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(71) Applicant *(for all designated States except US)*: **OVAL MEDICAL TECHNOLOGIES LIMITED** [GB/GB]; The Innovation Centre, Unit 23, Cambridge Science Park, Milton Road, Cambridge Cambridgeshire CB4 0EY (GB).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **REBER, Dominic Charles** [GB/GB]; 233 The Rowans, Cambridge Cambridgeshire CB24 6ZA (GB). **HUANG, Congyi** [CN/GB]; 109A York Street, Cambridge Cambridgeshire CB1 2PZ (GB). **YOUNG, Matthew** [GB/GB]; 85 Cox's End, Over, Cambridge Cambridgeshire CB24 5TY (GB).

(74) Agent: **REDDIE & GROSE LLP**; William Ponder, Patent Attorney, 16 Theobalds Road, London Greater London WC1X 8PL (GB).

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(54) Title: DELIVERY MECHANISM FOR AN AUTOINJECTOR

(57) Abstract: The invention provides a delivery mechanism for an autoinjector comprising: a first drive member configured to drive a first component in an axial direction; a second drive member configured to drive a second component in an axial direction; and a release mechanism configured to control a sequence of release of the first drive member and the second drive member, wherein the release mechanism is positioned at least partially within the first or second drive member.

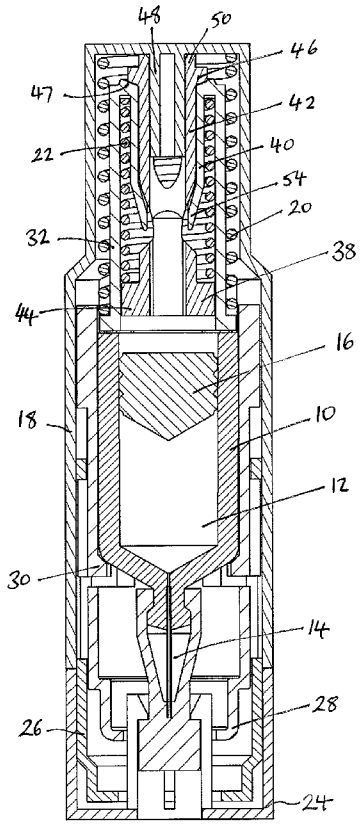

Fig. 1a

WO 2012/073035 A1

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DELIVERY MECHANISM FOR AN AUTOINJECTOR

Field of the Invention

This invention relates to devices for drug storage and drug administration to a patient. In particular the invention relates to mechanisms for automated administration of a dose of drug to a patient.

Background to the Invention

One type of drug delivery device known in the art is an autoinjector which contains a medical, therapeutic, diagnostic, pharmaceutical or cosmetic compound (drug) before it is administered, and which is used to administer the compound through the skin of the patient via a hollow needle. Autoinjectors may be used by the patient themselves or by a different user, and are also used to administer drugs to animals.

Autoinjectors are typically used because they reduce the amount of training and effort needed by a user compared with that needed for a syringe, by automating either or both processes of inserting the needle into the patient and expelling the drug through the needle. They can also reduce the fear of injection by hiding the needle from the patient.

Some autoinjectors use a single spring to provide the motive power to both insert the needle into the patient and deliver the drug. Examples of this approach include the EpiPen autoinjector from Meridian and the Humira autoinjector from Abbot.

Where an autoinjector includes only one spring to provide the force to drive both functions, the force that the spring provides for one of the functions may be higher than needed, to enable the spring to provide sufficient force for the other function. Advantageously the two functions happen one after another rather than simultaneously in order that the drug is delivered only after the needle is correctly positioned. Because the force provided by a spring typically reduces as the spring delivers energy, the spring inevitably provides a higher force for driving the first function, i.e. needle insertion, than for the following function i.e. drug delivery, whether or not this is desirable. The strength of the spring is determined by the requirement for the spring to be able to provide sufficient force and energy at every

point during the drug delivery process. This often means that much higher force than is needed or desirable is provided during the needle insertion phase.

However some autoinjectors use two separate springs within their operating mechanisms to provide the motive power to insert the needle and deliver the drug. Examples of this approach are described in US4,642,099and US7,749,195.

Where an autoinjector includes two springs, the force provided by each spring can be tailored to better suit the requirements of each function. The overall maximum stored spring force required in the autoinjector mechanism can be significantly reduced, because each spring on its own no longer needs to provide sufficient energy to drive both functions.

The use of two springs in this way typically requires an interlock mechanism to coordinate the sequence of the two functions so that significant drug is not expelled through the needle before the needle is inserted correctly into the patient. The interlock mechanism typically adds size and complexity to the autoinjector.

It is an object of the present invention to provide an improved mechanism to control the sequence of release of two drive members, such as springs, within an autoinjector, which allows the size and complexity of the autoinjector to be kept to a minimum.

Summary of the Invention

Aspects of the present invention are defined in the appended independent claims, to which reference should be made. The various aspects of the invention may be provided alone or in combination with one or more of the other aspects. Preferred features of the invention are defined in the dependent claims.

The use of two drive members, such as springs, in an autoinjector, instead of just one, can provide various benefits including those listed below:

- The level of pain and distress perceived by the user can be reduced due to lower needle insertion speeds and reduced noise and shock during drug delivery.

- The risk of breakage of the drug container within the autoinjector can be reduced because of the lower maximum spring force required. This is of particular benefit where the drug container within the autoinjector consists of a relatively fragile glass syringe or cartridge.

- The cost and size of the device can be reduced because one spring can be positioned within the other, and because a reduction in the maximum spring force can allow smaller autoinjector mechanisms. Reduced size makes the autoinjector more portable, which in turn increases the likelihood that a patient will carry it with them and therefore have it available if it is needed to treat an emergency condition.

In one aspect the present invention provides a release mechanism to control the sequence of release of two drive members, such as springs, within an autoinjector, but which allows the size of the autoinjector to be kept to a minimum. It also provides accurate control of a sequence of needle insertion and drug delivery, and allows the number of components and cost of the autoinjector to be minimised. This is achieved by providing the release mechanism at least partially within the drive members.

Many existing autoinjectors typically have a mechanism mounted on the opposite end of the autoinjector from the needle which engages with one or more of the springs to prevent accidental activation of the autoinjector. This can take the form of a button or removable safety cap. For this reason the interlock mechanism to control the sequence of needle insertion and drug delivery is typically mounted on the outside of one or more of the springs. These interlock mechanisms therefore generally have the disadvantage that they add to the size and complexity of the autoinjector. In contrast, the present invention allows for a release mechanism to be positioned at least partially inside a drive member. This minimises the size of the autoinjector.

In a first aspect, a delivery mechanism for an autoinjector comprises:
a first drive member configured to drive a first component; a second drive member configured to drive a second component; and a release mechanism configured to control a sequence of release of the first drive member and the second drive member, wherein the release mechanism is positioned at least partially within the first or second drive member.

Preferably, the release mechanism is positioned at least partially within both the first and the second drive member.

Typically, the first and second drive members are configured to drive the first and second components in the same direction, but it is possible for them to be different directions. For example the second direction may be parallel but opposite to the first direction.

The first drive member may be a helical spring. The second drive member may be a helical spring. Helical springs can be placed one within the other to provide a stable and compact delivery mechanism.

Preferably, one of the first and second drive members is mainly responsible for providing a force to insert a needle into a subject, and the other of the first and second drive members is mainly responsible for providing a force to expel a drug through the needle. However, the separate actions of the drive members may or may not correlate exactly with the separate functions of inserting the needle to the patient and delivering the drug; in other words, one drive member may provide the force needed for all of one function and part of the other, whereas the other drive member may provide only part of the force needed for the other function.

In one embodiment, the release mechanism comprises a locking surface, the locking surface being fixed to, or part of, the main body; and an inner retaining component configured to retain the second drive member until the locking surface is moved a predetermined distance relative to the inner retaining component, after which the second drive member is released; wherein release of the first drive member moves the inner retaining component relative to the locking surface in order to release the second drive member. This provides a robust, stable and compact release mechanism.

The inner retaining component may comprise a latch which engages on a bearing surface on the first component. The locking surface may maintain the latch in an engaged position with the bearing surface before the first drive member is released. The latch may be fixed to or part of the second component.

In use, the first drive member moves from an initial position before it is released to a final position after it has been released, and the second drive member moves from an initial position before it is released to a final position after it has been released. The mechanism may comprise a noise-generating mechanism configured to generate a sound when the first and second drive members have moved to their final positions. The noise generating mechanism informs a user when drug delivery has been successfully completed.

The noise-generating mechanism may be positioned at least partially, and preferably fully, within the first or second drive member. This allows the device to be made compact. The noise-generating mechanism is preferably positioned at least partially within both the first and second drive members.

The release mechanism is preferably part of an autoinjector. The autoinjector may comprise a drug container and a plunger within the drug container, and the second component may be a pusher configured to push the plunger within the drug container to deliver a drug.

The autoinjector may comprise a drug container containing a drug to be dispensed, and the first component may be fixed to the drug container so that it is not displaced relative to the drug container when the second drive member is released.

In another aspect, the invention provides a system for releasing a locking device that prevents the activation of the delivery mechanism, the releasing system being provided at a front end of the drug container, where the front end is the end to which the needle is attached and which is closest to the patient in use. This provides further opportunities to reduce the size, and in particular the width, of the overall device. It also allows for a simplified user interface which can be easier to use than that found on most autoinjectors available on the market.

In this aspect an autoinjector may comprise: a housing; a drug container having a front end coupled to a needle; a releasable drive mechanism coupled to a rear end of the drug container, in use the drive mechanism moving from a initial configuration to a final configuration to move the drug container and needle relative to the housing in order to insert the needle into a subject; and a releasable locking mechanism

retaining the drive mechanism in the initial configuration, the locking mechanism being fixed to the housing and engaging the front end of the drug container.

The locking mechanism may comprise a resilient arm fixed relative to the housing.

The releasable locking mechanism may be coupled to a skin sensor configured to sense a skin surface of a subject. The skin sensor may comprise a movable element that moves relative to the housing when it is pressed against a skin surface, movement of the movable element releasing the locking mechanism from engagement with the front end of the drug container. The movable element may be configured to be in contact with the locking mechanism when the locking mechanism is engaged with front end of the drug container.

