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(54) Title: AUTO INJECTOR WITH CASSETTE

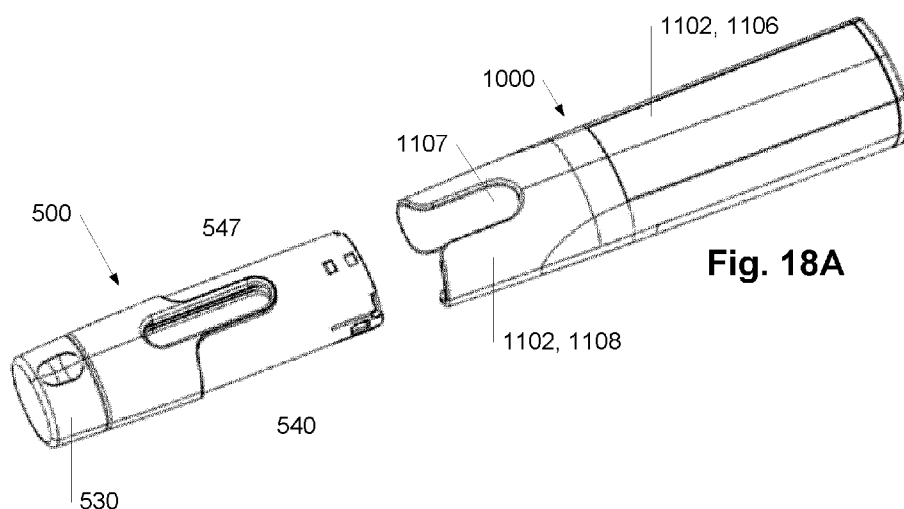


Fig. 18A

(57) Abstract: The invention also relates to an improved auto injector adapted for receiving a cassette with medicament and for administering the medicament in the cassette to a patient, the auto injector extending from a proximal end to a distal end along a longitudinal axis, wherein the cassette is removably received in the auto injector along the longitudinal direction.



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Auto injector with cassette

The invention relates to an improved cassette and auto injector system.

Background

5 Auto injectors for the delivery of medicament to a patient comes in many varieties depending on the type of medicament, which is to be delivered to the patient. Assembling of the auto injector and cassette to obtain a good fit between the two parts is often only ensured if the two parts are aligned in a specific manner. The same applies of the assembly of the individual parts in the cassette and the auto injector.

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If the auto injector is a re-usable item into which a cassette is inserted, the user needs to ensure that all operational parts stay full functional in order to prolong the lifetime of the auto injector.

15 **Summary**

Throughout this description, all references to the proximal direction or proximal surfaces refer to parts, surfaces and similar oriented in the direction of insertion, i.e. in the direction of the insertion needle and the outer part of the auto injector touching the skin during injection of the medicament. Movement of parts in a proximal direction and/or proximally refers to a movement in the direction of the insertion needle and the outer part of the auto injector touching the skin during injection of the medicament.

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Likewise, all references to the distal direction or distal surfaces refer to parts, surfaces and similar oriented in the direction away from the direction of the insertion needle, i.e. in the direction of the user. Movement of parts in a distal direction and/or distally refers to a movement in the direction away from the insertion needle and the outer part of the auto injector touching the skin during injection of the medicament, i.e. in the direction of the user.

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Disclosed herein in a **first aspect** is an auto injector adapted for receiving a cassette with medicament and for administering the medicament in the cassette to a patient, the auto injector extending from a proximal end to a distal end along a longitudinal axis, wherein the cassette is removably received in the auto injector along the longitudinal direction, wherein the auto injector further comprises one or more cassette interacting parts adapted for securing and locking the cassette inside the auto injector and for facilitating administering of the medicament, wherein the one or more cassette interacting parts are configured for moving in parallel with the longitudinal axis of the auto injector.

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By removable received is meant is meant a disposable cassette, which may be received in a reusable auto injector. The disposable cassette may be a one-time use cassette, or a cassette comprising multiple doses.

- 5 By a movement in parallel with the longitudinal axis of the auto injector it is ensured that a minimum of stress is inflicted on the auto injector. This prolongs the lifetime of the auto injector. Further, a slimmer design is obtainable by the movement of the cassette interacting parts in parallel with the longitudinal axis of the auto injector. As the auto injector and the cassette may be constructed to be interfacing with the auto injector and the cassette sharing
10 the same longitudinal axis, the risk of the cassette getting stuck inside in the injector is mitigated. This helps make the connection as slim as possible, and the auto injector as robust as possible.

Disclosed herein in a **second aspect** is an auto injector adapted for receiving a cassette with medicament and for administering the medicament, wherein the cassette is removable
15 received in the auto injector, wherein the auto injector is consisting of a housing extending from a proximal end to a distal end and a multiple of internal injector parts positioned inside the housing, the housing consisting of:

- a cassette covering section extending to cover at least a part of the cassette when
20 received inside the injector; and
- a distal section extending to cover the internal injector parts inside the housing before the cassette is secured inside the injector.

By cover the internal injector parts is meant to cover the internal injector parts along the
25 longitudinally extending direction of the internal injector parts.

By having two sections, the auto injector can be constructed such that the cassette is interfacing with the auto injector at the proximal end of the internal injector parts with the cassette sharing the same longitudinal axis as the auto injector. This mitigates risk of the
30 cassette getting stuck inside in the injector and also help to make the connection as slim as possible. Also, by the two-sectional construction where there is only a need for the cassette to positioned in the cassette covering section, user access to the internal parts inside the auto injector may be blocked. This also reduces impurities/dust from penetrating into the auto injector internal parts, in turn keeping the auto injector easily clean due to avoidance of
35 grooves to e.g. collect dirt and dust etc. A more robust auto injector is thereby obtained. This prolongs the lifetime of the auto injector.

Disclosed herein in a **third aspect** is an auto injector adapted for receiving a cassette with medicament and for administering the medicament, wherein the auto injector comprises a housing extending from a proximal end to a distal end along a longitudinal direction, the housing comprising:

- 5 • a cassette covering section extending to cover the cassette when received inside the injector; and
- a distal section extending to cover all internal injector parts,

wherein the auto injector comprises a cassette abutting surface adapted for abutting a distal end of the cassette when secured inside the auto injector,

- 10 wherein the cassette abutting surface defines a proximal end plane from where substantially no internal injector parts extends proximally prior to assembling the cassette and the auto injector.

- 15 By cover the internal injector parts is meant to cover the internal injector parts along the longitudinally extending direction of the internal injector parts.

By substantially is included a situation where only a minor part of the internal injector parts protrude a small amount, such as up to 2%, 5%, or 10%, proximally compared to the cassette abutting surface. In some examples no parts protrude proximally.

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By having cassette abutting surface from where substantially no internal injector parts extends proximally prior to assembling the cassette and the auto injector provides a smooth interior and cassette interface, which mitigates risk of the cassette getting stuck inside in the injector. Also, by the cassette abutting surface, user access to the internal parts inside the

25 auto injector may be blocked. This also reduces impurities/dust from penetrating into the auto injector internal parts, in turn keeping the auto injector easily clean due to avoidance of grooves to e.g. collect dirt and dust etc. A more robust auto injector is thereby obtained. In turn, the lifetime of the auto injector is prolonged.

- 30 In one or more examples, the cassette abutting surface defines a proximal end plane from where substantially no cavities extends distally into the distal section.

- In one or more examples, the housing encloses internal injector parts, the internal injector parts including at least a piston, a drive module adapted for moving the piston proximally,
- 35 and a chassis, wherein the internal injector parts are defined by a proximal end plane and a distal end plane, and wherein the auto injector comprises noise reducing material at both the proximal end plane and the distal end plane of the internal parts.

Disclosed herein in a **fourth aspect** is an auto injector adapted for receiving a cassette with medicament and for administering the medicament, wherein the cassette is removable received in the auto injector, wherein the auto injector comprises a housing enclosing
5 internal injector parts, the internal injector parts including at least a piston, a drive module adapted for moving the piston proximally, and a chassis, wherein the internal injector parts are defined by a proximal end plane and a distal end plane, and wherein the auto injector comprises noise reducing material, at both the proximal end plane and the distal end plane of the internal parts.

10 By the noise reducing material, the user experience is improved, as the sounds during use, which may concern a user, is reduced if not eliminated. A first noise reducing material may be positioned between the cassette and the internal injector parts, i.e. the proximal end plane, to dampen noise created when auto injector parts move and come in contact with
15 and/or act on cassette parts. The auto injector housing may also comprise a distal housing end plate against which a second noise reducing material is positioned. Thus, the second noise reducing material may be positioned between the distal end plane of the distal housing end plate. This dampens noise may by primarily distally moving parts in the auto injector and/or the cassette transferring force to the auto injector.

20 In one or more examples, the drive module is further adapted for moving the piston distally. Thus, the drive module may move the piston distally after end delivery of medicament to reset the auto injector making it ready for delivery of a new medicament dose when a new cassette is mounted in the auto injector.

25 In one or more examples, the noise reducing material, is one or more O-rings. Alternatively or complementary, the noise reducing material, is a soft material, such as rubber.

30 In one or more examples, the proximal end plane is extending in a direction perpendicular to the longitudinal direction of the auto injector.

In one or more examples, auto injector comprises one or more cassette interacting parts adapted for securing and fixating the cassette inside the auto injector and for facilitating administration of the medicament, wherein the one or more cassette interacting parts does
35 not extend proximally from the proximal end plane prior to securing the cassette inside the injector.

In one or more examples, the one or more cassette interacting parts are adapted for moving in a proximal direction after a cassette has been positioned in the auto injector, whereby at least a part of one or more of the cassette interacting parts are extending proximally from the proximal end plane inside the auto injector.

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In one or more examples, each of the cassette interacting parts are adapted for moving through the proximal end plane independently of another one of the cassette interacting parts.

10 In one or more examples, one or more cassette interacting parts includes a piston configured for proximal movement of a stopper comprised within the cassette, and one or more injector pins including:

- a first cassette locking pin; and
- a skin sensor pin.

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In one or more examples, one or more cassette interacting parts includes a cassette detection pin. The cassette detection pin may be substituted by other detection means such as a magnetic detection system, e.g. with magnets on cassette and auto injector surfaces coming in contact with each other and a corresponding Hall sensor inside the chassis.

20 Alternatively, the cassette may have a pin, which comes in contact with a surface on the injector, whereby detection of the cassette is registered in the auto injector.

In one or more examples, the one or more injector pins further include a second cassette locking pin. The term 'first' and 'second' cassette locking pin is only meant to symbolise the presence of two pins. The pins may perform the same operation depending on the orientation of the cassette when inserted into the auto injector. Thus, both pins may e.g. function to lock the cassette into the auto injector, and/or to release cassette parts enabling delivery of medicament and/or for locking cassette parts relative to each other after delivery of medicament e.g. to prevent access to an injection needle after delivery of medicament. If the auto injector is designed to allow insertion of a cassette only if it is orientated in a specific manner, fewer pins are needed. If the auto injector is designed to allow insertion of a cassette when orientated in a multiple manners compared to the auto injector, additional pins are normally needed. The pins may be arranged in a mirror image configuration allowing for insertion of the cassette when turning it 180 degrees around.

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In one or more examples, the auto injector comprises a chassis with a proximal chassis part at a proximal end of the chassis. The proximal chassis part is normally perpendicular to the

longitudinal direction of the auto injector. The proximal chassis part may be a plate having a circular shape, an elliptical shape, a square shape, a square shape with round corners, or similar. The proximal chassis part may be symmetrical around at least one mirror-image plane.

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In one or more examples, the proximal chassis part comprises one or more openings adapted for allowing passage of an injector pin or the piston through each opening after or during securing of the cassette inside the auto injector. The proximal chassis part may further comprises an opening having a U-shape adapted for limiting movement of any cassette parts distally past the proximal end plane. By U-shaped is also included a U with sharp corners.

10

In one or more examples, one or more openings comprises:

- a piston opening for allowing passage of the auto injector piston there through;
- a first pin opening for allowing passage of the first cassette locking pin there through;
- a third pin opening for allowing passage of the skin sensor pin of the auto injector there through.

15

In one or more examples, the one or more openings further comprises a second pin opening for allowing passage of a first cassette skin sensor pin comprised in the cassette. The second pin opening may be a U-shaped opening with an end surface limiting the distal movement of the first cassette sensor pin and thereby the cassette skin sensor inside the auto injector.

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In one or more examples, the one or more openings further comprises a fourth pin opening for allowing passage of the second cassette locking pin there through. As described above, the definition of 'first' and 'second' locking pin may depend and be defined by the orientation of the cassette, when the cassette is inserted into the au injector.

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In one or more examples, the one or more openings further comprises a fifth opening for allowing passage of the cassette detection pin there through. The cassette detection pin may be substituted by an alternative cassette detection system and the need for the fifth opening eliminated.

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In one or more examples, the auto injector comprises a drive module adapted for moving the piston in a proximal direction along the longitudinal axis. The drive module may further be adapted for moving the piston in a distal direction along the longitudinal axis

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In one or more examples, drive module is further configured for moving the first cassette locking pin, and/or the skin sensor pin, and/or the second cassette locking pin in the proximal direction along the longitudinal axis. Further, the first cassette locking pin and the second
5 cassette locking pin may be locked to the piston such that the piston and the cassette locking pins move together along the longitudinal axis.

Disclosed herein in a **sixth aspect** is a system comprising a cassette with medicament and an auto injector for administering the medicament, wherein the cassette is removable
10 received in the auto injector,
wherein the auto injector comprises a housing extending from a proximal end to a distal end along a longitudinal axis, the housing comprising a cassette covering section covering the cassette when received inside the injector, the cassette covering section comprising at least one opening extending in the longitudinal direction of the housing;
15 wherein the cassette extends from a proximal end to a distal end along a longitudinal axis and comprising a cassette housing enclosing at least:

- a syringe compartment containing the medicament and adapted to be in connection with a needle for delivery of the medicament;
- a stopper movable from a distal position to a proximal position inside the syringe
20 compartment for emptying the syringe compartment;

wherein the cassette housing comprises at least one opening extending along a longitudinal axis of the cassette housing;
wherein the opening in the cassette housing and the opening in the cassette covering section are aligned when the cassette is positioned inside auto injector to facilitate inspection
25 of the medicament in the syringe compartment.

By opening is also included an opening covered by a see-through material, i.e. a window type opening. The opening allows for easy inspection of the medicament. Further, the aligned openings allows for a user friendly assembly and guidance of the cassette into the
30 auto injector.

In one or more examples, the cassette covering section and the cassette housing each comprise two openings, extending in the longitudinal direction on opposite sides of the housing and the cassette housing, respectively, wherein the openings, are aligned when the
35 cassette is positioned inside auto injector to facilitate inspection of the medicament in the syringe compartment from two opposite directions. The openings may be formed as U-shaped openings extending into the housing. This allows a user to see through the entire

device, thereby enabling more light to shine through the syringe compartment to provide a better view of possible miscolouring and possibly particulates in the drug contained within syringe compartment.

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In one or more examples, the cassette covering section comprises interior guiding tracks in parallel with the longitudinal direction configured for guiding the cassette to a correct position when inserting the cassette into the cassette covering section. An easy guiding of the cassette inside the auto injector is ensuring correct positioning inside the injector.

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In one or more examples, the cassette covering section comprises interior guiding tracks in parallel with the longitudinal direction.

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In one or more examples, the interior guiding tracks forms part of the one or more openings inside the cassette covering section of auto injector housing.

The cassette receiving chassis, the piston, and the drive module are comprised inside the housing of the auto injector. The cassette is removable received in the auto injector.

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Disclosed herein in a **fifth aspect** is a system comprising an auto injector according to any of the above aspects and a cassette comprising:

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- a syringe compartment containing the medicament and extending from a proximal end to a distal end, wherein the proximal end is adapted for being in connection with a needle through which the medicament is allowed to exit the syringe compartment;
- a stopper movable from a distal position to a proximal position inside the syringe compartment by means of a piston in the auto injector moving the stopper proximally for emptying the syringe compartment; and
- a syringe holder extending around at least part of the syringe compartment.

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The needle may be a hollow needle in fluid connection with the proximal end of the syringe compartment and connected to the syringe as part of the syringe. Alternatively, a luer lock needle may be connected to the syringe prior to injection of medicament. As yet a further alternative, a syringe system with a syringe terminated with a stopper at its distal end and a rubber septum at its proximal end, where a penetrating needle at a distal end pierces the septum when mounted onto the syringe while a proximal needle end penetrates into the patient skin.

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In one or more examples, the cassette further comprises a hollow needle in fluid connection with the proximal end of the syringe compartment. Further, the cassette may comprise a rigid needle shield connected to the proximal end of the syringe compartment and adapted for covering a hollow needle. The hollow needle may be part of the cassette or be connected to the syringe in the cassette prior to medicament delivery. The latter may be the case if a luer lock or a needle system penetrating a septum in the syringe when connected to the cassette as described above.

In one or more examples, the cassette further comprises a cassette cap, and a cassette skin sensor. In one or more examples, the cassette cap comprises a first part positioned between the rigid needle shield and the proximal end of the syringe compartment. The first part could alternatively have a 'hook' with sharp edges, which carve into the side of the rigid needle shield instead of at the distal end of it. Other alternatives may also be possible.

The cassette may thus comprise:

- a syringe compartment containing the medicament and extending from a proximal end to a distal end;
- a hollow needle in fluid connection with the proximal end of the syringe compartment;
- a rigid needle shield connected to the proximal end of the syringe compartment and covering the hollow needle;
- a stopper movable from a distal position to a proximal position inside the syringe compartment by means of the piston moving the stopper proximally for emptying the syringe compartment;
- a syringe holder extending around at least part of the syringe compartment;
- a cassette cap having a first part positioned between the rigid needle shield and the proximal end of the syringe compartment, and
- a cassette skin sensor.

In one or more examples, the syringe compartment, the hollow needle and the stopper is part of a syringe. The syringe may be fixed inside the syringe holder, at a distal end of the syringe.

In one or more examples, the cassette is interfacing with the auto injector at the distal end of the cassette sharing the same longitudinal axis. This mitigates risk of the cassette getting stuck inside in the injector and also help to make the connection as slim as possible.

In one or more examples, the cassette is adapted for being received in the auto injector by movement of the cassette and the auto injector towards each other along a shared longitudinal axis without significant rotation of the cassette around the shared longitudinal axis.

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In one or more examples, when the drive module moves the first cassette locking pin proximally, the cassette is locked in auto injector. The second cassette locking pin may in addition or alternatively lock the cassette in the auto injector by proximal movement of the second cassette locking pin. The cassette locking pins may move simultaneously or individually. The cassette locking pins may also move together with the piston by e.g. locking/connecting the three pins together.

10

In one or more examples, when the drive module moves the first cassette locking pin further in the proximal direction, the cassette skin sensor is adapted for being distally unlocked from the syringe holder allowing for distal movement of the cassette skin sensor. The second cassette locking pin may in addition or alternatively unlock the syringe holder by further proximal movement of the second cassette locking pin. The cassette locking pins may move simultaneously or individually. The cassette locking pins may also move together with the piston by e.g. locking/connecting the three pins together. Thus, when the drive module moves the second cassette locking pin further in the proximal direction, the cassette skin sensor may be adapted for being proximally unlocked from the syringe holder allowing for proximal movement of the cassette skin sensor relative to the syringe holder.

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In one or more examples, when the drive module moves the piston proximally, the second cassette locking pin is adapted for also unlocking for movement of the cassette skin sensor.

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In one or more examples, the system according further comprising a skin sensor spring system adapted for pushing the skin sensor pin of auto injector against a second cassette skin sensor pin at least after release of the cassette skin sensor from the syringe holder by movement of the first cassette locking pin and/or the second cassette locking pin in a proximal direction.

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In one or more examples, the skin sensor spring system is adapted for pushing the cassette skin sensor in a proximal direction into a locked position preventing movement of the cassette skin sensor in a distal direction. This ensures that the needle is not exposed after end delivery of medicament. The cassette skin sensor may be pushed into a locked position preventing distal movement of the cassette skin sensor. The distal locking may be facilitated

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by a cassette skin sensor arm, where a locking surface of the cassette skin sensor arm locks into an inner opening in the cassette housing. Proximal movement of the cassette skin sensor may also be prevented, e.g. by an additional set of housing-skin sensor surfaces.

- 5 In one or more examples, the syringe holder comprises a syringe holder support tube, which supports the syringe compartment.

In one or more examples, the cassette skin sensor covers at least part of the syringe holder, such as the majority of the syringe holder.

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In one or more examples, the cassette skin sensor comprises at least a first skin sensor pin and/or a second skin sensor pin extending from the distal end of the cassette skin sensor.

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In one or more examples, the syringe holder comprises one or more openings selected from the group of:

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- a first pin opening for allowing passage of a first cassette locking pin of the auto injector there through;
- a second pin opening for allowing passage of the first cassette skin sensor pin;
- a third pin opening for allowing passage of a skin sensor pin of the auto injector, and/or the second cassette skin sensor pin there through;
- a fourth pin opening for allowing passage of a second cassette locking pin of the auto injector there through;
- a piston opening for allowing passage of the auto injector piston there through.

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In one or more examples, the syringe holder comprises a syringe holder plate, wherein the piston opening and/or one or more of the pin openings are positioned in the syringe holder plate.

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In one or more examples, the syringe holder comprises a first syringe holder arm extending in a proximal direction from the syringe holder plate.

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In one or more examples, the first syringe holder arm comprises a proximal surface, and wherein the cassette skin sensor comprises a first locking protrusion engaging with the proximal surface, wherein the engagement of the first locking protrusion and the proximal surface prevents movement of the cassette skin sensor towards the syringe holder.

In one or more examples, the first syringe holder arm is flexibly connected to the syringe holder plate.

5 In one or more examples, the first syringe holder arm is deflectable by proximal movement of the first cassette locking pin of the auto injector through the first pin opening in the syringe holder, wherein the deflection of the first syringe holder arm releases the cassette skin sensor allowing it to move towards the syringe holder.

10 In one or more examples, upon movement of the cassette skin sensor towards the syringe holder:

- the first cassette skin sensor pin is brought into / extends through the second pin opening in the syringe holder, and
- the second cassette skin sensor pin is brought into / extends through the third pin opening in the syringe holder.

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In one or more examples, the syringe holder comprises a second syringe holder arm extending in a proximal direction from the syringe holder plate.

20 In one or more examples, the second syringe holder arm comprises a distal surface, and wherein the cassette skin sensor comprises a second locking protrusion against which the distal surface is resting, wherein the engagement of the second locking protrusion and the distal surface prevents movement of the cassette skin sensor away from the syringe holder.

25 In one or more examples, the second syringe holder arm is flexibly connected to the syringe holder plate.

30 In one or more examples, the second syringe holder arm is deflectable by proximal movement of the second cassette locking pin of the auto injector through the fourth pin opening in the syringe holder, wherein the deflection of the second syringe holder arm allows the cassette skin sensor it to move away from the syringe holder.

In one or more examples, the syringe holder further comprises one or more syringe locking protrusions locking the syringe in the cassette.

35 In one or more examples, the syringe holder and thereby the cassette is locked to the auto injector housing when the cassette is positioned in the auto injector.

In one or more examples, the syringe holder and the skin sensor are longitudinally movable relative to each other upon release of the skin sensor from the syringe holder.

5 In one or more examples, the cassette further comprises a cassette housing extending from a proximal to a distal end, the cassette housing enclosing at least the syringe holder and the cassette skin sensor.

10 In one or more examples, the cassette housing comprises one or more locking openings at the distal end into which the one or more syringe holder locking protrusions on the syringe holder locks syringe holder to the cassette housing.

In one or more examples, the cassette housing comprises one or more internal protruding rails inside the cassette housing for guiding the skin sensor inside the cassette housing.

15 In one or more examples, the cassette housing comprises a distal end surface with a skin sensor housing opening through which the cassette skin sensor extends.

In one or more examples, the cassette housing is oval.

20 In one or more examples, the cassette cap comprises an inner rigid needle shield tube with the first part and an outer an outer rigid needle shield tube, wherein:

- the outer rigid needle shield tube surrounds the inner rigid needle shield tube, and
- the inner rigid needle shield tube surrounds the rigid needle shield.

25 In one or more examples, the outer rigid needle shield tube abuts the distal end surface of the cassette housing, and wherein the proximal end of the cassette skin sensor is positioned between the inner rigid needle shield tube and the outer rigid needle shield tube.

30 In one or more examples, the cassette cap is removable from the syringe compartment, and wherein when the cassette cap is removed, the rigid needle shield follows with it, whereby the hollow needle is exposed.

In one or more examples, the cassette cap is an elongated tube positioned between the syringe and the cassette skin sensor.

35 In one or more examples, the cassette cap comprises at least one holder pin extending from a distal end of the cassette cap.

In one or more examples upon proximal movement of a cassette cap pin in the auto injector abutting the at least one holder pin, the cassette cap and thereby also the rigid needle shield is pushed proximally for release of the rigid needle shield.

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In one or more examples, the cassette covering section comprises at least one opening extending in the longitudinal direction of the housing, wherein the cassette housing comprises at least one opening extending along a longitudinal axis of the cassette housing, wherein the at least one opening in the cassette housing and the at least one opening in the cassette covering section are aligned when the cassette is positioned inside auto injector to facilitate inspection of the medicament in the syringe compartment. By opening is also included an opening covered by a see-through material, i.e. a window type opening.

10

In one or more examples, the cassette covering section and the cassette housing each comprise two openings, extending in the longitudinal direction on opposite sides of the housing and the cassette housing, respectively, wherein the openings, are aligned when the cassette is positioned inside auto injector to facilitate inspection of the medicament in the syringe compartment from two opposite directions. The openings may be formed as U-shaped openings extending into the housing. This allows a user to see through the entire device, thereby enabling more light to shine through the syringe compartment to provide a better view of possible miscolouring and possibly particulates in the drug contained within syringe compartment.

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In one or more examples, the cassette and auto injector housing have cross sectional planes perpendicular to the longitudinal axis of the cassette housing and the auto injector housing, wherein the cross sectional planes are non-circular in shape, such as oval or square in shape. By cross sectional planes are meant planes perpendicular to the longitudinal axis. The oval shape includes cross-sectional planes where two perpendicular radius differs by at least 10% such as 20% such as 30%. Max 50%

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In one or more examples, the cassette covering section comprises interior guiding tracks in parallel with the longitudinal direction configured for guiding the cassette to a correct position when inserting the cassette into the cassette covering section. Easy guiding of the cassette inside auto injector ensuring correct positioning inside the injector.

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In one or more examples, the interior guiding tracks forms part of the openings inside the cassette covering section of auto injector housing.

In one or more examples, the cassette receiving chassis is a cassette receiving chassis extending from a proximal end to a distal end, wherein the proximal end of the chassis comprises a proximal chassis part with one or more openings selected from the group of:

- 5 • a piston opening for allowing passage of the auto injector piston there through;
- a first pin opening for allowing passage of the first cassette locking pin there through;
- a second pin opening for allowing passage of the first cassette skin sensor pin;
- 10 • a third pin opening for allowing passage of:
 - the skin sensor pin of the auto injector, and/or
 - the second cassette skin sensor pinthere through;
- a fourth pin opening for allowing passage of the second cassette locking pin there through;
- 15 • a fifth opening for allowing passage of the cassette detection pin there through.

In one or more examples, the second pin opening is a well-shaped opening with an end surface limiting the distal movement of the first cassette sensor pin and thereby the cassette skin sensor inside the auto injector.

20

In one or more examples, drive module is further configured for moving the first cassette locking pin, the skin sensor pin, the second cassette locking pin, and the cassette detection pin proximally.

- 25 In one or more examples, when the drive module moves the first cassette locking pin proximally, the cassette skin sensor is distally unlocked from the syringe holder allowing for distal movement of the cassette skin sensor, wherein the unlocking of the cassette skin sensor locks the cassette in the auto injector.

