal portion is having a peripheral ridge **22a**. The peripheral ridge **22a** may be positioned proximal to first shoulder **23**. The peripheral ridge **22a** is having front end **22aa** and rear end **22ab** portions, whereas the first sleeve section **22** is affixed into the front end portion **22aa** and the second sleeve section **25** is extending from the rear end portion **22ab**. At the rear end **22ab**, a pair of diametrically opposed rectangular shaped like projection heads **93a**, **93b**, **93c**, **93d** extending downwardly on the surface of second sleeve section **25** (**93c** and **93d** not shown in **FIGURE 12**). The peripheral ridge may facilitate sliding of needle cover **4**.

There may be plurality of inward transverse projections extending from the inner surface **71** of the housing **1** towards the distal portion. Referring to **FIGURE 10**, in the preferred embodiment the first sleeve section **22** of the housing **1** may be having an inward transverse projections **70b**, **70a** extending from the inner surface **71** of the housing. The inward transverse projections **70b**, **70a** may be provided in diametrically opposite directions. The inward transverse projections **70a**, **70b** may be rectangular in shape.

Some of the examples of an autoinjector **59** disclose wherein the second sleeve section **25** at distal end comprises a diametrically opposite cutting arms **89**, **89a** having flank surfaces **90**, **90a** as shown in **FIGURE 12**.

Some of the examples of an autoinjector **59** disclose wherein second sleeve section **25** comprises locking projections **88**, **88a** diametrically opposite to flank surfaces **90**, **90a** of cutting arms **89**, **89a**.

Some of the examples of an autoinjector **59** disclose wherein flank surfaces **90**, **90a** of cutting arms **89**, **89a** comprises cam profile **13**.

Referring to **FIGURE 13**, in some of the embodiments of an autoinjector wherein slots **76**, **76a** may be formed on the proximal portion of the cartridge holder **2** carved out of the proximal portion of the cartridge holder **2**. The slots **76**, **76a** may be positioned diametrically opposite. The slot **76** may have two opposite surfaces **76b**, **76c**. Similarly the slot **76a** may have two opposite surfaces **76d**, **76e**. There may be diametrically opposite openings **77**, **77a** distal to the slots **76**, **76a** as shown in **FIGURE 13** positioned on the cartridge holder **2**. The distal portion of the cartridge holder **2** may have conical portion **2a** and further distal to it a cylindrical portion **2c**. The cartridge holder **2** may have plurality of ledges provided towards the distal portion. In one of the preferred embodiments the cartridge holder **2** may have on the distal portion diametrically opposite ledges **91**, **92** provided on the outer surface. Each of the ledges **91**, **92** may be described as follows. The ledge **91** may have been formed due to two parallel projections **91a**, **91b** spaced apart. The shape of the projections **91a**, **91b** may be rectangular one. Similarly ledge **92** may have been formed due to two parallel projections **92a**, **92b** spaced apart. (Projections **92a** and **92b** are not shown in the **FIGURE 13**). The thickness of inward transverse projections **70b**, **70a** of the housing **1** is smaller than the gap between the two projections **91a**, **91b**. Hence the inward transverse projection **70b** is allowed

to pass through the spatial gap between the projections **91a**, **91b** of ledge **91**. Similarly inward transverse projection **70a** is allowed to pass through the spatial gap between the projections **92a**, **92b** of ledge **92**. This feature of traverse of the inward transverse projections **70b**, **70a** of the housing **1** in the spatial gap between the projections **91a**, **91b** of ledge **91** and the projections **92a**, **92b** of ledge **92** allow proper alignment of the cartridge holder **2** and the housing **1**.

Some examples of the autoinjector disclose wherein the cartridge holder **2** is having slots **76**, **76a** provided on the proximal portion of the cartridge holder **2**; openings **77**, **77a** are provided on the outer surface of the cartridge holder **2**.

Some examples of the autoinjector disclose wherein the slots **76**, **76a** are having four surfaces **76b**, **76c**, **76d** and **76e**.

Some examples of autoinjector **59** disclose wherein the distal closed end of the cartridge holder **2** abuts the inside surface of needle cover **4** in the first locking position **17**.

FIGURE 14 shows the position of the cam follower **14** on the second sleeve section **25** of the housing **1** of an auto injector **59** after needle cover **4** extensions in the second locking position **18**.

Referring to **FIGURE 15** the cam profile **13** provided on the outer surface of second sleeve section **25** on the distal portion of the housing **1** may be described as follows. An angled contour surface **41** of the cam profile **13** may have **41** a frustum of a cone contour surface **42** in the proximal portion and cylindrical or rectangular contour surface **42a** towards the distal portion. Cam profile **13** may be formed out as a groove **43** in the housing to facilitate engagement or coupling of cam follower button **38**, on to housing **1**. It could also be that Cam profile **13** may be formed out as a protrusion on the housing **1** to facilitate engagement or interaction of cam follower button **38**, on to housing **1** (not shown in the **FIGURE**). The engagement or interaction may be by snap fit, a butt joint, a bayonet coupling, welding or other methods of attachment.

Referring to **FIGURE 16**, diametrically opposite wings **68**, **68a** have been provided on the distal portion of the plunger **19** on the outer surface. The wings **68**, **68a** may also be known as

the left wing **68** and the right wing **68a**. The wings **68, 68a** may be a sort of a diametrically opposite protrusions extending from a circular flange **79** like structure in the distal portion of the plunger **19**. The wings **68, 68a** may be of any geometrical shape such as rectangular, circular, square and trapezoidal and the like. The wings **68, 68a** shown in **FIGURE 16** may be of rectangular shape with a distal surfaces **80, 80a** and proximal surfaces **81, 81a**. Wings **68, 68a** having a rectangular shape may also have two opposite side surfaces **82, 83** connecting the distal and proximal surfaces for the left wing **68** and **82a, 83a** for the right wing **68a**. The proximal portion of the plunger **19** may have two diametrically opposite longitudinal blades **85, 85a**. The proximal portion of the longitudinal blades **85, 85a** may have collapsible lock portion **86, 86a**. It may be that the collapsible lock portion **86, 86a** may have the appearance of a frustum of a cone and the like.

FIGURE 17 shows a side view of an auto injector **59** with safety cap **11** in place. In some of the embodiments window **84, 84a** (only **84** is shown in the **FIGURE 17**); **84a** not shown in the **FIGURE 17**) may be provided on the outer surface of the first sleeve section **22** of the housing **1**. In some other embodiments, windows **84, 84a** may be provided on the outer surface of the first sleeve section **22** towards the distal portion of the housing **1**.

The working of the auto injector **59** may further be illustrated referring **FIGURE 17** to **FIGURE 21** and **FIGURE 10**. In the initial position the safety cap **11** may be in the proximal end of the auto injector **59** mounted over the housing **1** as shown in **FIGURE 17**. In this initial position the medicament may be visible through the windows **84, 84a** on the outer surface of the housing **1** and due to the openings **77, 77a** on the cartridge holder **2**. The windows **84, 84a** on the outer surface of the housing **1** may be formed by virtue of the unwrapped label over the transparent housing **1** portion corresponding to the shape of window. The transparent windows **84, 84a** and the openings **77, 77a** may be in an alignment. The purpose of the window **84, 84a** may be to ensure visibility of stopper **20** on completion of medicament administration. The safety pin **12** of the safety cap **11** may pass through the top cover **21** central aperture **52**. The positioning of the safety pin **12** inside the central aperture **52** may prevent the collapsible lock portion **86, 86a** of the plunger **19** access to the frusto conical cam surface **58** of the top cover **21**. Further collapsible lock portion **86, 86a** of the plunger **19** may be locked with the collet **9** by the first biasing member **15**. This can help the auto injector **59** to be on a non activated position. Further insertion of safety cap **11** through the collapsible snap lock **10** may prevent accidental unlocking of the drive assembly

8. In the initial position, the needle cover top **64** and needle cover bottom **65** of the needle cover **4** may be biased by the second biasing member **16**. The second biasing member **16** may be biased from the housing **1**. The distal end of the cylindrical portion of the cartridge holder **2** may have an engagement with the proximal end of the inner cover bottom **65**. The engagement may be a simple butt joint. However, the proximal end **29** of the cartridge holder **2** does not have any engagement with the collet **9**. There may be a gap between the proximal end of the cartridge holder **2** and the collet **9** as shown in **FIGURE 10**.

FIGURE 18 shows a perspective view of the auto injector **59** with safety cap **11** removed. To actuate the auto injector **59**, the next step is to pull out the safety cap **11** by holding the ridges of the safety cap **11**. This action may place the auto injector **59** in an activating position as a result of collapsible lock portion **86**, **86a** of the plunger **19** finding access to the frusto conical cam surface **58** of the top cover **21**.

FIGURE 19 shows a sectional view of the autoinjector **59** with needle **5** exposed from the needle cover bottom **65** of the needle cover **4** before the medicament administration. After the safety cap **11** is removed the user may hold the auto injector **59** first sleeve section **22** of the housing **1** in the hand and press the needle cover bottom **65** on to the body for actuation. The needle cover bottom **65** and needle cover top **64** of the needle cover **4** may move in the proximal direction towards the housing **1** and may push the cartridge holder **2** backward due to the butt joint between the needle cover bottom **65** and the cartridge holder **2** and butt against the collet **9**. The cartridge holder **2** may push back the collet **9** due to the butt joint between the needle cover **4** and the cartridge holder **2** which in turn may push the collapsible lock portion **86**, **86a** to release the first biasing member **15**. The first biasing member **15** and the second biasing member **16** may be spring. The collapsible lock portion **86**, **86a** may move inward through the chamfer provided on the top cover **21** resulting in unlocking of the collet **9** of the drive assembly **8** and collapsible lock **10** of the plunger **19**. The first biasing member **15** may relax and hold the collet **9** against the top cover **21** at the proximal end and may push the cartridge **3** along with the needle on the distal end. As a consequence the needle **5** may get enough force from the first biasing member **15** to pierce the needle sheath **7**, clothing of the patient and finally through the skin. While the needle cover bottom **65** and the needle cover top **64** may be pushed against the housing **1**, the cam follower **14** may move along the cam profile angled contour surface **41** and may occupy the proximal position. The cam follower **14** may have both rotational and linear movement with respect to the needle cover

bottom **65** and needle cover top **64** of the needle cover **4** while the needle cover **4** may have only linear motion.

The needle sheath **7** is positioned over the needle **7** such that the open end of the sheath fits over and around the needle **5**. The length of the sheath **7** is such that its closed end is slightly beyond or spaced from the end of needle **5**. The cartridge **3** moves forward whereby the needle sheath **7** is compressed the most between the cartridge holder **2** and the cartridge **3**. At this juncture, the cartridge **3** may move forward and the distal surface of the cartridge **3** may have an engagement with the proximal surface of the compressed needle sheath **7**.

Some of the examples of auto injector **59** disclose wherein the proximal end of the cartridge holder **2** abuts the distal end of the collet **9** on actuation of the auto injector **59** by pressing the needle cover **4** against the body after the removal of the safety cap **12** due to backward movement of the cartridge holder **2**.

Some of examples of an autoinjector **59** disclose wherein the top cover **21** inner surface is having a chamfer shape; the collapsible lock **10** is having a collapsible lock portion **86**, **86a** towards the proximal end; the collapsible lock portion **86**, **86a** moves inward through the chamfer on actuation of the auto injector **59** by pressing the needle cover **4** against the body after the removal of the safety cap **12** due to backward movement of the cartridge holder **2** resulting in unlocking of the collet **9** and collapsible lock **10** of the plunger **19**.