Brief Description of the Drawings

Examples of the present invention will now be described in detail with reference to the accompanying drawings, in which:

Figure 1a shows a longitudinal cross-section of a first embodiment of an autoinjector before administration of the drug to the patient;
Figure 1b shows the section view of the autoinjector of Figure 1a from a different perspective;
Figure 2a shows the same autoinjector after the needle cover has been removed;
Figure 2b shows the section view of Figure 2a from a different perspective;
Figure 3a shows the same autoinjector in the process of inserting the needle into the patient;
Figure 3b shows the section view of Figure 3a from a different perspective;
Figure 4a shows the same autoinjector with the needle fully extended and the second spring released so that it can expel the drug into the patient;
Figure 4b shows the section view of Figure 4a from a different perspective;
Figure 5a shows the same autoinjector as the drug is being expelled;
Figure 5b shows the autoinjector of Figure 5a from a different perspective;
Figure 6a shows the same autoinjector after the drug has been expelled;
Figure 6b shows the section view of Figure 6a from a different perspective;
Figure 7 shows the autoinjector after the drug has been expelled and the autoinjector has been removed from the patient, allowing a needle safety mechanism to extend;

Figure 8 shows an alternative design of autoinjector to Figure 1b, incorporating a piercable foil and low-friction plunger

Figure 9a shows the drug container coupled to the drive mechanism from the autoinjector of Fig 1;

Figure 9b is a section view of Figure 9a;

Figure 10a shows the outer spring component;

Figure 10b shows a section view of Figure 10a;

Figure 11a shows the inner spring component;

Figure 11b shows a section view of Figure 11b;

Figure 12 shows a section view of a second embodiment of an autoinjector having only a single drive spring prior to drug delivery;

Figure 13 shows the autoinjector of Figure 12 after drug delivery;

Figure 14 shows the autoinjector of Figure 1a from a different perspective, with the housing not shown;

Figure 15 shows the autoinjector of Figure 2a from a different perspective with the housing not shown;

Figure 16 shows the autoinjector of Figure 15 with the skin sensor pushed back;

Figure 17 shows the autoinjector of Figure 16 a moment later; and

Figure 18 shows the autoinjector of Figure 3a from a different perspective with the housing not shown.

Detailed Description

Figure 1a shows a longitudinal cross-section of an autoinjector in accordance with a first embodiment of the invention, before administration of the drug to the patient.

Figure 1b shows the section view of the autoinjector of Figure 1a from a different perspective. The autoinjector comprises a drug container 10 in which a dose of drug 12 is contained. A hollow hypodermic needle 14 is fixed to a front end of the drug container 10 and a plunger 16 provided within the drug container 10. Movement of the plunger 16 towards the needle 14 causes the drug to be expelled from the drug container through the needle. As used herein "front" refers to the end of the drug container or autoinjector closest to the patient in use, i.e. the end through which the drug is delivered to the patient.

This basic syringe assembly is housed within a housing 18 that contains drive mechanisms for inserting the needle 14 into a subject and for moving the plunger 16 within the drug container 10 to expel the drug 12. The housing also contains a skin

sensing mechanism for activating the drive mechanisms on contact with the skin of a subject and a noise generating mechanism to indicate to a user when delivery of the drug has been completed.

The drive mechanism comprises two springs, one for inserting the needle and one for moving the plunger. In this example, helical springs formed from metal are used. However, it should be clear that other forms of spring may be used, such as gas springs or indeed any suitable mechanical drive incorporating a resilient member that can store potential energy to be subsequently released for driving the needle or plunger, and in any combination.

The helical springs are arranged one within the other, in a coaxial relationship. However, it is not essential that they are coaxial, nor that they nest within each other, but there are advantages to both these features. The outer spring 20 is used for driving the drug container 10 and needle 14 forward through the housing 18 to insert the needle into a subject. The inner spring 22 is used to drive the plunger within the drug container to expel the drug 12 through the needle. However, in other embodiments the roles may be reversed with an inner spring driving the needle and an outer spring driving a plunger.

The sequence of operation of the two springs 20 and 22 will now be described. Figures 1a and 1b show the autoinjector in an initial state as it is delivered to an end user. The autoinjector includes a needle cover 24 for safety, which must be removed prior to use of the autoinjector.

The needle cover 24 can be simply pulled off by a user or caregiver to expose the skin sensor 26. Figures 2a and 2b show the autoinjector with the needle cover 24 removed. The skin sensor 26, which extends beyond the front end of the housing, is placed against the skin of a subject in a position where the drug is to be injected. Application of pressure to the body of the autoinjector towards the skin surface pushes the skin sensor 26 back relative to the autoinjector housing 18. The needle 14 is still covered by a front end housing 28, so the user applied pressure does not directly cause the needle 14 to be inserted through the skin. Instead the skin sensor acts as a trigger. The needle 14 and drug container 10 are retained relative to the front end housing 28 by needle insertion latches 30 that engage a front end of the drug container 10. Once the skin sensor is pushed back a predetermined distance

the needle insertion latches 30 are released, as is explained in detail with reference to Figures 14 to 18. Once the needle insertion latches 30 are disengaged from the drug container 10, the outer spring 20 pushes the drug container 10 and needle 14 forward through the housing 18 to insert the needle into the patient. This is illustrated in Figures 3a and 3b.

The outer spring 20 is positioned between the main housing 18 and a first component 32, in this embodiment referred to as outer spring component 32. The outer spring component is coupled to the drug container, as can be seen more clearly in Figures 9a and 9b. The outer spring component 32 comprises engaging arms 34 that engage with lugs 36 formed on an outer surface of the drug container 10. However, any suitable means of engagement between the outer spring component and the drug container 10 may be used, or simply abutment of the outer spring component 32 against the drug container 10.

The outer spring component 32 moves with the drug container 10 as the needle 14 is inserted. The inner spring 22 is held between the outer spring component 32 and a second component 38, in this embodiment also referred to as an inner spring component 38. The inner spring component acts on the plunger during expulsion of the drug. But the outer spring component 32 retains the inner spring 22 in a compressed condition until the needle is partially or fully inserted. The outer spring component 32 extends around the inner spring 22, over a back side of the inner spring, and has leg portions 40 positioned within the inner spring. The leg potions 40 are clearly illustrated in Figure 10b. The inner spring component 38 comprises a front end pusher portion 44 that engages with the plunger, as will be described with reference to Figures 5a and 5b. The inner spring component 38 also comprises an inner retaining component in the form of inner resilient leg portions 42 that include inner spring retaining lobes 46 at their back ends. The inner resilient leg portions are pressed outwardly by a locking surface 48 that is part of (or rigidly fixed to) the main housing so that retaining lobes 46 engage with an inner spring retaining surface 47 on the outer spring component 32 and are prevented from disengagement by the locking surface 48. In this way the inner spring is locked in a compressed state, and moves with the outer spring component 32, until the retaining lobes 46 can be released from the inner spring retaining surface 47.

Once the outer spring is released by the needle insertion latches 30, it drives the outer spring component 32 down through the housing. The locking surface 48 is dimensioned so that the inner resilient leg portions 42 disengage with the locking surface 48 as or just before the drug container 10 reaches the end of its travel within the main housing 18, i.e. as the outer spring reaches its fullest extension. As soon as the inner resilient leg portions 42 are disengaged from the locking surface 48, the lobes 46 disengage from the retaining surface 47. This disengagement is due to the action of the inner spring 22.

Figures 4a and 4b show the autoinjector in a position when the inner spring 22 has been released and lobes 46 of the inner resilient leg portions 42 are pressed within the outer spring component 32. The front end pusher portion 44 of the inner spring component is driven towards the plunger 16. As illustrated in Figure 8, a seal 56 may be provided across the back end of the drug container 10 to maintain the drug in pristine condition during storage, and this seal is ruptured by the front end pusher portion 44. The front end pusher portion 44 then engages the plunger 16 and drives it within the drug container to expel the drug, as shown in Figures 5a and 5b.

When the plunger 16 reaches the bottom of the drug container 10, the drug is fully expelled. The leg portions 40 of the outer spring component are dimensioned so that at or just before the point when the plunger reaches the end of its travel, the lobes 46 on the inner spring component 42 are released from the leg portions 40. This release causes the inner resilient arms 42 to expand outwardly from their compressed state, and percussive surfaces 50 on the inner resilient arms above the lobes 46 strike the end of the leg portions 40 to generate an audible sound. This position is illustrated in Figures 6a and 6b. The sound indicates to the user that delivery of the drug is complete and that the needle can be withdrawn from the subject.

Figure 7 illustrates the autoinjector after the drug has been expelled and the autoinjector has been removed from the patient, allowing a needle safety mechanism to extend to cover the needle.

The materials used for the housing 18, cap 24, skin sensor 26, front end housing 28, needle insertion latches 30, outer spring component 32 and inner spring component 38 may be plastic, such as EVOH or polyamide, or metal. The inner surface of the drug container must be compatible with the drug and the drug container may be

formed from glass or plastic. The various elements described as resilient must have suitable elasticity.

The plunger may be a standard rubber plunger 16 or may be a cup seal plunger 52, as illustrated in Figure 8. A cup seal plunger, used in conjunction with a back end sealing element 56 which is ruptured by the inner spring component, provides for a more reliable and low friction engagement with the inner wall of the drug container 10. The cup seal plunger may be formed from a substantially non-elastomeric material such as polypropylene, polyethylene or FEP (Fluorinated Ethylene Propylene).

The drive mechanism described with reference to Figures 1 to 11 allows for different drive members to be used for needle insertion and for drug expulsion. The release mechanism for the drug expulsion is provided internally of the both the drive means, i.e. the outer and inner springs 20, 22. This allows for compact springs to be used that supply an appropriate force for each stage of drug delivery, and for a compact overall device.

The noise generating mechanism provided by the percussive surface 50 on the inner spring component striking the outer spring component 32 can be reversed or enhanced by forcing a surface on the outer spring component 32 to strike a portion of the inner spring component 38 as, or just before, drug delivery is completed. This can be achieved by forming legs 40 with an inwardly extending lower end 54, as shown in the Figures. When the lobes 46 pass the legs 40, the inwardly extending lower ends 54 are flexed outwardly by the lobes. The ends 54 then snap back to strike the percussive surface 50 once the lobes 46 have passed. However, it should be clear that the noise generating mechanism does not require the lower ends of the legs 40 to be inwardly extending; they may simply be straight, and struck by percussive surface 50 to generate a noise.

It should be clear that a noise generating mechanism of this type may also be used in autoinjectors employing only a single drive spring to provide for either or both needle insertion and drug expulsion. This is illustrated in Figures 12 and 13. Fig. 12 shows second embodiment of an autoinjector with a single drive spring 60 that drives both a needle 62 and a drug container 64 through a housing 66 for needle insertion and a drives a plunger 68 through the drug container 64 for expulsion of the drug. The drive

mechanism is activated by a push button 70 that squeezes spring component 72 to release it from bearing surface 74. The same lobe and percussive surface structure described with reference to the first embodiment is used in this embodiment. As the spring reaches its fullest extension, as shown in Figure 13, the percussive surfaces 76 strike the end of legs 78 to generate an audible indication to a user that drug delivery is complete.

Figures 14 to 18 illustrate more clearly the mechanism used to release the outer spring 20 of the first embodiment using the skin sensor 26. Figure 14 is a view of the autoinjector shown in Figure 1a from a different perspective, with the main housing 18 removed. Figure 14 illustrates more clearly that the skin sensor 26 extends to about midway up the drug container 10. The needle insertion latches 30 are resilient arms 300 on which heads 310 are provided. The heads engage the front end of the drug container 10 to retain the outer spring. The latches 30 may be formed as a single moulding with the front end body 24. In the position shown in Figure 14 heads 310 are held in engagement with the drug container by the skin sensor 26, including skin sensor lugs 260.