- 30 In one or more examples, when the drive module moves the piston proximally for delivery of medicament, the second cassette locking pin is also unlocked for movement of the cassette skin sensor proximally after delivery of medicament and/or removal of the auto injector from the patient's skin.

- 35 In one or more examples, the auto injector further comprising a skin sensor spring system pushing the skin sensor pin of the auto injector against the second cassette skin sensor pin

at least after release of the cassette skin sensor from the syringe holder by proximal movement of the first cassette locking pin and the second cassette locking pin.

5 In one or more examples, the skin sensor spring system pushes the cassette skin sensor proximally in a locked position preventing distal movement of the cassette skin sensor.

In one or more examples, the housing is in one piece with a proximal opening for receiving the cassette.

10 Disclosed herein in a **seventh aspect** is a method for assembling a cassette for use in an auto injector, the method comprising:

- assembling an outer cassette part comprising a cassette housing and a cassette cap by connecting a proximal end of the cassette housing to a distal end of the cassette cap;
- 15 • inserting a proximal end of an inner cassette part into a distal end of the outer cassette part and pushing the inner cassette part into the outer cassette part such that the majority of the inner cassette part is covered by the outer cassette part.

20 The method allows for very easy assembly of the cassette, which may be unscaled and atomized. Also, the method allows for assembly of the cassette at one location from where the cassette can be shipped to a different location for a subsequent step of inserting a syringe into the cassette. This allows the cassette to be used with a variety of syringes containing different medicament.

25 In one or more examples, the inner cassette part comprises a comprising a syringe holder. In one or more examples, the method is further comprising assembling the inner cassette part comprising the syringe holder and a cassette skin sensor by inserting a proximal end of the syringe holder into a distal end of the cassette skin sensor and pushing the syringe holder into the cassette skin sensor such that a part of the syringe holder is covered by the cassette skin sensor. Assembling of the outer cassette part and inner cassette part may be performed
30 simultaneously or in random order.

In one or more examples, the part of the syringe holder covered by the cassette skin sensor constitutes at least 10%, such as at least 20%, such as at least 30%, such as at least 40%,
35 such as at least 50%.

5 In one or more examples, the cassette cap is extending from the distal end to a proximal end along a longitudinal axis, wherein the method further comprises positioning the cassette cap in a first mount with the longitudinal axis positioned in an upwards direction such that the distal end is positioned above the proximal end prior to the assembling of the outer cassette part.

In one or more examples, the cassette cap is maintained positioned in the position in the first mount while assembling the outer cassette part.

10 In one or more examples, the cassette skin sensor is extending from the distal end to a proximal end along a longitudinal axis, wherein the method further comprises comprising positioning the cassette skin sensor in a second mount with the distal end in an upwards direction such that the distal end is positioned above the proximal end prior to the assembling of the inner cassette part.

15 In one or more examples, the cassette skin sensor is maintained positioned in the second mount while assembling the inner cassette part.

20 In one or more examples, the inner cassette part is inserted into the outer cassette part while the outer cassette part is positioned in the first mount. The first and second mount may be an integrate mount or separate mounts. The first mount may e.g. by a first part of a mount and the second mount a second part of the same mount. By using mounts, a large batch of parts can be assembled at once.

25 The cassette housing may be extending from a distal end to the proximal end along a longitudinal axis. The method may also include positioning the cassette housing in an upwards direction such that the proximal end is positioned above the distal end prior to the assembling of the outer cassette part, and flipping the cassette housing around to have the distal end point in the upwards for assembling of the cassette housing and the cassette cap.

30 In one or more examples, the syringe holder comprises one or more syringe locking protrusions, wherein the method further comprises fixating a syringe inside the inner cassette part by inserting a proximal end of the syringe into the distal end of the inner cassette part, pushing the syringe into the inner cassette part, and moving the one or more syringe locking protrusions to lock the syringe inside the inner cassette. If the cassette housing is without the cassette locking protrusions, the syringe may be fixed in the syringe holder be frictional force.

35

In one or more examples, syringe extends from a proximal end to a distal end and comprises:

- 5 ○ a syringe compartment containing medicament, and extending from a proximal end to a distal end, wherein the proximal end is adapted for being in connection with a needle through which the medicament is allowed to exit the syringe compartment;
 - a stopper adapted for being moved from a distal position to a proximal position inside the syringe compartment.
- 10 The needle may be a hollow needle in fluid connection with the proximal end of the syringe compartment and connected to the syringe as part of the syringe. Alternatively, a luer lock needle may be connected to the syringe prior to injection of medicament. As yet a further alternative, a syringe system with a cartridge terminated with a stopper at its distal end and a rubber septum at its proximal end, where a penetrating needle at a distal end pierces the
- 15 septum when mounted onto the cartridge while a proximal needle end penetrates into the patient skin.

In one or more examples, the syringe further comprises a hollow needle in fluid connection with the proximal end of the syringe compartment. The syringe may also comprise a rigid

20 needle shield connected to the proximal end of the syringe compartment and adapted for covering the hollow needle. The hollow needle may be part of the cassette or be connected to the syringe in the cassette prior to medicament delivery. The latter may be the case if a luer lock or a needle system penetrating a septum in the syringe when connected to the cassette as described above.

25 The syringe may in this example for example be a 2.25 ml syringe.

In one or more examples, the method further comprises inserting a proximal end of a cassette sleeve into the distal end of the syringe holder and pushing the cassette sleeve into

30 the syringe holder such that the majority of the cassette sleeve is covered by the syringe holder prior to or directly after inserting the syringe holder into the cassette skin sensor, the cassette sleeve thereby constituting a part of the inner cassette part.

In one or more examples, the cassette sleeve comprises proximal extending deflectable

35 sleeve arms.

In one or more examples, the syringe comprises the hollow needle, and a rigid needle shield, wherein the deflectable sleeve arms deflects into openings in the syringe holder and cassette skin sensor when the syringe is inserted into the inner cassette part allowing the rigid needle shield to pass the deflectable sleeve arms.

5

In one or more examples, the deflectable sleeve arms relax into a position between the rigid needle shield and the syringe compartment after the rigid needle shield has passed the deflectable sleeve arms.

- 10 In one or more examples, after the deflectable sleeve arms has relaxed into a position between the rigid needle shield and the syringe compartment, and the syringe is pushed further proximally before locking it to the cassette, the cassette sleeve rotates into a position from where the sleeve arms cannot deflect. The cassette sleeve may comprises at least one sleeve locking protrusion coming in contact with at least one inner helical surface part inside
- 15 the syringe holder when the syringe is pushed proximally. The helical shape of the at least one inner helical surface part forces the cassette sleeve to rotate. The rotation may be between 70-110 degrees, such as 80-100 degrees, such as 85-95 degrees, such as approximately 90 degrees.

- 20 In one or more examples, the rotation of the cassette sleeve rotates it into a position allowing a viewer to view the medicament inside the syringe.

In one or more examples, the syringe is inserted in the inner cassette part while the outer cassette part assembled with the inner cassette part is positioned in the first mount.

25

The cassette cap may comprise a first part positioned between the rigid needle shield and the proximal end of the syringe compartment when the syringe is positioned inside the inner cassette part, and an inner rigid needle shield tube with the first part and an outer rigid needle shield tube, wherein the outer rigid needle shield tube surrounds the inner rigid

30 needle shield tube, and the inner rigid needle shield tube surrounds the rigid needle shield.

The first part of the cassette cap may extend inside the cassette housing opening when the outer cassette part is assembled.

- 35 Any of the above features described in conjunction with a particular aspect/example is not limited to that aspect/example and can be practiced in any other examples even if not so illustrated, or if not so explicitly described.

Brief description of the drawings

Various examples are described hereinafter with reference to the figures. Like reference numerals refer to like elements throughout. Like elements will, thus, not be described in
5 detail with respect to the description of each figure. It should also be noted that the figures are only intended to facilitate the description of the examples. They are not intended as an exhaustive description of the claimed invention or as a limitation on the scope of the claimed invention. In addition, an illustrated example needs not have all the aspects or advantages shown. An aspect or an advantage described in conjunction with a particular example is not
10 necessarily limited to that example and can be practiced in any other examples even if not so illustrated, or if not so explicitly described.

Figure 1A shows an example of a cassette in an exploded view, and figures 1B-C show a
15 close-up of a syringe holder in the cassette in figure 1A seen from two different directions.

Figure 2 shows a cut-through of the assembled cassette of figure 1A.

Figure 3 shows an example of an auto injector for receiving a cassette as shown e.g. in
20 figures 1-2, where the auto injector is shown in an exploded view.

Figure 4A shows a cut-through view and figure 4B a side-view of the of the auto injector of
figure 3.

Figure 5 shows a close-up of the chassis shown in figure 3.

25 Figures 6A-C show cut-through views of the auto injector of figures 3-5 with a cassette as shown in figures 1-2 in different positions during loading and locking of the cassette in the auto injector, and figure 6D show the auto injector with the cassette in a perspective view.

30 Figures 7A-C show the steps in releasing the cassette skin sensor from the syringe holder in the cassette of figures 1-2 by means of the auto injector of figures 3-5, figures 7D-F show the locking of the cassette skin sensor in a proximal position after delivery of medicament, and figure 7G shows the cassette skin sensor seen from a different angle compared to figures
35 7A-F.

Figure 8A-B show an assembly of an outer cassette part.

Figure 9A-C show an assembly of an inner cassette part, and figure 9D shows a cut-through of the inner cassette part of figure 9C.

5 Figures 10A-C show the assembly of a cassette comprising the outer cassette part of figures 8A-C and the inner cassette part of figures 9A-D.

Figures 11A-D show the assembly of the cassette of figures 10B-C with a syringe.

10 Figures 12A-B show a cassette sleeve.

Figure 13A-B show a cassette sleeve and the inside of a syringe holder.

15 Figures 14A-E show the assembling of a syringe into a cassette having a cassette sleeve as shown in figures 12A-B included.

Figures 15A-D show the assembling of a syringe into a cassette having a cassette sleeve as shown in figures 12A-B included in a cut-through view as compared to figures 14A-E.

20 Figure 16 shows an example of an auto injector for receiving a cassette as shown e.g. in figures 1-2 or figures 8-15, where the auto injector is shown in an exploded view.

Figure 17 shows a view into an assembled auto injector as shown in figure 16.

25 Figures 18A-B show the assembling of a cassette and an auto injector.

Figure 19 shows a cut-through of the internal parts in the auto injector of figures 16-18.

30 Figures 20A-I show the steps in releasing the cassette skin sensor from the syringe holder in the cassette, and locking of the cassette skin sensor in a proximal position after delivery of medicament.

Description of drawings

35 Exemplary examples will now be described more fully hereinafter with reference to the accompanying drawings. In this regard, the present examples may have different forms and should not be construed as being limited to the descriptions set forth herein. Accordingly, the examples are merely described below, by referring to the figures, to explain aspects. As used herein, the term "and/or" includes any and all combinations of one or more of the

associated listed items. Expressions such as "at least one of," when preceding a list of elements, modify the entire list of elements and do not modify the individual elements of the list.

- 5 In the drawings, thicknesses of a plurality of layers and areas are illustrated in an enlarged manner for clarity and ease of description thereof. When a layer, area, element, or plate is referred to as being "on" another layer, area, element, or plate, it may be directly on the other layer, area, element, or plate, or intervening layers, areas, elements, or plates may be present therebetween. Conversely, when a layer, area, element, or plate is referred to as
- 10 being "directly on" another layer, area, element, or plate, there are no intervening layers, areas, elements, or plates therebetween. Further when a layer, area, element, or plate is referred to as being "below" another layer, area, element, or plate, it may be directly below the other layer, area, element, or plate, or intervening layers, areas, elements, or plates may be present therebetween. Conversely, when a layer, area, element, or plate is referred to as
- 15 being "directly below" another layer, area, element, or plate, there are no intervening layers, areas, elements, or plates therebetween.

- The spatially relative terms "lower" or "bottom" and "upper" or "top", "below", "beneath", "less", "above", and the like, may be used herein for ease of description to describe the
- 20 relationship between one element or component and another element or component as illustrated in the drawings. It will be understood that the spatially relative terms are intended to encompass different orientations of the device in use or operation, in addition to the orientation depicted in the drawings. For example, in the case where a device illustrated in the drawings is turned over, elements described as being on the "lower" side of other
- 25 elements, or "below" or "beneath" another element would then be oriented on "upper" sides of the other elements, or "above" another element. Accordingly, the illustrative term "below" or "beneath" may include both the "lower" and "upper" orientation positions, depending on the particular orientation of the figure. Similarly, if the device in one of the figures is turned over, elements described as "below" or "beneath" other elements would then be oriented
- 30 "above" the other elements. The exemplary terms "below" or "beneath" can, therefore, encompass both an orientation of above and below, and thus the spatially relative terms may be interpreted differently depending on the orientations described.

- Throughout the specification, when an element is referred to as being "connected" to another
- 35 element, the element is "directly connected" to the other element, or "electrically connected" to the other element with one or more intervening elements interposed therebetween.

The terminology used herein is for the purpose of describing particular examples only and is not intended to be limiting. As used herein, the singular forms “a,” “an,” and “the” are intended to include the plural forms, including “at least one,” unless the content clearly indicates otherwise. “At least one” is not to be construed as limiting “a” or “an.” It will be further understood that the terms “comprises,” “comprising,” “includes” and/or “including,” when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof.

It will be understood that, although the terms “first,” “second,” “third,” and the like may be used herein to describe various elements, these elements should not be limited by these terms. These terms are only used to distinguish one element from another element. Thus, “a first element” discussed below could be termed “a second element” or “a third element,” and “a second element” and “a third element” may be termed likewise without departing from the teachings herein.

“About” or “approximately” as used herein is inclusive of the stated value and means within an acceptable range of deviation for the particular value as determined by one of ordinary skill in the art, considering the measurement in question and the error associated with measurement of the particular quantity (i.e., the limitations of the measurement system). For example, “about” may mean within one or more standard deviations, or within $\pm 30\%$, 20% , 10% , 5% of the stated value.

Unless otherwise defined, all terms used herein (including technical and scientific terms) have the same meaning as commonly understood by those skilled in the art to which this invention pertains. It will be further understood that terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and will not be interpreted in an idealized or overly formal sense unless expressly so defined in the present specification.

Exemplary examples are described herein with reference to cross section illustrations that are schematic illustrations of idealized examples, wherein like reference numerals refer to like elements throughout the specification. As such, variations from the shapes of the illustrations as a result, for example, of manufacturing techniques and/or tolerances, are to be expected. Thus, examples described herein should not be construed as limited to the particular shapes of regions as illustrated herein but are to include deviations in shapes that

result, for example, from manufacturing. For example, a region illustrated or described as flat may have rough and/or nonlinear features. Moreover, sharp angles that are illustrated may be rounded. Thus, the regions illustrated in the figures are schematic in nature and their shapes are not intended to illustrate the precise shape of a region and are not intended to
5 limit the scope of the present claims. Some of the parts which are not associated with the description may not be provided in order to specifically describe exemplary examples of the present disclosure.

All references to the proximal direction or proximal surfaces refer to parts, surfaces and
10 similar oriented in the direction of insertion, i.e. in the direction of the insertion needle and the outer part of the auto injector touching the skin during injection of the medicament.

Likewise, all references to the distal direction or distal surfaces refer to parts, surfaces and
15 similar oriented in the direction away from the direction of the insertion needle, i.e. in the direction of the user.

Figure 1A shows an example of a cassette 500 in an exploded view. An auto injector 1000 for receiving the cassette 500 is shown in figures 3-5. The cassette comprises a syringe 200 with a syringe compartment 202 containing the medicament, a hollow needle 204 in fluid
20 connection with the syringe compartment, a rigid needle shield 206 connected to the proximal end of the syringe compartment and covering the hollow needle, and a stopper 208 movable from a distal position to a proximal position inside the syringe compartment 202 by means of a piston in the auto injector.

25 The needle shield 206 shown in figure 1A has both an outer part 206, and an inner part 207. The parts may normally be a connected or even produced as a one-piece item.

Positioned around the syringe 200 is a syringe holder 510 extending around at least part of the syringe compartment 202. The syringe holder 510 (see further details in figures 1B-C)
30 has a syringe holder support tube 511, which supports the syringe compartment 202. The tube 511 has an opening for inspection of the medicament in the syringe compartment 202. The syringe 200 is fixed inside the syringe holder 510 at the distal end 205 of the syringe 200, which has a collar-like shape. Syringe holder rings 507a, 507b may be used for further securing the syringe 200 inside the syringe holder 510. These may also be omitted.

35 The cassette 500 comprises a cassette housing 540 extending from a proximal 541 to a distal end 542. The cassette housing 540 is oval, which helps ensure an accurate positioning

of the cassette 500 inside the auto injector 1000. The oval shape may also make the cassette more compact. Alternative shapes such as square shape may also be imagined.

The cassette housing 540 is enclosing a cassette skin sensor 550. At the proximal end 541 of the cassette housing 540 is a housing shoulder 546 with an opening 545 through which the cassette skin sensor 540 can extend. The cassette housing 540 have internal protruding rails 548 (not shown in the figure) on its inside for guiding the skin sensor 550. The two parts 540, 550 are movable in relation to each other in an unlocked configuration. The cassette skin sensor 550 is positioned such that it extends proximally from the cassette housing 540.

The cassette housing 540 has a distal end surface 543 with a skin sensor housing opening 545 through which the cassette skin sensor 550 extends. This is most clearly seen in the cut-through images, e.g. in figure 2. The cassette housing 540 has an opening 547 in the longitudinal direction for inspection of the medicament in the cassette 500.

The cassette skin sensor 550 has two pins; a first skin sensor pin 557 and a second skin sensor pin 558, extending from the distal end 552 of the cassette skin sensor 550.

The cassette skin sensor 550 covers at least part if not the majority of a syringe holder 510, which is shown in more details in figures 1B-C in a front-end and a rear-end perspective view. The syringe holder 510 has an elongated tubular part 511 with an opening for inspection of the medicament. At the distal end 509 of the syringe holder 510 is a syringe holder plate 519, which has a number of openings including: a first pin opening 526, a second pin opening 527, a third pin opening 528, a fourth pin opening 529, and a piston opening 525. It is through the piston opening 525 that the auto injector piston 1168 extends when medicament is delivered to the patient. The openings are normally circular, but may also have different shapes mimicking the shape of the pins extending there through. The openings may be positioned at the peripheral edge of the syringe holder plate 519 such that only part of the circular opening extends into the syringe holder plate 519. This is shown in the example in figures 11C-D.

The syringe holder 510 also comprises a first syringe holder arm 512 extending in a proximal direction from the syringe holder plate 519. The first syringe holder arm 512 has a proximal surface 514 at the proximal end of the arm 512. When the cassette skin sensor 550 and the syringe holder 510 are in a first position, a first locking protrusion 553 on the cassette skin sensor 550 engages with the proximal surface 514. This engagement of the first locking protrusion 553 and the proximal surface 514 prevents movement of the cassette skin sensor

550 towards the syringe holder 510. The first syringe holder arm 512 is flexibly connected to the syringe holder plate 519.

5 The syringe holder 510 may also comprise a syringe holder ring 507a, which locks the syringe 200 inside the syringe holder 510.

When the cassette 500 is positioned in the auto injector 1000, the first pin opening 526 allows for passage of a first cassette locking pin 1156 of the auto injector 1000 there through. This is seen and described in connection with e.g. figures 7A-F. When the first
10 cassette locking pin 1156 of the auto injector 1000 passes through the first pin opening 526 in the syringe holder 510, it comes in contact with the first syringe holder arm 512 and deflects it. This causes a release of the cassette skin sensor 550 allowing it to move towards the syringe holder 510, i.e. a distal direction movement of the cassette skin sensor 550. Upon movement of the cassette skin sensor 550 towards the syringe holder 510, the first
15 cassette skin sensor pin 557 moves towards – and possibly through – the second pin opening 527 in the syringe holder 510. Similarly, the second cassette skin sensor pin 558 moves towards – and possibly through – the third pin opening 528 in the syringe holder 510 when the cassette skin sensor 558 moves distally.

20 The syringe holder 510 and the skin sensor 550 are longitudinally movable relative to each other upon release of the skin sensor 550 from the syringe holder 510.

The syringe holder 510 also has a second syringe holder arm 516 extending in a proximal direction from the syringe holder plate 519 (see figure 7G). The second syringe holder arm
25 516 comprises a distal surface 518 at the proximal end of the arm. The distal surface 518 is resting against a second locking protrusion 554 on the cassette skin sensor 550. This engagement prevents movement of the cassette skin sensor 550 away from the syringe holder 510. Before unlocking the cassette skin sensor 550 and the syringe holder 510 by deflection of the first syringe holder arm 512, the two parts are thus prevented from both
30 moving towards and away from each other.

The second syringe holder arm 516 is also flexibly connected to the syringe holder plate 519. When a second cassette locking pin 1159 of the auto injector 1000 is pushed through the fourth pin opening 529, it comes in contact with the second syringe holder arm 516 (see
35 figure 7G). This results in a deflection of the second syringe holder arm 516, which in turn releases the cassette skin sensor 550 again, this time allowing it to move away from the syringe holder 510 in the proximal direction.

The third pin opening 528 allows passage of a skin sensor pin 1158 of the auto injector 1000 (see figures 7A-F), which pushes on the second cassette skin sensor pin 558 of the cassette skin sensor 550. The second cassette skin sensor pin 558 may also pass through the third
5 pin opening 528 before coming in contact with the skin sensor pin 1158.

The syringe holder 510 has two syringe holder locking protrusions 524 fitting into openings 544 at the distal end 541 of the cassette housing 540. This locks the syringe holder 510 and the cassette housing 540 together. More locking protrusions/openings could also be
10 imagined.

The syringe holder 510 further comprises one or more syringe locking protrusions 515 locking the syringe 200 to the cassette 500.

15 The cassette 500 further has a cassette cap 530 having a first part 531 positioned between the rigid needle shield 206 and the proximal end of the syringe compartment 201. The cassette cap 530 comprises an inner rigid needle shield tube 535 with the first part 531 and an outer rigid needle shield tube 536. This is most clearly seen in figures 6A-C. The outer rigid needle shield tube 536 surrounds the inner rigid needle shield tube 535, and the inner
20 rigid needle shield tube 535 surrounds the rigid needle shield 206.

The outer rigid needle shield tube 536 abuts the housing shoulder 546 of the cassette housing 540 as shown in figure 2. The proximal end 560 of the cassette skin sensor 550 is positioned between the inner rigid needle shield tube 535 and the outer rigid needle shield tube 536 as shown in figure 2. The cassette cap 530 is removable from the syringe
25 compartment 202, and when the cassette cap 530 is removed, the rigid needle shield 206 follows with it, whereby the hollow needle 204 is exposed.

Figures 3-4 show an example of an auto injector 1000 for receiving the cassette of figures 1-
30 2. The auto injector 1000 is shown in an exploded view in figure 3, whereas figure 4A-B show the assembled auto injector 1000. For obtaining a clear view inside the auto injector, the outer housing 1102 has been omitted. The outer housing 1102 can be seen in figures 6A-D.

35 The auto injector 1000 extends from a proximal end to a distal end and comprises the housing 1102 extending from a proximal end 1103 to a distal end 1104. The housing is in

one piece in this example of the auto injector. The cassette 500 is loaded into the auto injector 1000 in a front-loading configuration.

5 The auto injector 1000 comprises a cassette receiving chassis 1110 configured to receive the cassette 500. The cassette 500 is interfacing with the auto injector 1000 at the distal end of the cassette 500, whereby the two parts are sharing the same longitudinal axis. This mitigates the risk of the cassette getting stuck inside in the auto injector. Further, it makes the connection as slim as possible. The only auto injector element, which extends in parallel with the cassette 500 is normally the injector housing 1102. The injector housing may
10 therefore be seen as having two sections; a cassette covering section 1108 and a distal section 1106 covering internal injector parts inside the auto injector 1000 (see the auto injector example in figures 18A-B). The internal injector parts includes a drive module 1150, which is adapted to move a piston 1168. The piston 1168 is moved proximally pushing on the stopper 208 inside the syringe whereby medicament can be expelled from the syringe
15 200. The piston 1168 has an inner threading (not shown in the figure), which engages with an outer threading on a led screw 1169. When the lead screw 1169 is rotated by the drive element 1150, the piston 1168 moves proximally. The drive module 1150 includes a motor 1151, which through a gear assembly 1153, rotates the led screw 1151. The gear assembly 1153 is covered by a gear cover 1152, some O-rings 1155 and a chassis cover 1154. The O-
20 rings may be seen as a noise reducing material, which dampers any noise may by the internal parts inside the auto injector during use. A similar noise reducing material is found at the proximal end of the internal parts shown here in the form of a larger O-ring 1109.

25 The drive element 1150 also controls the movement of a number of pins comprised in the auto injector 1000. As shown in figure 3, the number of pins include; a first cassette locking pin 1156, a skin sensor pin 1158, a second cassette locking pin 1159, and a cassette detection pin 1160. Thus, the drive module 1150 is further configured for moving the first cassette locking pin 1156, the skin sensor pin 1158, the second cassette locking pin 1159, and the cassette detection pin 1160 proximally. The pins and the piston may also be referred
30 to as cassette interacting parts adapted for securing and locking the cassette 500 inside the auto injector 1000 and for facilitating administering of the medicament. In common for the cassette interacting parts shown in figure 3 is that they move in parallel with the longitudinal axis of the auto injector 1000.

35 Acting on the skin sensor pin 1158, which pushes the cassette skin sensor 550 proximally after delivery of medicament, is a spring system 1140. The spring system 1140 includes a spring guidance pin 1141 around which a supporting chassis 1142 connected to the skin

sensor pin 1158 is found. Extending around the guidance pin 1141 is also a spring 1143. When the spring 1143 is allowed to relax, it pushes the supporting chassis 1142 forward, which in turn pushes the skin sensor pin 1158 proximally. Inside the skin sensor pin 1158 at the distal end thereof is a guide pin 1161 for the skin sensor pin 1158. When the skin sensor
5 spring system 1140 pushes the cassette skin sensor 550 proximally after delivery of medicament, it is pushed into a locked position preventing distal movement of the cassette skin sensor 550. Proximal movement of the cassette skin sensor 550 may also be prevented in this locked position.

10 The auto injector 1000 also comprises a cassette receiving chassis 1110 configured to receive a cassette 500. The cassette receiving chassis 1110 is in the shape of a chassis as seen in figures 3 and 5, the latter showing an enlarged view of the cassette receiving chassis 1110. The cassette receiving chassis 1110 is extending from a proximal end 1111 to a distal end 1112. At the proximal end 1111 of the chassis 1110, is a proximal chassis part 1114 with
15 a number of openings including a piston opening 1115, a first pin opening 1116, a second pin opening 1117, a third pin opening 1118, a fourth pin opening 1119, and a fifth opening 1120. Depending on the number of pins in the auto injector, fewer openings could also be used. The openings are round circular openings in this shown example in figure 5, but may also have a different shape mimicking the shape of the pins if they are not round.

20 When the cassette 500 is positioned in the auto injector 1000, the piston opening 1115 is aligned with piston opening 525 in the syringe holder 510 to allow the auto injector piston 1168 to extend there through. Likewise, the first pin opening 526 in the syringe holder 510 is aligned with the first pin opening 1116 such that the first cassette locking pin 1156 can pass
25 through both openings to deflect the first syringe holder arm 512 thereby unlocking the cassette skin sensor 550 from the syringe holder 510.

The second pin opening 1117 in the proximal chassis part 1114 is aligned with the second pin opening 527 in the syringe holder 510 for allowing passage of the first cassette skin
30 sensor pin 557 of the cassette skin sensor 550 to pass there through. The second pin opening 1117 does not extend all the way through, but instead has an end surface 1121 (see figure 7G), which stops the first cassette skin sensor pin 557 of the cassette skin sensor 550 in its distal movement towards the auto injector. Thus, the second pin opening 1117 is a well-shaped opening with an end surface 1121 limiting the distal movement of the first
35 cassette sensor pin 557 and thereby the cassette skin sensor 550 inside the auto injector 1000.