FIGURE 20 shows a sectional view of the autoinjector **59** with needle **5** exposed from the needle cover bottom **65** after medicament administration. Once the needle **5** may be pierced into the skin of the patient, due to the spring force of the first biasing member **15** the plunger **19** may move forward and may deliver the pre defined volume of medicament through the needle **5**. The plunger **19** may move from the position with respect to the housing **1** as shown in **FIGURE 19** and the distal surface of the left wing **80** of the plunger **19** and distal surface of the right wing **80a** of the plunger **19** may engage the proximal surface of the inward transverse projections **70b**, **70a** of the first sleeve section **22** of the housing **1** thus preventing the plunger **19** from hitting the cartridge **3** surface, inducing no stress on the cartridge **3**. During this stage the stopper **20** may move toward the distal end and the stopper **20** position may correspond with the window **84**, **84a** provided on the distal portion of the first sleeve

section **22** of the housing **1** and thus providing a visual indication for the user that the medicament is delivered.

Some of the examples of an autoinjector disclose wherein the distal surfaces **80**, **80a** of the wings **68**, **68a** of the plunger **19** engage the surface of the inward transverse projection **70b**, **70a** of the housing **1** at the end of the medicament administration; contacting surfaces **82**, **83** of wing **68** engage with the surfaces of the slots **76c**, **76b** of the cartridge holder **2**; and contacting surfaces **82a**, **83a** of wing **68a** engage with the surfaces of the slots **76e**, **76d** of the cartridge holder **2**.

FIGURE 21 shows a sectional view of the autoinjector **59** with needle cover top **64** and needle cover bottom **65** of the needle cover **4** in extended position protecting the exposed needle **5** after the medicament administration. After the medicament may be delivered, the auto injector **59** may be held against the body for the desired period before the auto injector **59** may be withdrawn from the body. Simultaneously, the needle cover **4** comprising needle cover top **64** and needle cover bottom **65** may extend forward due to the tension of the second biasing member **16**. The cam follower **14** may follow the cylindrical contour surface **42a** of the cam profile **13**. The cylindrical contour surface **42a** being longer than cam profile angled contour surface **41** the longer travel of the cam follower **14** leading to longer extension of the needle cover **4**. During this stage the needle cover **4** may extend forward and may get locked with the housing **1** at the second locking position **18**. There may also be a fool-proof locking of the needle cover **4** with housing **1** such that both forward and backward movement of needle cover **4** may be restricted.

FIGURE 8 is a side exploded view of locking mechanism **60** comprising the cam follower **14** and cam profile **13** provided on the second sleeve section **25** of housing **1**. Projections **88**, **88a** may be provided on the distal portion of the second sleeve section **25** of the housing **1**. Projection corresponding to numeral **88** is shown in **FIGURE 8** whereas the opposite projection numeral **88a** is not shown. Fool proof locking of the needle cover **4** may be achieved by the abutment of projections **88**, **88a** provided on the second sleeve section **25** towards the distal end with the diametrically opposite grooves **87a**, **87b** (not shown in **FIGURE 8**) provided on the inner surface of the needle cover top **64** due to the force of the relaxation of the second biasing member **16**. Referring to **FIGURE 8** cam follower **14** may comprise a cam follower protrusion **40** in the distal portion, a cam follower body **39**

extending towards proximal portion and a cam follower button **38** in the proximal portion. The cam follower protrusion **40** and cam follower button **38** may be located on opposite surfaces of the cam follower body **39**. The shape of the cam follower protrusion **40** and cam follower button **38** may be cylindrical, conical, square, rectangular, trapezoid and the like.

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The cam profile **13** may be provided on the outer surface of second sleeve section **25** on the distal portion of the housing **1**. An angled contour **41** of Cam profile **13** may have in the proximal portion a frustum of a cone contour **42** (not shown in **FIGURE 8**) and cylindrical contour **42a** towards the distal portion. The distal portion contour surface **42a** shown in **FIGURE 8** may be a cylindrical one. Cam profile **13** may be formed out as a groove **43** in the housing to facilitate a coupling of cam follower button **38**, on to housing **1**. It could also be that Cam profile **13** may be formed out as a protrusion (not shown in **FIGURE 8**) on the second sleeve section **25** of the housing **1** with a void space defining the boundaries of the protrusion to facilitate interaction of cam follower button **38** into the void space. The interaction may be by snap fit, a bayonet coupling or other methods of attachment that may facilitate free movement of the cam follower button **38**. Further the protrusion **40** of the cam follower **14** may mate with groove **45** on the inner surface of the needle cover **4** both in the first locking position **17** and the second locking position **18**. It may be considered that groove **45** on the inner surface of the needle cover **4** traverses both in the needle cover top **64** and the needle cover bottom **65**. The advantage thereof may be that the protrusion **40** provided over the width of the cam follower **14** component may establish effective operable connection to the corresponding groove **45** provides better stability between the needle cover **4** and second sleeve section surface **25** of the housing **1**.

Some of the embodiments of auto injector **59** disclose wherein the cam profile **13** comprises an angled contour surface **47** in the proximal portion and cylindrical contour surface **42a** in the distal portion.

Some of the embodiments of autoinjector disclose wherein the cam follower button **38** of the cam follower **14** mates with cylindrical contour surface **48a** of the cam profile **13** in the second locking position **18**.

Some of the embodiments of autoinjector **59** disclose wherein various medicaments may be administered. Some of the embodiments of the autoinjector **59** are particularly suitable for the administration of medicaments such as dihydroergotamine or epinephrine.

- 5 Various modifications and variations to the above described autoinjector of the various embodiments can be made without departing from the scope of the present invention. It is intended that the present invention encompasses all such modifications.

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CLAIMS

1. An autoinjector **59** for administering a fluid medicament to a subject comprising: a
5 housing **1** having a proximal portion and a distal portion; a cartridge holder **2** received
within the housing **1**; the cartridge holder **2** is having a proximal end and a distal end;
an opening at the distal end ; a cartridge **3**; a plunger **19**; a needle cover **4**, wherein the
housing **1** is at least partially received within the needle cover **4**; the auto injector **59**
10 further comprises a needle cover locking mechanism **60**; wherein the needle cover
locking mechanism **60** comprises a cam profile **13**, a cam follower **14**; and wherein the
cam follower **14** of locking mechanism **60** is located between the needle cover **4** and
the distal portion of the housing **1** in both first locking position **17** and second locking
position **18**.
- 15 2. The auto injector of claim 1, wherein the proximal portion of the housing **1** is having a
first sleeve section **22** and the distal portion of the housing is having second sleeve
section **25**.
3. The auto injector of claim 2, wherein the second sleeve section **25** at distal end
20 comprises a diametrically opposite cutting arms **89**, **89a** having flank surfaces **90**, **90a**.
4. The autoinjector of claim 3, wherein the second sleeve section **25** comprises locking
projections **88**, **88a** diametrically opposite to flank surfaces **90**, **90a** of cutting arms **89**,
89a.
25
5. The autoinjector of claim 3, wherein the flank surfaces **90**, **90a** of cutting arms **89**, **89a**
comprises cam profile **13**.
6. The autoinjector of claim 2, wherein the first sleeve section **22** of the housing **1** is
30 having inward transverse stopping projections **70b**, **70a** on the inner surface **71**.
7. The auto injector of claim 1, wherein the proximal portion of the housing **1** is having a
first sleeve section **22**; a first shoulder **23** at the distal end of the first sleeve section **22**;

a second sleeve section **25** extends distally from the first shoulder **23** in the distal portion.

5 8. The autoinjector of claim 1, wherein the cam profile **13** comprises an angled contour surface **47** in the proximal portion and cylindrical contour surface **42a** in the distal portion.

10 9. The autoinjector of claim 1, wherein the cam follower **14** comprises a cam follower protrusion **40** on the distal portion; a cam follower button **38** on the proximal portion; and a cam follower body **39** extending between them.

15 10. The autoinjector of claim 9, wherein the protrusion **40** of the cam follower **14** mates with groove **45** on the inner surface of the needle cover **4** both in the first locking position **17** and the second locking position **18**.

11. The autoinjector of claim 10, wherein the cam follower button **38** of the cam follower **14** mates with the distal portion of angled contour surface **44** of the cam profile **13** in the first locking position **17**.

20 12. The autoinjector of claim 11, wherein the cam follower button **38** of the cam follower **14** mates with cylindrical contour surface **48a** of the cam profile **13** in the second locking position **18**.

25 13. The autoinjector of claim 1, wherein the distal closed end of the cartridge holder **2** abuts the inside surface of needle cover **4** in the first locking position **17**.

30 14. The autoinjector of claim 1, further comprising a driver assembly **8**; a first biasing member **15**; a second biasing member **16**; a safety cap **11**; and a top cover **21**; the first biasing member **15** configured to bias the driver assembly **8**; the drive assembly **8** comprises a collet **9** and a collapsible lock **10**.

15. The autoinjector of claim 1, wherein the proximal end of the cartridge holder **2** abuts the distal end of the collet **9** on actuation of the auto injector **59** by pressing the needle

cover **4** against the body after the removal of the safety cap **12** due to backward movement of the cartridge holder **2**.

5 16. The auto injector of claim 14, wherein the top cover **21** having inner surface comprising a chamfer; the collapsible lock **10** is having a collapsible lock portion **86**, **86a** towards the proximal end; the collapsible lock portion **86**, **86a** moves inward through the chamfer on actuation of the auto injector **59** by pressing the needle cover **4** against the body after the removal of the safety cap **12** due to backward movement of the cartridge holder **2** resulting in unlocking of the collet **9** and collapsible lock **10** of the plunger **19**.

10 17. The auto injector of claim 1, wherein the cartridge holder **2** is having slots **76**, **76a** provided on the proximal portion of the cartridge holder **2**; openings **77**, **77a** are provided on the outer surface of the cartridge holder **2**.

15 18. The autoinjector of claim 17, wherein the slots **76**, **76a** are having four surfaces **76b**, **76c**, **76d** and **76e**.

20 19. The auto injector of claim 1, wherein the plunger **19** is having two wings **68**, **68a** provided on the outer surface of the plunger **19**.

25 20. The auto injector of claim 19, wherein the distal surfaces **80**, **80a** of the wings **68**, **68a** of the plunger **19** engage the surface of the inward transverse projection **70b**, **70a** of the housing **1** at the end of the medicament administration; contacting surfaces **82**, **83** of wing **68** engage with the surfaces of the slots **76c**, **76b** of the cartridge holder **2**; and contacting surfaces **82a**, **83a** of wing **68a** engage with the surfaces of the slots **76e**, **76d** of the cartridge holder **2**.

30 21. The auto injector of claim 1, further comprising windows **84**, **84a** provided on the outer surface of the first sleeve section **22** of the housing **1** towards the distal portion.

22. An autoinjector **59** for administering a fluid medicament to a subject comprising: a housing **1** having a proximal portion and a distal portion, a cartridge holder **2** received within the housing **1**, the cartridge holder **2** is having a proximal end and a distal end;

an opening at the distal end; a cartridge **3**; the housing **1** is having a first sleeve section **22**; first sleeve section **22** is having inward transverse projections **70b**, **70a** on the inner surface **71**; a plunger **19**; the plunger **19** is having two wings **68**, **68a** provided on the outer surface; a needle cover **4**, wherein the housing **1** is at least partially received within the needle cover **4**; the auto injector **59** further comprises a needle cover locking mechanism **60**; wherein the needle cover locking mechanism **60** comprises a cam profile **13**, a cam follower **14**; wherein the cam follower **14** of locking mechanism **60** is located between the needle cover **4** and the second sleeve section **25** of the housing **1** in both first locking position **17** and second locking position **18**; wherein the distal surfaces **80**, **80a** of the wings **68**, **68a** of the plunger **19** engage the surface of the inward transverse stopping projection **70b**, **70a** of the housing **1** at the end of the medicament administration.