Figure 15 is a view of the autoinjector shown in Fig. 2a from a different perspective, with the main housing 18 removed. The cap 26 has been removed.

Figure 16 illustrates the autoinjector of Figure 15 with the skin sensor moved back as a result of contact with the skin of a patient. The skin sensor has cut out portions 262 that correspond to heads 310 which are moved into alignment with heads 310 in the position shown in Figure 16.

Figure 17 shows the autoinjector of Figure 16 a moment later. The space provided by cut out portions 262 allow the arms 300 to flex outwardly under the force provided by the outer spring 20 through the drug container 10. The heads 310 are thus moved out of engagement with the front end of the drug container and the drug container 10 can then move forward within the housing to insert the needle 14.

Figure 18 is a view of the autoinjector shown in Fig. 3a from a different perspective, with the main housing 18 removed. In Figure 18 the outer spring 20 is fully extended and the needle in an inserted position. The arms 300 remain flexed away from the drug container 10, and the heads remain within cut out portions 262.

Again it should be clear that a skin sensor activation mechanism of this type which releases a front end of a drug container to activate a needle insertion mechanism may be used with an autoinjector having only a single drive means for either or both needle insertion and drug expulsion.

Claims

1. A delivery mechanism for an autoinjector comprising:
a first drive member configured to drive a first component;
a second drive member configured to drive a second component; and
a release mechanism configured to control a sequence of release of the first drive member and the second drive member, wherein the release mechanism is positioned at least partially within the first or second drive member.

2. A delivery mechanism according to claim 1 wherein the release mechanism is positioned at least partially within both the first and the second drive member.

3. A delivery mechanism according to claim 1 or 2 wherein the first drive member is a helical spring.

4. A delivery mechanism according to claim 1, 2 or 3 wherein the second drive mechanism is a helical spring.

5. A delivery mechanism according to any preceding claim, wherein the second drive member is positioned at least partially within the first drive member.

6. A delivery mechanism according to any one of the preceding claims, wherein, in use, one of the first and second drive members is mainly responsible for providing a force to insert a needle into a subject, and the other of the first and second drive members is mainly responsible for providing a force to expel a drug through the needle.

7. A delivery mechanism according to any preceding claim, wherein the first drive member is positioned between a main body and the first component and the second drive member is positioned between the first component and the second component.

8. A delivery mechanism according to claim 7, wherein the release mechanism comprises:
a locking surface, the locking surface being fixed to, or part of, the main body; and

an inner retaining component configured to retain the second drive member until the locking surface is moved a predetermined distance relative to the inner retaining component, after which the second drive member is released;
wherein release of the first drive member moves the inner retaining component relative to the locking surface in order to release the second drive member.

9. A mechanism according to claim 8, where the inner retaining component comprises a latch which engages on a bearing surface on the first component.

10. A mechanism according to claim 9, where the locking surface maintains the latch in an engaged position with the bearing surface before the first drive member is released.

11. A mechanism according to claim 9 or 10, wherein the latch is fixed to or part of the second component.

12. A mechanism according to any one of the preceding claims, wherein in use the first drive member moves from an initial position before it is released to a final position after it has been released, and the second drive member moves from an initial position before it is released to a final position after it has been released, further comprising a noise-generating mechanism configured to generate a sound when the first and second drive members have moved to their final positions.

13. A mechanism according to claim 12 wherein the noise-generating mechanism is positioned at least partially within the first or second drive member.

14. A mechanism according to claim 13 where the noise-generating mechanism is positioned at least partially within both the first and second drive members.

15. A mechanism according to any one of claims 12 to 14, wherein the noise-generating means is comprised of two or more surfaces, one of which is caused to strike the other to make the noise substantially at the time that the second drive member reaches its final position.

16. A mechanism according to claim 15 wherein one of the surfaces is fixed to or part of the second component.

17. A mechanism according to claim 15 or 16 wherein one of the surfaces is fixed to or part of the first component.

18. A mechanism according to claim 15, 16 or 17 wherein one of the surfaces is fixed to or part of a main body of an autoinjector.

19. A mechanism according to any one of claims 15 to 18 when dependent on claim 9, wherein one of the surfaces is on the latch.

20. A mechanism according to any one of claims 15 to 19 wherein one of the surfaces is on a resilient arm which is temporarily deformed and then released during movement of the first or second drive member so that it strikes a second surface to create a noise.

21. A mechanism according to claim 20 where the resilient arm is fixed to the second component.

22. A mechanism according to claim 20 where the resilient arm is fixed to the first component.

23. A mechanism according to claim 20 where the resilient arm is fixed to a main body of an autoinjector.

24. An autoinjector comprising a mechanism in accordance with any one of the preceding claims.

25. An autoinjector according to claim 24, further comprising a drug container and a plunger within the drug container, wherein the second component is a pusher configured to push the plunger within the drug container to deliver a drug.

26. An autoinjector according to claim 24, further comprising a drug container containing a drug to be dispensed, wherein first component is fixed to the drug container so that it is not displaced relative to the drug container when the second drive member is released.

27. An autoinjector of according to claim 26 where the first drive member is retained in an initial state before release by a retaining feature which is attached to a body of the autoinjector and which engages with the first component or with the drug container.

28. An autoinjector according to claim 27, wherein the drug container has a front end which is closest to the patient in use and a rear end, wherein the retaining feature engages the front end and the first component engages or is part of the rear end.

29. An autoinjector comprising:
a housing;
a drug container having a front end coupled to a needle;
a releasable drive mechanism coupled to a rear end of the drug container, in use the drive mechanism moving from a initial configuration to a final configuration to move the drug container and needle relative to the housing in order to insert the needle into a subject; and
a releasable locking mechanism retaining the drive mechanism in the initial configuration, the locking mechanism being fixed to the housing and engaging the front end of the drug container.

30. An autoinjector according to claim 29, wherein the drive mechanism comprises one or more springs.

31. An autoinjector according to claim 29 or 30, wherein the locking mechanism comprises a resilient arm fixed relative to the housing.

32. An autoinjector according to claim 29, 30 or 31, wherein the releasable locking mechanism is coupled to a skin sensor configured to sense a skin surface of a patient.

33. An autoinjector according to claim 32, wherein the skin sensor comprises a movable element that moves relative to the housing when it is pressed against a skin surface, movement of the movable element releasing the locking mechanism from engagement with the front end of the drug container.

34. An autoinjector according to claim 33, wherein the movable element is in contact with the locking mechanism when the locking mechanism is engaged with front end of the drug container.

35. A delivery mechanism for an autoinjector comprising:
a releasable drive mechanism, in use the drive mechanism moving from a initial configuration to a final configuration to expel a drug from the autoinjector;
a noise-generating means coupled to the drive mechanism and configured to generate a sound when drive mechanism has moved to the final configuration, the noise generating means being positioned at least partially within the drive mechanism.

36. A delivery mechanism according to claim 35, wherein the drive mechanism comprises one or more helical springs.

37. A delivery mechanism according to claim 35 or 36, wherein the noise-generating means is comprised of two or more surfaces, one of which is caused to strike the other to make the noise substantially at the time that the second drive mechanism reaches its final configuration.

38. A delivery mechanism according to claim 37 wherein one of the surfaces is fixed to or part of the drive mechanism.

39. A delivery mechanism according to claim 37or 38 wherein one of the surfaces is fixed to or part of a main body of the autoinjector.

40. A delivery mechanism according to any one of claims 37 to 39 wherein one of the surfaces is on a resilient arm which is temporarily loaded and then released during movement of drive mechanism so that it strikes a second surface to create a noise.

41. A delivery mechanism according to any one of claims 37 to 40 wherein the noise generating means is positioned fully within the drive mechanism in use.