The third pin opening 1118 is aligned with the third pin opening 528 in the syringe holder 510 for allowing passage of the skin sensor pin 1158, and/or the second cassette skin sensor pin 558 there through. This is shown in details in figures 7A-F. The fourth pin opening 1119 is aligned with the fourth pin opening 529 in the syringe holder 510 for allowing passage of the
5 second cassette locking pin 1159 there through.

The fifth opening 1120 does not have a corresponding opening in the syringe holder. Instead, through the fifth opening 1120 cassette detection pin 1160 extends. The cassette detection pin 1160 detects when a cassette 500 is connected to the auto injector 1000. The
10 release of the cassette skin sensor 550 will not occur if there is no detection of a cassette by the cassette detection pin 1160. Instead of a cassette detection pin, a detection system based on e.g. magnets on cassette and auto injector surfaces coming in contact with each other and a corresponding Hall sensor inside the chassis may be used elimination the need for a detection pin and a corresponding opening in the proximal chassis part 1114.
15 Alternatively, the cassette may have a pin, which comes in contact with a surface on the injector, whereby detection of the cassette is registered in the auto injector.

The cassette receiving chassis 1110, the piston 1168 and the drive module 1150 are comprised inside the housing 1102 of the auto injector 1000, and the cassette 500 is
20 removable received in the auto injector 1000. By removable received is meant is meant that the cassette is a disposable cassette, which may be received in a reusable auto injector. The disposable cassette may be a one-time use cassette, or a cassette comprising multiple doses for multiple individual injections.

Figures 6A-C show cut-through views of the auto injector 1000 with the cassette 500 during the loading and locking of the cassette 500 in the auto injector 1000. In figure 6A, the cassette 500 has been received inside the auto injector housing 1102. As seen in figures 6A-C, the injector housing 1102 has a protruding tab 1105 on its inside. When the cassette 500 is positioned in the auto injector 1000, a cassette locking protrusion 539 is positioned near
25 the protruding tab 1105. The auto injector then moves the cassette locking pins 1156, 1159 forward along with the piston 1168 as seen when comparing figure 6A and 6B. The cassette locking protrusion 539 are now prevented from deflecting the protruding tab 1105, thereby locking the cassette 500 to the auto injector 1000. As the cassette 500 is now firmly locked inside the auto injector 1000, the cassette cap 530 can now be manually removed from the
30 cassette 500. This also removes the rigid needle shield 206 exposing the needle 204.

By further proximal movement of at least the first cassette locking pin 1156, the cassette skin sensor 500 is released from the syringe holder 510. This process is shown in figures 7A-C illustrating the steps in releasing the cassette skin sensor 550 from the syringe holder 510 by means of moving the first cassette locking pin 1156 proximally. As seen in figures 7B, the
5 first locking protrusion 553 and the proximal surface 514 of the arm 512 no longer engage. The auto injector is now ready for insertion of the needle 204 into a patient. This is done by pressing the cassette 500 towards the skin of the patient thereby pushing the cassette skin sensor 550 distally as shown in figures 7C and 7D. Thus, when the drive module 1150 moves the first cassette locking pin 1156 proximally, the cassette skin sensor 550 is distally
10 unlocked from the syringe holder 510 allowing for distal movement of the cassette skin sensor 550, wherein the unlocking of the cassette skin sensor 550 locks the cassette 500 in the auto injector 1000.

When the drive module 1150 moves the piston 1168 proximally for delivery of medicament,
15 the second cassette locking pin 1156 is also unlocked for movement of the cassette skin sensor 550 proximally after delivery of medicament and/or removal of the auto injector 1000 from the patient's skin.

Figures 7D-E show the locking of the cassette skin sensor 550 in a proximal position after
20 delivery of medicament. Figure 7D illustrates delivery position. In this position, the skin sensor pin 1158 exerts a pressure on the second cassette skin sensor pin 558 by the spring system 1140. In figure 7E, the auto injector has been lifted from the skin of the patient. By doing so, the spring system 1140 pushes the cassette skin sensor 550 forward in the proximal direction. As the cassette skin sensor 550 has been unlocked for movement in the
25 proximal direction by second cassette locking pin 1159, the cassette skin sensor 550 can be locked in a forward position where contact with the needle is prevented by e.g. a protrusion inside the cassette housing engaging with the cassette skin sensor protrusion.

After delivery of medicament, the drive module retracts the piston and the skin sensor
30 release pins 1156, 1157, which unlocks the cassette from the auto injector allowing the user to remove the cassette. The rigid needle shield and the cassette cap cannot be connected to the cassette after use, which ensures that the user will not mistake a used cassette for a non-used.

35 In figures 8A-B and figures 9A-C is shown the assembly of a cassette 500 comprising similar parts as shown and discussed in the previous figures. Figure 8A show a cassette housing 540 and a cassette cap 530, which is assembled in figure 8B to form an outer cassette part

504 by connecting a proximal end 541 of the cassette housing 540 to a distal end 534 of the cassette cap 530. Compared to the corresponding cassette housing 540 in figures 1A, 2, and 6A-D, the cassette housing in figures 8A-B is absent of a housing shoulder 546.

- 5 The cassette cap 530 comprises a first part 531 at the distal end 534 of the cassette cap 530. The first part 531 may be part of an inner rigid needle shield tube 535 surrounded by an outer rigid needle shield tube 536. If a syringe comprising a rigid needle shield is positioned in the cassette 500, the first part 531 will normally be positioned between the rigid needle shield 206 and the proximal end of the syringe compartment or around the rigid needle shield 206 as shown in figure 15D, where the first part 531 is positioned around the distal end of the rigid needle shield. The first part 531 of the cassette cap 530 extend inside the cassette housing opening 545 when the outer cassette part 504 is assembled as shown in figure 8B.
- 10
- 15 Figures 9A-C show the assembling of an inner cassette part 501 comprising a syringe holder 510 and a cassette skin sensor 550. In figure 9A, the two parts are shown as separate parts before assembling by inserting a proximal end 508 of the syringe holder 510 into a distal end 552 of the cassette skin sensor 550. In figure 9B, the syringe holder 510 has been pushed part of the way into a distal end 552 of the cassette skin sensor 550, and in figures 9C-D, the two parts have been assembled such that a part of the syringe holder 510 is covered by the cassette skin sensor 550. The part of the syringe holder 510 covered by the cassette skin sensor 550 constitutes at least 10%, such as at least 20%, such as at least 30%, such as at least 40%, such as at least 50%.
- 20
- 25 The inner and outer cassette parts are assembled by inserting a proximal end 502 of the inner cassette part 501 into a distal end 506 of the outer cassette part 504 and pushing the inner cassette part 501 into the outer cassette part 504 such that the majority of the inner cassette part 501 is covered by the outer cassette part 504. This is shown in figures 10A-B, where figure 10A shows the initial position of the cassette parts before they have been completely assembled in figures 10B-C.
- 30

Figures 11A-D shows the insertion and fixation of a syringe 200 inside the cassette 500. The cassette parts can be assembled on one location and the syringe inserted at a different location. In figure 11A, the syringe 200 is ready for insertion into the cassette 500 by inserting a proximal end of the syringe 200 into the distal end 503 of the inner cassette part 501, and pushing the syringe 200 into the inner cassette part 501 as shown in figures 11B-C.

35

The syringe holder 510 shown in figures 9A-11D comprises one or more syringe locking protrusions 515. By moving the one or more syringe locking protrusions 515 centrally, the syringe 200 is locked inside the inner cassette 501. This is seen by comparing figure 11C and 11D. If the cassette housing is without the cassette locking protrusions, the syringe may be fixed in the syringe holder 510 by frictional force.

The syringe 200 extends from a proximal end 201 to a distal end 203 and comprises a syringe compartment 202 containing medicament where a proximal end is adapted for being in connection with a needle through which the medicament is allowed to exit the syringe compartment 202. In figure 11A, the needle is shown as a hollow needle 204 in fluid connection with the proximal end of the syringe compartment, i.e. connected to the syringe as part of the syringe. Alternatively, a luer lock needle may be connected to the syringe prior to injection of medicament. As yet a further alternative, a syringe system with a cartridge terminated with a stopper at its distal end and a rubber septum at its proximal end, where a penetrating needle at a distal end pierces the septum when mounted onto the cartridge while a proximal needle end penetrates into the patient skin. Inside the syringe compartment 202 is a stopper 208 adapted for being moved from a distal position to a proximal position inside the syringe compartment 202. This forces the medicament out of the syringe.

The syringe 200 shown in figure 11A also comprises a rigid needle shield 206 connected to the proximal end of the syringe compartment and covering the hollow needle 204. If the hollow needle is not part of the syringe, but instead connected thereto prior to medicament delivery, e.g. by a luer lock or a needle system penetrating a septum in the syringe when connected to the cassette, the rigid needle shield 206 may still be present as part of the cassette and used after medicament delivery for shielding the used needle for the user.

The syringe may contain different amounts of medicament such as e.g. 1.00 ml or 2.25 ml medicament. When using the cassette 500 for smaller syringes, a cassette sleeve 570 may be included inside the syringe holder 510 to ensure that a thin syringe 200 is kept inside the syringe holder 510. An example of a cassette sleeve is shown in figures 12A-B. Prior to inserting a syringe 200 into a cassette 500 comprising the cassette sleeve 570, a proximal end 571 of the cassette sleeve 570 is inserted into the distal end 509 of the syringe holder 510 and pushed into the syringe holder 510 such that the majority of the cassette sleeve 570 is covered by the syringe holder 510 prior to or directly after inserting the syringe holder 510 into the cassette skin sensor 550. The cassette sleeve 570 thereby constituting a part of the inner cassette part 501 is shown as an included part in the cassette 500 in figure 14A. The

sleeve 570 is secured in the syringe holder 510 by a small tap inside the syringe holder, which fits into the small opening 576 in the cassette sleeve 570.

5 The cassette sleeve 570 comprises proximal extending deflectable sleeve arms 573 (see figures 12A-B). The deflectable sleeve arms 573 can deflect through an opening 580 in the syringe holder 510.

10 In figures 14A-E and 15A-D, inserting a syringe 200 inside a cassette 500 comprising the cassette sleeve 570 is shown. When inserting a syringe 200 comprises the hollow needle 204 and a rigid needle shield 206, the deflectable sleeve arms 573 deflects into openings in the syringe holder 510 and cassette skin sensor 550 allows the rigid needle shield 206 to pass the deflectable sleeve arms 573. By this motion, the locking in the opening 576 in the cassette sleeve 570 is unlocked. Further, the deflectable sleeve arms 573 relax into a position between the rigid needle shield 206 and the syringe compartment 202 after the rigid
15 needle shield 206 has passed the deflectable sleeve arms 573. This is seen in figures 14B and 15B, where the rigid needle shield 206 is shown after having passed the deflectable sleeve arms 573.

20 After the deflectable sleeve arms 573 has relaxed into a position between the rigid needle shield 206 and the syringe compartment 202, and the syringe 200 is pushed further proximally before locking it to the cassette 500, the cassette sleeve 570 rotates into a position from where the sleeve arms 573 cannot deflect. The rotation of the cassette sleeve 570 is seen in figures 14B-14D, with figure 14B showing the sleeve 570 prior to rotation, figure 14C showing the sleeve 570 halfway rotated and figure 14D showing the sleeve 570
25 fully rotated. The rotation may also be seen in the cut-through illustrations in figures 15B-D. The rotation of the cassette sleeve 570 rotates it into a position allowing a viewer to view the medicament inside the syringe 200.

30 The cassette sleeve 570 comprises at least one sleeve locking protrusion 574 as shown in figures 12A-B. When the sleeve locking protrusion(s) 574 comes in contact with an inner helical surface part 575 inside the syringe holder 510 as the syringe 200 is pushed proximally, the helical shape of the at least one inner helical surface part 575 forces the cassette sleeve 570 to rotate. The rotation is approximately 90 degrees. The inner helical surface part 575 is shown in figures 13A-B. When the syringe 200 has been inserted in the
35 cassette 500 and the syringe locking protrusions 515 locked around the syringe 200 preventing it and thereby the also the cassette sleeve 570 from moving in the distal direction, the cassette sleeve 570 cannot rotate backwards as this rotational motion would require that

the cassette sleeve 570 moves in the distal direction due to the interaction of the inner helical surface part 575 and the sleeve locking protrusion 574. Thus, backwards rotation of the cassette sleeve 570 is prevented by the locking of the syringe 200 in the cassette 500. Further rotational movement of the sleeve 570 is also prevented as the inner helical surface part 575 has an end surface point 577 stopping the rotational motion in the first direction. The end surface point 577 may be a small opening into which the sleeve locking protrusion 574 enters without the option to move away again.

Figures 16-19 show an example of an auto injector 1000 for receiving the cassette of figures 8-15. The auto injector 1000 is shown in an exploded view in figure 16, whereas figures 17-19 show different views of the assembled auto injector 1000. For obtaining a clear view inside the auto injector, the outer housing 1102 has been omitted in figures 16 and 19. The outer housing 1102 can be seen in figures 17 and 18A-B. The housing 1102 is in one piece in this example of the auto injector. A two-part housing could also be imagined.

The cassette 500 is loaded into the auto injector 1000 in a front-loading configuration. Thus, the proximal end of the cassette 500 is inserted into the proximal end of the auto injector 1000 as illustrated in figures 18A-B. As also seen in figures 18A-B, the housing 1102 comprises an opening 1107, which facilitating inspection of the medicament in the cassette 500. The opening 1107 extends into the housing surface. Along a longitudinal axis of the injector housing 1102, the housing 1102 may be divided into two sections; a cassette covering section 1108 covering at least part of the cassette 500 when received inside the injector 1000, and a distal section 1106 covering internal injector parts. These internal injector parts are shown in figure 16 in the exploded view. The opening 1107 is in the cassette covering section 1108 and is extending in the longitudinal direction of the housing 1102.

The auto injector 1000 as shown in figure 16 comprises a cassette receiving chassis 1110 configured to receive the cassette 500. By receiving the cassette is meant to connect/couple with the cassette. The cassette 500 is interfacing with the auto injector 1000 at the distal end of the cassette 500, whereby the two parts are sharing the same longitudinal axis. This mitigates the risk of the cassette getting stuck inside in the auto injector. Further, it makes the connection as slim as possible. The only auto injector element, which extends in parallel with the cassette 500 when the cassette is inserted into the auto injector is normally the injector housing 1102, i.e. the cassette covering section 1108.

The internal injector parts include a drive module 1150, which is adapted to move a piston 1168. The piston 1168 is moved proximally pushing on the stopper 208 inside the syringe 200 whereby medicament can be expelled from the syringe 200. The piston 1168 has an inner threading (see figure 19), which engages with an outer threading on a lead screw 1169.

5 When the lead screw 1169 is rotated by the drive element 1150, the piston 1168 moves proximally. Rotation of the lead screw 1169 in the opposite direction, moves the piston 1168 distally. At the proximal end of the piston 1168 is a piston end plate 1178, which fits into an opening 1115 in the chassis 1110.

10 The drive module 1150 includes a motor 1151, which through a gear assembly rotates the lead screw 1169. The gear assembly comprising a set of gears 1148, 1149, a lead screw plate 1176, and a connecting ring between a chassis cover 1154 and the lead screw 1169. Different versions of this gear set may also be imagined.

15 The chassis 1110 comprises a cassette abutting surface 1114a adapted for abutting a distal end 503, 506 of the cassette 500 when secured inside the auto injector 1000. The cassette abutting surface 1114a defines a proximal end plane from where substantially no internal injector parts extends in the proximal direction prior to assembling the cassette 500 and the auto injector 1000. By substantially is included that a minor tip, e.g. up to 2%, 5% or 10%, of

20 the total length of one or more of the pins 1156, 1158, 1159 extends proximately outside the cassette abutting surface 1114a. Similarly, at the distal end of the internal injector parts, is a distal plane. At both the proximal plane and the distal plan of the internal injector parts, noise reducing material 1109, 1155 is positioned for dampening noise made by any internal

25 injector parts during use. The noise reducing material 1109, 1155 may be a flexible material, such as rubber, and/or one or more O-ring(s), possibly in the form of square shaped O-rings as shown in figure 16.

The drive element 1150 also controls the movement of a number of pins comprised in the auto injector 1000. As shown in figure 16, the number of pins may include; a first cassette

30 locking pin 1156, a skin sensor pin 1158, and a second cassette locking pin 1159. The first locking pin 1156 and second locking pin 1159 are connected to the piston 1168. This is obtained by a first locking pin bridge connection 1162 and a second locking pin bridge connection 1163 on the piston 1168. The distal end 1166 of the first cassette locking pin 1156 is fixed to the first cassette locking pin bridge connection 1162 and the distal end 1167

35 of the second cassette locking pin 1159 is fixed to the second cassette locking pin bridge connection 1163. This enables the drive module 1150 to move the first cassette locking pin 1156, and the second cassette locking pin 1159 when moving the piston 1168. Alternatively,

the movement of the two cassette locking pins 1156, 1159 can be decoupled from the movement of the piston 1168. Thus, the movement of the cassette locking pins can be individual or in the form of multiple pins moving simultaneously.

- 5 The skin sensor pin 1158 also moves with the piston 1168 as it moves proximally. The skin sensor 1158 is coupled to a spring system, which includes a spring 1143 and a stopper 1144 against which the spring 1143 presses in the proximal direction. The stopper 1144 is positioned in at the stopper accommodating part 1164 being the skin sensor. When the cassette 500 is positioned in the auto injector 1000 and the skin sensor pin 1158 is moved
- 10 proximally, the skin sensor 1158 comes in contact with the second cassette skin sensor pin 558. As long as the cassette skin sensor 550 is pushed in the distal direction, it prevents the skin sensor pin 1158 from moving with the piston 1168 and two cassette locking pins 1156, 1158 in the proximal direction. This tensions the spring 1143. Since the tensioned spring 1143 acts on the skin sensor pin 1158, when releasing the cassette skin sensor 550, the
- 15 spring 1143 pushes the cassette skin sensor 550 proximally. This ensures that the needle is not exposed after end delivery of medicament. The cassette skin sensor 550 is pushed into a locked position preventing distal movement of the cassette skin sensor 550. The distal locking is facilitated by the cassette skin sensor arm 566, where the locking surface 567 of the cassette skin sensor arm 566 locks into an inner opening in the cassette housing 540.
- 20 Proximal movement of the cassette skin sensor 550 may also be prevented by an additional set of housing-skin sensor surfaces.

- As the cassette locking pins 1156, 1159 move in parallel in a symmetric configuration in the auto injector shown in figure 16, the naming of 'first' and 'second' could be interchanged.
- 25 Also, depending on the direction, which the cassette 500 is inserted into the auto injector 1000, the naming may change. By combining the features of the first and second syringe holder arms 512, 516, into one syringe holder arm, the second cassette locking pin 1159 and corresponding opening 1119 could be removed. This would require that the cassette 500 is inserted in a specific manner ensuring that the one cassette locking pin comes in contact
- 30 with the one syringe holder arm.

- The pins 1156, 1158, 1159 and the piston 1168 may also be referred to as cassette interacting parts adapted for securing and locking the cassette 500 inside the auto injector 1000 and for facilitating administering of the medicament. In common for the cassette
- 35 interacting parts shown in figure 16 is that they move in parallel with the longitudinal axis of the auto injector 1000. The cassette interacting parts could possibly be configured for rotating around their own axis in addition to moving in parallel with the longitudinal axis of the

auto injector. Also, the cassette interacting parts may be prevented from moving in directions different from parallel with the longitudinal axis of the auto injector.

5 The cassette receiving chassis 1110 configured to receive a cassette 500. The cassette receiving chassis 1110 is extending from a proximal end 1111 to a distal end 1112, where at the distal end, distally extending chassis arms 1113 are found. At the proximal end 1111 of the chassis 1110 is a proximal chassis part 1114 with a number of openings including a piston opening 1115, a first pin opening 1116, a second pin opening 1117, a third pin opening 1118, and a fourth pin opening 1119. Depending on the number of pins in the auto
10 injector, fewer openings could also be used. The openings are round circular openings, but may also have a different shape mimicking the shape of the pins if they are not round.

When the cassette 500 is positioned in the auto injector 1000, the piston opening 1115 is aligned with piston opening 525 in the syringe holder 510 to allow the auto injector piston
15 1168 to extend there through. Likewise, the first pin opening 526 in the syringe holder 510 is aligned with the first pin opening 1116 such that the first cassette locking pin 1156 can pass through both openings to deflect the first syringe holder arm 512 thereby unlocking the cassette skin sensor 550 from the syringe holder 510 as explained earlier in connection with figures 7A-G.

20 The second pin opening 1117 in the proximal chassis part 1114 is aligned with the second pin opening 527 in the syringe holder 510 for allowing passage of the first cassette skin sensor pin 557 of the cassette skin sensor 550 to pass there through. The second pin opening 1117 does not extend all the way through, but instead has an end surface 1121 (see
25 figure 7G), which stops the first cassette skin sensor pin 557 of the cassette skin sensor 550 in its distal movement towards the auto injector. If the first cassette skin sensor pin 557 is shortened, the second pin opening 1117 can be eliminated and the first cassette skin sensor pin 557 instead be stopped by the proximal chassis part 1114.

30 The third pin opening 1118 is aligned with the third pin opening 528 in the syringe holder 510 for allowing passage of the skin sensor pin 1158, and/or the second cassette skin sensor pin 558 there through. This was also shown and discussed in connection with the auto injector in figures 7A-F. The fourth pin opening 1119 is aligned with the fourth pin opening 529 in the syringe holder 510 for allowing passage of the second cassette locking pin 1159 there
35 through.

When the cassette 500 is positioned in the auto injector 1000, the cassette locking pins 1156, 1159 pass into the pin openings 526, 529 in the cassette 500 and push cassette locking protrusions into the auto injector housing 1102, where internal parts inside the injector housing 1102 prevent the proximal movement of the cassette housing 530, thereby
5 locking the cassette 500 to the auto injector 1000. As the cassette locking pins 1156, 1159 moves further into the cassette 500, the first cassette locking pin 1156 deflects the first syringe holder arm 512. This causes a release of the cassette skin sensor 550 allowing it to move towards the syringe holder 510, i.e. a distal direction movement of the cassette skin sensor 550. The syringe holder 510 and the skin sensor 550 are longitudinally movable
10 relative to each other upon release of the skin sensor 550 from the syringe holder 510. By pressing the auto injector against the patient's skin will allow the needle to be inserted into the patient as movement of the cassette skin sensor 550 distally exposes the needle.

Upon movement of the cassette skin sensor 550 towards the syringe holder 510, the first
15 cassette skin sensor pin 557 moves towards – and possibly through – the second pin opening 527 in the syringe holder 510. Similarly, the second cassette skin sensor pin 558 moves towards – and possibly through – the third pin opening 528 in the syringe holder 510 when the cassette skin sensor 558 moves distally. When the second cassette skin sensor pin 558 passes through the openings 528, 1118 it comes in contact with the skin sensor pin
20 1158 as described above.

The further movement of the cassette locking pins 1156, 1159 into the cassette 500, causes the second cassette locking pin 1159 to deflect the second syringe holder arm 516. This releases the cassette skin sensor 550 allowing it to move away from the syringe holder 510
25 in the proximal direction. Thus, when/if the user removes the auto injector from the patient's skin, the cassette skin sensor 550 is now allowed to move proximally to cover the needle after end medicament injection. The spring 1143 acting on the skin sensor pin 1158 ensures that the cassette skin sensor 550 is locked after use as described above.

30 The auto injector as shown in figure 16 also comprises a printed circuit board (PCB) 1180, a USB connection 1181, USB PCB plate 1182, and a battery 1184. On the PCB board 1180 is also positioned a number of switches 1171a, 1171b, 1171c for detecting the position of the pins inside the auto injector.

35 Figure 17 shows the assembled auto injector 1000 in a view as seen from the front where the cassette 500 is inserted. The cassette abutting surface 1114a defines a proximal end plane from where substantially no internal injector parts extends proximally prior to

assembling the cassette 500 and the auto injector 1000. By substantially is included a situation where only a minor part of the internal injector parts protrude a small amount, such as up 2%, 5%, or 10% proximally compared to the cassette abutting surface 1114a. This is shown in figure 19, where the tip of the second cassette locking pin 1159 protrudes outside
5 the cassette abutting surface 1114a. The pins 1156, 1158, 1159 are also indicated in figure 17.

The cassette abutting surface 1114a may also define a proximal end plane from where substantially no cavities extends distally into the distal section 1106. By substantially is here
10 also included that a small closed well-type opening is present in the surface 1114a as illustrated in figure 7G, item 1121.

The smooth cassette abutting surface 1114a and the supporting plate 1114b behind it, ensure that the auto injector can be kept clean in an easy manner due to avoidance of
15 grooves to e.g. collect dirt and dust etc. Also, a user is prevented from accessing the internal parts of the auto injector. This prolongs the lifetime of the auto injector 1000.

Figures 20A-I shows the interaction between the cassette 500 of figures 8-15 and the auto injector of figures 16-19. Compared to figures 7A-G, the cassette release pins 1156, 1159
20 has switched position such that the second cassette release pin 1159 is positioned next to the skin sensor pin 1158. As the cassette release pins 1156, 1158 are working in an interchangeable manner and move together, this has no impact on the interaction between the auto injector 1000 and the cassette 500. Also, compared to figures 7A-G, figures 20 A-I show the cassette 500 turned 180 degrees, thereby showing the second syringe holder arm
25 516 and the second cassette locking pin 1159 in figures 20A-H instead of the first syringe holder arm 512 and the first cassette locking pin 1156 as in figures 7A-F.

The cassettes 500 and auto injectors 1000 are shown and described in a configuration using manual insertion of the needle. An automatic needle insertion could also be envisioned by
30 included a spring-motor system.