23. The autoinjector of claim 22, wherein the cam profile **13** comprises an angled contour surface **47** in the proximal portion and cylindrical contour surface **42a** in the distal portion.

24. The autoinjector of claim 22, wherein the cam follower **14** comprises a cam follower protrusion **40** on the distal portion; a cam follower button **38** on the proximal portion; and a cam follower body **39** extending between them.

25. The autoinjector of claim 24, wherein the protrusion **40** of the cam follower **14** mates with groove **45** on the inner surface of the needle cover **4** both in the first locking position **17** and the second locking position **18**.

26. The autoinjector of claim 24, wherein the cam follower button **38** of the cam follower **14** mates with the distal portion of the angled contour surface **44** of the cam profile **13** in the first locking position **17**.

27. The auto injector of claim 25, wherein the cam follower button **38** of the cam follower **14** mates with cylindrical contour surface **48a** of the Cam profile **13** in the second locking position **18**.

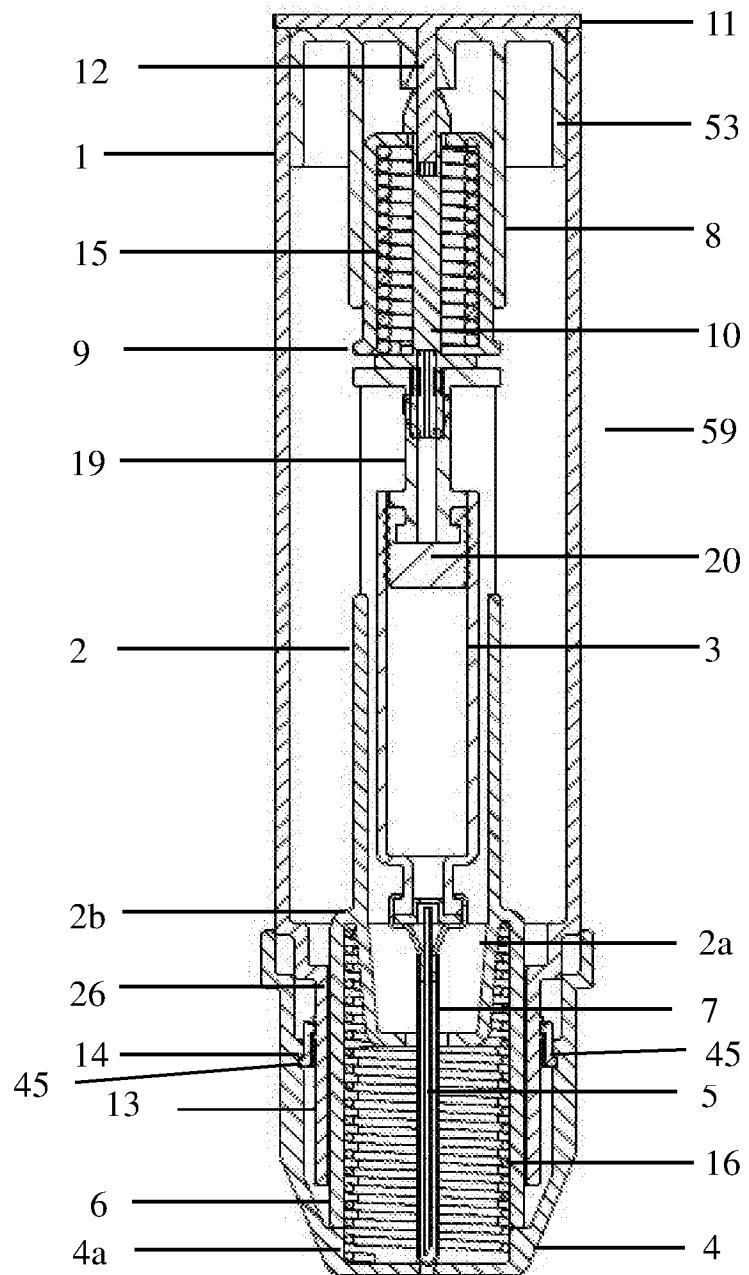


FIGURE 1