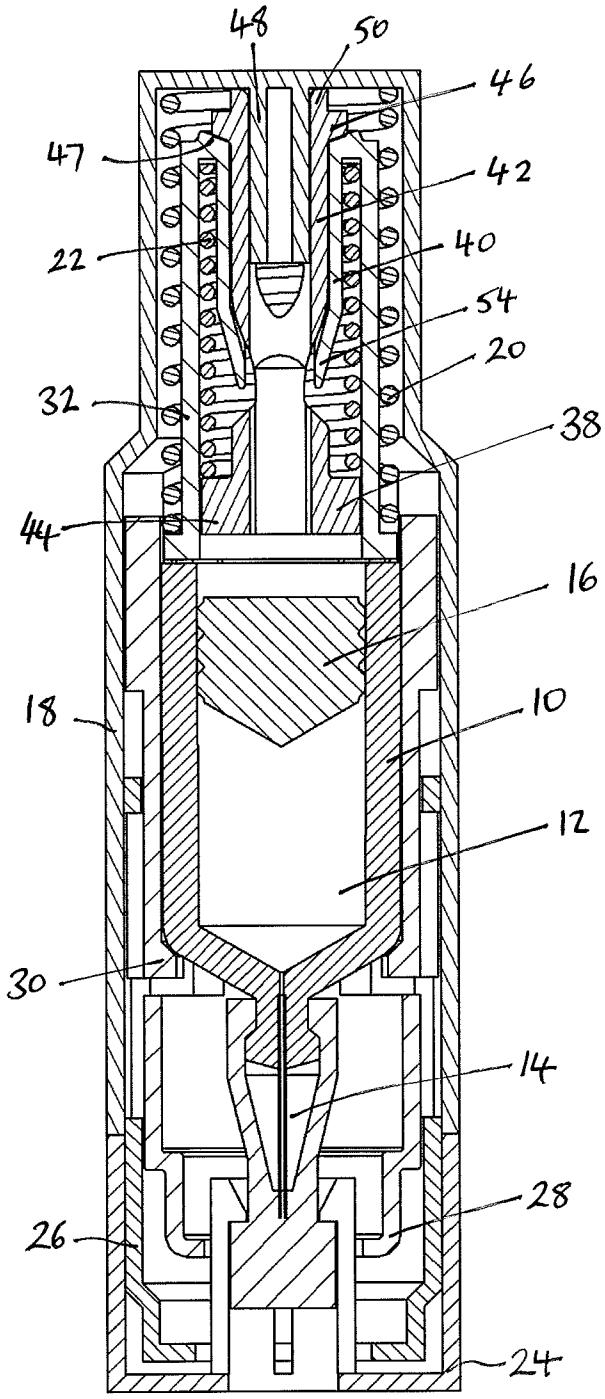

Fig. 1a

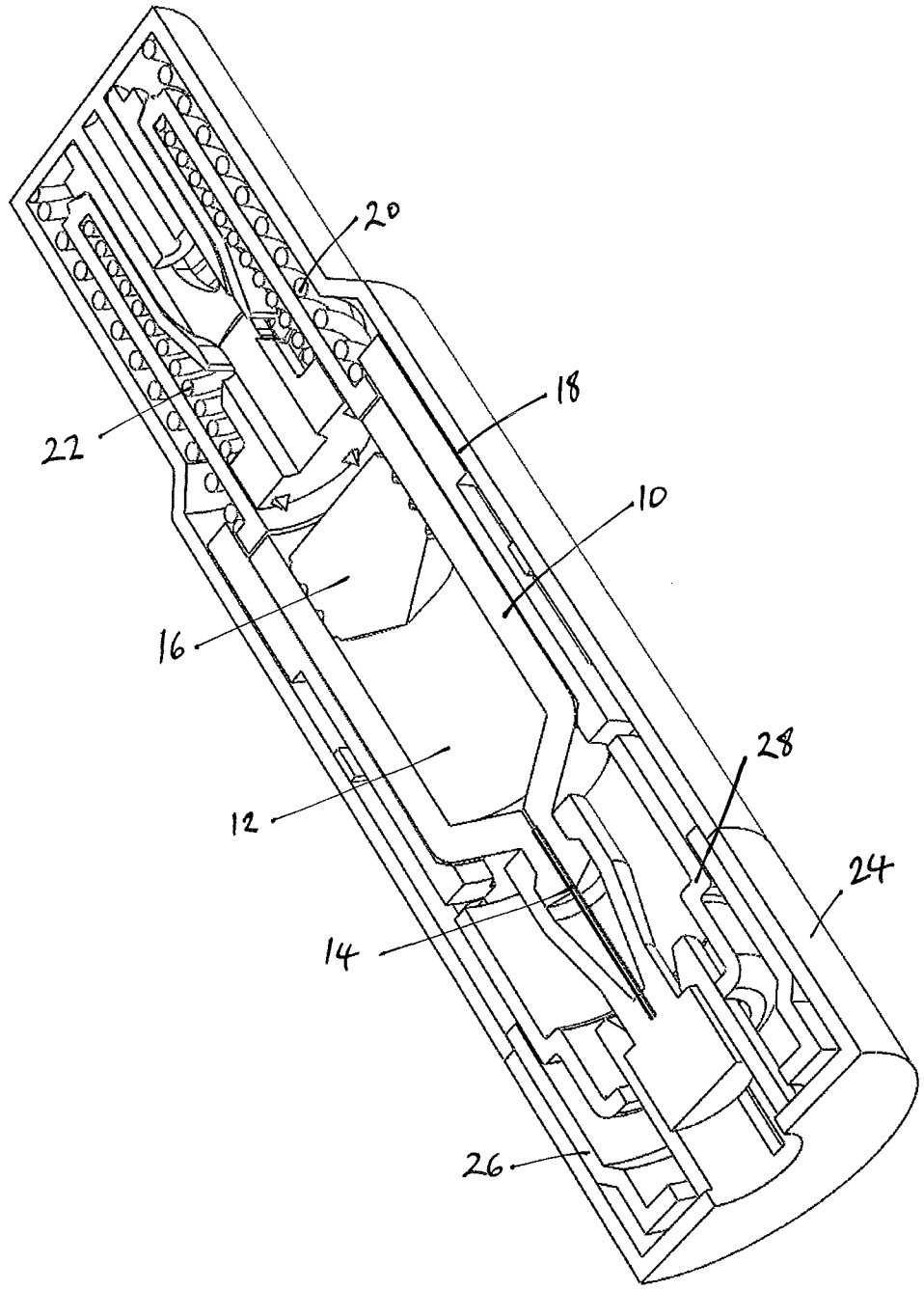

Fig. 1b

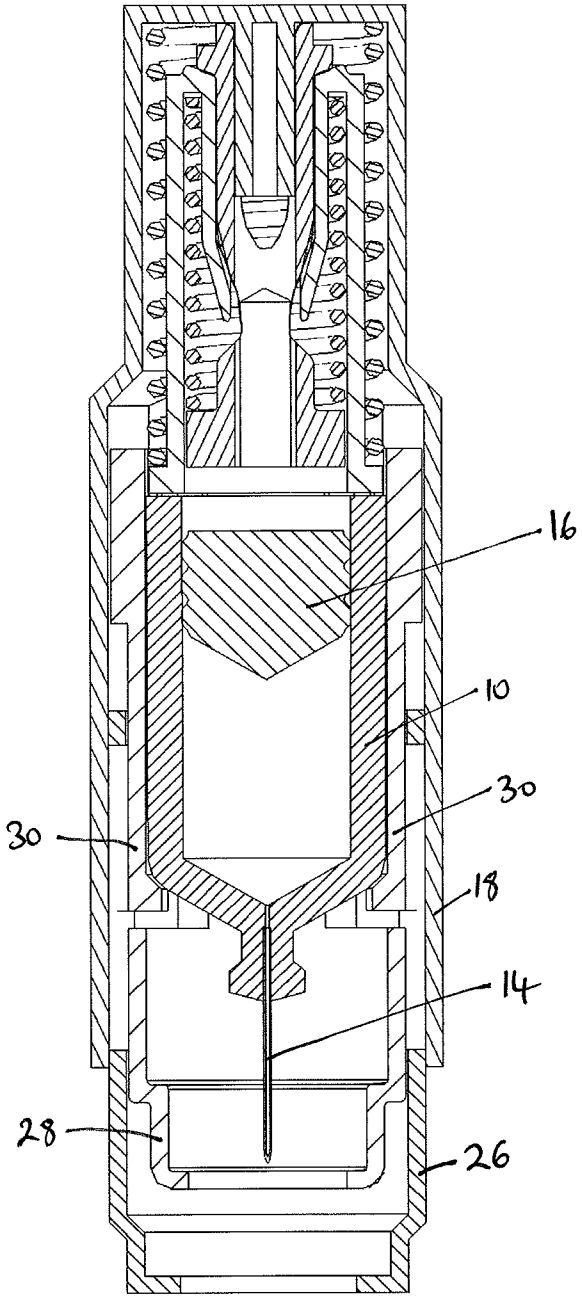

Fig. 2a

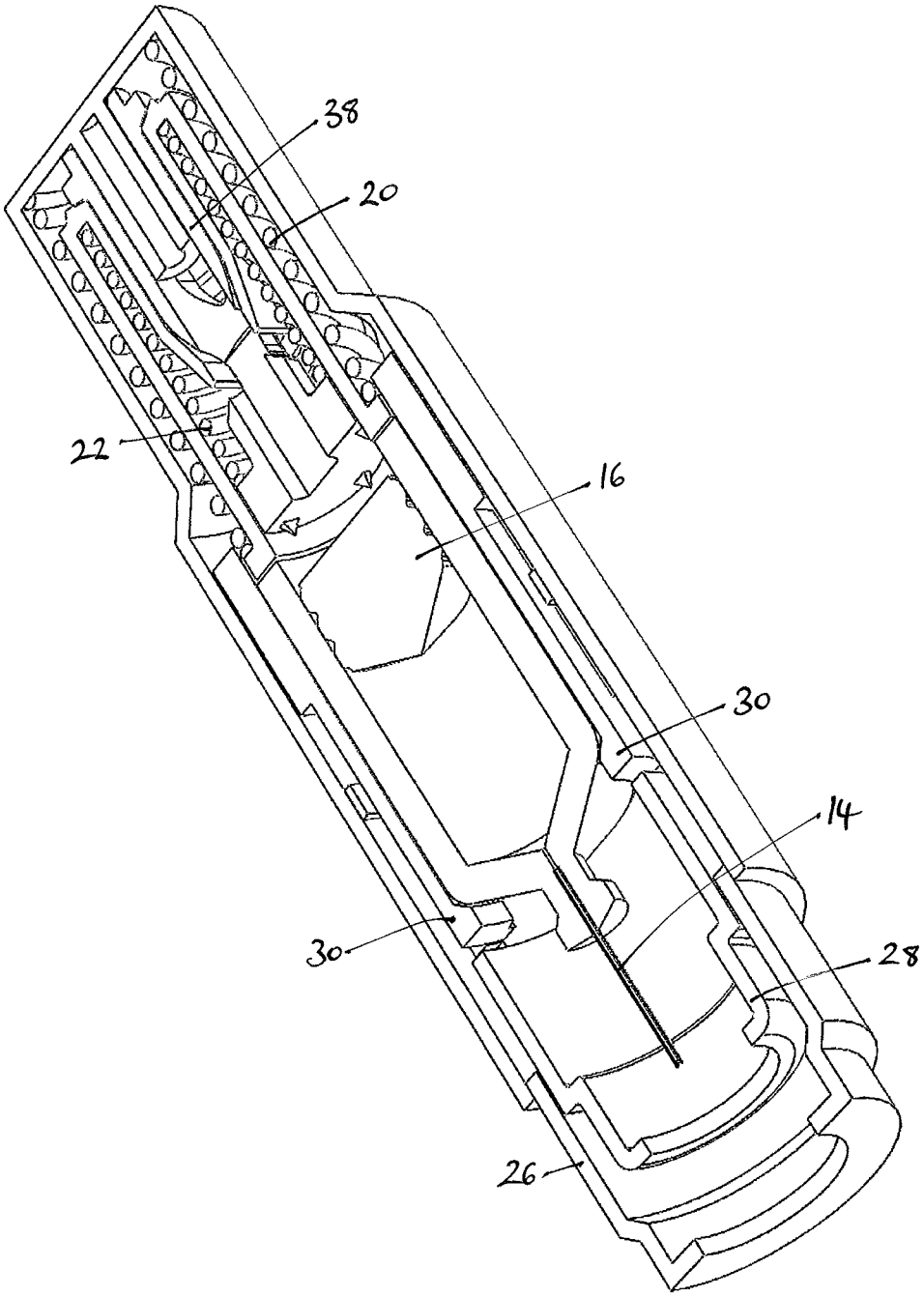

Fig. 2b