References

	200	syringe
	201	proximal end of the syringe / syringe compartment
	202	syringe compartment
5	203	distal end of the syringe / syringe compartment
	204	hollow needle
	205	distal end surface of the syringe
	206	rigid needle shield
	207	inner part of the rigid needle shield
10	208	stopper
	210	plunger rod
	500	cassette
	501	inner cassette part
15	502	proximal end of the inner cassette part
	503	distal end of the inner cassette part
	504	outer cassette part
	505	proximal end of the outer cassette part
	506	distal end of the outer cassette part
20	507a	syringe holder ring
	507b	syringe holder ring
	508	proximal end of the syringe holder
	509	distal end of the syringe holder
	510	syringe holder
25	511	syringe holder support tube
	512	first syringe holder arm
	513	proximal end of the first syringe holder arm
	514	proximal surface at the proximal end of the first syringe holder arm

	515	syringe locking protrusion
	516	second syringe holder arm
	517	proximal end of the second syringe holder arm
	518	distal surface at the proximal end of the second syringe holder arm
5	519	syringe holder plate
	520	proximal support surface of the syringe holder plate
	521	distal support surface of the syringe holder plate
	522	first syringe holder locking arm
	523	second syringe holder locking arm
10	524	syringe holder locking protrusions housing
	525	piston opening in the syringe holder plate
	526	first pin opening in the syringe holder plate
	527	second pin opening in the syringe holder plate
	528	third pin opening in the syringe holder plate
15	529	fourth pin opening in the syringe holder plate
	530	cassette cap
	531	first part positioned between the rigid needle shield and the proximal end of the syringe compartment
	532	proximal end of the cassette cap
20	534	distal end of the cassette cap
	535	inner rigid needle shield tube
	536	outer rigid needle shield tube
	537	distal end of the cassette cap
	538	proximal end of the cassette cap
25	539	cassette locking protrusion
	540	cassette housing
	541	proximal end of the cassette housing
	542	distal end of the cassette housing

	543	distal end surface of the cassette housing
	544	locking opening in the cassette housing
	545	skin sensor housing opening
	546	housing shoulder
5	547	opening in the housing for inspection of medicament
	548	protruding rail on the inside of the cassette housing
	549	syringe locking arms
	550	cassette skin sensor
	552	distal end of the cassette skin sensor
10	553	first locking protrusion
	554	second locking protrusion
	556	opening for inspection of the syringe
	557	first cassette skin sensor pin
	558	second cassette skin sensor pin
15	560	proximal end of the cassette skin sensor
	562	skin touching surface of the cassette skin sensor
	566	cassette skin sensor arm
	567	locking surface of the cassette skin sensor arm
	568	cassette skin sensor rail to fit into the rails inside the cassette housing
20	570	cassette sleeve
	571	proximal part of the cassette sleeve
	572	distal part of the cassette sleeve
	573	sleeve arms on the cassette sleeve
	574	sleeve locking protrusion
25	575	inner helical surface part
	576	opening in the cassette sleeve
	577	end surface point on the inner helical surface part
	580	opening in the syringe holder

	1000	auto injector
	1102	housing
	1103	proximal end of the housing
5	1104	distal end of the housing
	1105	protruding tab on the inside of the housing
	1106	distal section of the housing covering internal injector parts
	1107	opening in the housing
	1108	cassette covering section
10	1109	noise reducing material / O-ring
	1110	cassette receiving chassis
	1111	proximal end of the chassis
	1112	distal end of the chassis
	1113	distally extending chassis arm
15	1114	proximal chassis part
	1114a	proximal surface of the proximal chassis part / cassette abutting surface
	1114b	support plate
	1115	piston opening in the proximal chassis part
	1116	first pin opening in the proximal chassis part
20	1117	second pin opening in the proximal chassis part
	1118	third pin opening in the proximal chassis part
	1119	fourth pin opening in the proximal chassis part
	1120	fifth opening in the proximal chassis part
	1121	end surface of the second pin opening
25	1140	spring system acting on the skin sensor
	1141	spring guidance pin
	1142	supporting chassis for guiding the skin sensor pin
	1143	spring in the spring system acting on the skin sensor

	1144	stopper for stopping the spring in the spring system acting on the skin sensor
	1148	gear
	1149	gear
	1150	drive module
5	1151	motor
	1152	gear cover
	1153	gear assembly
	1154	chassis cover
	1155	noise reducing material / O-ring
10	1156	first cassette locking pin
	1158	skin sensor pin
	1159	second cassette locking pin
	1160	cassette detection pin
	1161	guide pin for the skin sensor pin
15	1162	first locking pin bridge connection
	1163	second locking pin bridge connection
	1164	stopper accommodating part
	1166	distal end of the first cassette locking pin connecting to the bridge connection
	1167	distal end of the second cassette locking pin connecting to the bridge connection
20	1168	piston internally threaded to match the led screw
	1169	led screw
	1170	bridge
	1171	switch
	1171a	switch
25	1171b	switch
	1171c	switch
	1172	opening in the chassis cover
	1174	connecting ring between the chassis cover and led screw

- 1176 led screw plate
- 1178 piston end plate
- 1180 printed circuit board
- 1181 USB connection
- 5 1182 USB printed circuit board plate
- 1184 battery

Claims

1. An auto injector (1000) adapted for receiving a cassette (500) with medicament and for administering the medicament in the cassette (500) to a patient, the auto injector (1000) extending from a proximal end to a distal end along a longitudinal axis, wherein
5 the cassette (500) is removably received in the auto injector (1000) along the longitudinal direction, wherein the auto injector further comprises one or more cassette interacting parts adapted for securing and locking the cassette (500) inside the auto injector (1000) and for facilitating administering of the medicament, wherein the one or more cassette interacting parts are configured for moving in parallel with the
10 longitudinal axis of the auto injector (1000).
2. The auto injector according to claim 1, wherein the one or more cassette interacting parts are configured for rotating around their own axis in addition to moving in parallel with the longitudinal axis of the auto injector.
15
3. The auto injector according to claim 1, wherein the one or more cassette interacting parts are configured not for moving in directions different from parallel with the longitudinal axis of the auto injector.
- 20 4. The auto injector according to any of the claims 1-3, wherein the auto injector (1000) comprises a housing (1102) and a multiple of internal injector parts positioned inside the housing (1102), the housing (1102) comprising:
 - a cassette covering section (1108) extending to cover at least a part of the cassette (500) when received inside the injector (1000); and
 - 25 • a distal section (1106) extending to cover the internal injector parts inside the housing (1102) before the cassette (500) is secured inside the injector (1000).
5. An auto injector (1000) adapted for receiving a cassette (500) with medicament and for administering the medicament, wherein the cassette (500) is removably received in
30 the auto injector (1000), wherein the auto injector (1000) is consisting of a housing extending from a proximal end (1103) to a distal end (1104) and a multiple of internal injector parts positioned inside the housing (1102), the housing (1102) consisting of:
 - a cassette covering section (1108) extending to cover at least a part of the cassette (500) when received inside the injector (1000); and
 - 35 • a distal section (1106) extending to cover the internal injector parts inside the housing (1102) before the cassette (500) is secured inside the injector (1000).

6. The auto injector (1000) according to claim 4 or 5, wherein when the cassette (500) is received inside the injector (1000), the cassette covering section (1108) extends to cover between 20-90% of the cassette (500), such as between 30-75% of the cassette (500), such as between 40-60% of the cassette (500).
- 5
7. The auto injector (1000) according to any preceding claim, wherein the auto injector (1000) comprises a cassette abutting surface (1114a) adapted for abutting a distal end (503, 506) of the cassette (500) when secured inside the auto injector (1000), wherein the cassette abutting surface (1114a) defines a proximal end plane from where
- 10 substantially no internal injector parts extends proximally prior to assembling the cassette (500) and the auto injector (1000).
8. An auto injector (1000) adapted for receiving a cassette (500) with medicament and for administering the medicament, wherein the auto injector (1000) comprises a
- 15 housing (1102) extending from a proximal end (1103) to a distal end (1104) along a longitudinal direction, the housing (1102) comprising:
- a cassette covering section (1108) extending to cover the cassette (500) when received inside the injector (1000); and
 - a distal section (1106) extending to cover all internal injector parts,
- 20 wherein the auto injector (1000) comprises a cassette abutting surface (1114a) adapted for abutting a distal end (503, 506) of the cassette (500) when secured inside the auto injector (1000),
- wherein the cassette abutting surface (1114a) defines a proximal end plane from where substantially no internal injector parts extends proximally prior to assembling
- 25 the cassette (500) and the auto injector (1000).
9. The auto injector according to any of the claims 7-8, wherein the cassette abutting surface (1114a) defines a proximal end plane from where substantially no cavities extends distally into the distal section (1106).
- 30
10. The auto injector according to any of the claims 4-9, wherein the housing (1102) encloses internal injector parts, the internal injector parts including at least a piston (1168), a drive module (1150) adapted for moving the piston proximally, and a chassis (1110), wherein the internal injector parts are defined by a proximal end plane and a distal end plane, and wherein the auto injector comprises noise reducing
- 35 material (1109, 1155) at both the proximal end plane and the distal end plane of the internal parts.

11. An auto injector adapted for receiving a cassette (500) with medicament and for administering the medicament, wherein the cassette (500) is removably received in the auto injector (1000), wherein the auto injector (1000) comprises a housing (1102) enclosing internal injector parts, the internal injector parts including at least a piston (1168), a drive module (1150) adapted for moving the piston proximally, and a chassis (1110), wherein the internal injector parts are defined by a proximal end plane and a distal end plane, and wherein the auto injector comprises noise reducing material (1109, 1155) at both the proximal end plane and the distal end plane of the internal parts.
12. The auto injector according to any of the claims 10-11, wherein the drive module (1150) is further adapted for moving the piston distally.
13. The auto injector according to any of the claims 10-12, wherein the noise reducing material (1109, 1155) is one or more O-rings.
14. The auto injector according to any of the claims 10-13, wherein the noise reducing material (1109, 1155) is a soft material, such as rubber.
15. The auto injector (1000) according to any of the claims 6-14, wherein the proximal end plane is extending in a direction perpendicular to the longitudinal direction of the auto injector.
16. The auto injector according to any of the claims 5-15, wherein the auto injector (1000) comprises one or more cassette interacting parts adapted for securing and fixating the cassette (500) inside the auto injector and for facilitating administration of the medicament, wherein the one or more cassette interacting parts does not extend proximally from the proximal end plane prior to securing the cassette (500) inside the injector.
17. The auto injector according claim 16, wherein the one or more cassette interacting parts are adapted for moving in a proximal direction after a cassette (500) has been positioned in the auto injector (1000), whereby at least a part of one or more of the cassette interacting parts are extending proximally from the proximal end plane inside the auto injector.

18. The auto injector according to any of the claims 1 and 16-17, wherein each of the cassette interacting parts are adapted for moving through the proximal end plane independently of another one of the cassette interacting parts.
- 5 19. The auto injector according to any of the claims 1 and 16-18, wherein the one or more cassette interacting parts includes a piston (1168) configured for proximal movement of a stopper comprised within the cassette, and one or more injector pins including:
- a first cassette locking pin (1156); and
 - a skin sensor pin (1158).
- 10 20. The auto injector according to claim 19, wherein the one or more injector pins further include a cassette detection pin (1160).
- 15 21. The auto injector according to claim 19 or 20, wherein the one or more injector pins further include a second cassette locking pin (1159).
22. The auto injector according to any preceding claim, wherein the auto injector comprises a chassis (1110) with a proximal chassis part (1114) at a proximal end of the chassis (1111).
- 20 23. The auto injector according to claim 22, wherein the proximal chassis part (1114) comprises one or more openings (1115, 1116, 1118, 1119) adapted for allowing passage of an injector pin (1156, 1158, 1159) or the piston (1168) through each opening after or during securing of the cassette (500) inside the auto injector (1000).
- 25 24. The auto injector according to claim 23, wherein the one or more openings comprises:
- a piston opening (1115) for allowing passage of the auto injector piston (1168) there through;
 - a first pin opening (1116) for allowing passage of the first cassette locking pin (1156) there through;
 - a third pin opening (1118) for allowing passage of the skin sensor pin (1158) of the auto injector there through.
- 30 25. The auto injector according to claim 24, wherein the one or more openings further comprises a second pin opening (1117) for allowing passage of a first cassette skin sensor pin (557) comprised in the cassette (500).
- 35

26. The auto injector according to any of the claims 24-25, wherein the one or more openings further comprises a fourth pin opening (1119) for allowing passage of the second cassette locking pin (1159) there through.
- 5 27. The auto injector according to any of the claims 24-26, wherein the one or more openings further comprises a fifth opening (1120) for allowing passage of the cassette detection pin (1160) there through.
- 10 28. The auto injector according to any of the claims 18-27, wherein the auto injector comprises a drive module (1150) adapted for moving the piston (1168) in a proximal direction along the longitudinal axis.
- 15 29. The auto injector according to claim 28, wherein the drive module (1150) is further adapted for moving the piston (1168) in a distal direction along the longitudinal axis.
30. The auto injector according to claim 28 or 29, wherein drive module (1150) is further configured for moving the first cassette locking pin (1156), and/or the skin sensor pin (1158), and/or the second cassette locking pin (1159) in the proximal direction along the longitudinal axis.
- 20 31. The auto injector according to any of the claims 28-30, wherein the first cassette locking pin (1156) and the second cassette locking pin (1159) is locked to the piston (1168) such that the piston (1168) and the cassette locking pins (1156, 1159) move together along the longitudinal axis.
- 25 32. A system comprising an auto injector according to any of the claims 1-31 and a cassette (500) comprising:
- 30 o a syringe compartment (202) containing the medicament and extending from a proximal end to a distal end, wherein the proximal end is adapted for being in connection with a needle through which the medicament is allowed to exit the syringe compartment (202);
- 35 o a stopper (208) movable from a distal position to a proximal position inside the syringe compartment by means of a piston (1168) in the auto injector moving the stopper proximally for emptying the syringe compartment; and
- o a syringe holder (510) extending around at least part of the syringe compartment (202).

33. The system according to claim 32, wherein the cassette (500) is adapted for being received in the auto injector (1000) by movement of the cassette (500) and the auto injector towards each other along a shared longitudinal axis without significant rotation of the cassette around the shared longitudinal axis.
- 5
34. The system according to any of the claims 32-33, wherein the cassette further comprises a hollow needle (204) in fluid connection with the proximal end of the syringe compartment (202).
- 10
35. The system according to any of the claims 32-34, wherein the cassette further comprises a rigid needle shield (206) connected to the proximal end of the syringe compartment and adapted for covering a hollow needle (204).
- 15
36. The system according to claim 34 or 35, wherein the syringe compartment (202), the hollow needle (204) and the stopper (208) are part of a syringe (200) fixed inside the syringe holder (510).
- 20
37. The system according to any of the claims 32-36, wherein when the drive module (1150) moves the first cassette locking pin (1156) proximally, the cassette (500) is locked in auto injector (1000).
38. The system according to any of the claims 32-37, wherein the cassette further comprises a cassette cap (530), and a cassette skin sensor (550).
- 25
39. The system according to claim 38, wherein the cassette cap (530) comprises a first part (531) positioned between the rigid needle shield (206) and the proximal end of the syringe compartment (202).
- 30
40. The system according to any of the claims 38-39, wherein when the drive module (1150) moves the first cassette locking pin (1156) further in the proximal direction, the cassette skin sensor (550) is adapted for being distally unlocked from the syringe holder (510) allowing for distal movement of the cassette skin sensor (550).
- 35
41. The system according to any of the claims 38-40, wherein when the drive module (1150) moves the second cassette locking pin (1158) further in the proximal direction, the cassette skin sensor (550) is adapted for being proximally unlocked from the

syringe holder (510) allowing for proximal movement of the cassette skin sensor (550) relative to the syringe holder (510).

- 5 42. The system according to any of the claims 38-41 further comprising a skin sensor spring system (1143) adapted for pushing the skin sensor pin (1158) of auto injector (1000) against a second cassette skin sensor pin (558) at least after release of the cassette skin sensor (550) from the syringe holder (510) by movement of the first cassette locking pin (1156) and/or the second cassette locking pin (1159) in a proximal direction.
- 10 43. The system according to claim 42, wherein the skin sensor spring system (1143) is adapted for pushing the cassette skin sensor (550) in a proximal direction into a locked position preventing movement of the cassette skin sensor (550) in a distal direction.
- 15 44. The system according to any of the claims 32-43, wherein the cassette covering section (1108) comprises at least one opening (1107) extending in the longitudinal direction of the housing (1102), wherein the cassette housing (540) comprises at least one opening (547) extending along a longitudinal axis of the cassette housing (540),
- 20 wherein the at least one opening (547) in the cassette housing (540) and the at least one opening (1107) in the cassette covering section (1108) are aligned when the cassette is positioned inside auto injector to facilitate inspection of the medicament in the syringe compartment (202).
- 25 45. The system according to claim 44, wherein the cassette covering section (1108) and the cassette housing (540) each comprise two openings (1107, 547) extending in the longitudinal direction on opposite sides of the housing (1102) and the cassette housing (540), respectively, wherein the openings (547, 1107) are aligned when the
- 30 cassette is positioned inside auto injector to facilitate inspection of the medicament in the syringe compartment (202) from two opposite directions.
- 35 46. The system according to any of the claims 44-45, wherein the cassette and auto injector housing have cross sectional planes perpendicular to the longitudinal axis of the cassette housing (540) and the auto injector housing (1102), wherein the cross sectional planes are non-circular in shape, such as oval or square in shape.

47. The system according to any of the claims 44-46, wherein the cassette covering section (1108) comprises interior guiding tracks in parallel with the longitudinal direction configured for guiding the cassette to a correct position when inserting the cassette into the cassette covering section.
- 5
48. The system according to claim 47, wherein the interior guiding tracks forms part of the openings (1107) inside the cassette covering section (1108) of auto injector housing.
- 10
49. A system comprising a cassette (500) with medicament and an auto injector (1000) for administering the medicament, wherein the cassette (500) is removably received in the auto injector (1000),
wherein the auto injector (1000) comprises a housing (1102) extending from a proximal end (1103) to a distal end (1104) along a longitudinal axis, the housing (1102) comprising a cassette covering section (1108) covering the cassette (500)
15 when received inside the injector (1000), the cassette covering section (1108) comprising at least one opening (1107) extending in the longitudinal direction of the housing (1102);
wherein the cassette extends from a proximal end (502, 505) to a distal end (503, 506) along a longitudinal axis and comprising a cassette housing (540) enclosing at least:
20 ○ a syringe compartment (202) containing the medicament and adapted to be in connection with a needle for delivery of the medicament;
 ○ a stopper (208) movable from a distal position to a proximal position inside the syringe compartment for emptying the syringe compartment;
wherein the cassette housing (540) comprises at least one opening (547) extending
25 along a longitudinal axis of the cassette housing (540);
wherein the opening (547) in the cassette housing (540) and the opening (1107) in the cassette covering section (1108) are aligned when the cassette is positioned inside auto injector to facilitate inspection of the medicament in the syringe compartment (202).
30
50. The system according to claim 49, wherein the cassette covering section (1108) and the cassette housing (540) each comprise two openings (1107, 547) extending in the longitudinal direction on opposite sides of the housing (1102) and the cassette housing (540), respectively, wherein the openings (547, 1107) are aligned when the
35 cassette is positioned inside auto injector to facilitate inspection of the medicament in the syringe compartment (202) from two opposite directions.

51. The system according to any of the claims 49-50, wherein the cassette covering section (1108) comprises interior guiding tracks in parallel with the longitudinal direction configured for guiding the cassette to a correct position when inserting the cassette into the cassette covering section.
- 5
52. The system according to any of the claims 49-51, wherein the cassette covering section (1108) comprises interior guiding tracks in parallel with the longitudinal direction.
- 10 53. The system according to claim 52, wherein the interior guiding tracks forms part of the one or more openings (1107) inside the cassette covering section (1108) of auto injector housing.

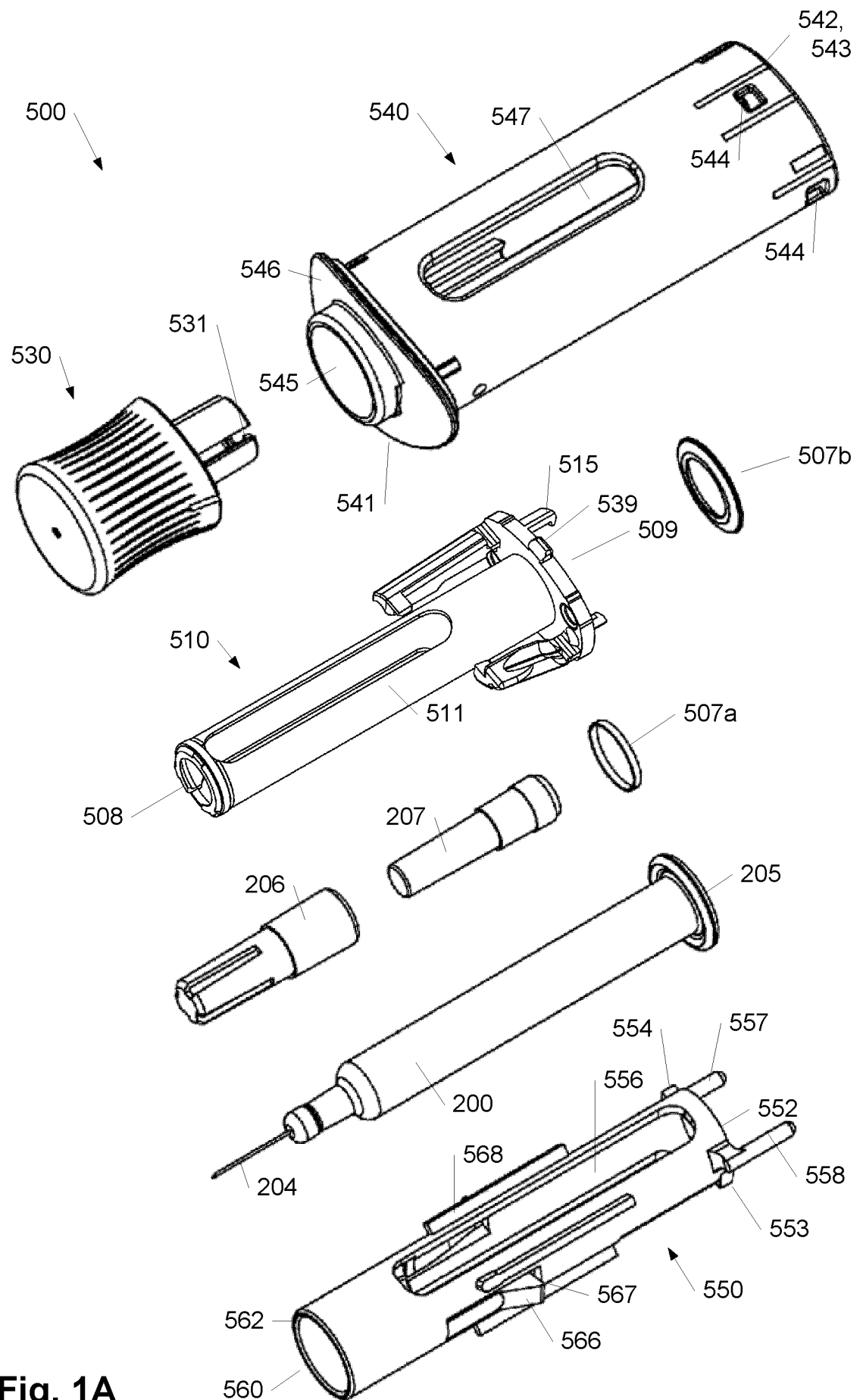
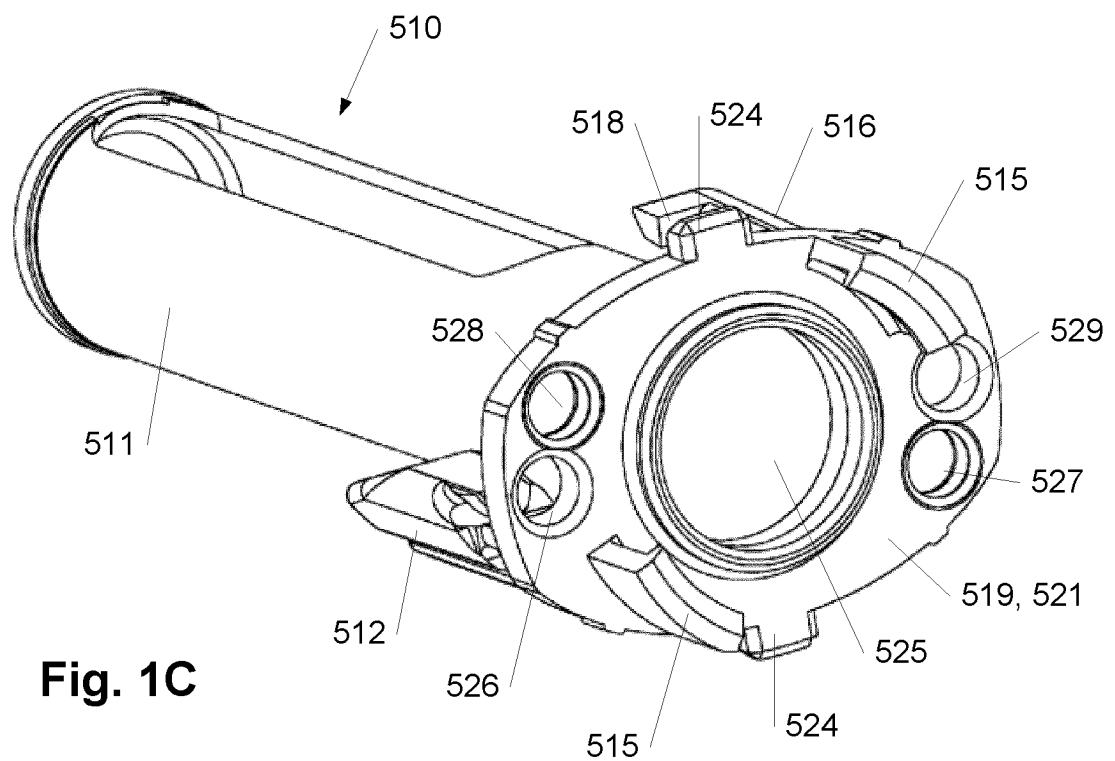
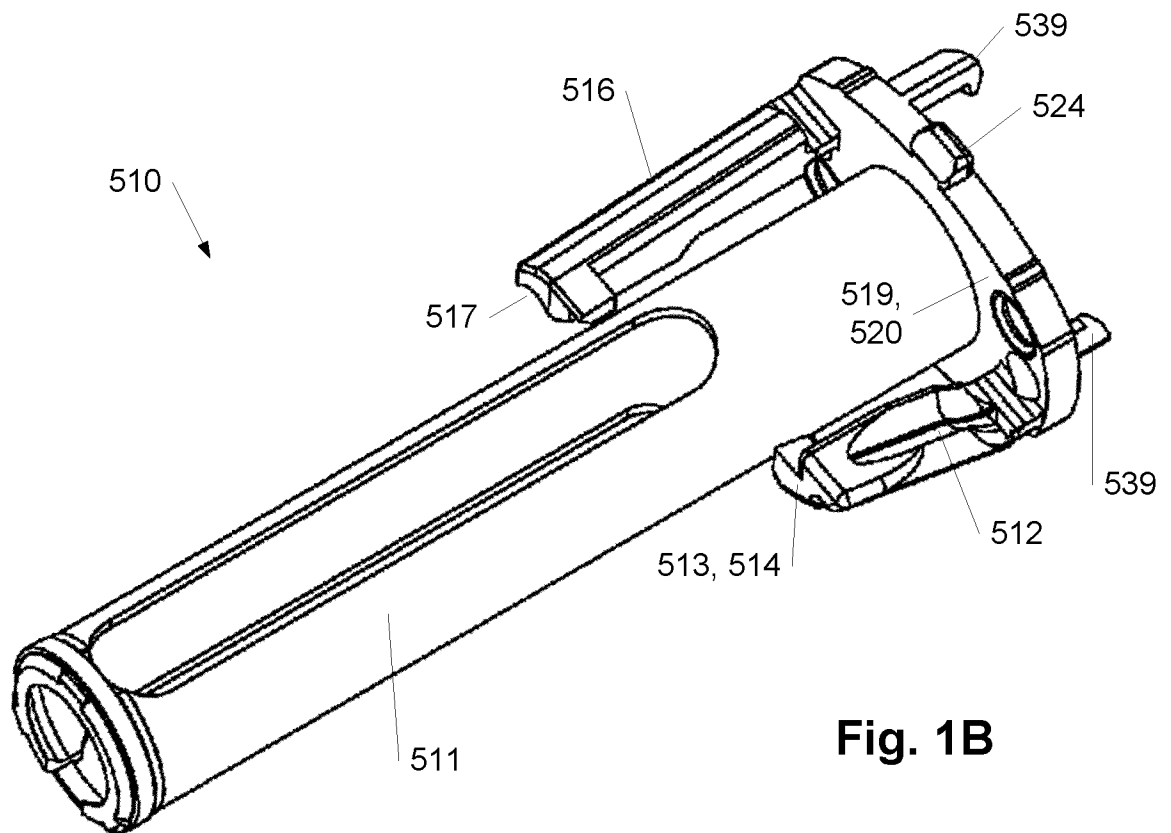