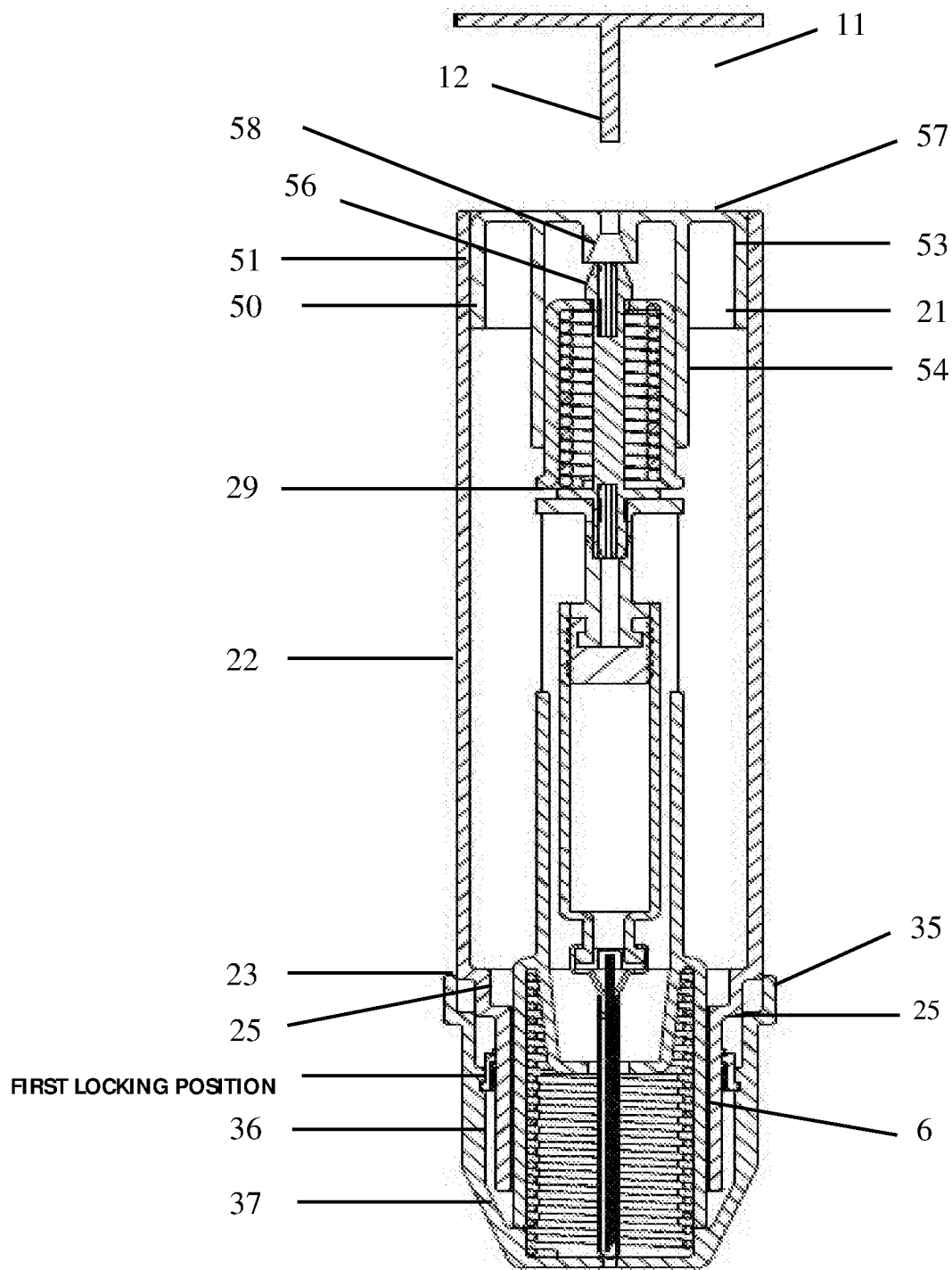


FIGURE 2

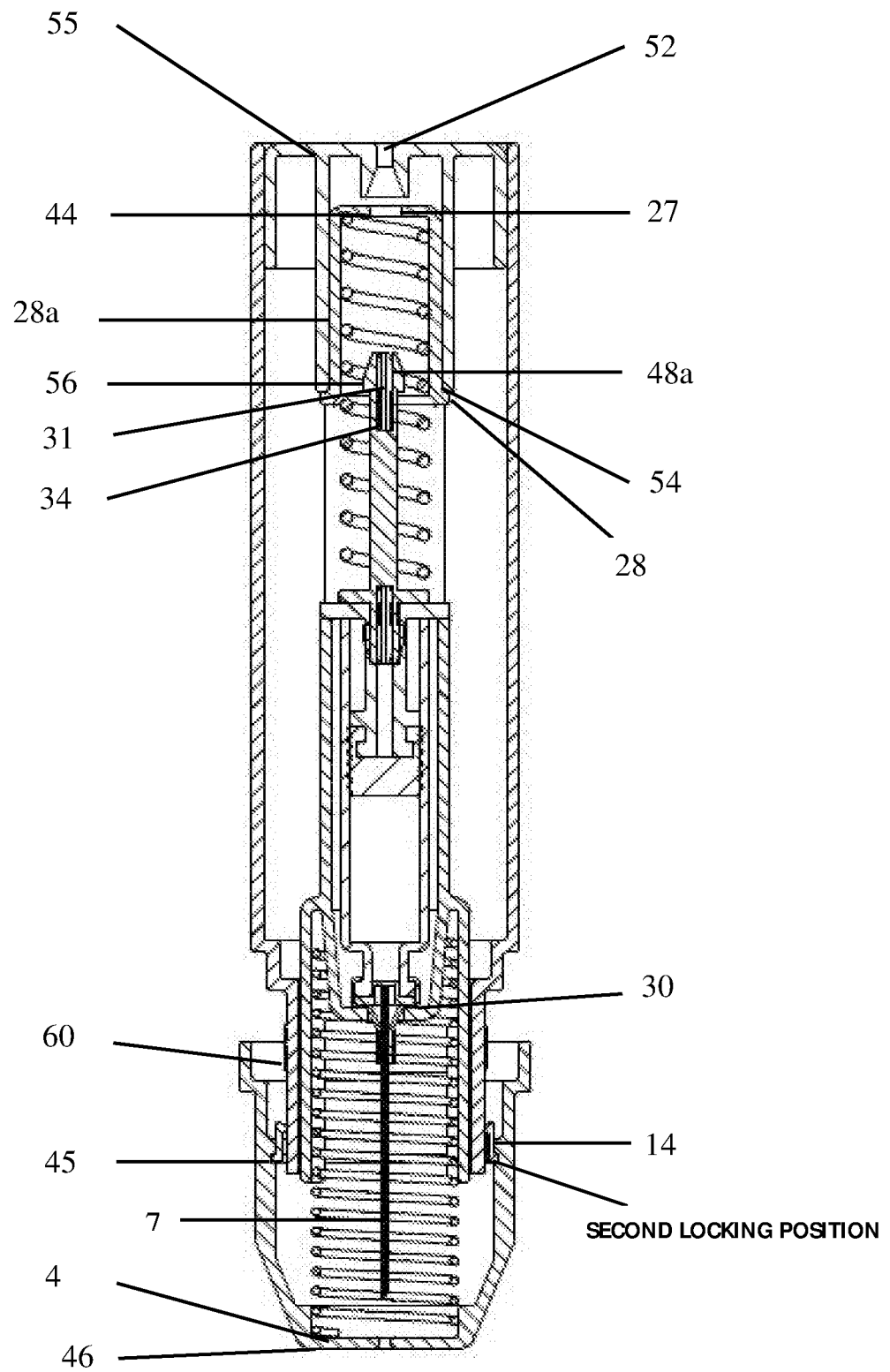


FIGURE 3

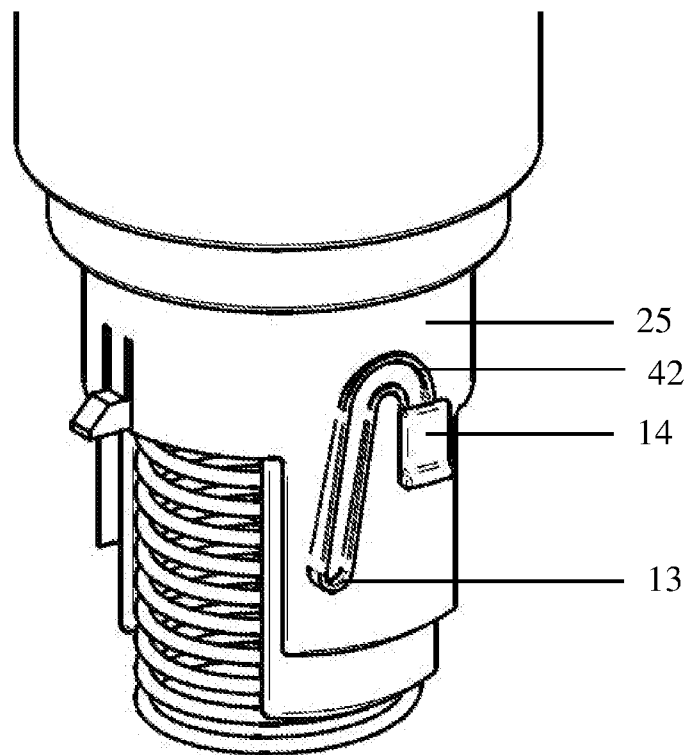


FIGURE 4

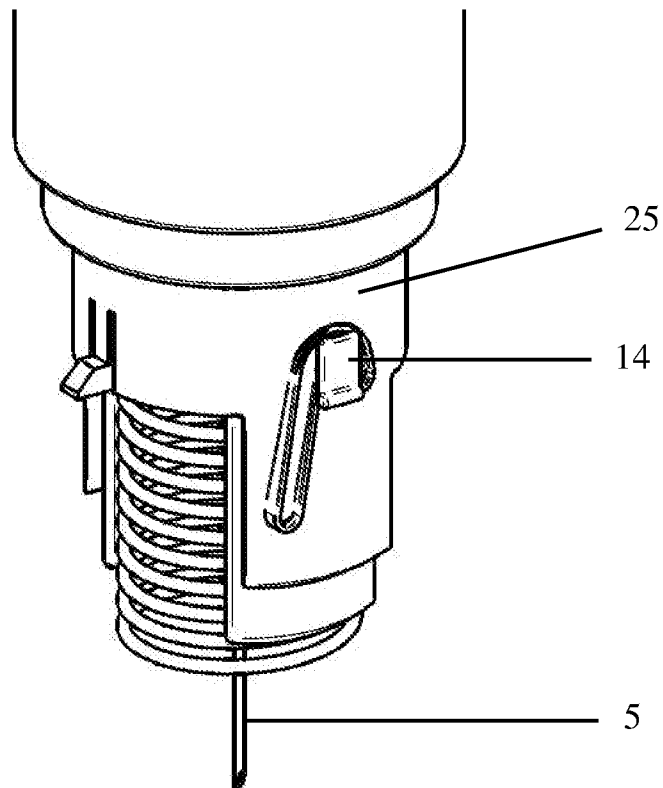


FIGURE 5

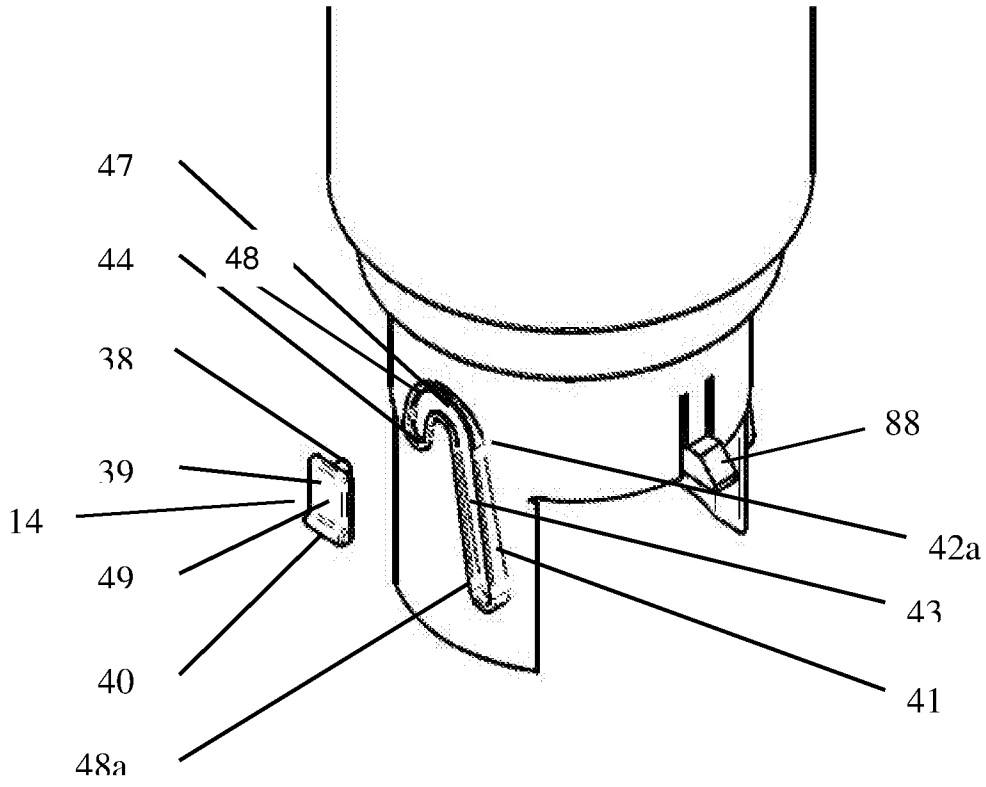


FIGURE 6

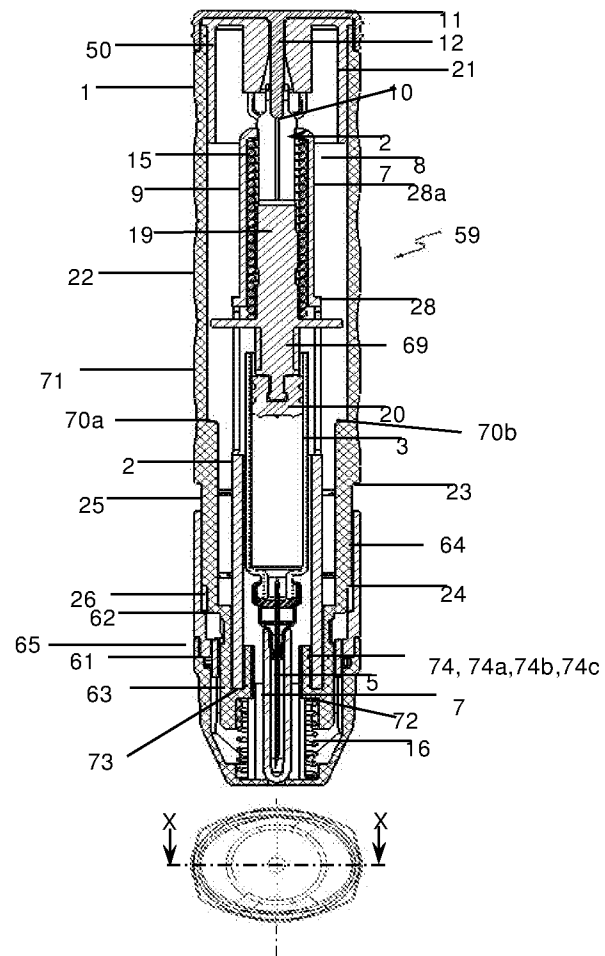


FIGURE 7

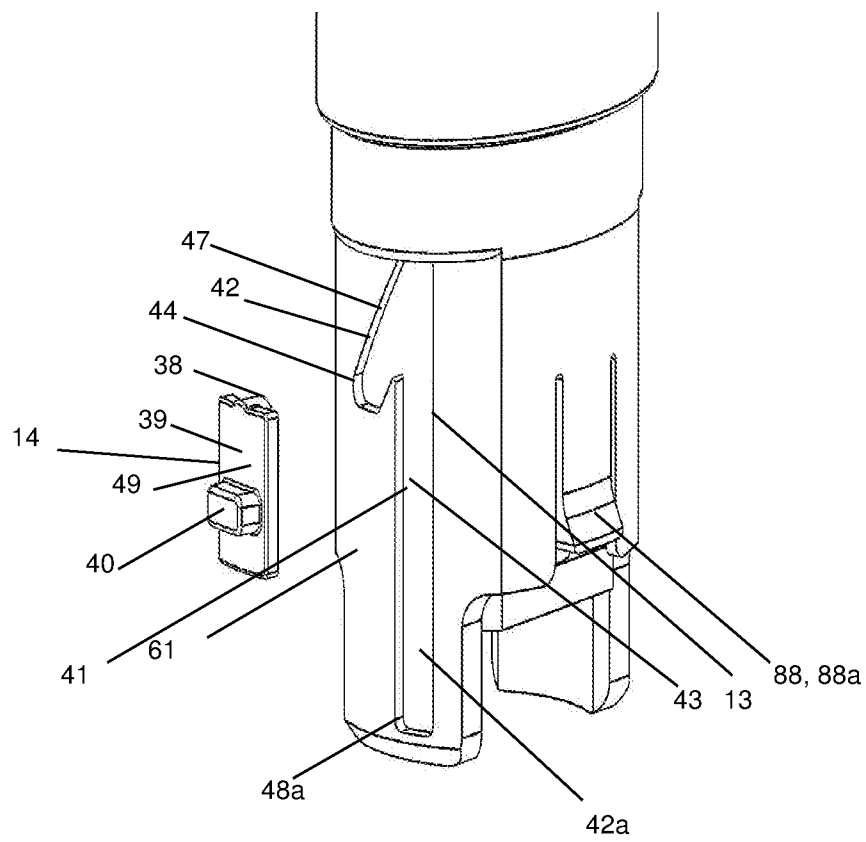


FIGURE 8

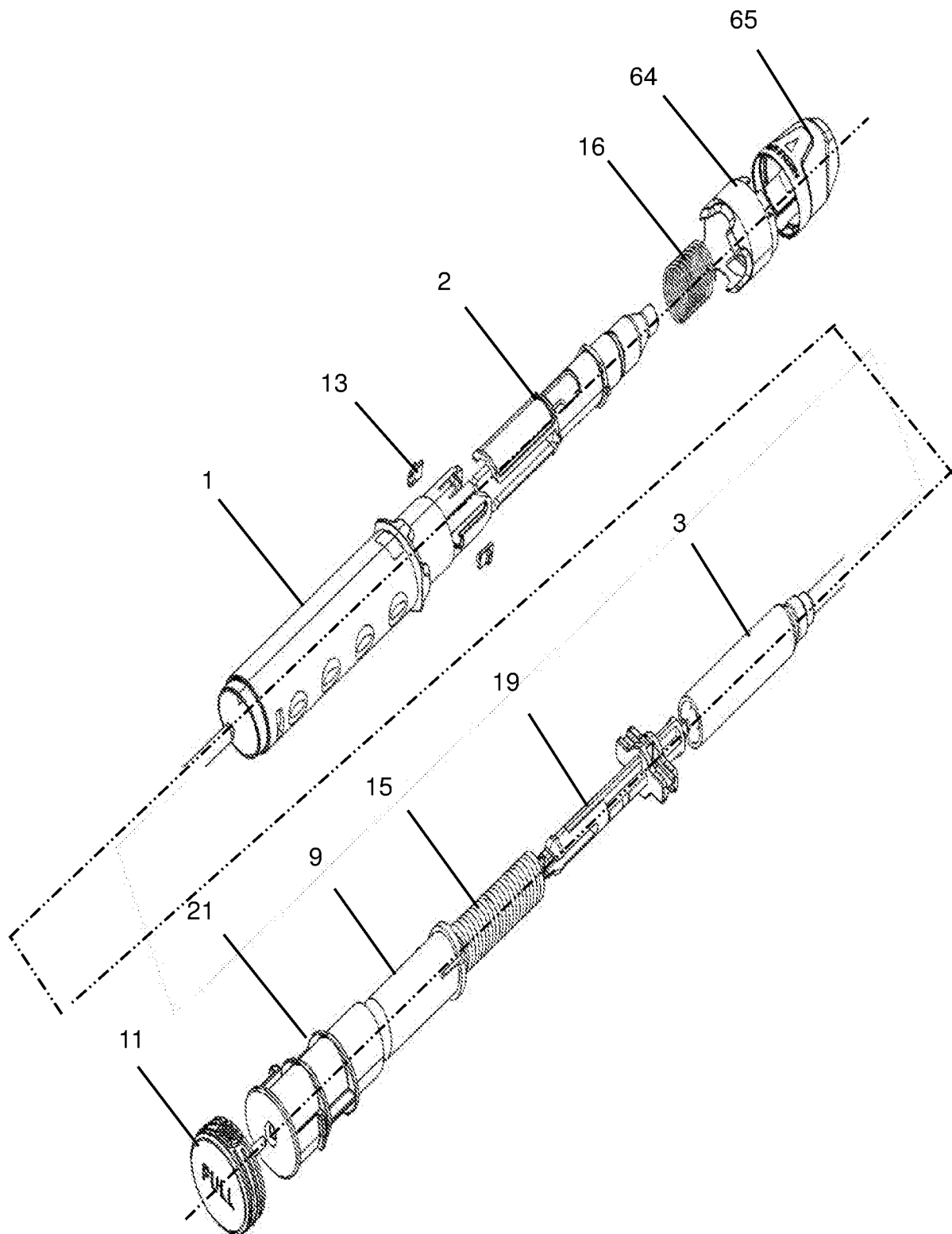


FIGURE 9

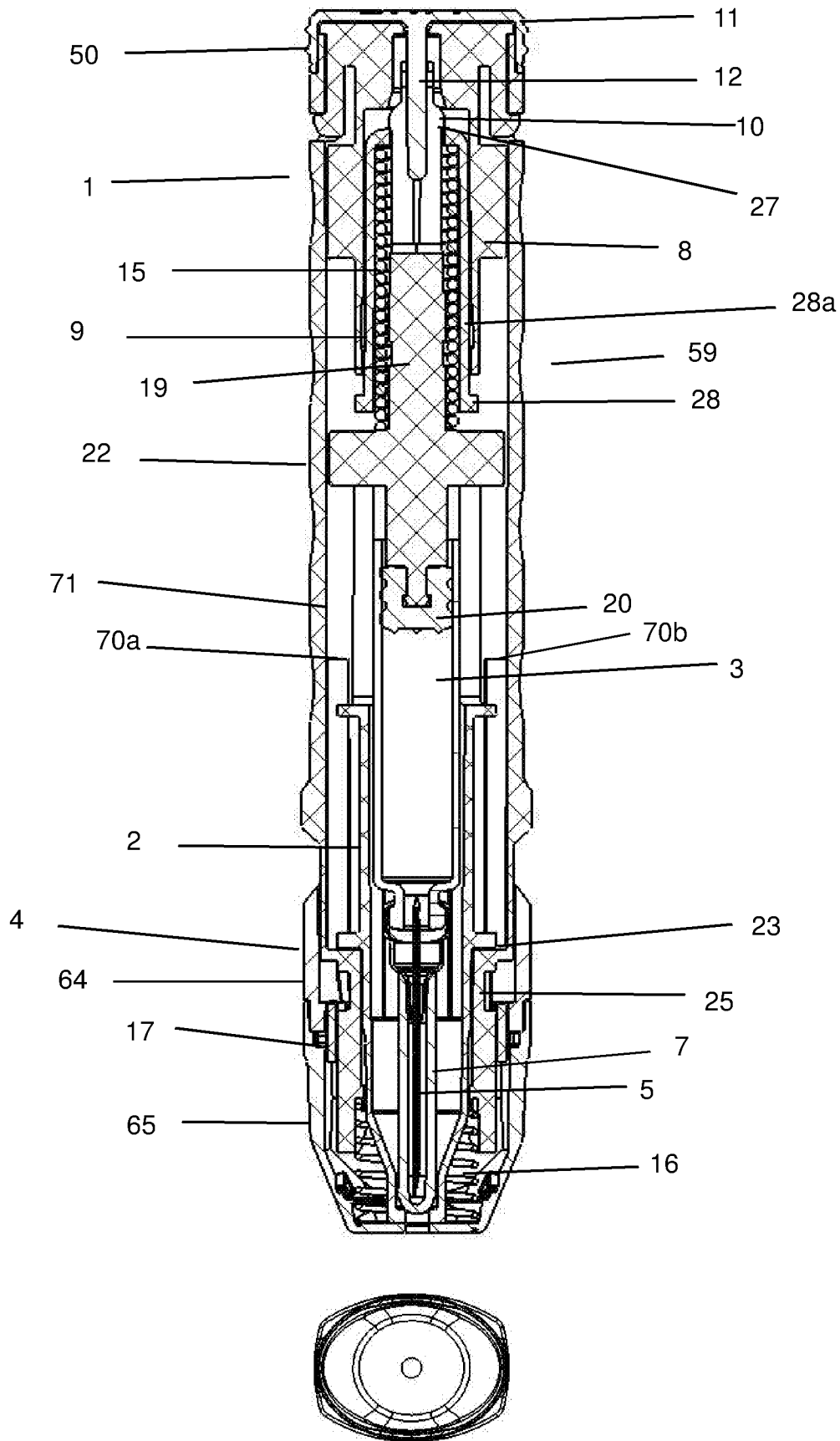


FIGURE 10

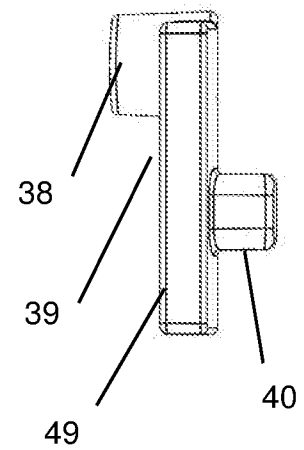
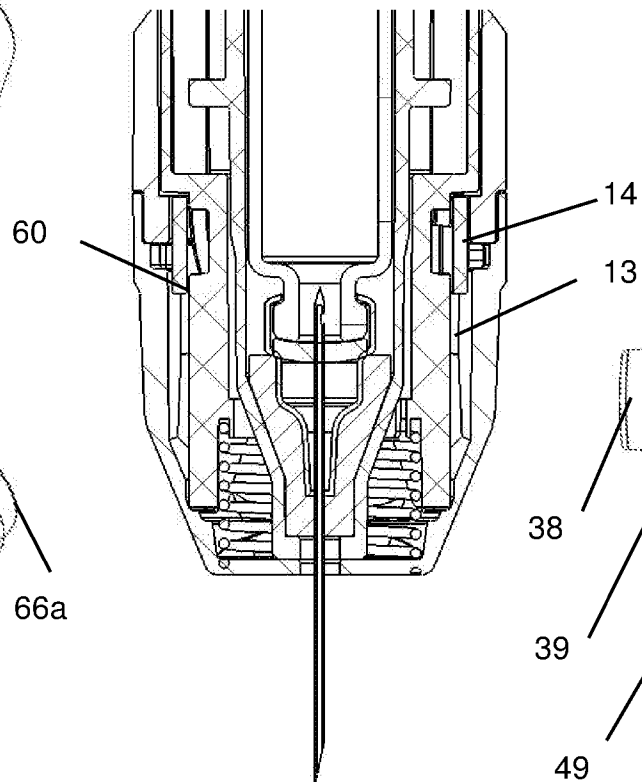
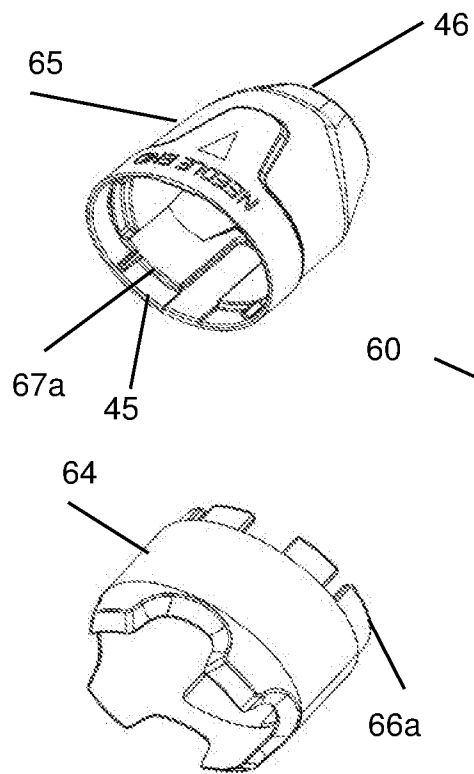