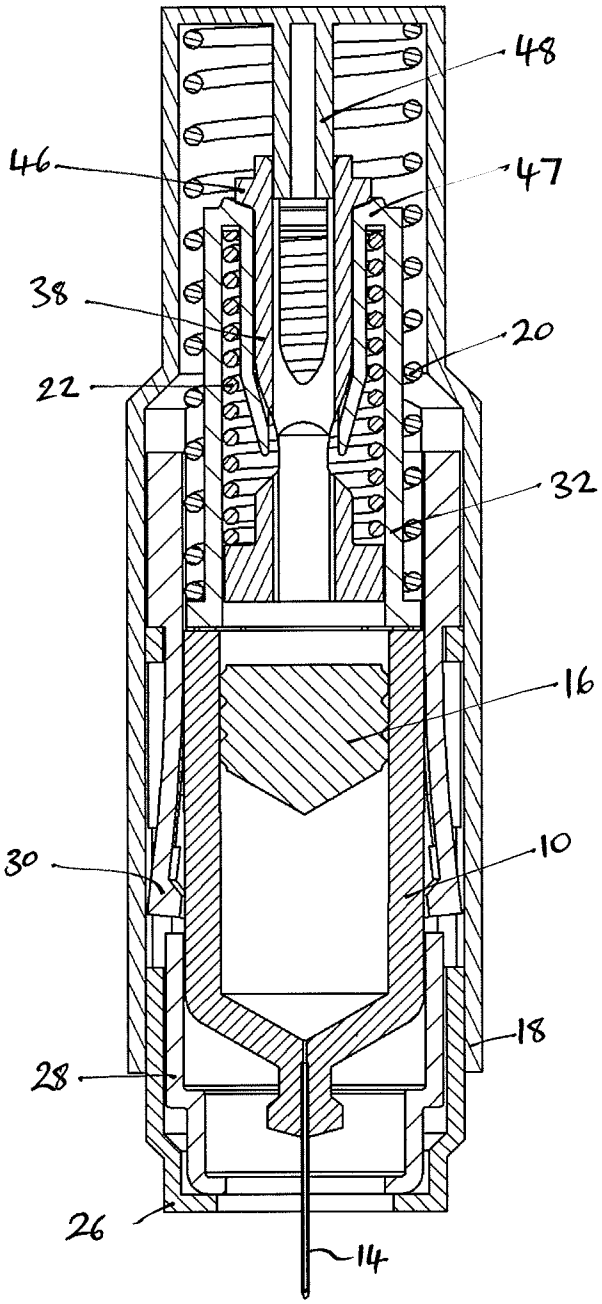

Fig. 3a

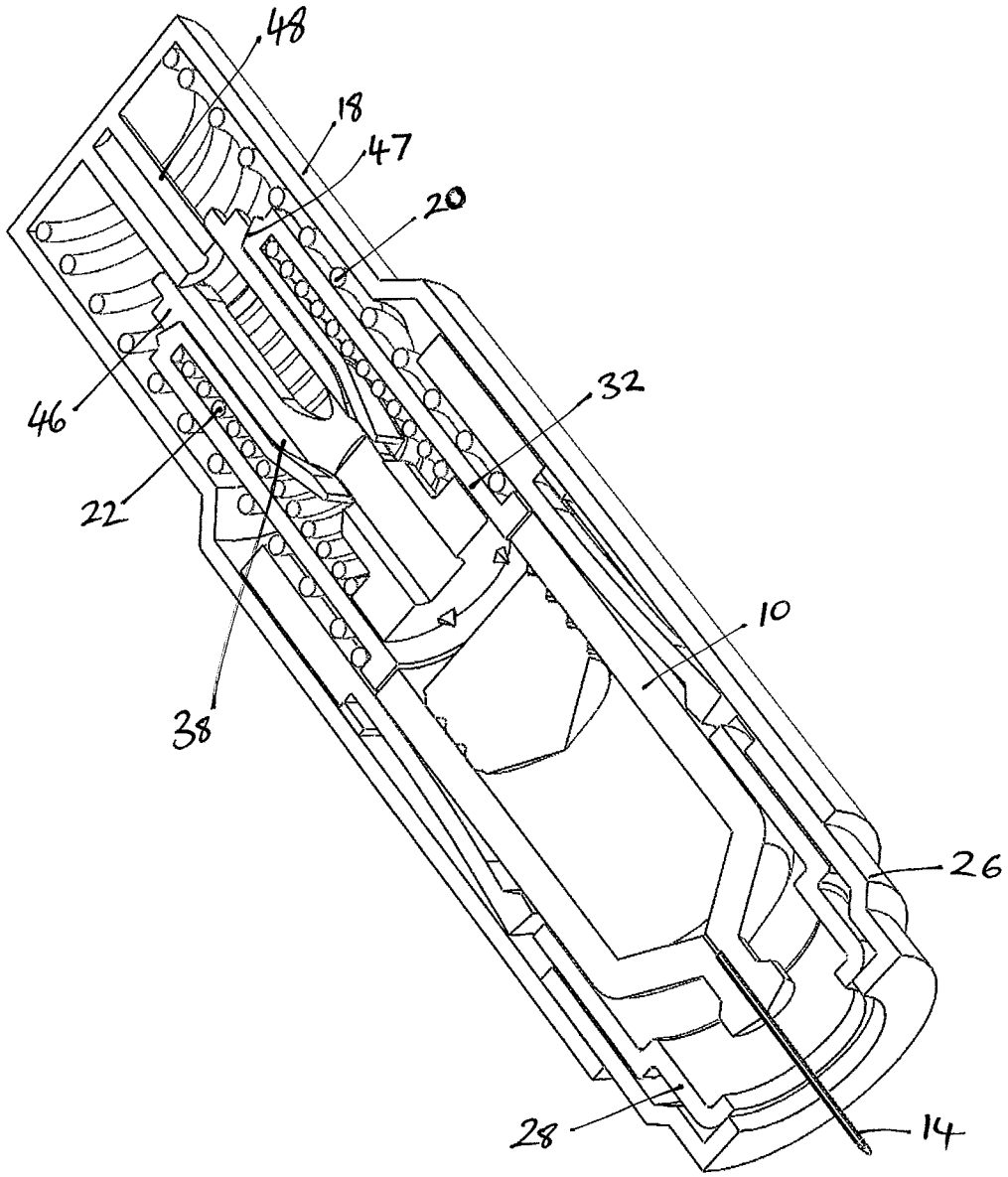

Fig. 3b

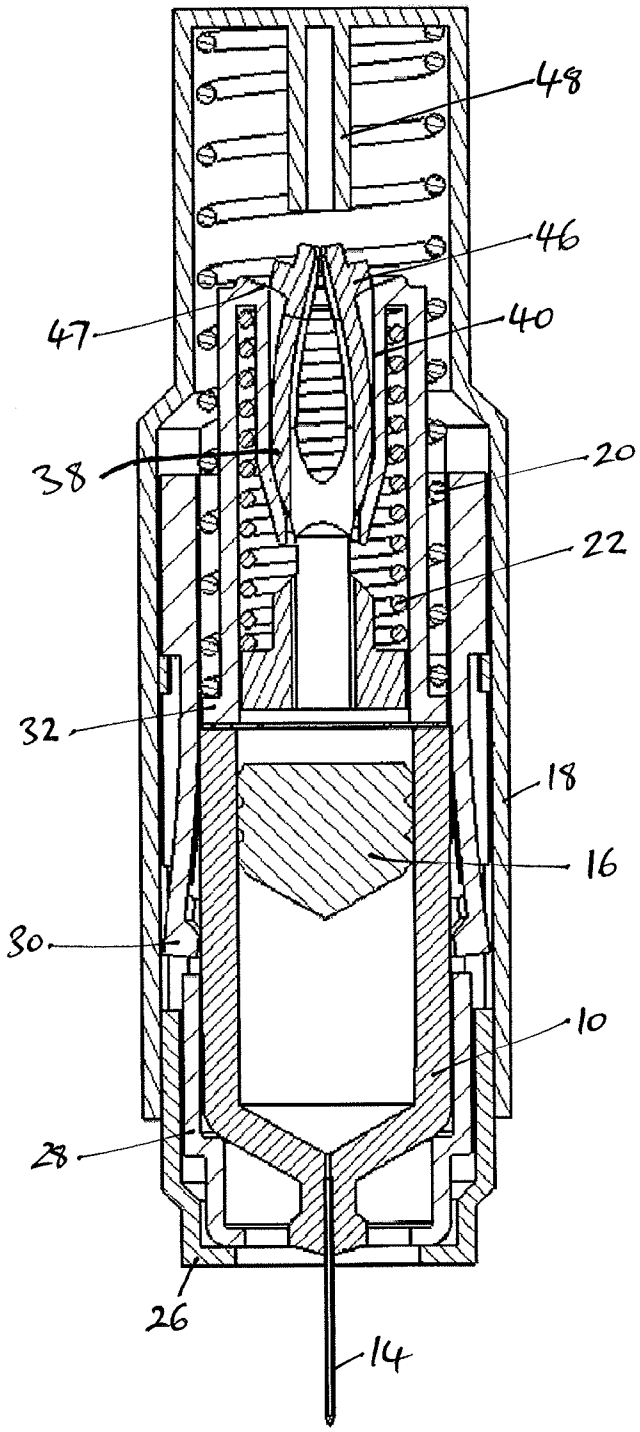

Fig. 4a

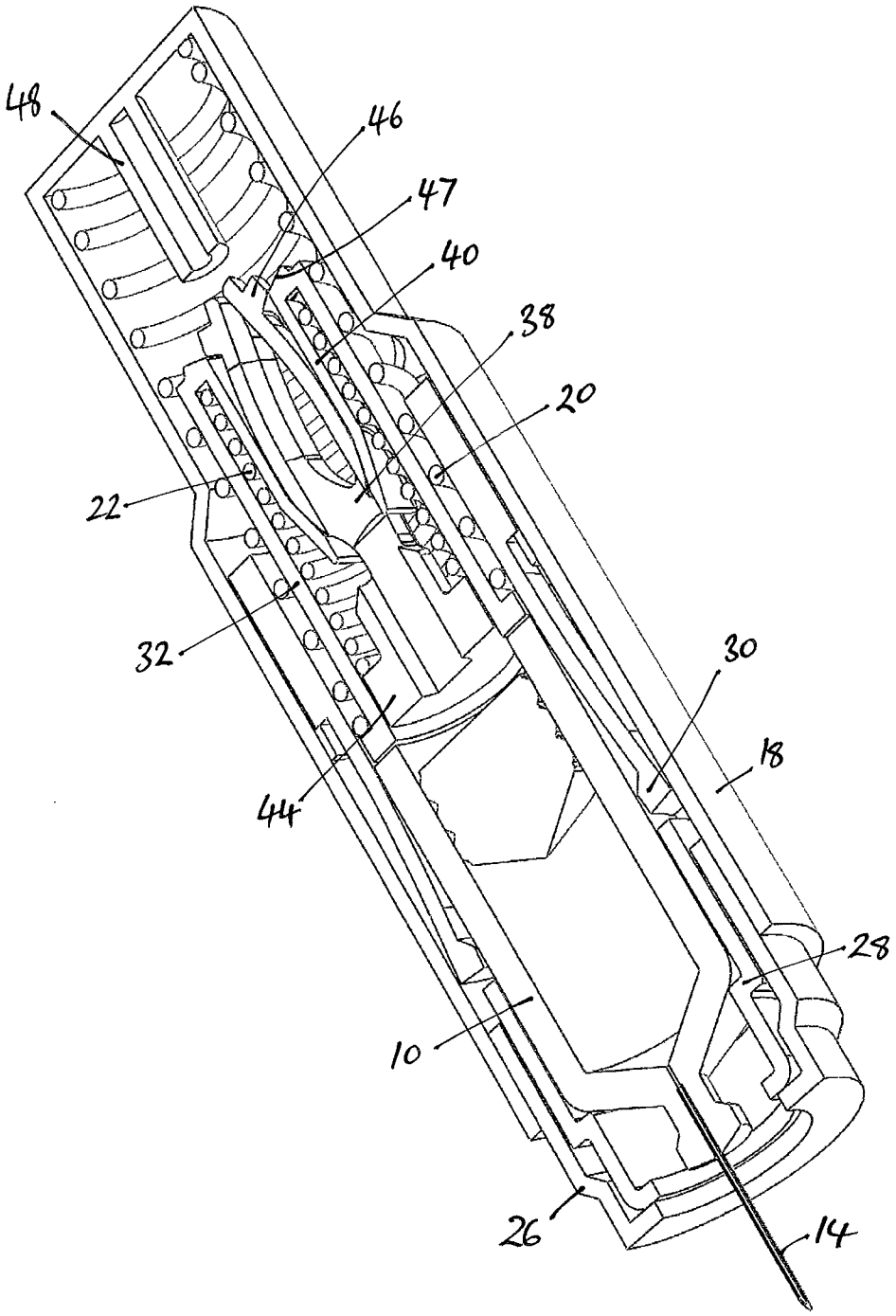

Fig. 4b

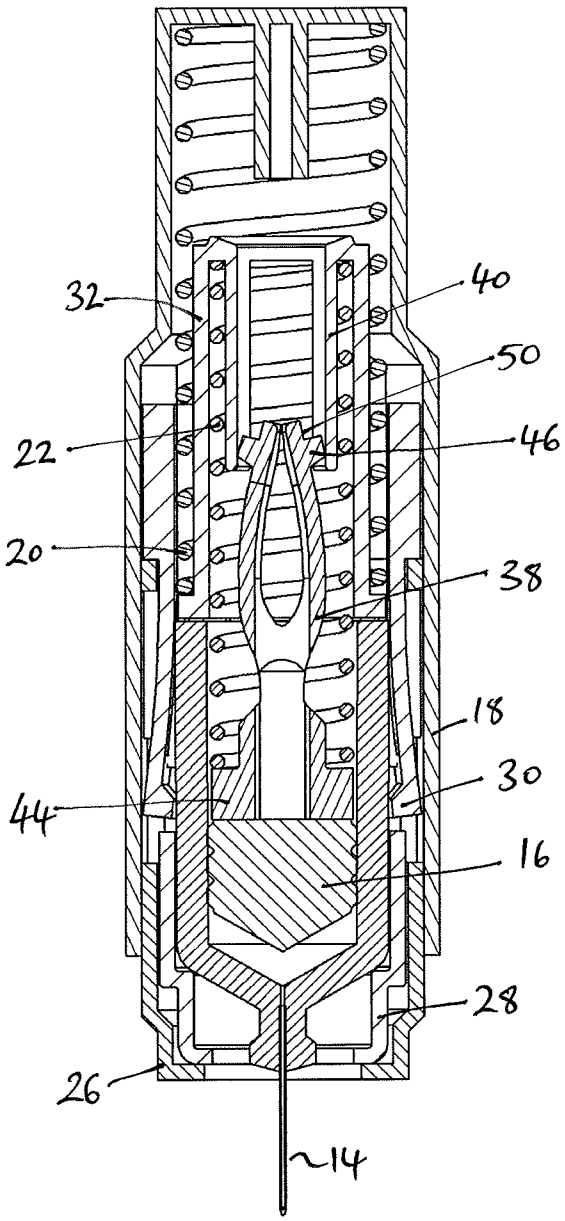