Fig. 1A



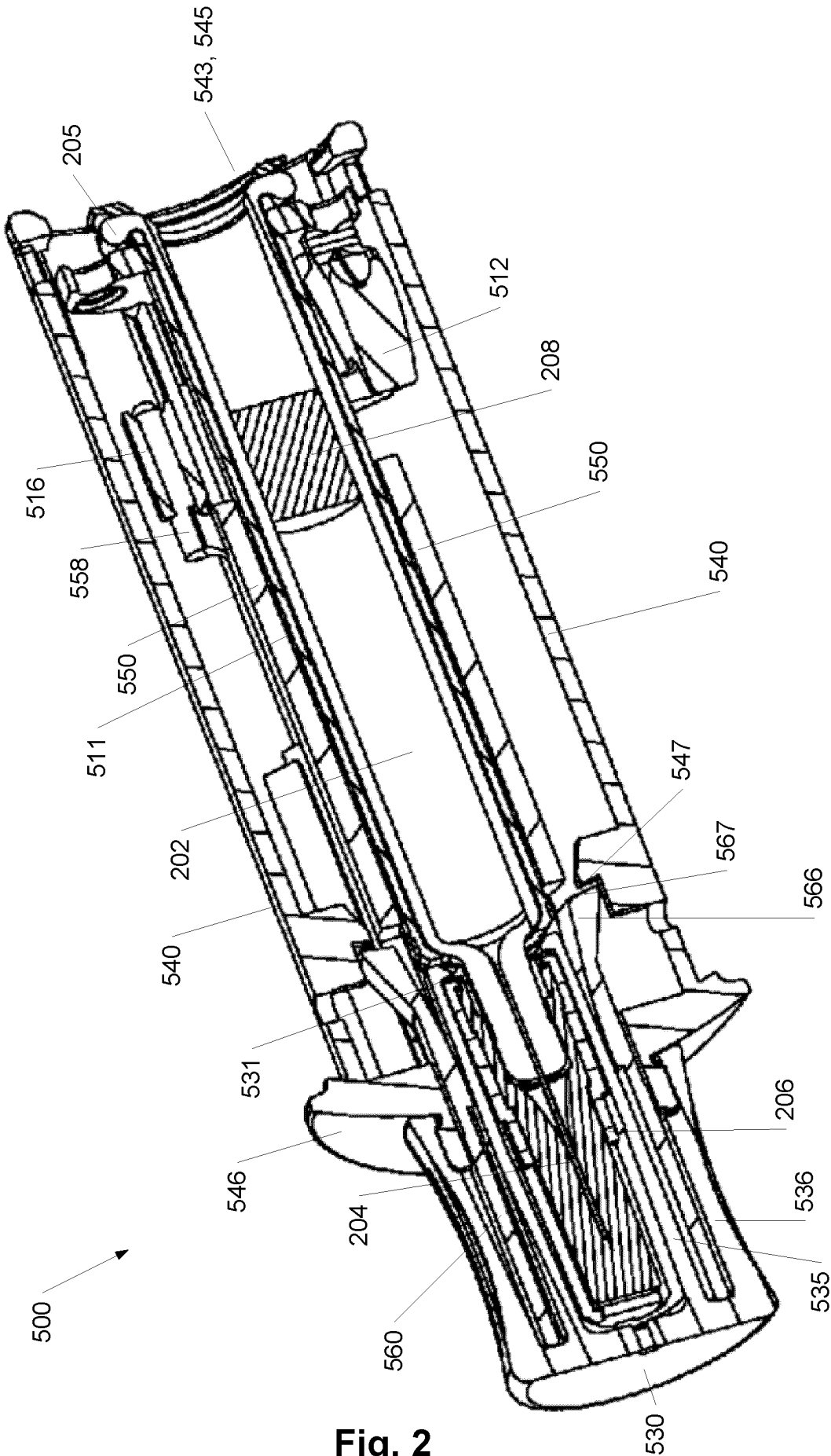


Fig. 2

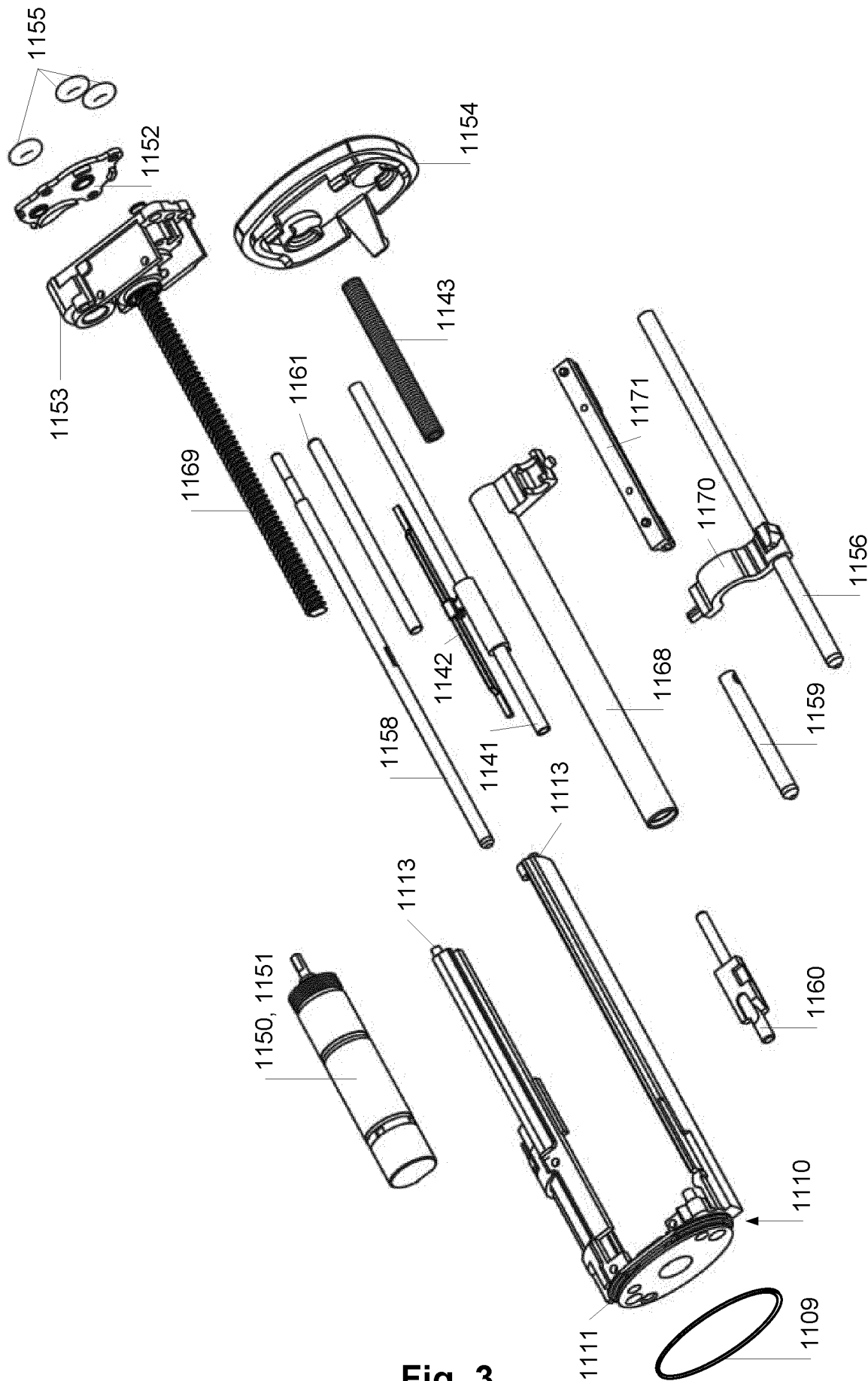


Fig. 3

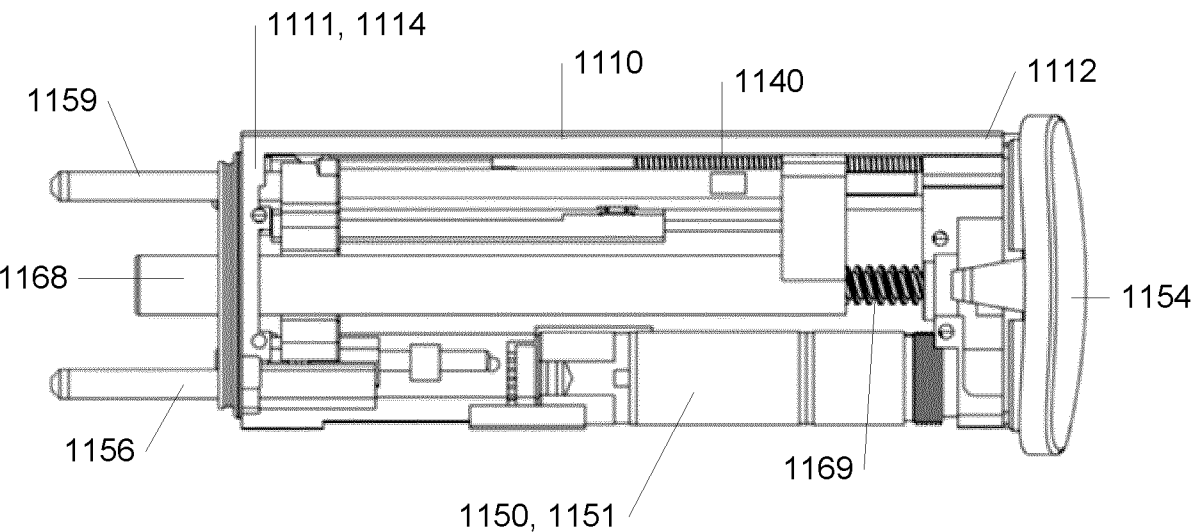


Fig. 4A

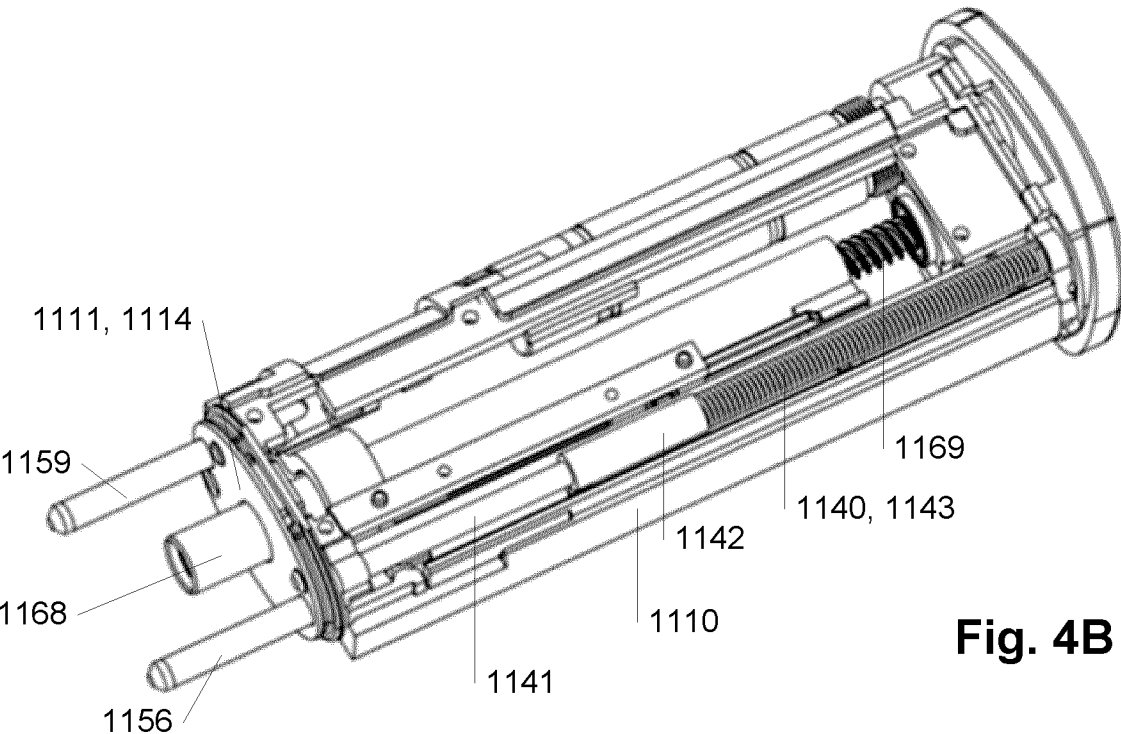


Fig. 4B

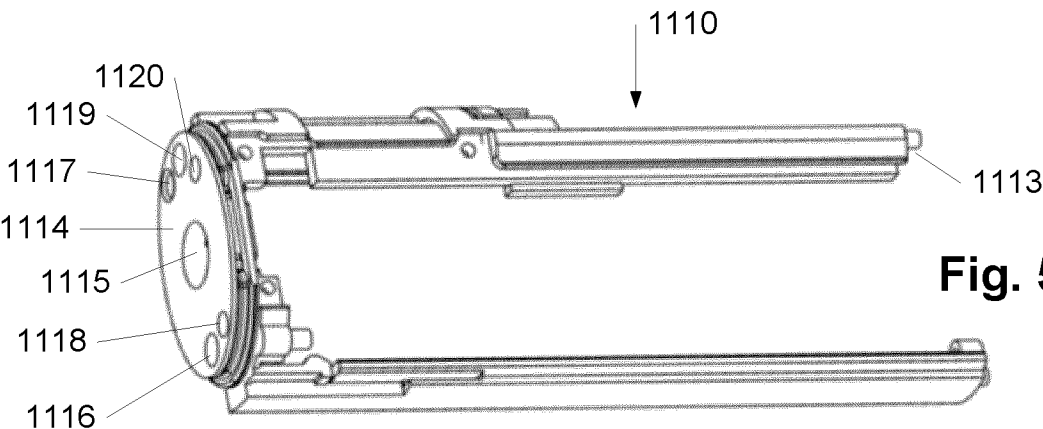


Fig. 5

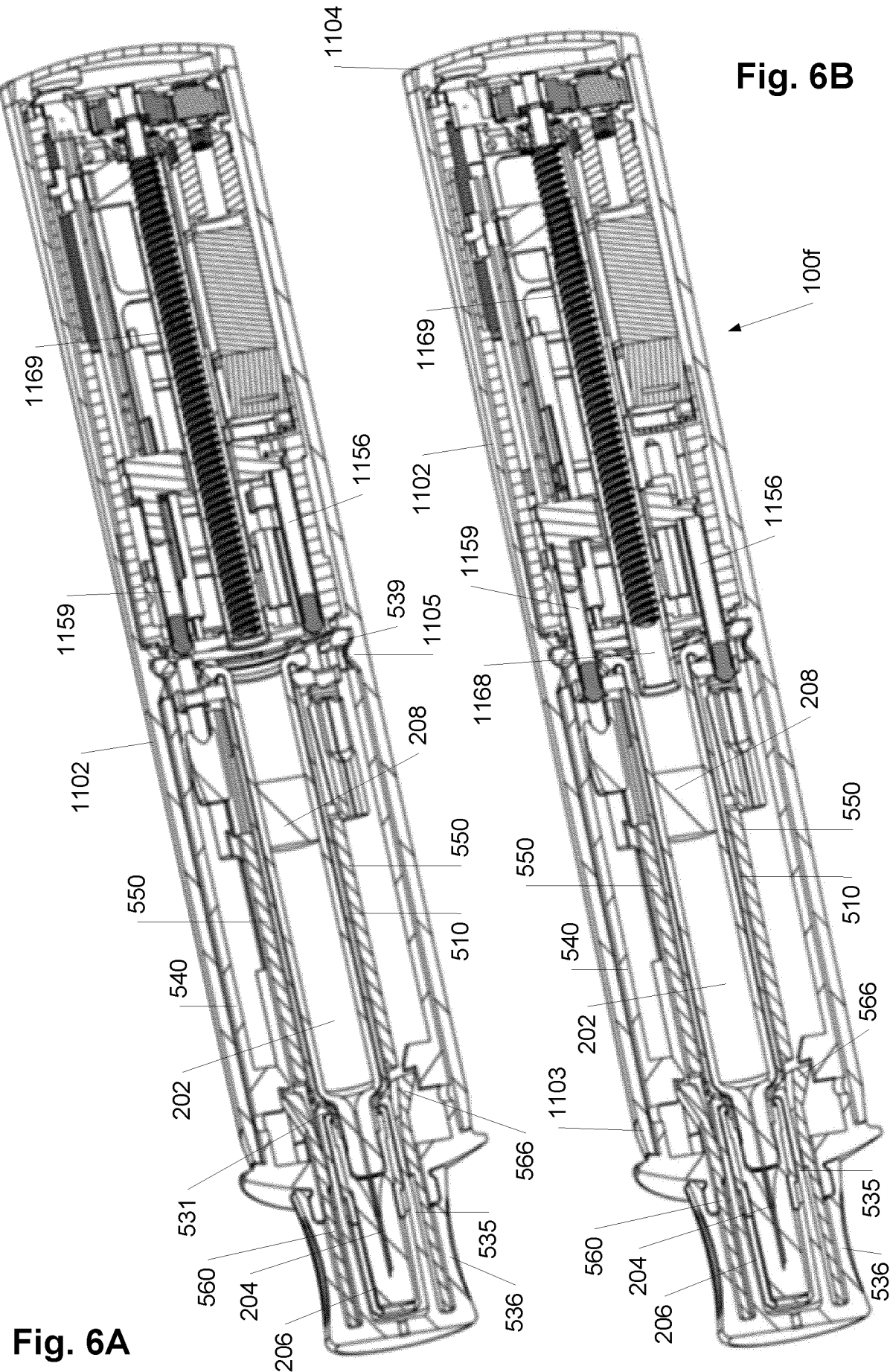
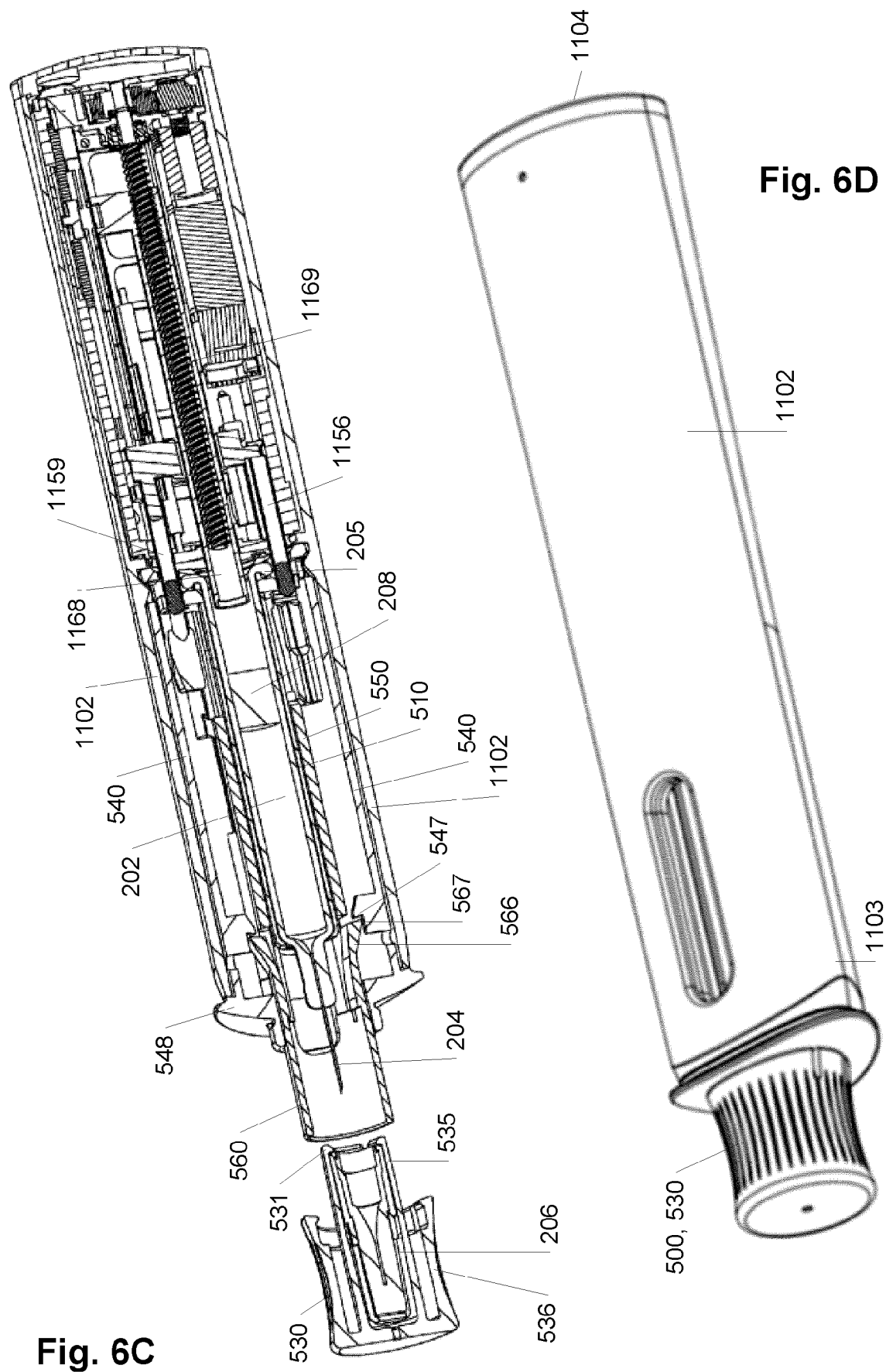