FIGURE 11A

FIGURE 11C

FIGURE 11B

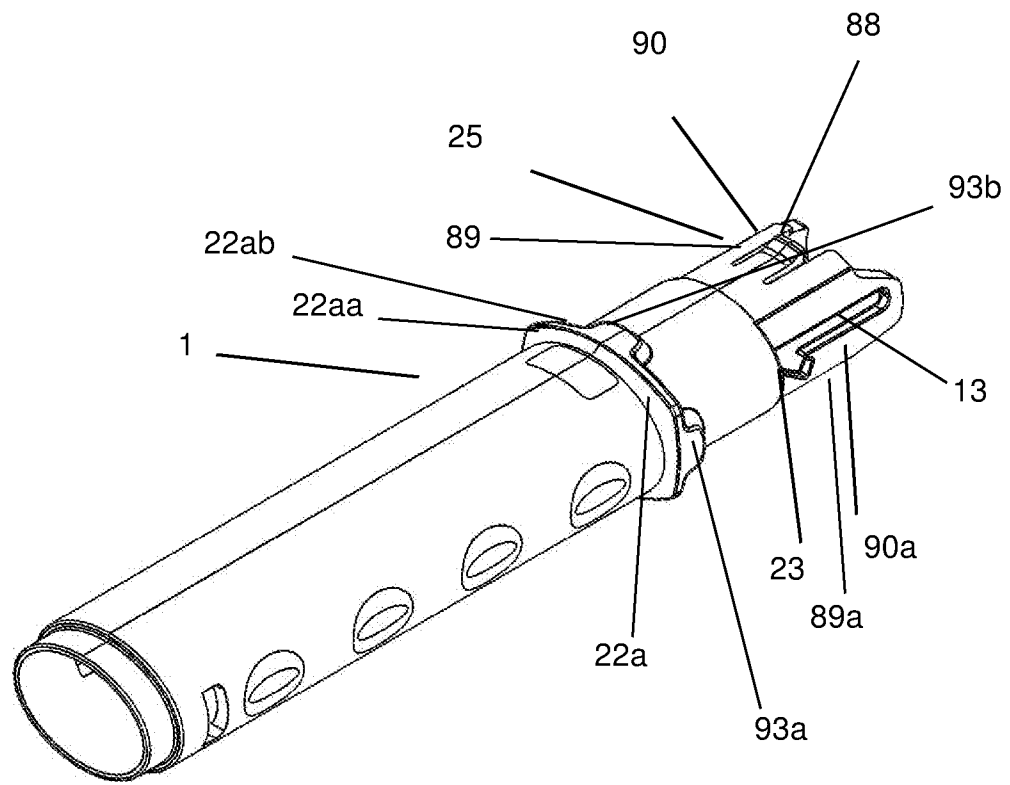


FIGURE 12

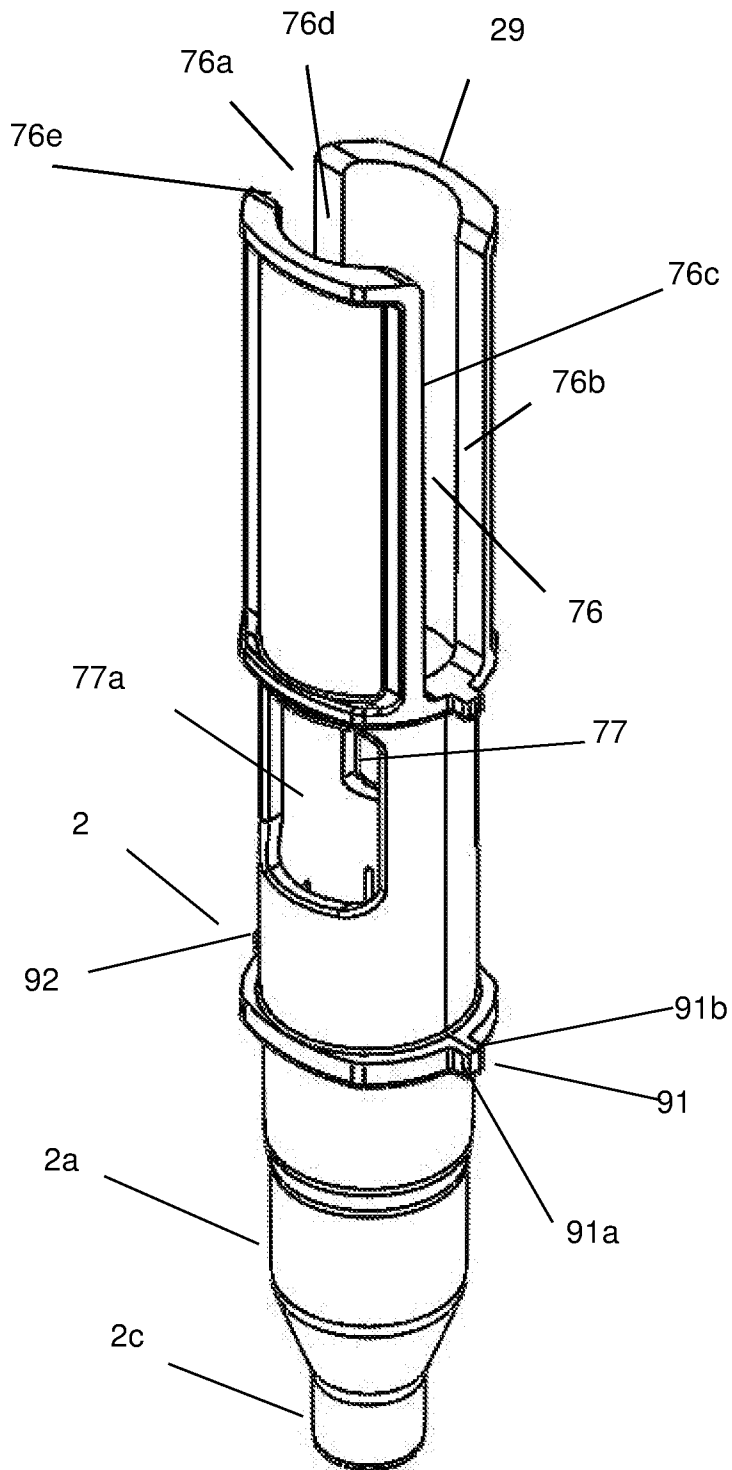


FIGURE 13

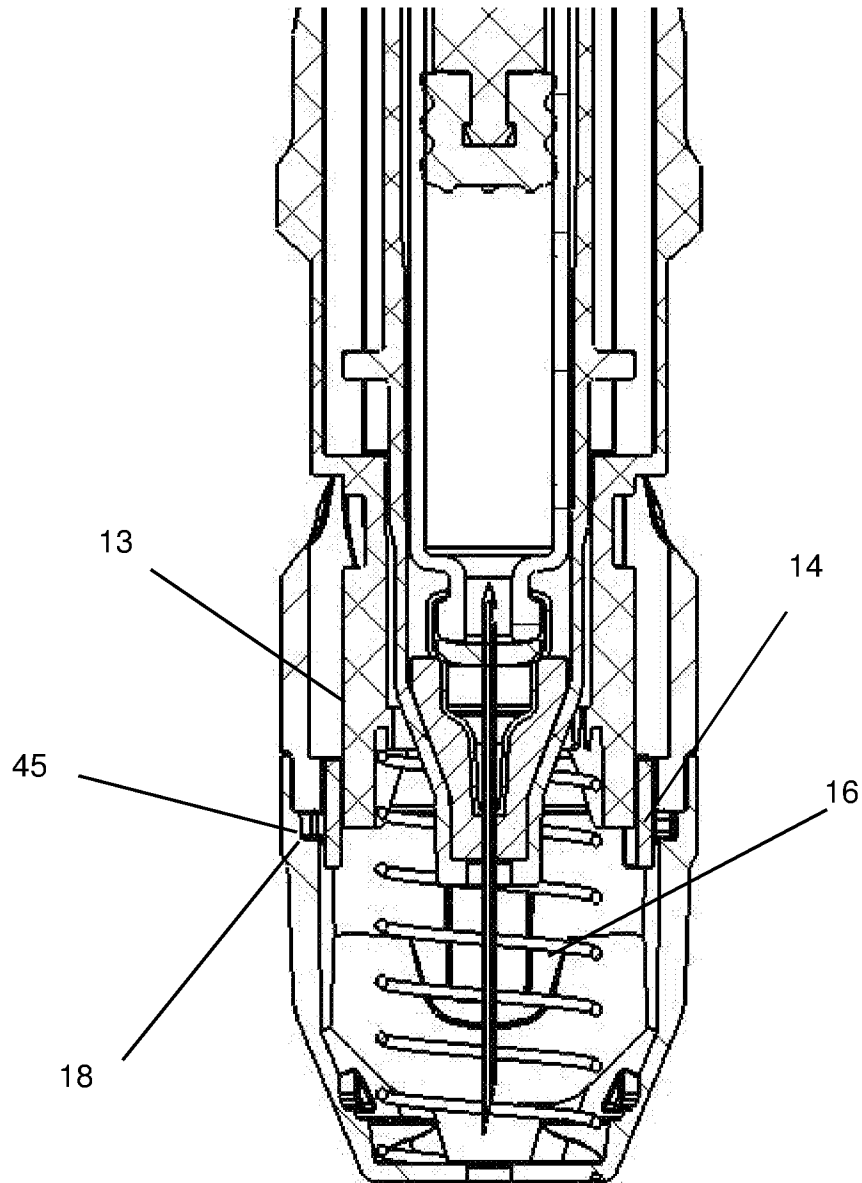


FIGURE 14

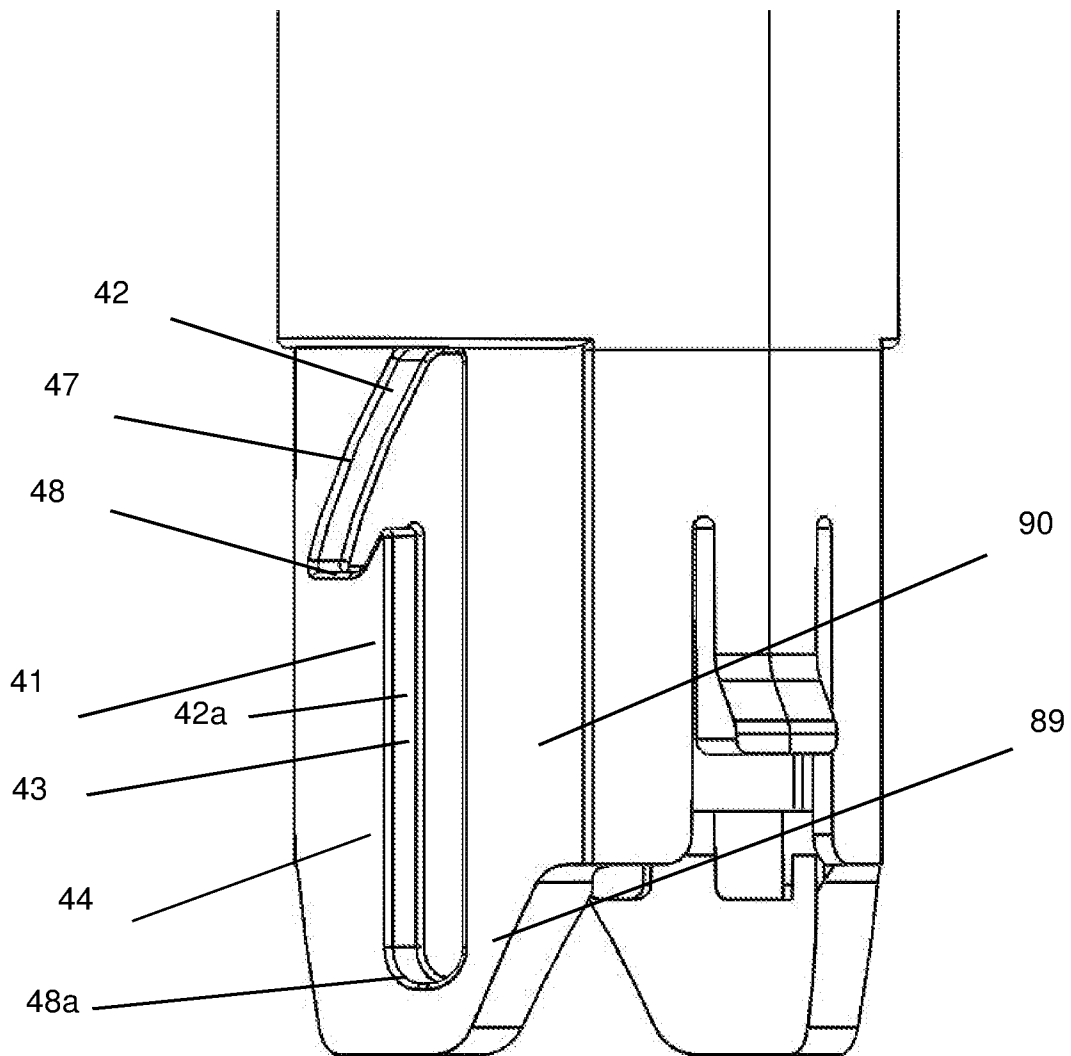


FIGURE 15

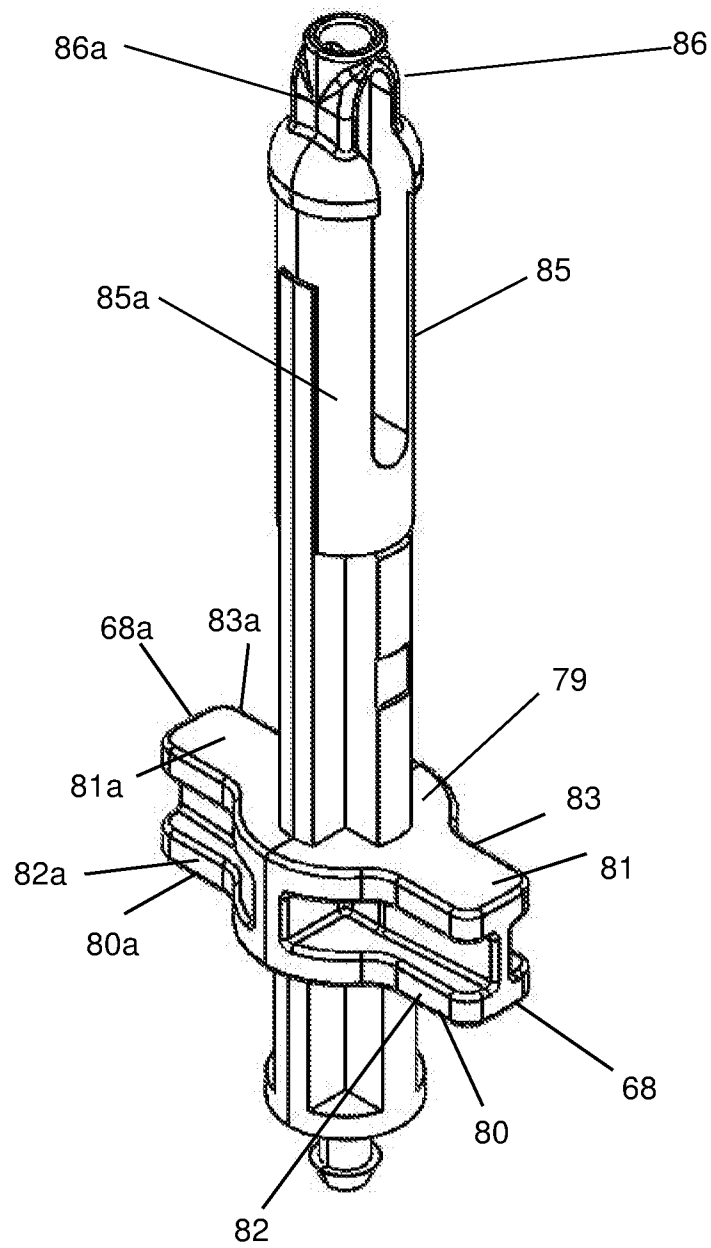


FIGURE 16

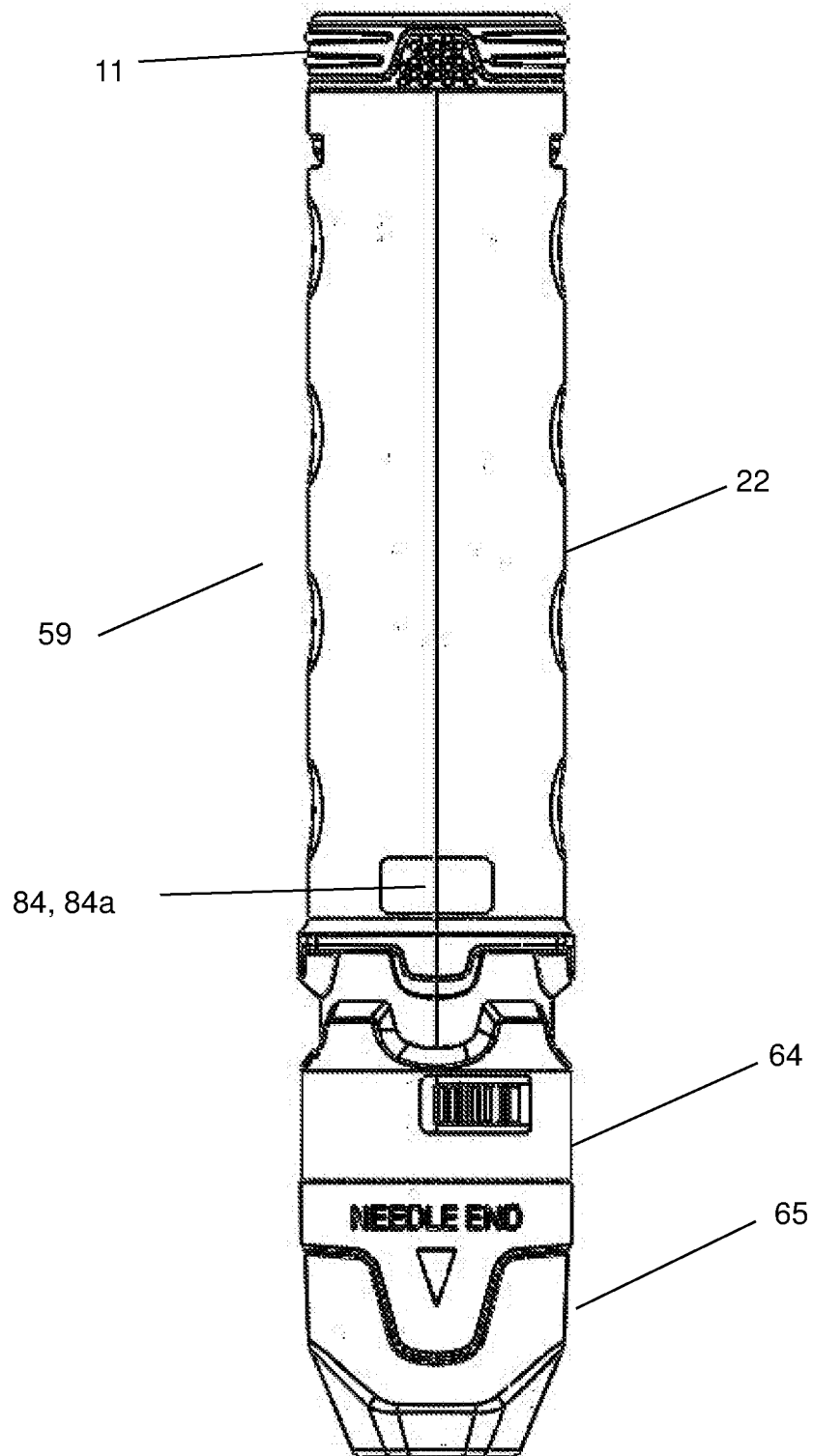


FIGURE 17

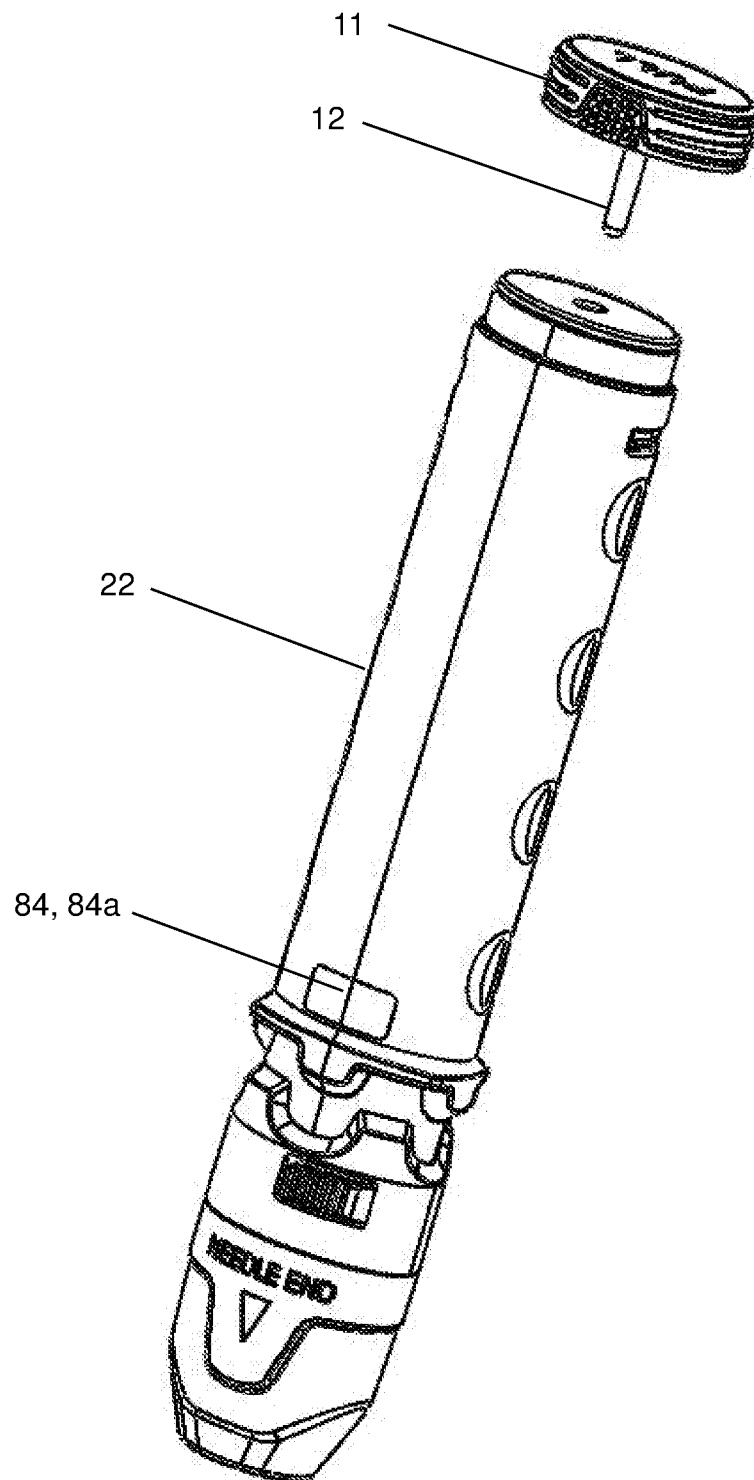


FIGURE 18

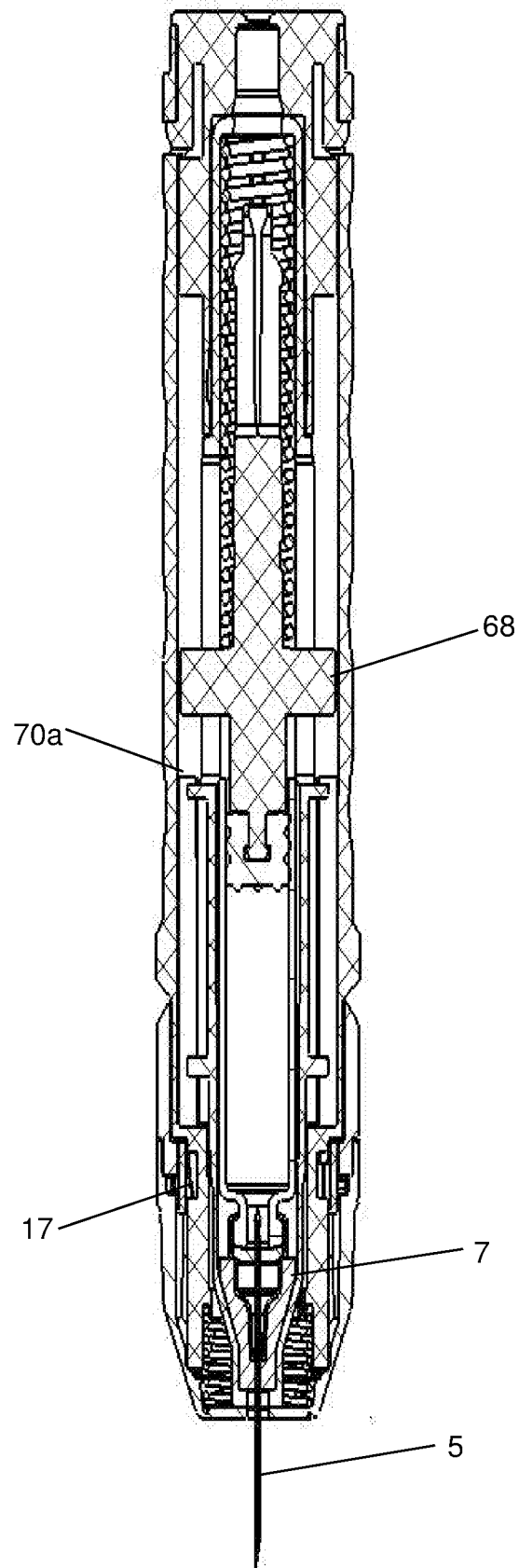


FIGURE 19

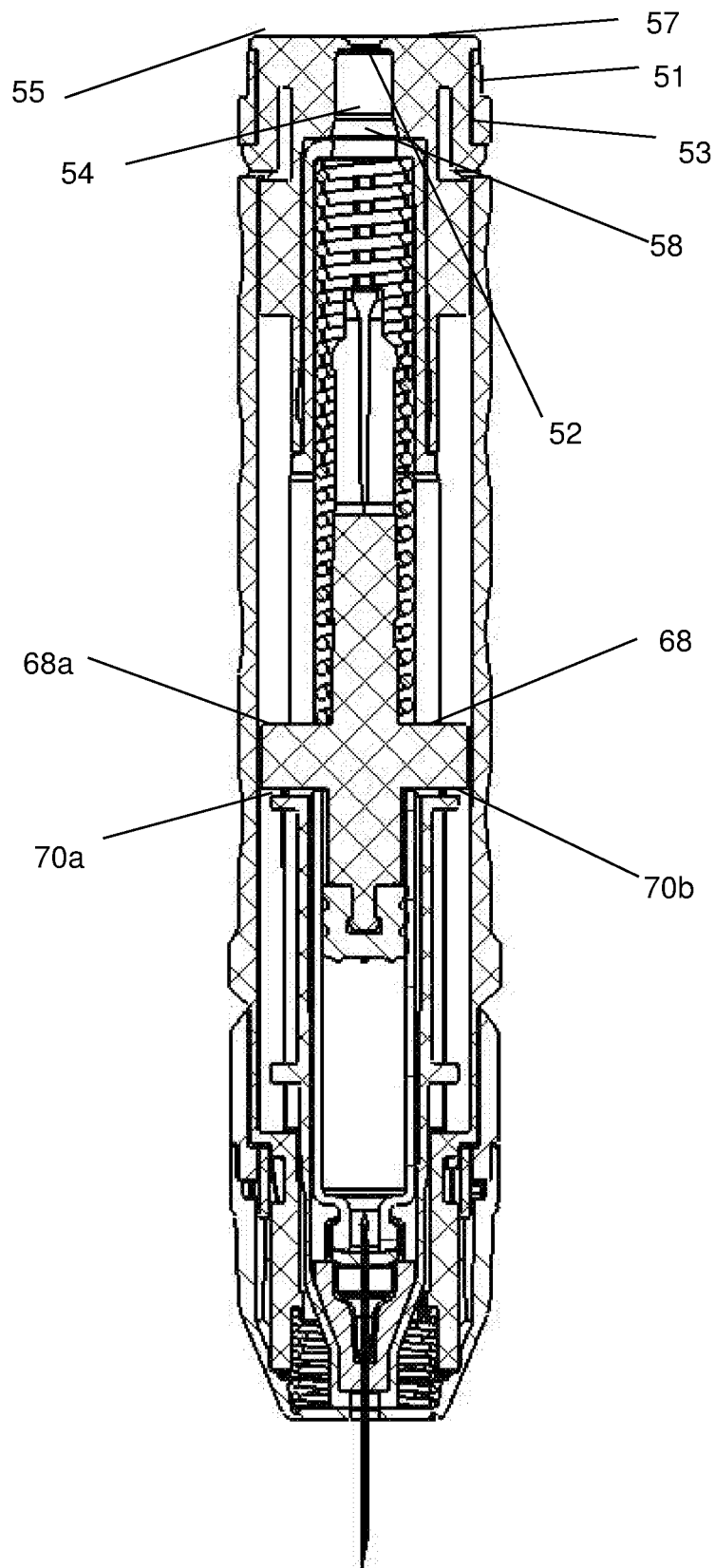


FIGURE 20

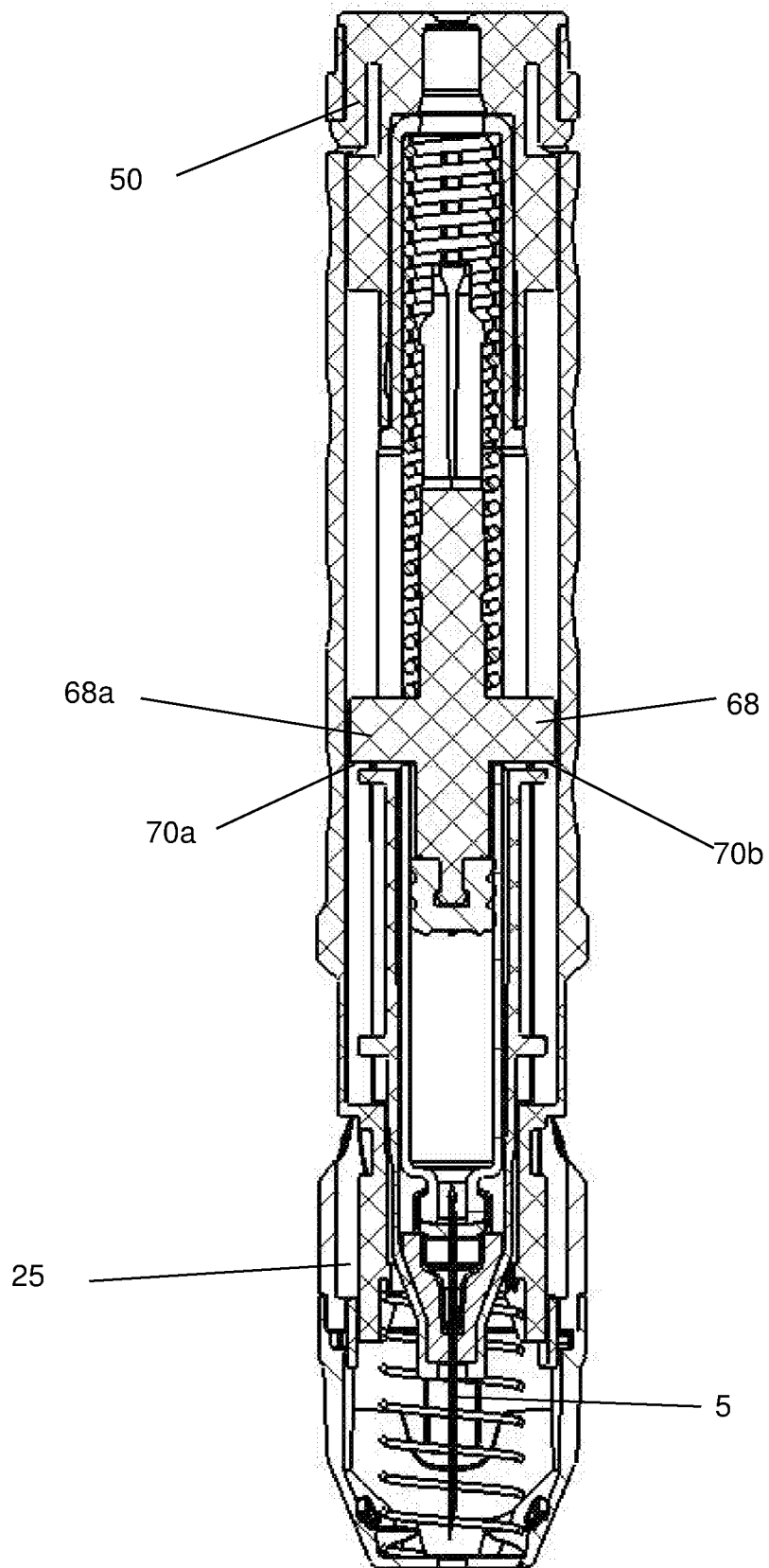


FIGURE 21

INTERNATIONAL SEARCH REPORT

International application No

PCT/IB2018/051057

A. CLASSIFICATION OF SUBJECT MATTER

INV. A61M5/20 A61M5/32