Fig. 5a

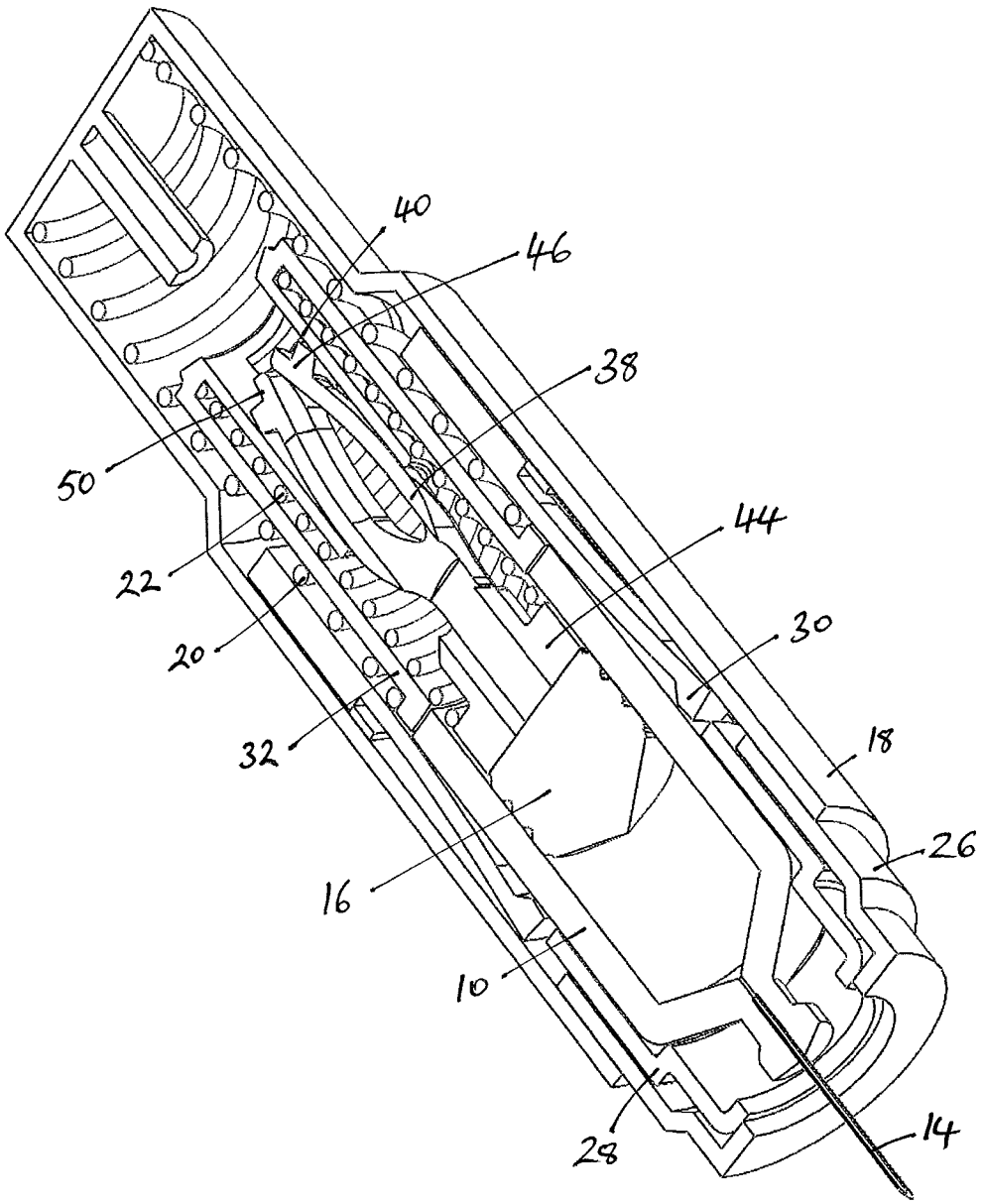

Fig. 5b

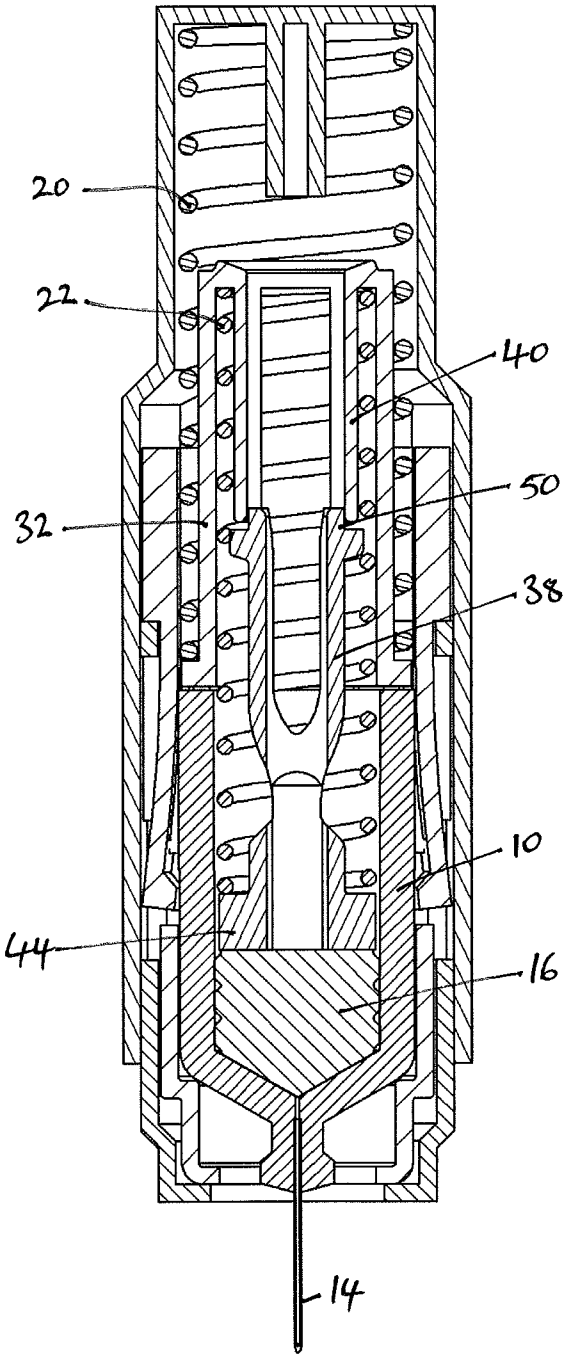

Fig. 6a

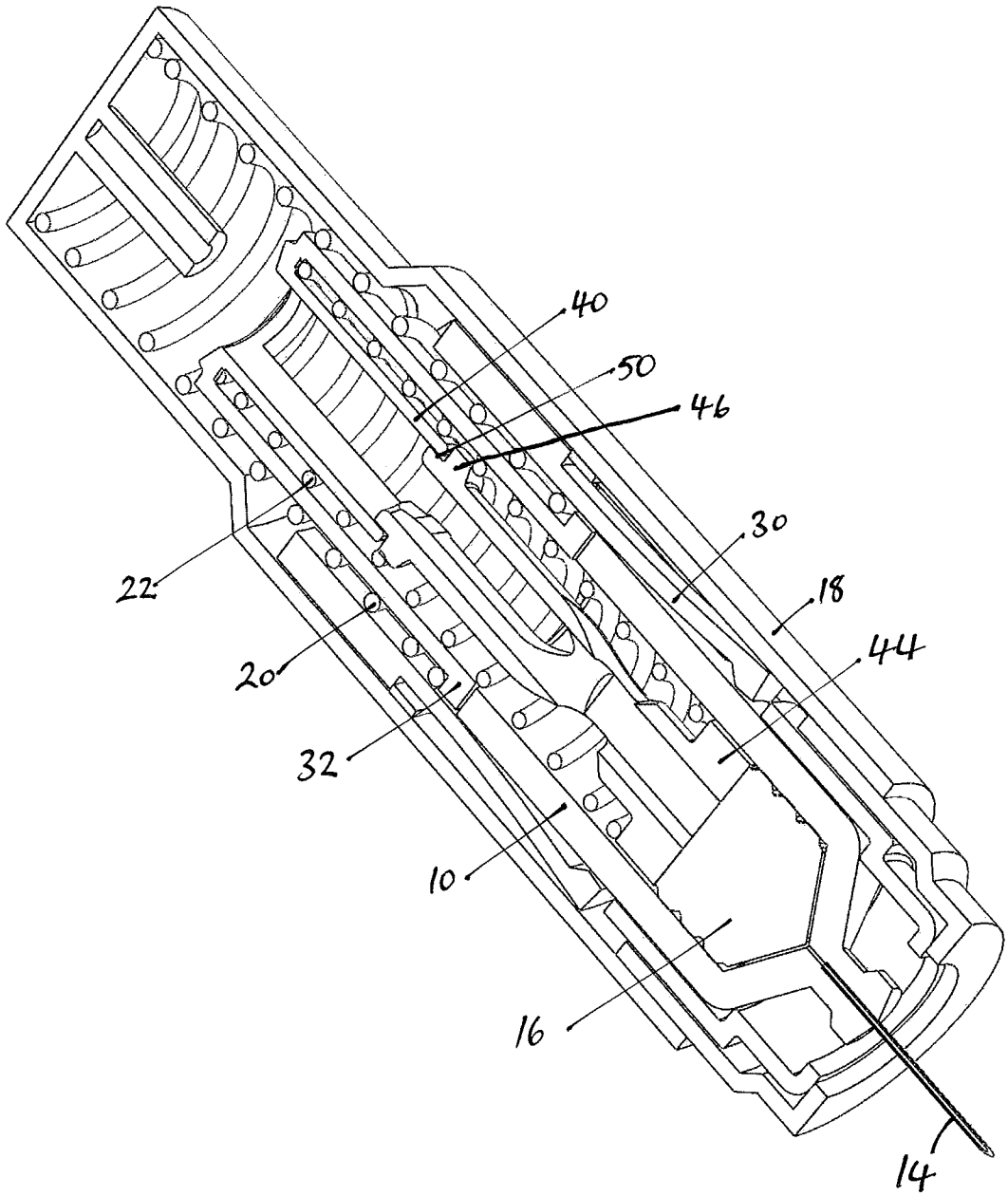

Fig. 6b

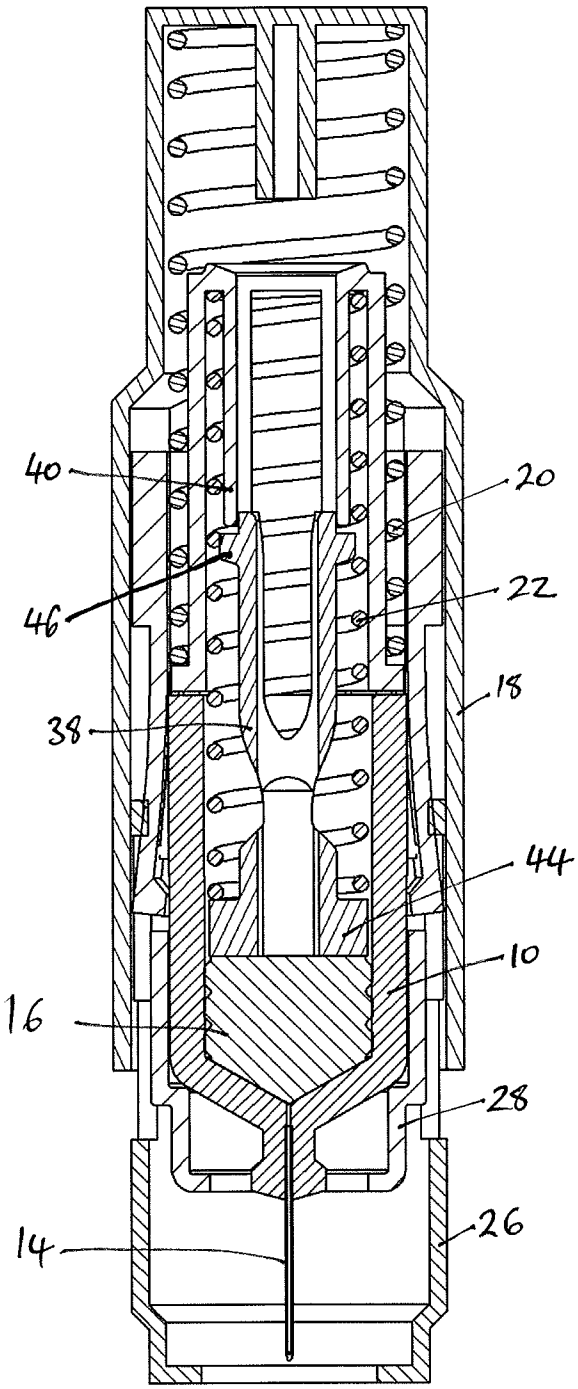