Fig. 6A

Fig. 6B



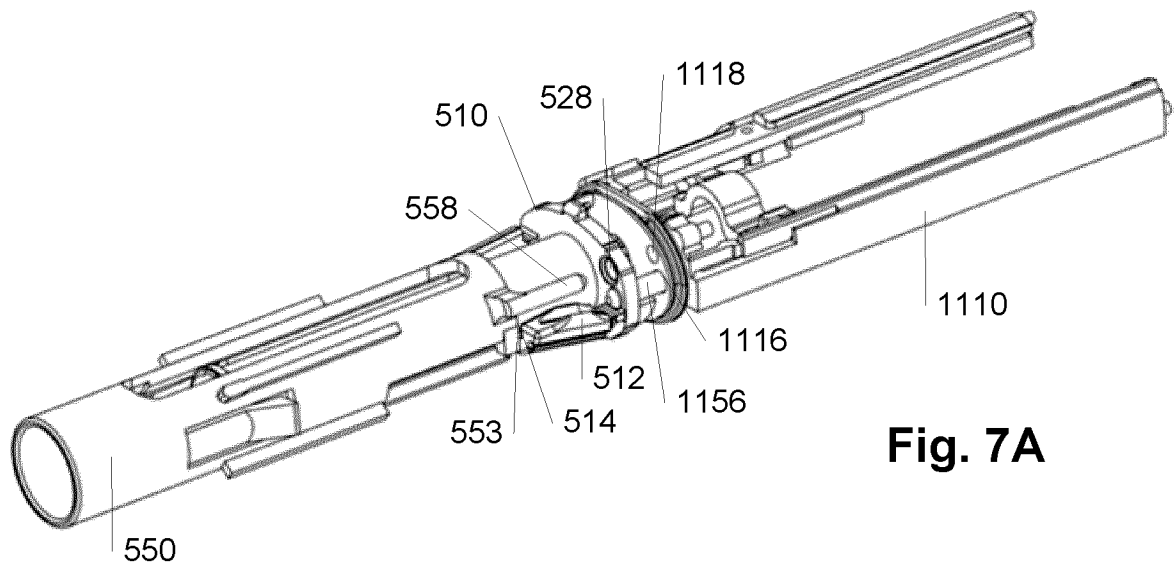


Fig. 7A

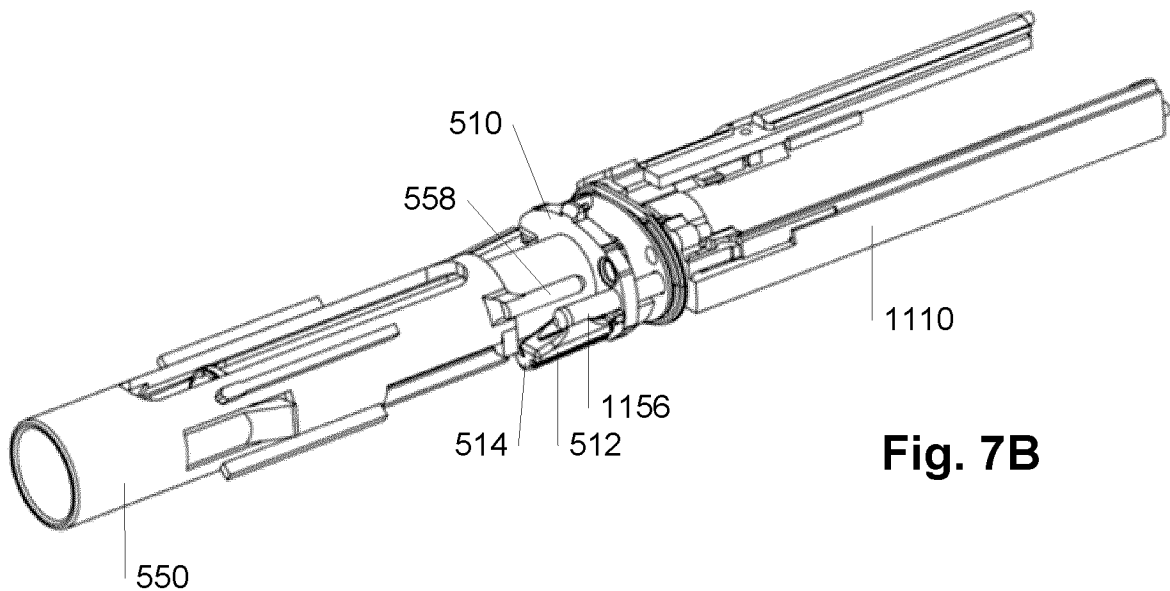


Fig. 7B

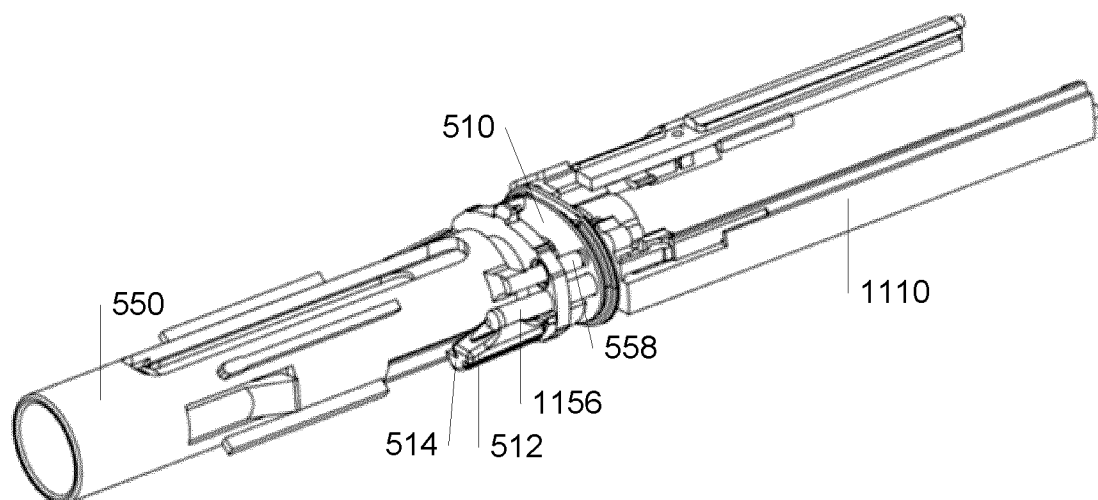


Fig. 7C

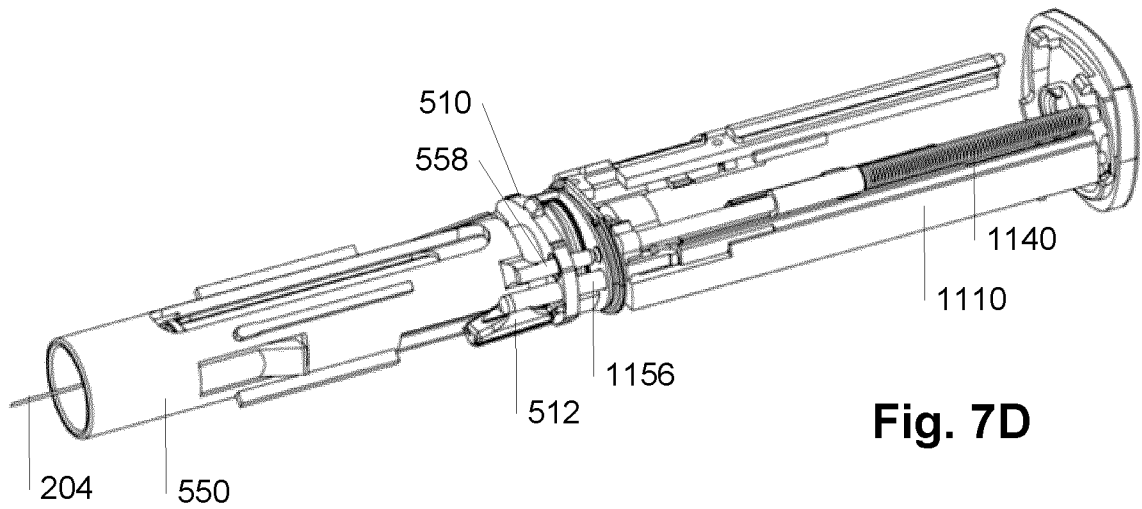


Fig. 7D

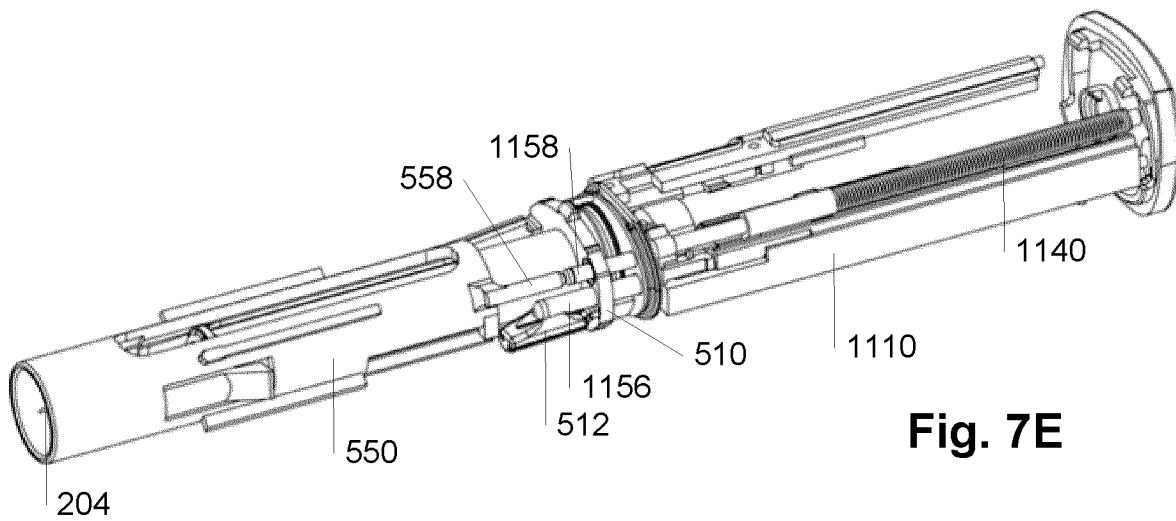


Fig. 7E

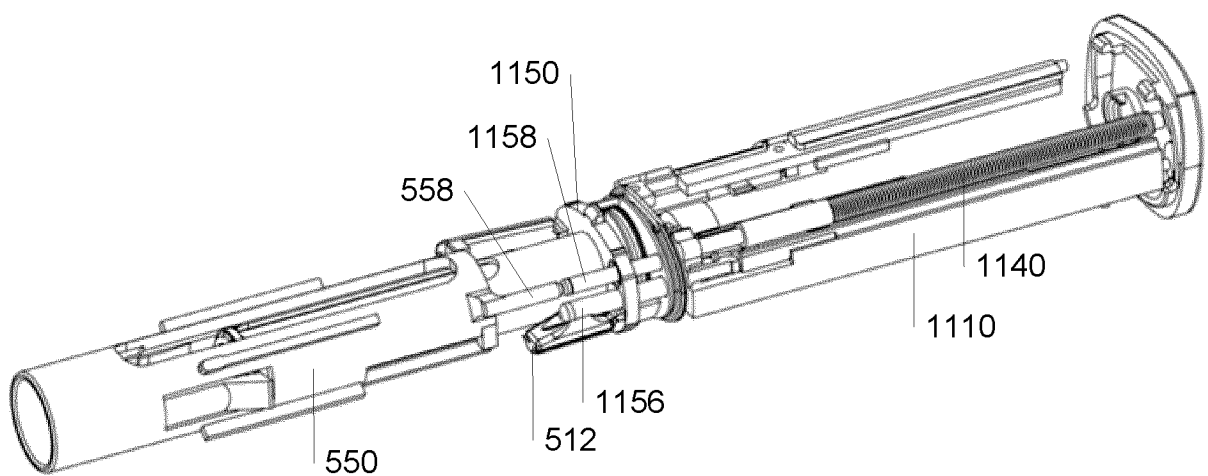


Fig. 7F

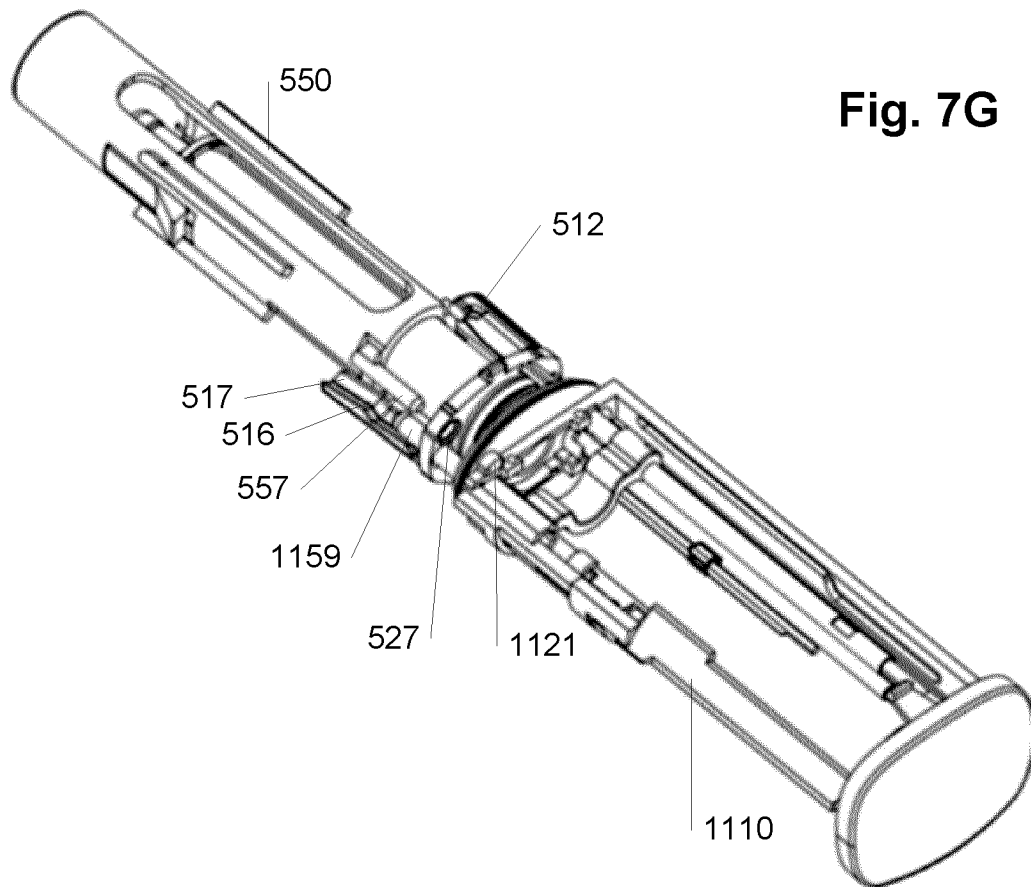


Fig. 7G

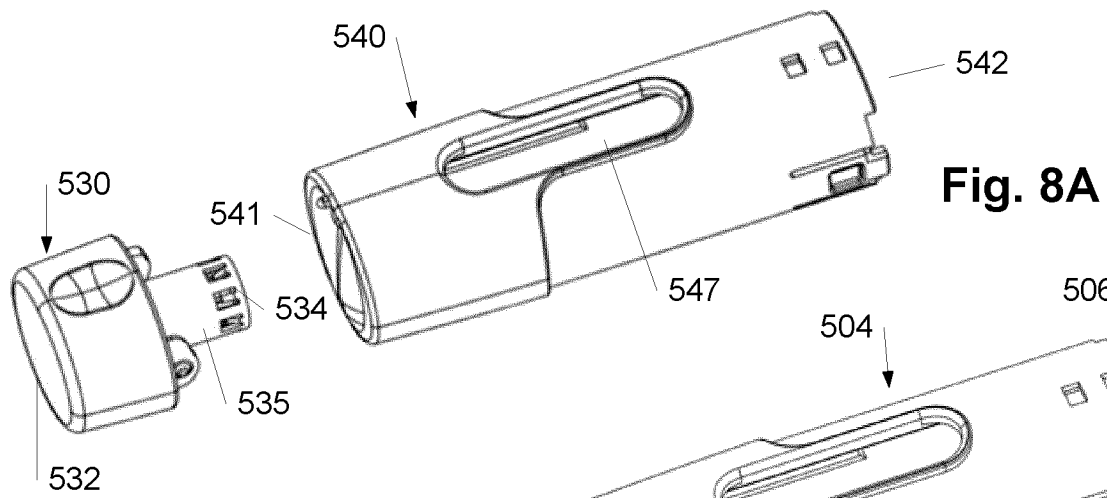


Fig. 8B

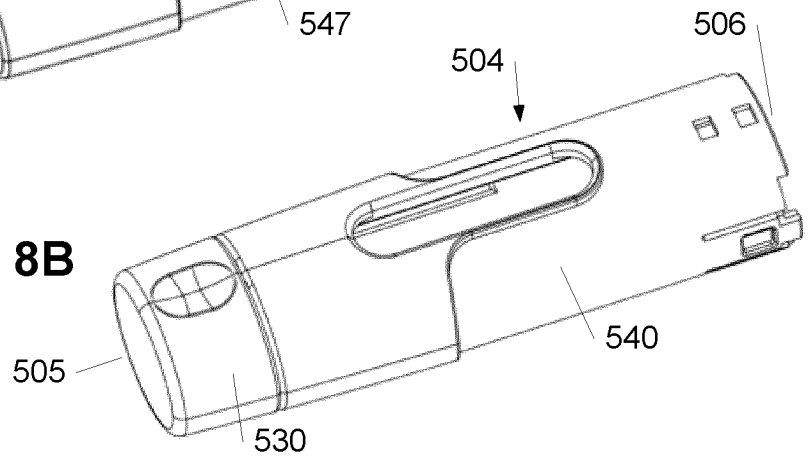


Fig. 9A

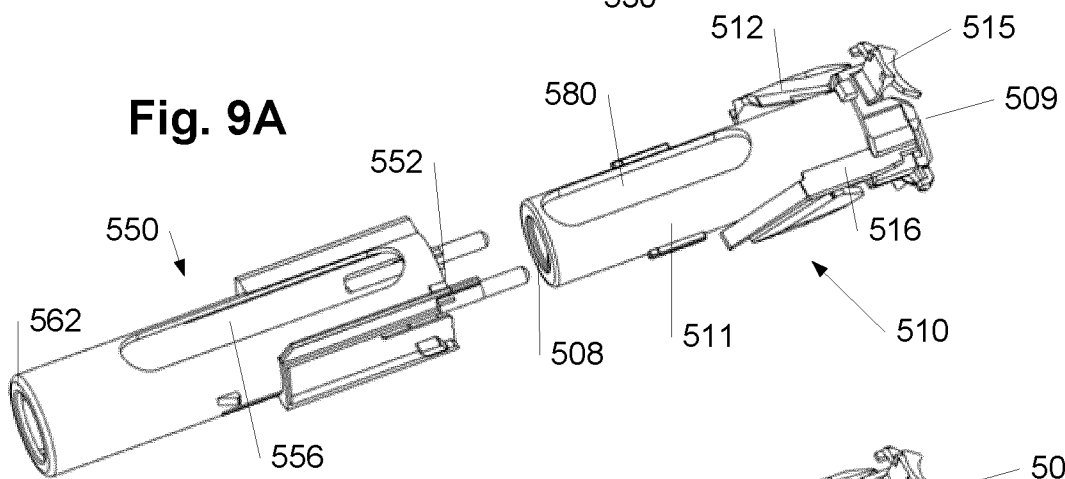
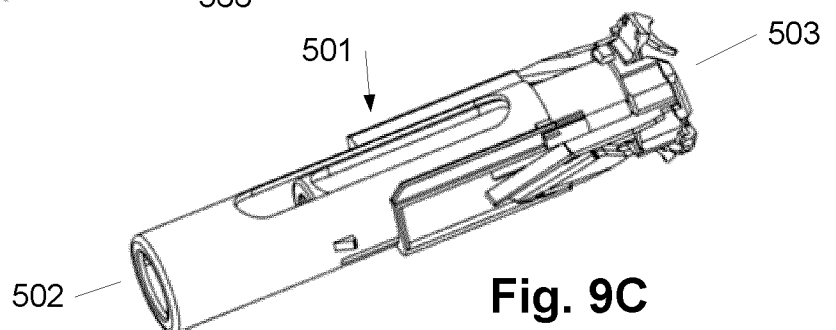
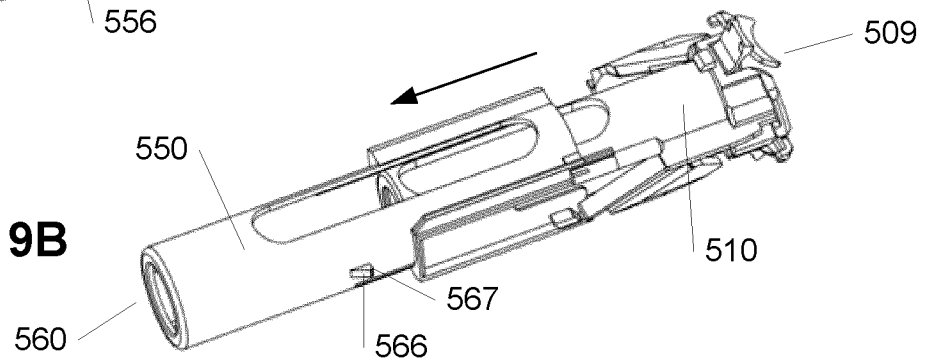
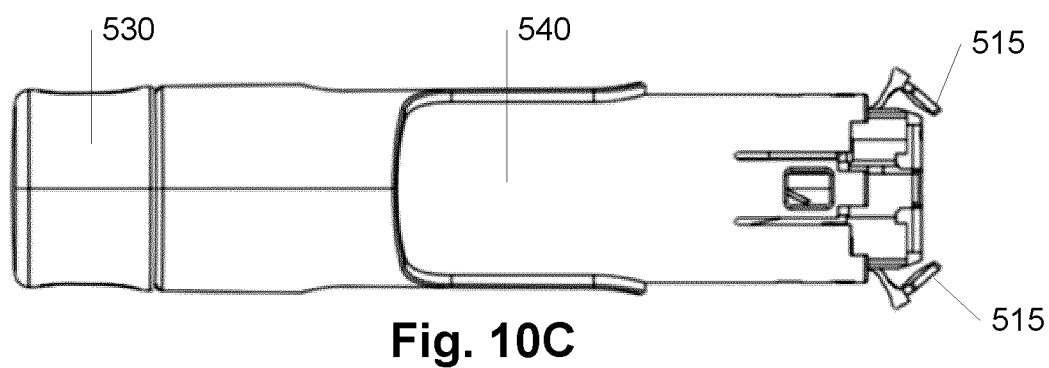
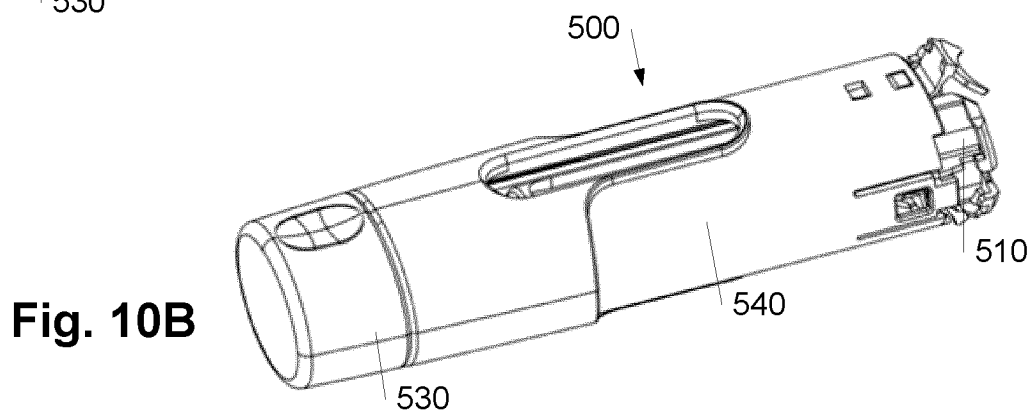
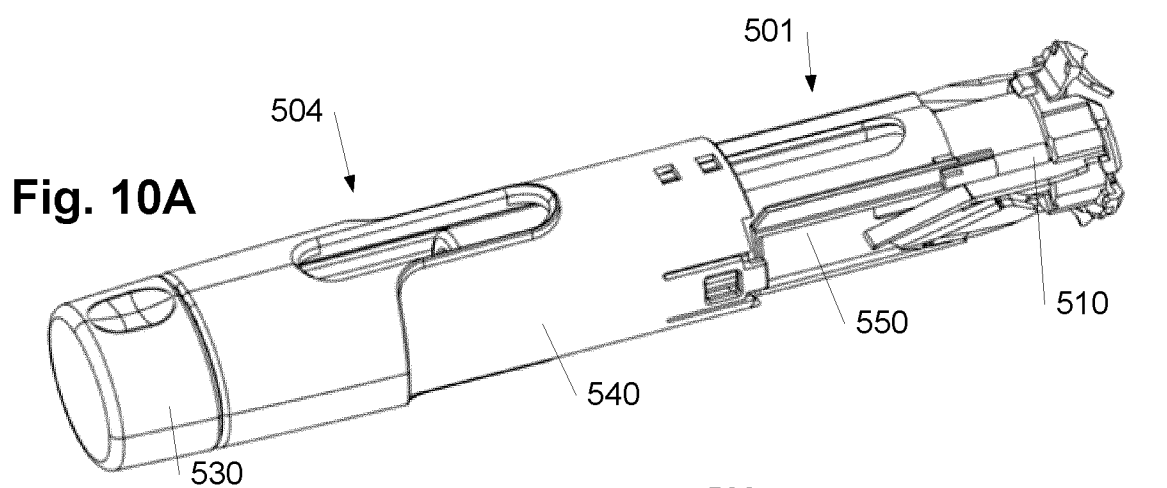
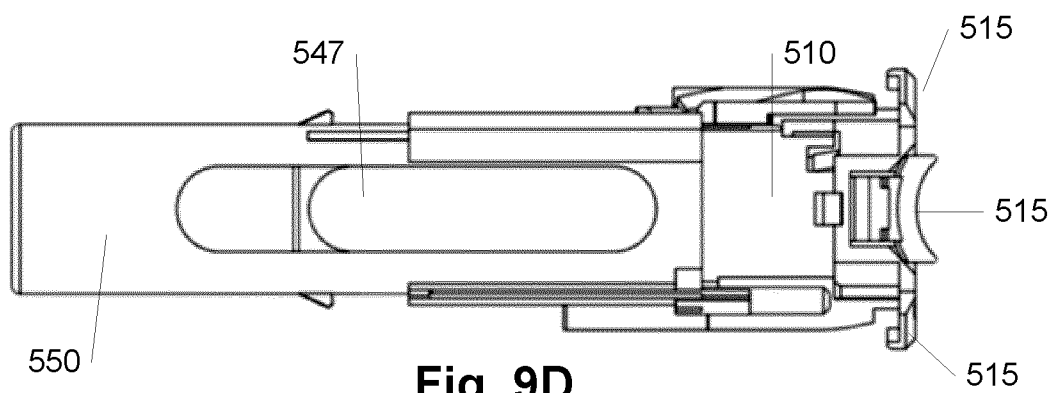