ADD.

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, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 6 767 336 B1 (KAPLAN SHELDON [US]) 27 July 2004 (2004-07-27) cited in the application column 8, line 65 - column 9, line 43 figures 2,3,7,8,13	1-27
Y	----- EP 3 106 193 A1 (GERRESHEIMER REGENSBURG GMBH [DE]; GERRESHEIMER BÜNDE GMBH [DE]) 21 December 2016 (2016-12-21) paragraph [0059] figures 3A,4,5A-5D	1-27
A	----- WO 93/13819 A1 (STI INT LTD [GB]) 22 July 1993 (1993-07-22) page 22, lines 17-31 figures 26,28A-C ----- -/-	1-27



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

17 May 2018

Date of mailing of the international search report

28/05/2018

Name and mailing address of the ISA/

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Fax: (+31-70) 340-3016

Authorized officer

Walther, Manuel

INTERNATIONAL SEARCH REPORT

International application No

PCT/IB2018/051057

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 2006/189933 A1 (ALHEIDT TOM [US] ET AL) 24 August 2006 (2006-08-24) figures 12-15 -----	1-27
A	WO 2016/193349 A1 (SANOFI AVENTIS DEUTSCHLAND [DE]) 8 December 2016 (2016-12-08) page 11, lines 15-23 figures 9A-D -----	1-27
A	US 7 449 012 B2 (MERIDIAN MEDICAL TECHNOLOGIES [US]) 11 November 2008 (2008-11-11) cited in the application figure 5 -----	1-27

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IB2018/051057

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