Fig. 7

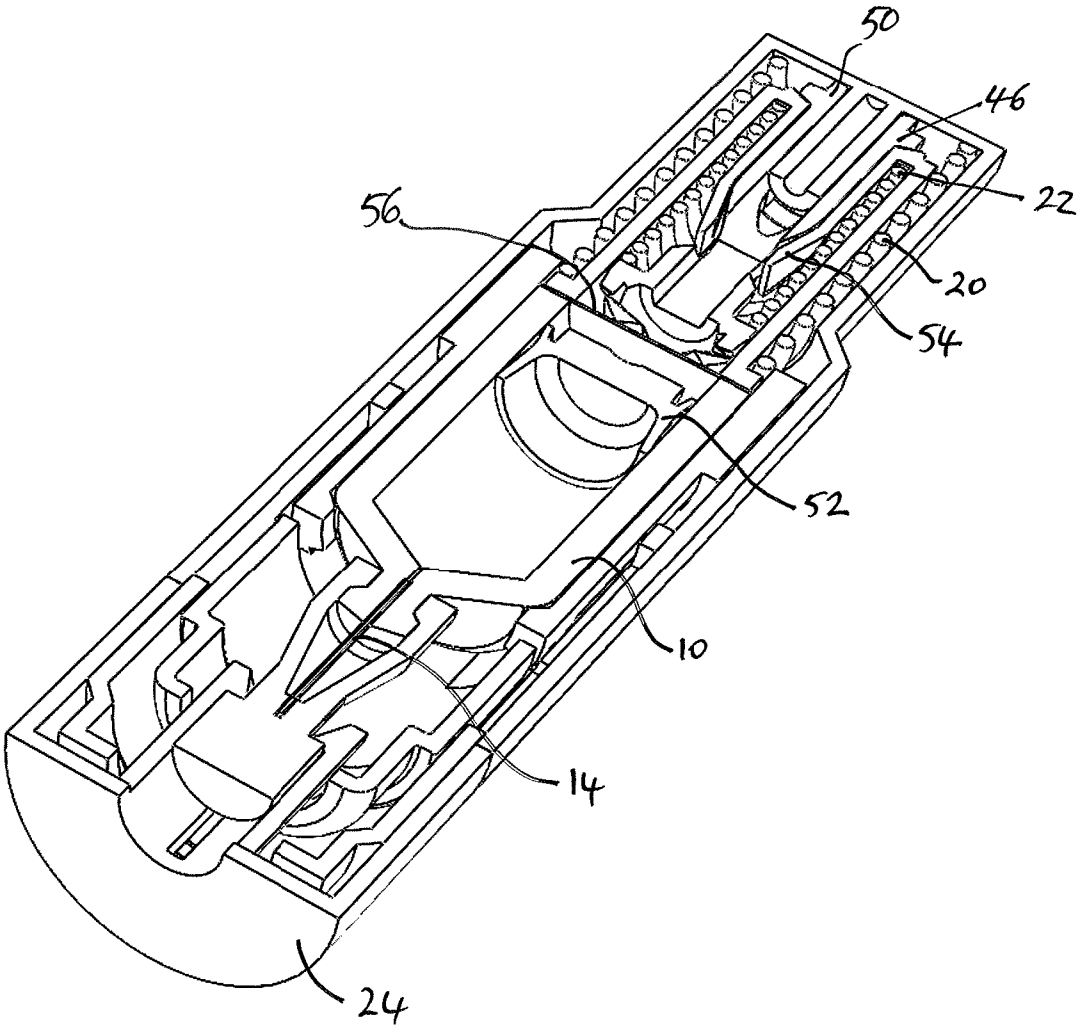

Fig. 8

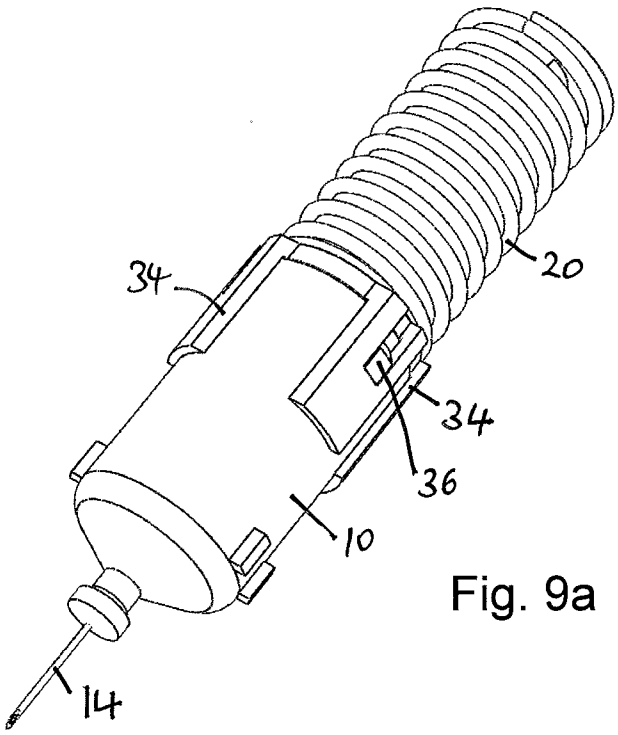

Fig. 9a

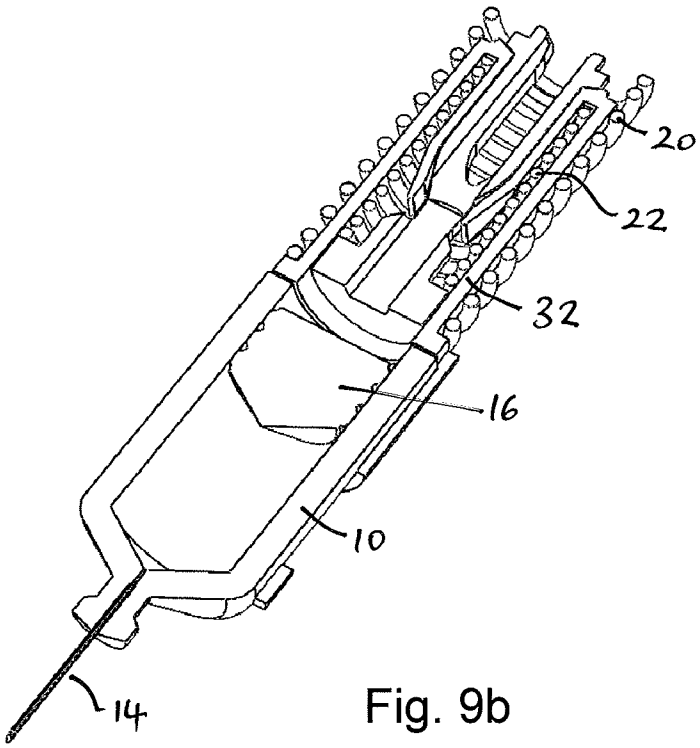

Fig. 9b

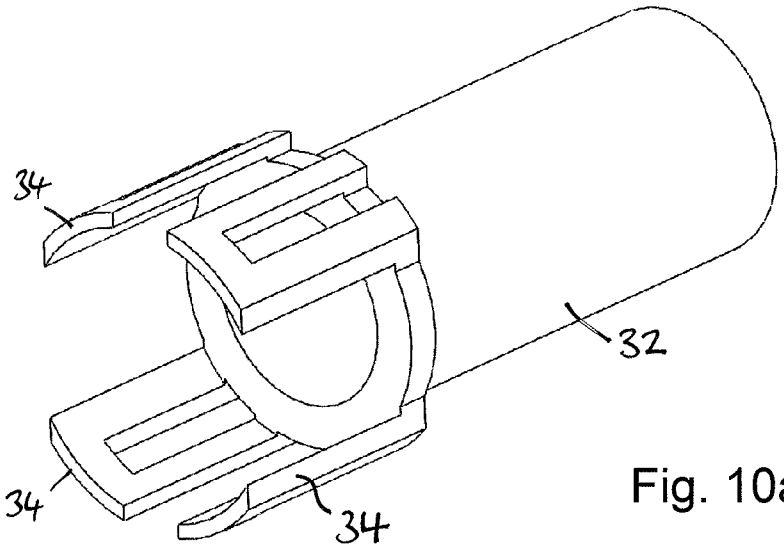