Fig. 9B





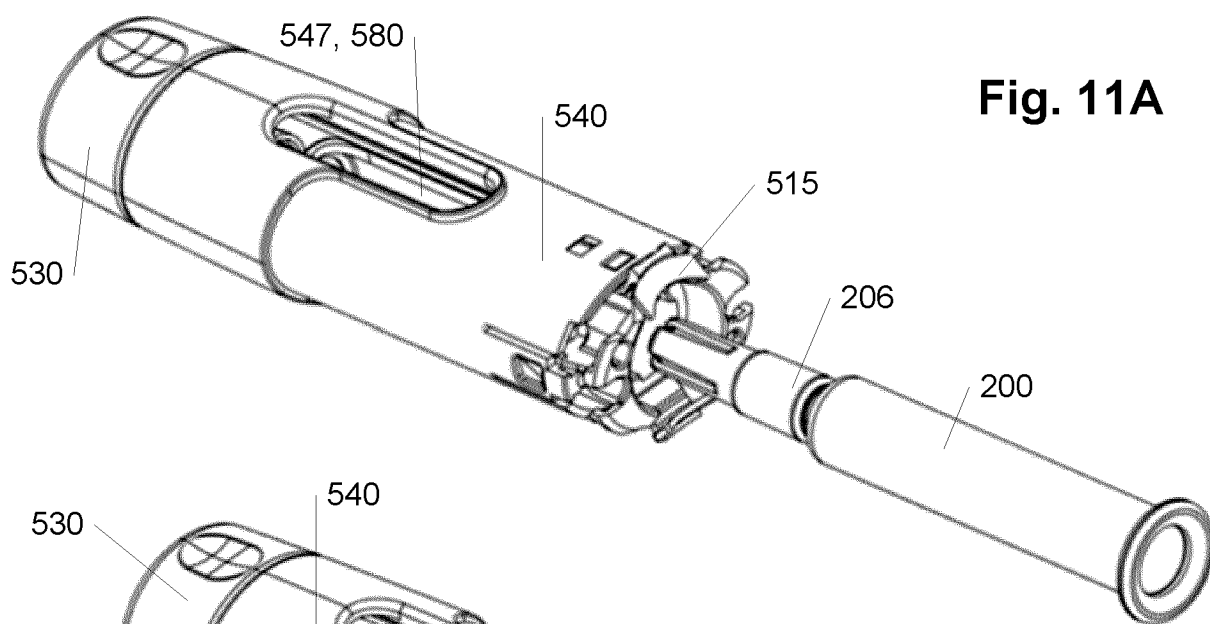


Fig. 11A

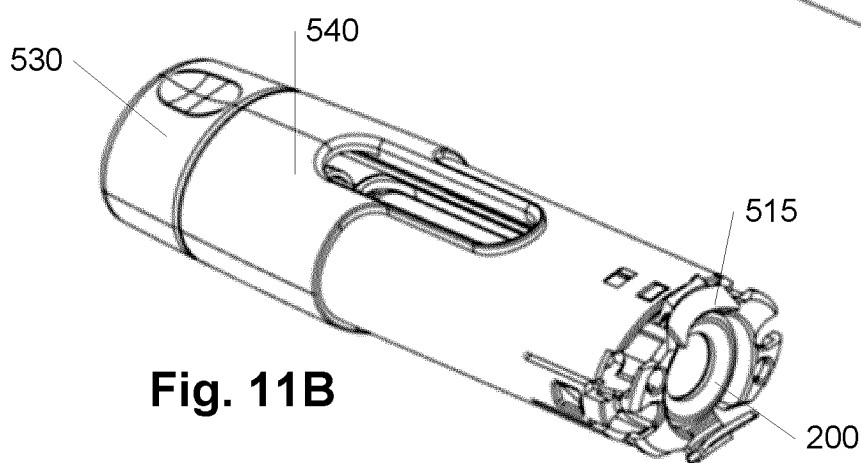


Fig. 11B

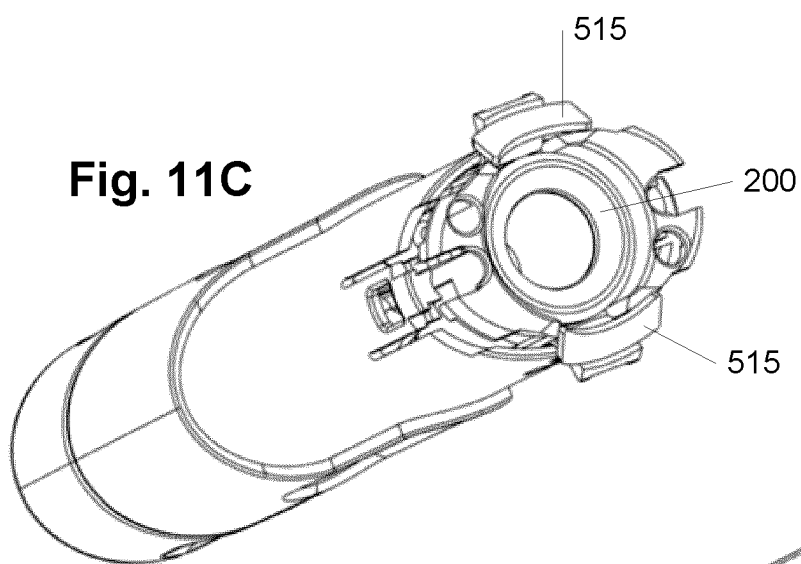


Fig. 11C

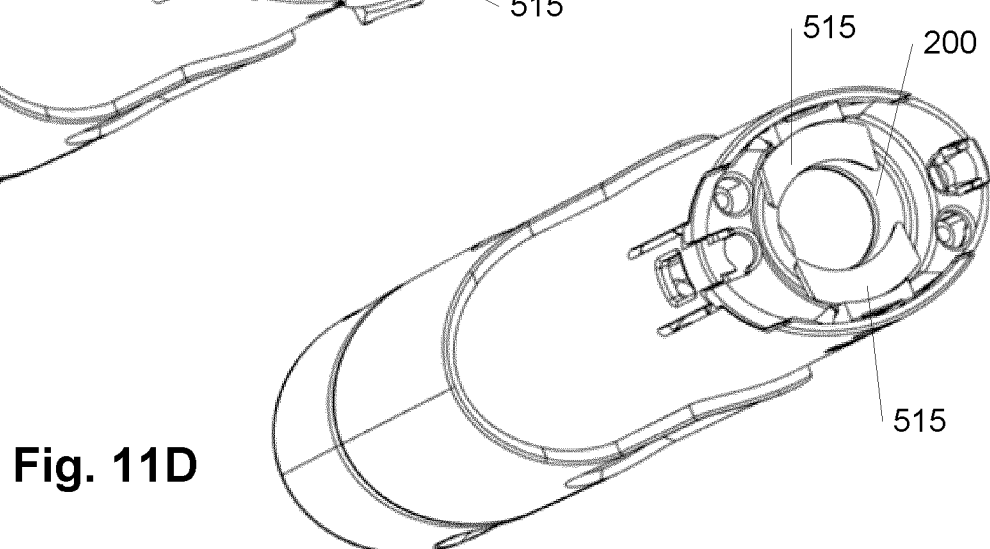
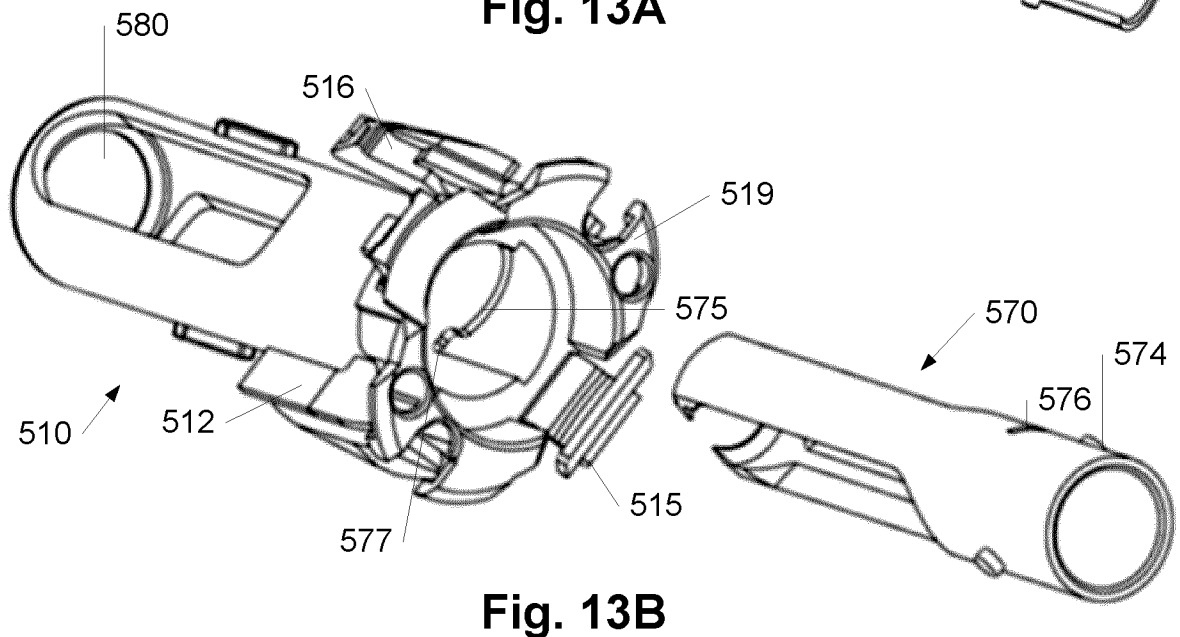
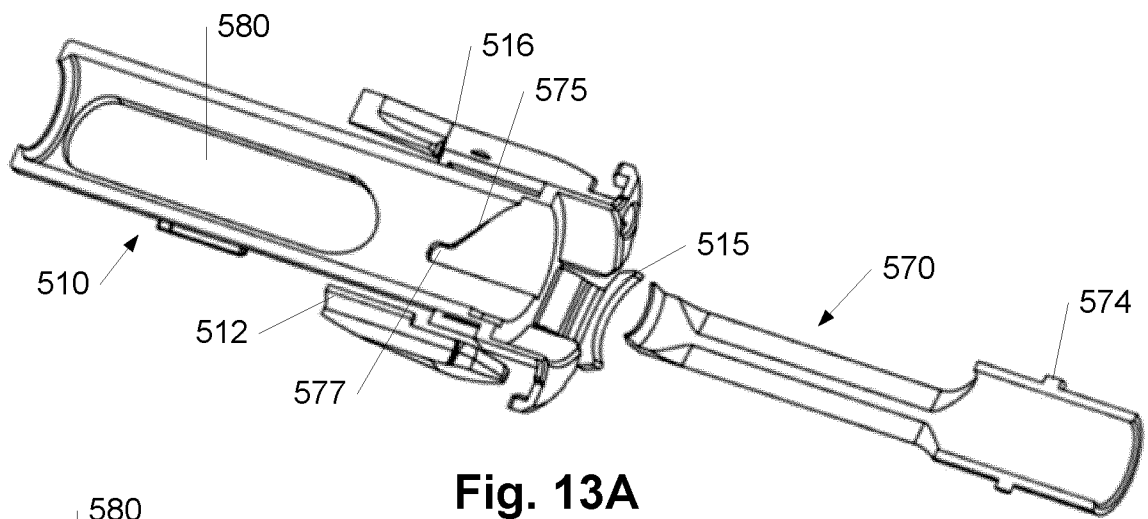
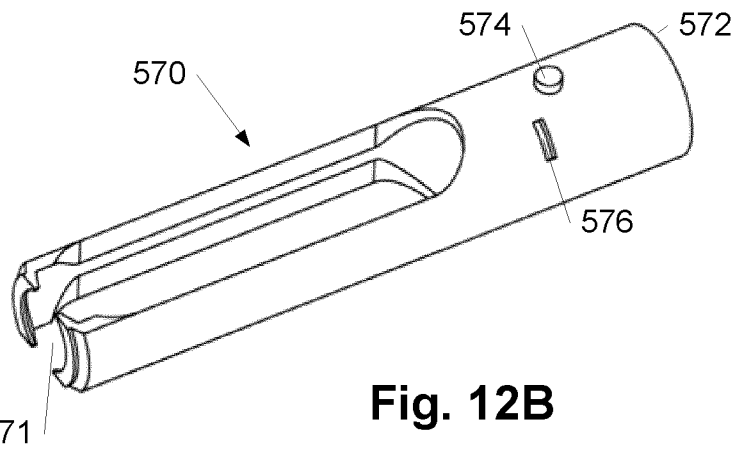
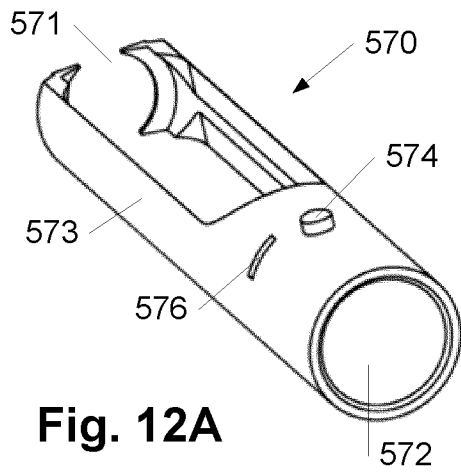


Fig. 11D



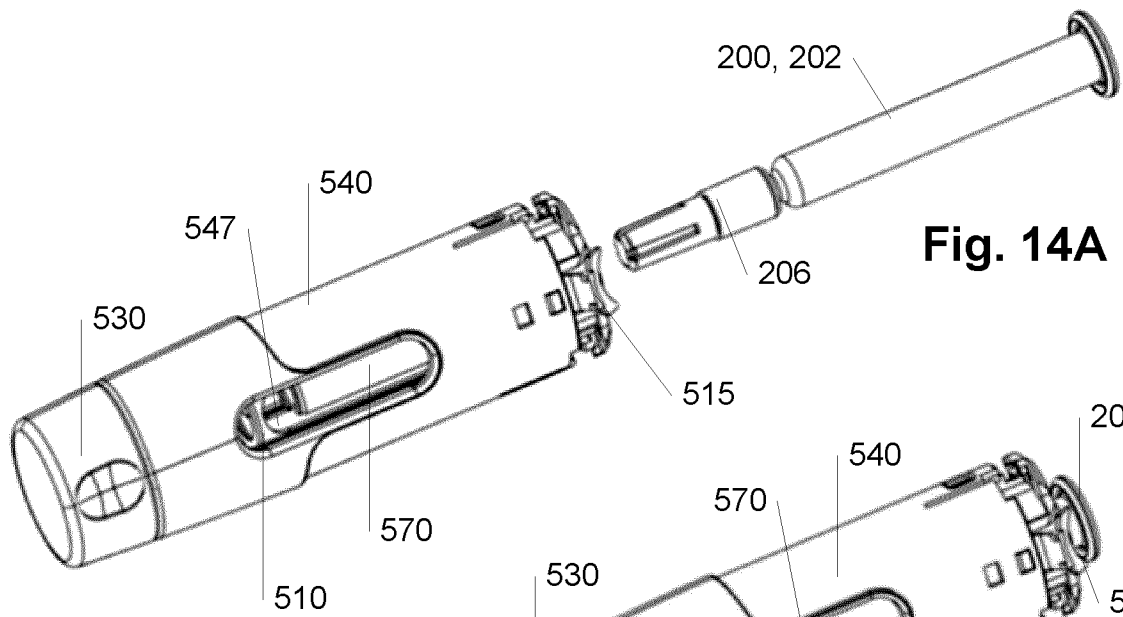


Fig. 14A

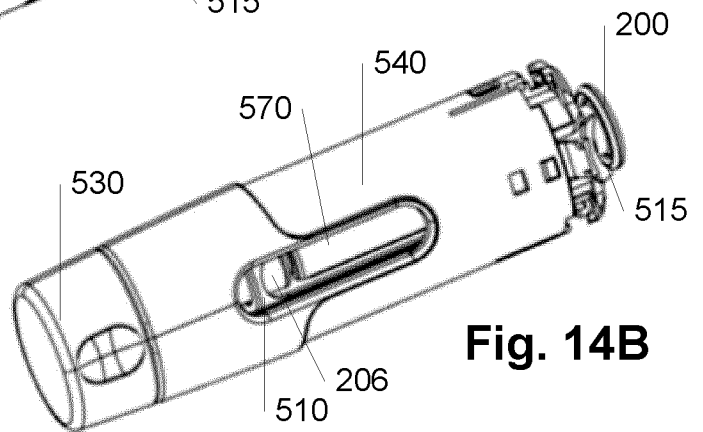


Fig. 14B

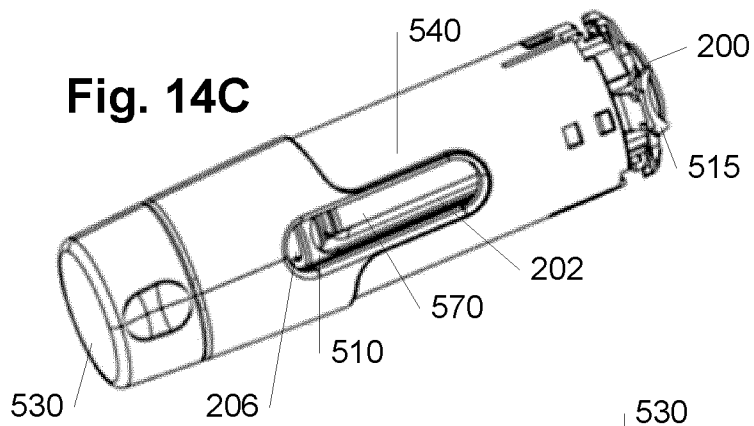


Fig. 14C

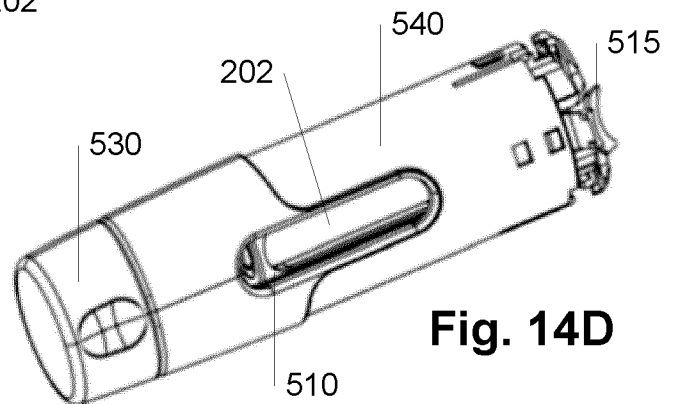


Fig. 14D

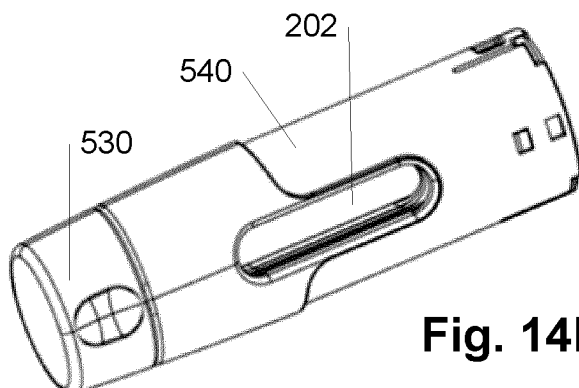


Fig. 14E

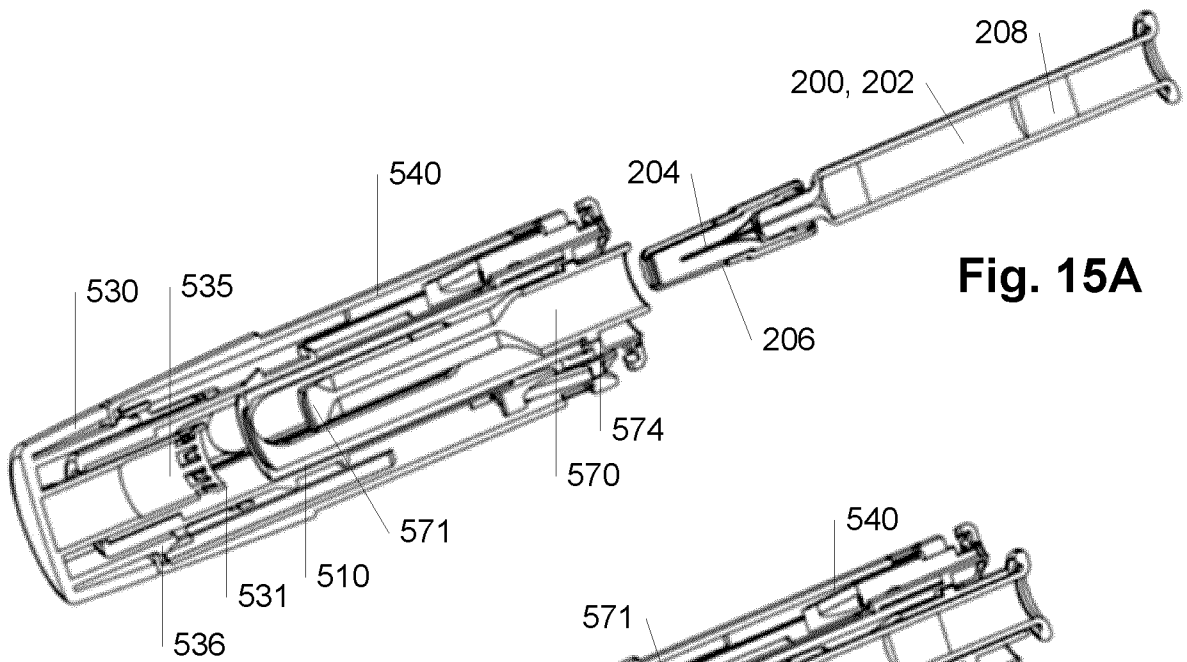


Fig. 15A

Fig. 15B

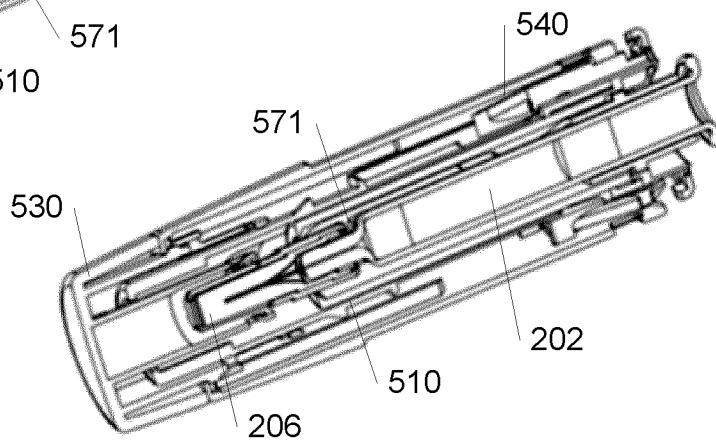


Fig. 15C

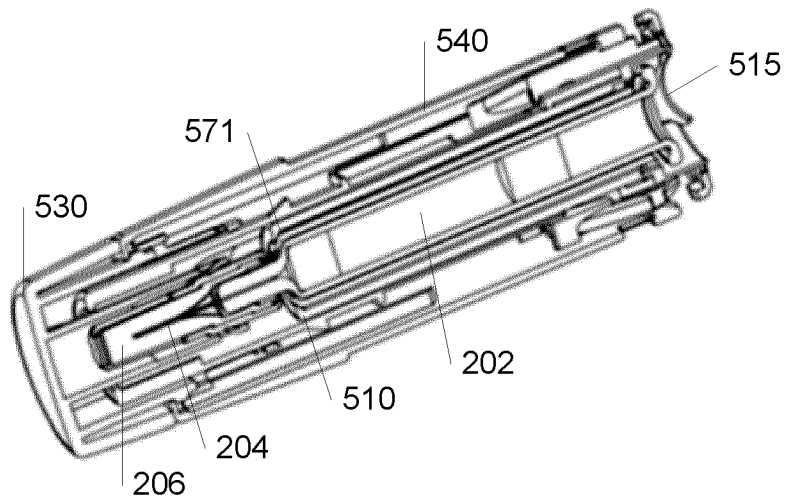
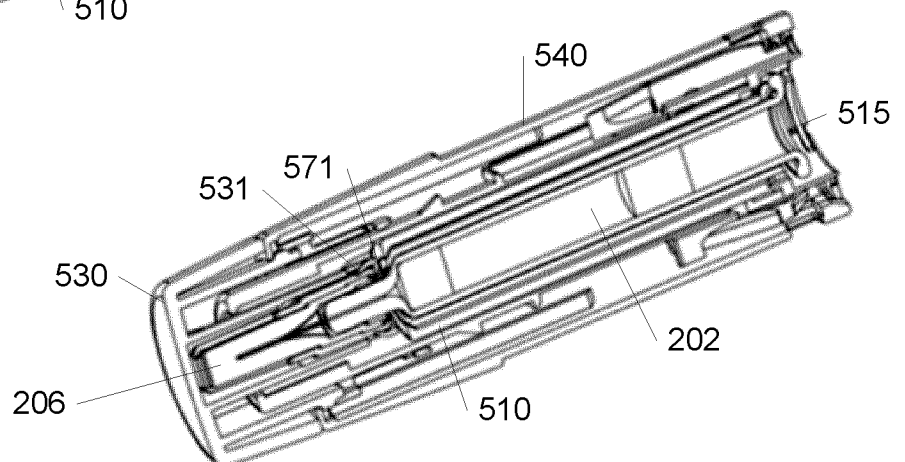


Fig. 15D



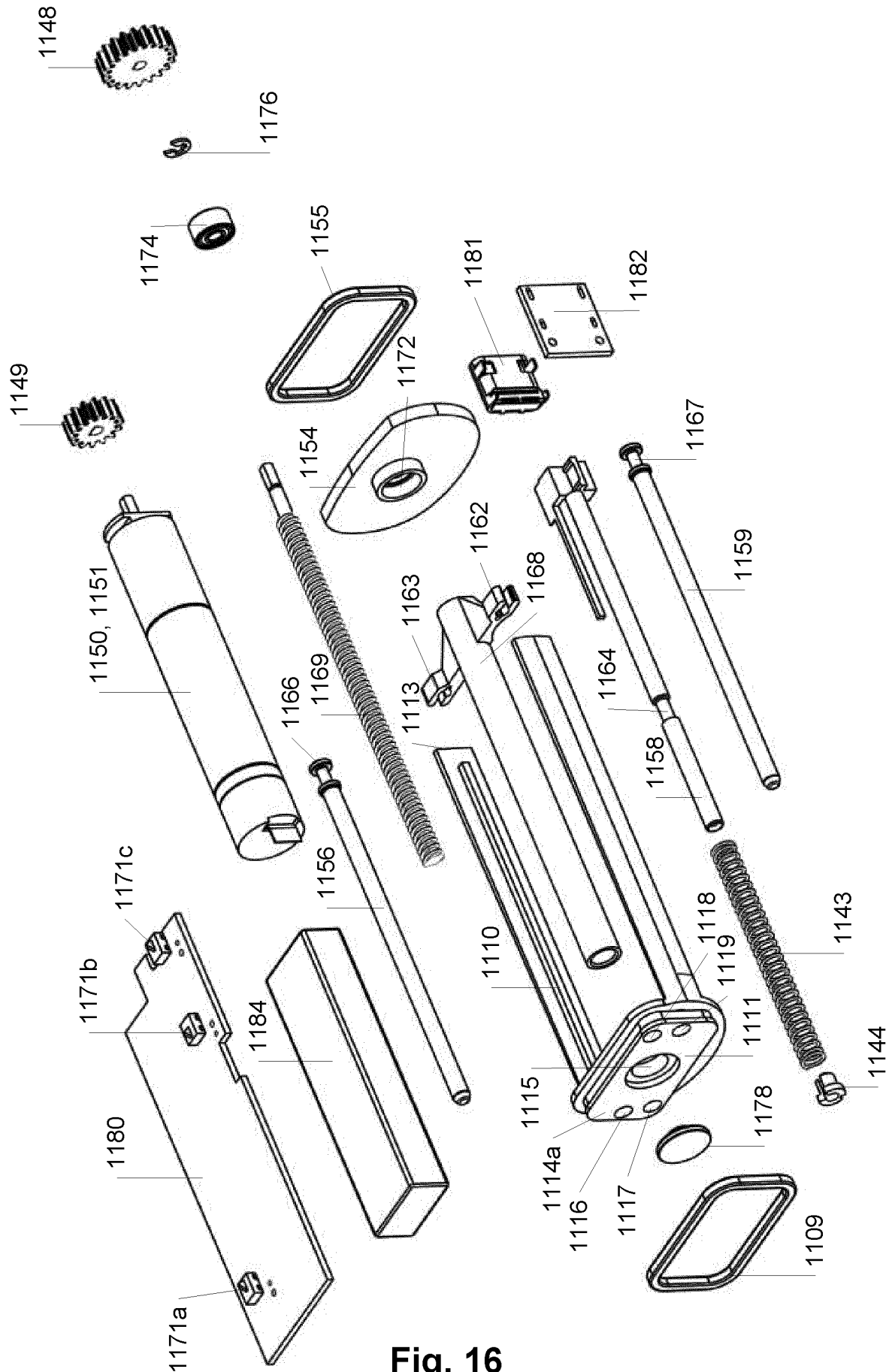


Fig. 16

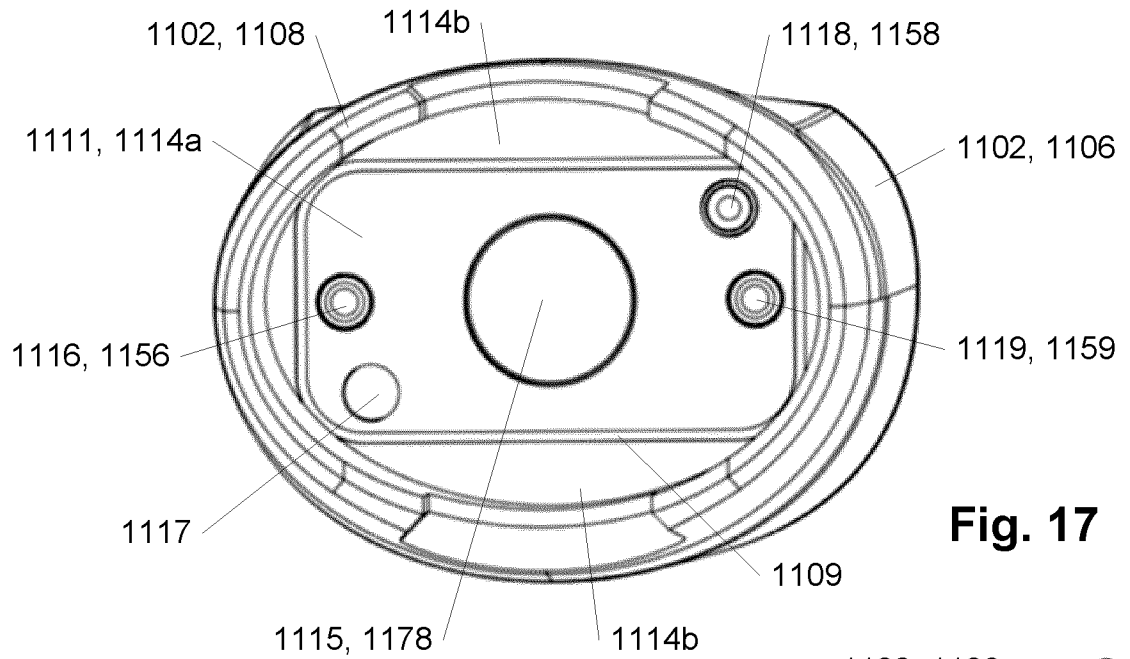


Fig. 17

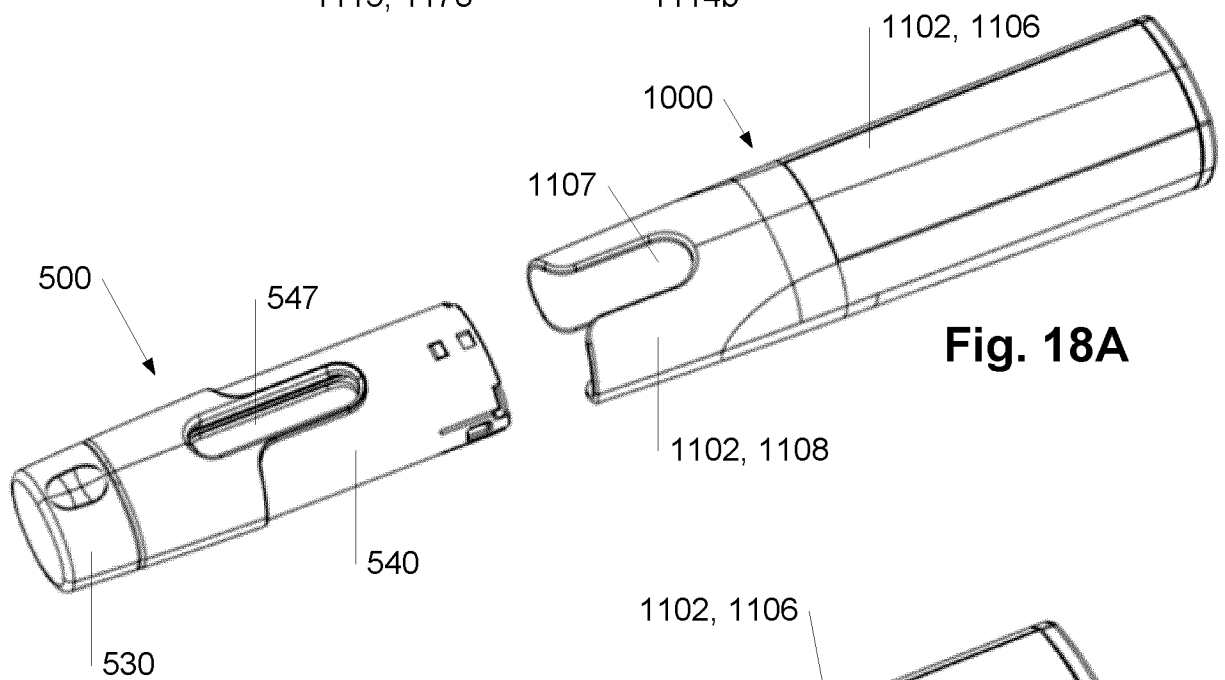


Fig. 18A

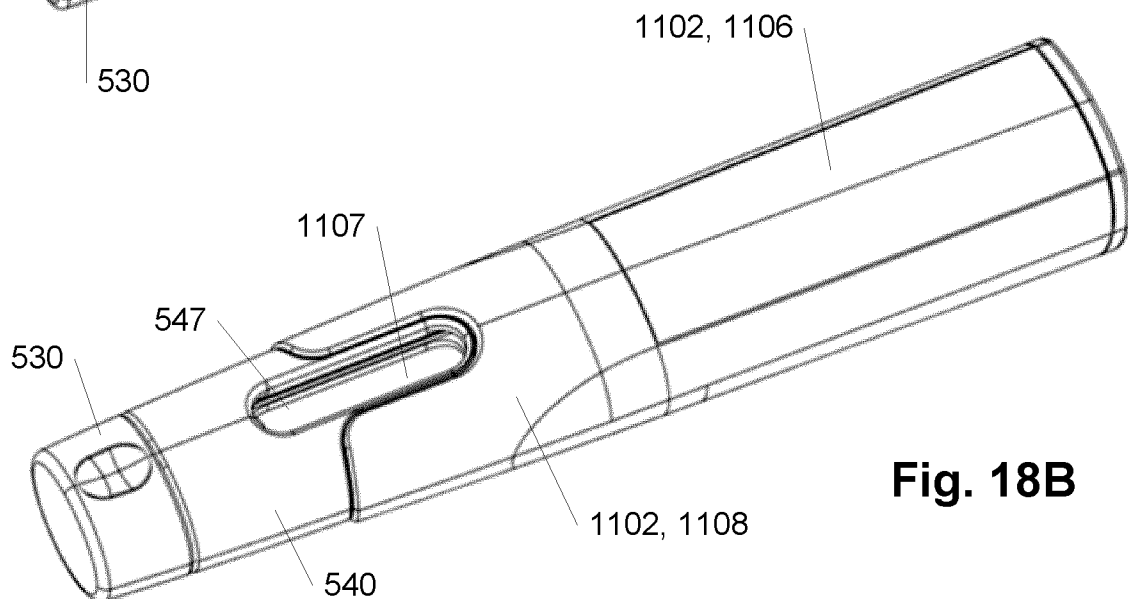


Fig. 18B

Fig. 19

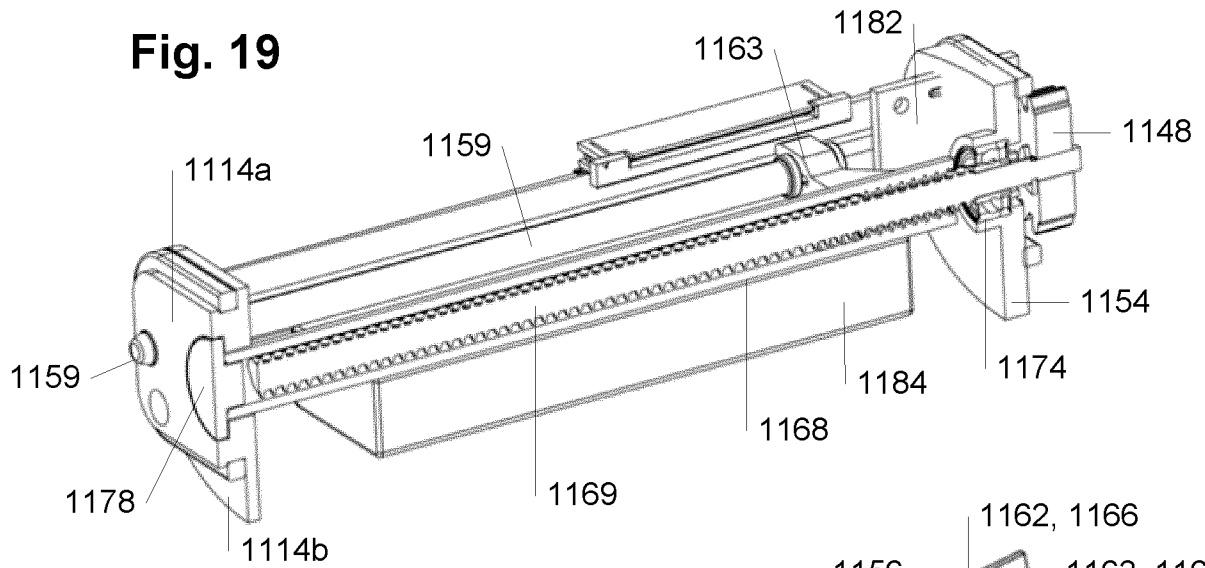


Fig. 20A

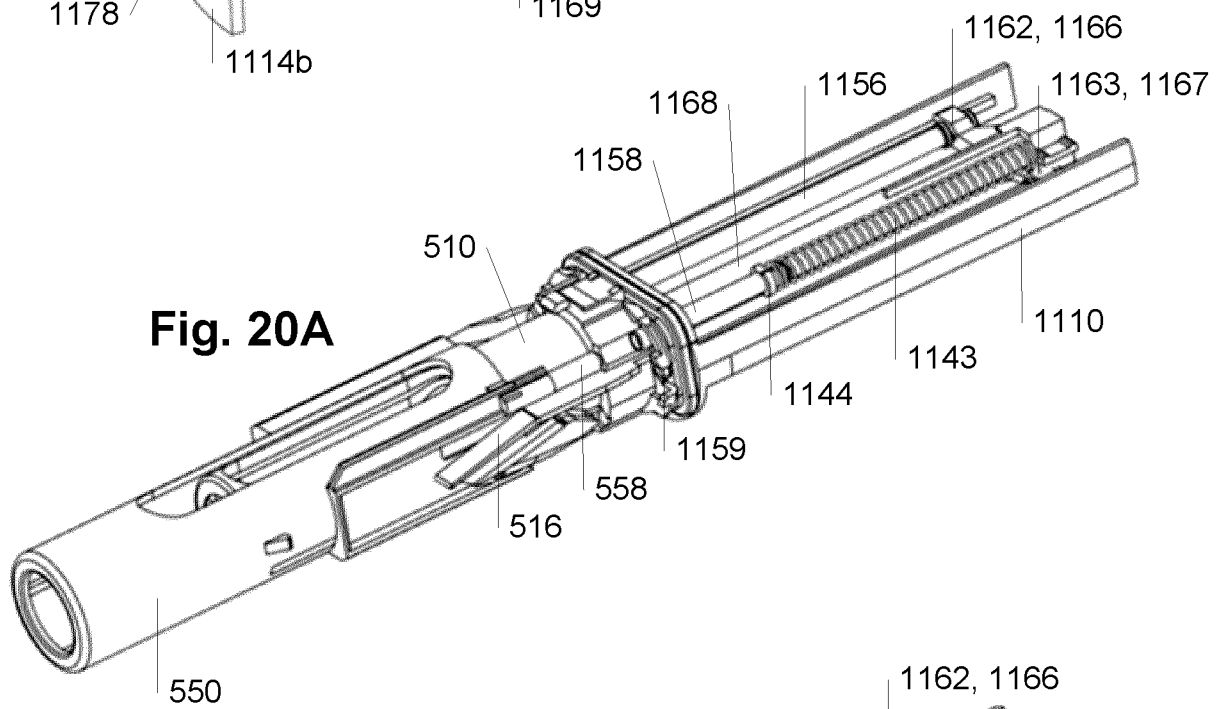


Fig. 20B

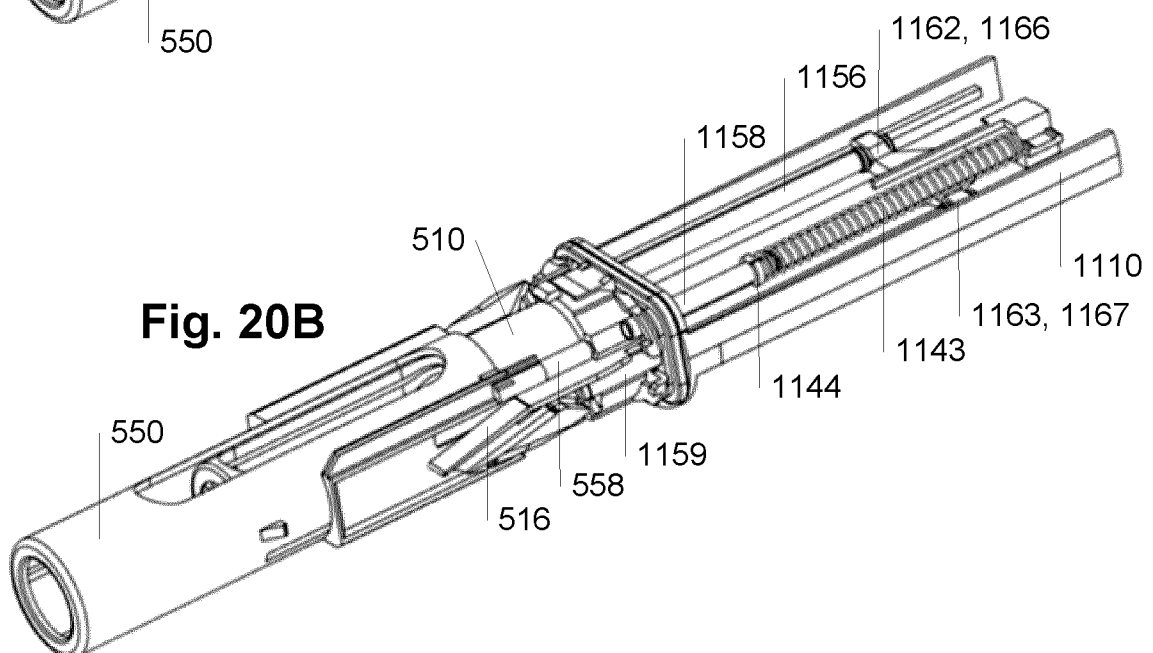


Fig. 20C

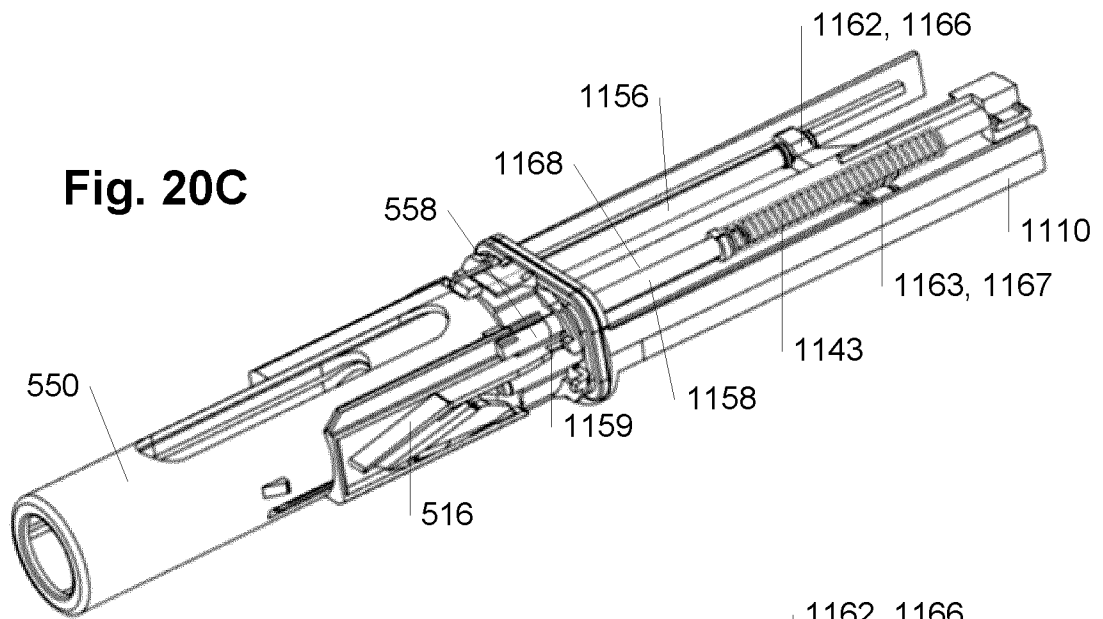


Fig. 20D

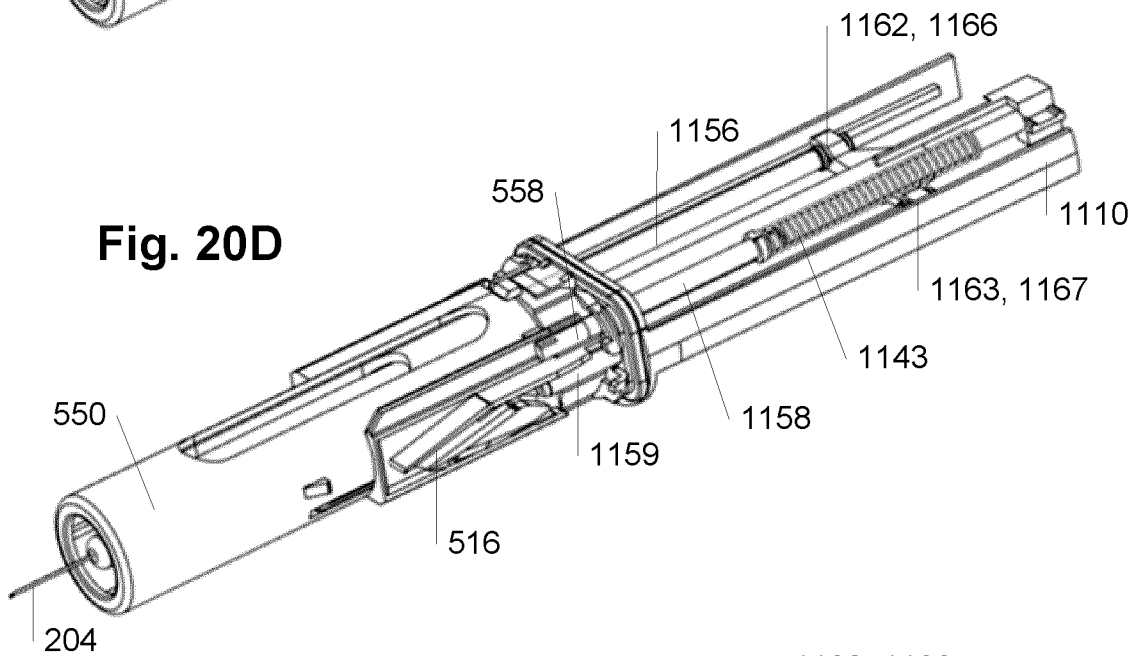


Fig. 20E

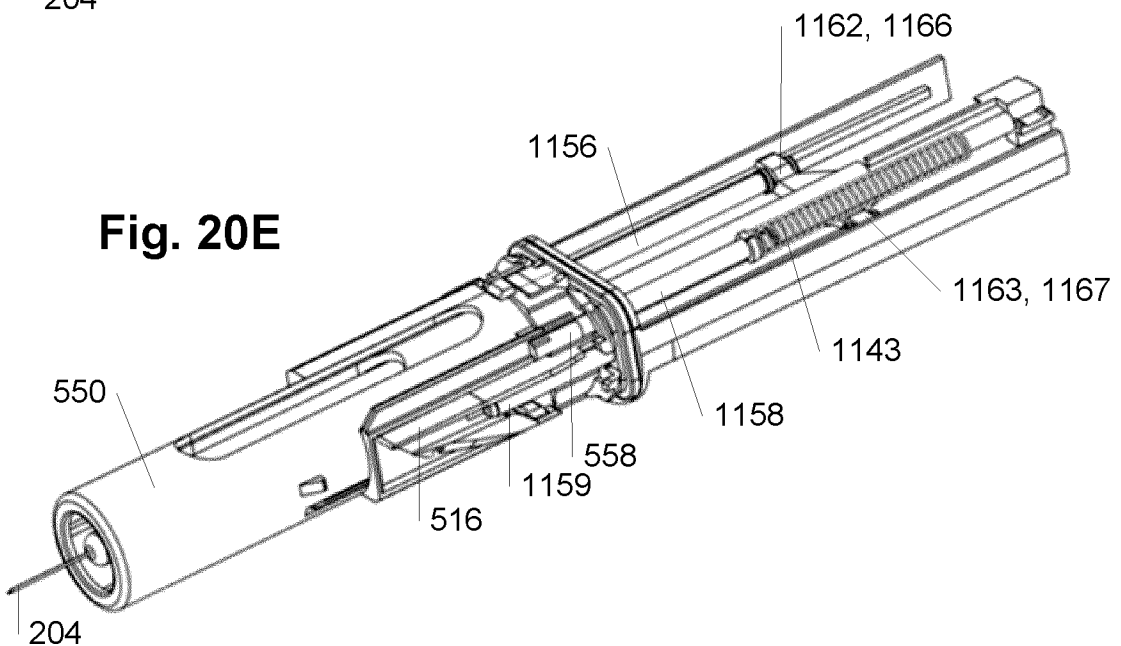


Fig. 20F

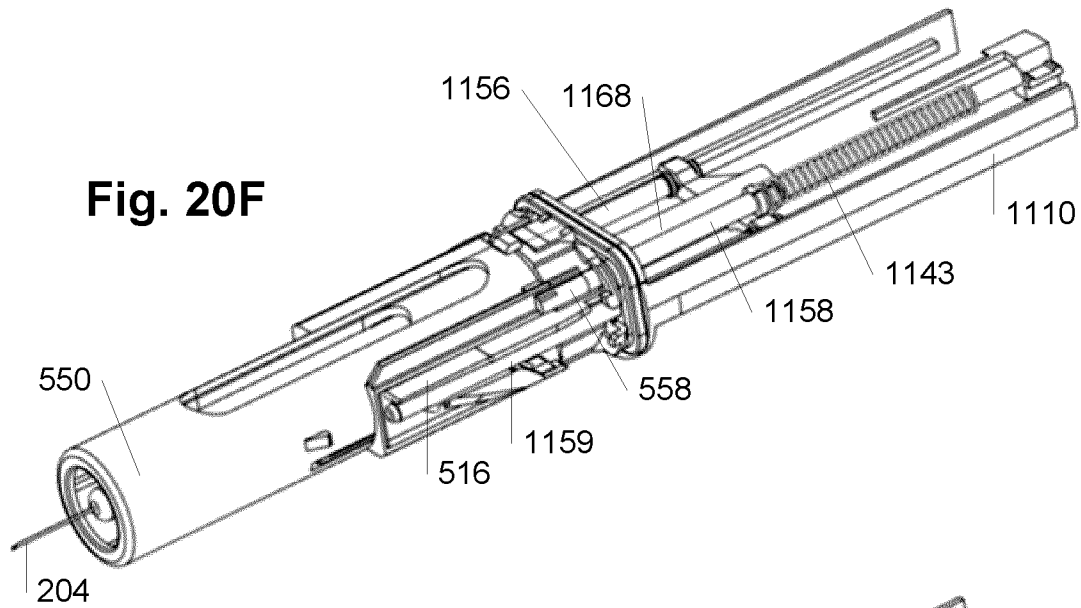


Fig. 20G

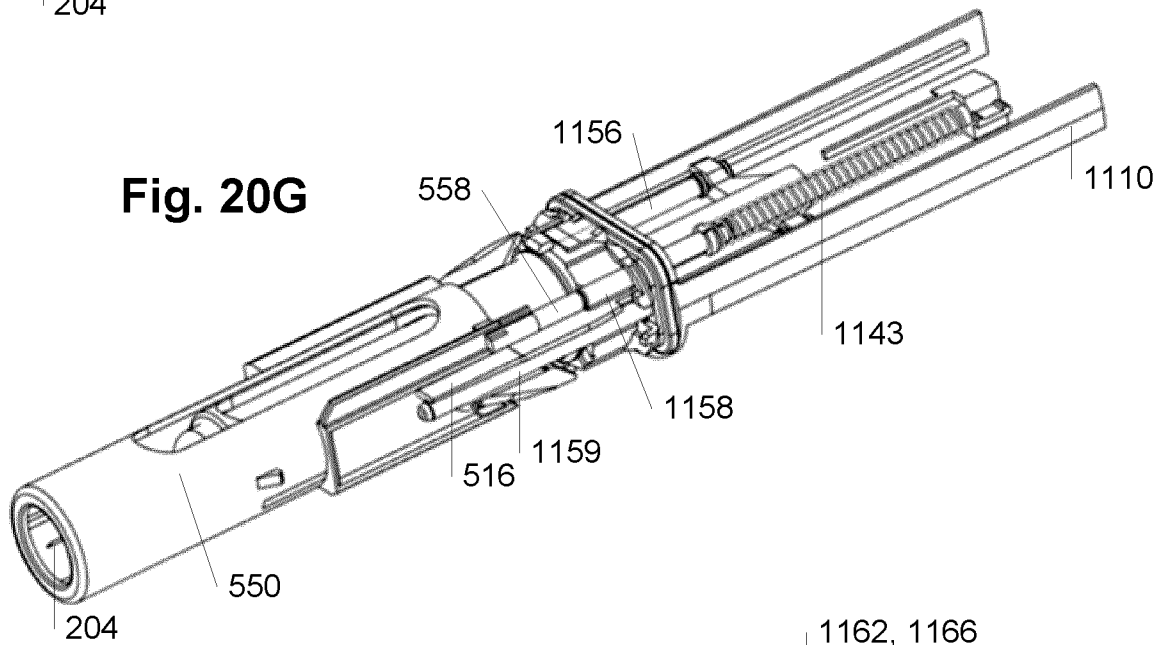


Fig. 20H

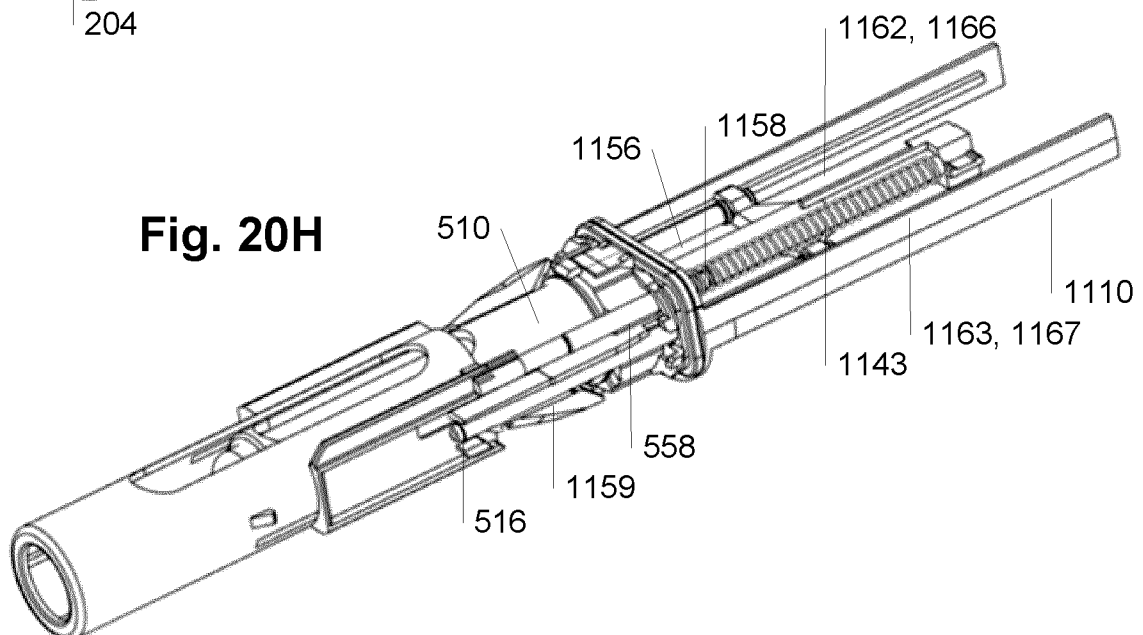
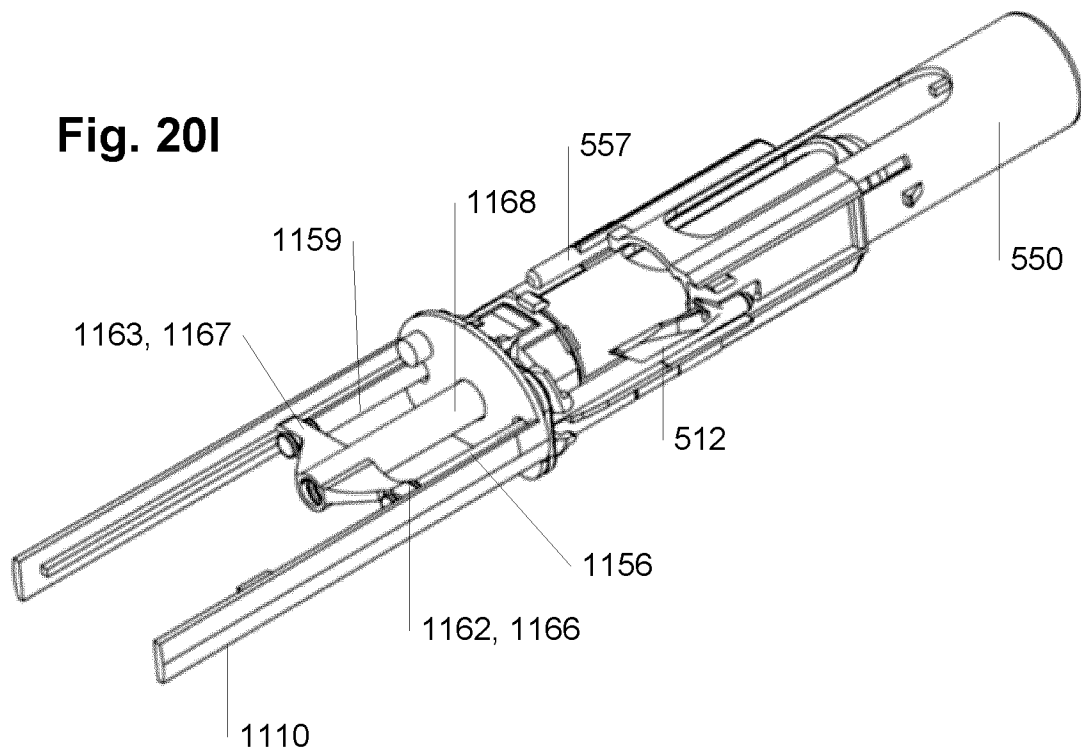


Fig. 20I



INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2020/059737

A. CLASSIFICATION OF SUBJECT MATTER
 INV. A61M5/28 A61M5/20 A61M5/24
 ADD. A61M5/32

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.
X	WO 2015/118550 A2 (ELCAM MEDICAL AGRICULTURAL COOPERATIVE ASS LTD [IL]) 13 August 2015 (2015-08-13) page 25, lines 7-16 page 50, line 25 - page 51, line 11 figures 1, 61A-64C -----	1-10, 12, 15-53
X	WO 2014/066256 A1 (UCB PHARMA SA [BE]; MCLOUGHLIN MARTIN JOHN [GB] ET AL.) 1 May 2014 (2014-05-01) page 78, paragraph 5 - page 79, paragraph 1 figures 1, 20, 23A-C -----	1-10, 12, 15-53
A	WO 2014/037946 A1 (ELCAM MEDICAL AGRICULTURAL COOPERATIVE ASS LTD [IL]) 13 March 2014 (2014-03-13) page 62, paragraph 3 ----- -/-	49-53



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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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

15 May 2020

Date of mailing of the international search report

27/07/2020

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
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Authorized officer

Diamantouros, S

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2020/059737

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2010/076569 A2 (OWEN MUMFORD LTD [GB]; ROLFE STEVEN MARK GUY [GB] ET AL.) 8 July 2010 (2010-07-08) page 7, paragraph 2; figures 3-5 -----	49-53

INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP2020/059737

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-10, 49-53(completely); 12, 15-48(partially)

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-10, 49-53(completely); 12, 15-48(partially)

Injection system with a cassette adapted for a slimmer configuration

2. claims: 11, 13, 14(completely); 12, 15-48(partially)

Injection system with cassette and noise reduction elements

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2020/059737

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2015118550 A2	13-08-2015	CA 2938787 A1 US 2016354556 A1 WO 2015118550 A2	13-08-2015 08-12-2016 13-08-2015
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