Fig. 10a

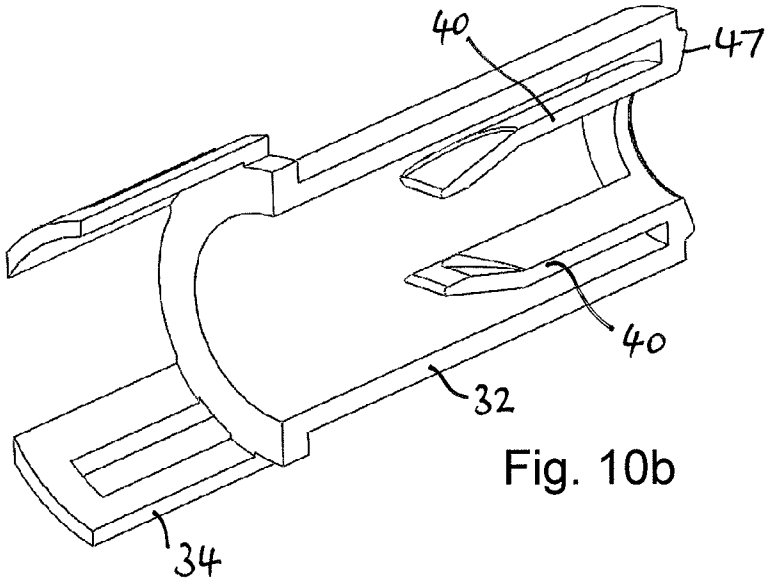

Fig. 10b

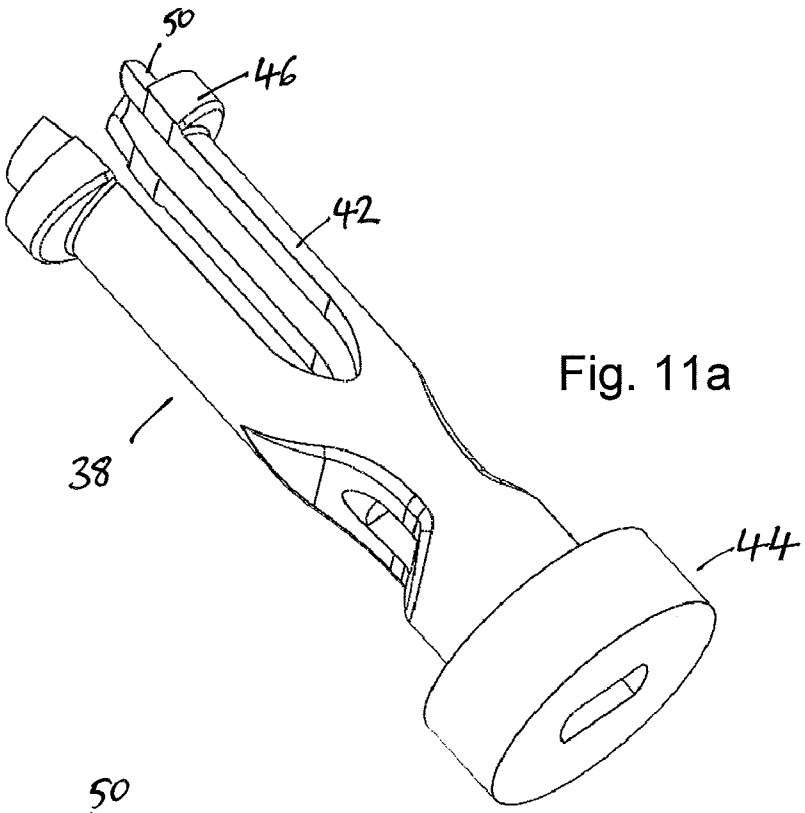

Fig. 11a

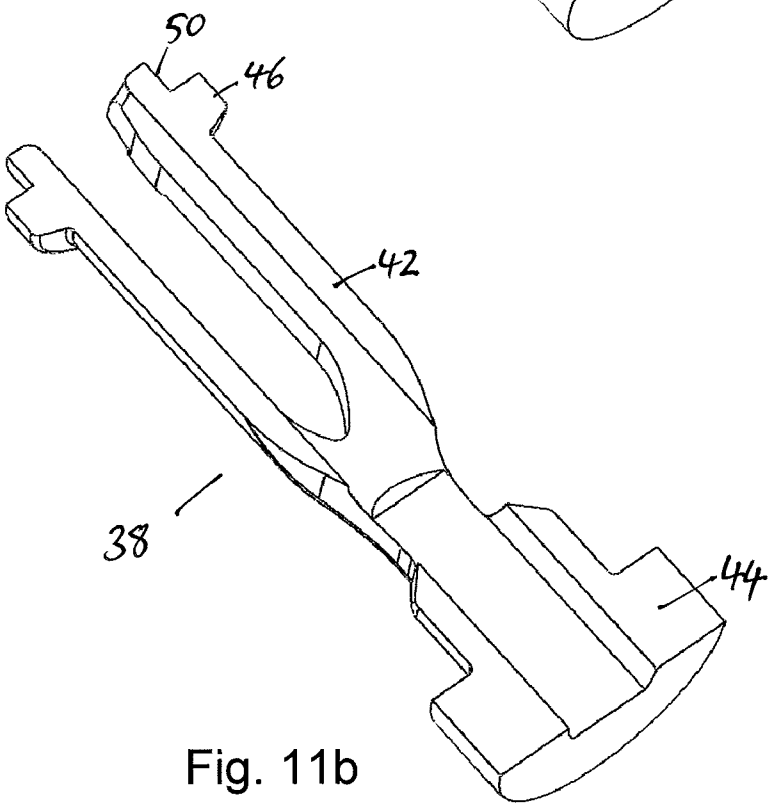

Fig. 11b

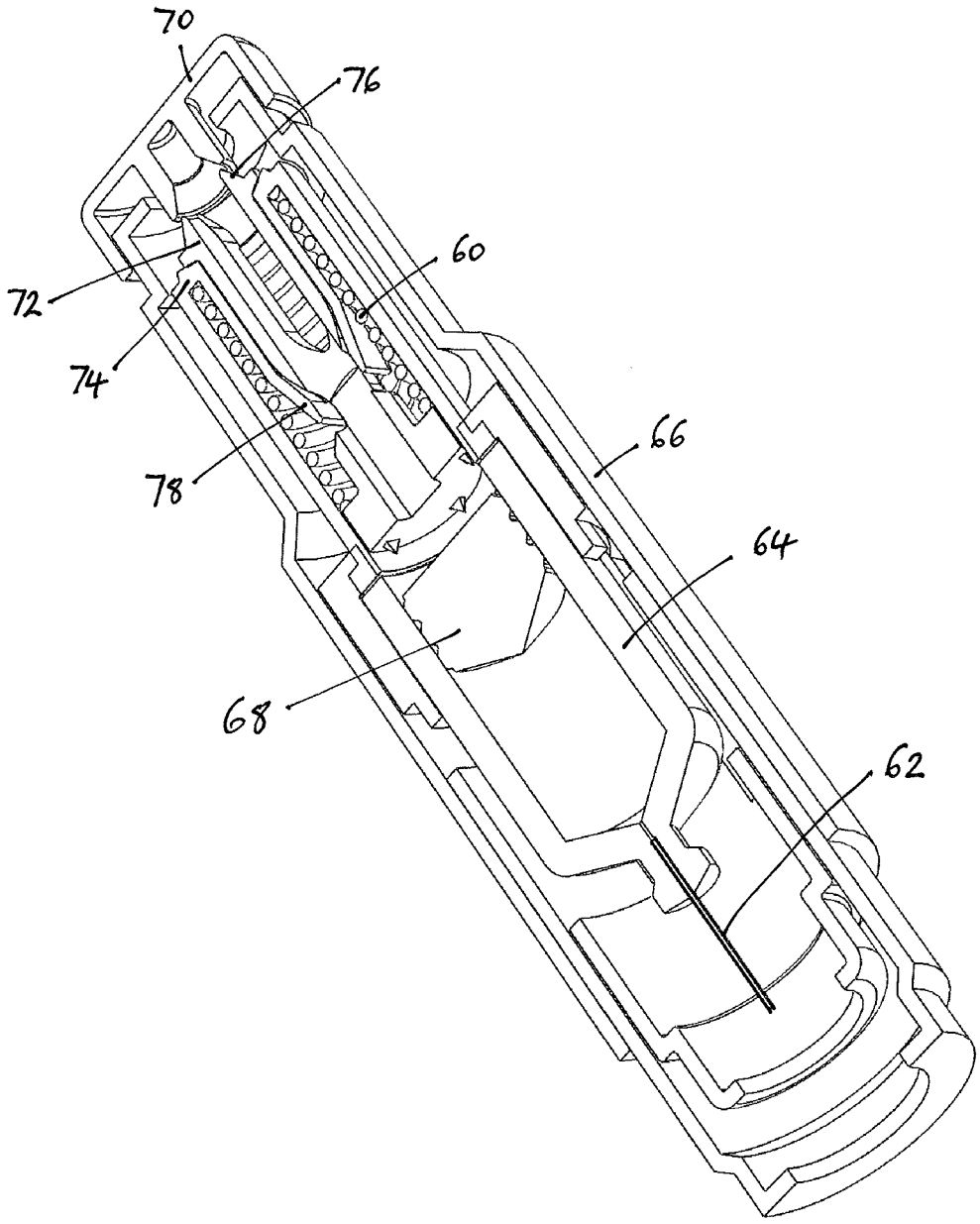

Fig. 12

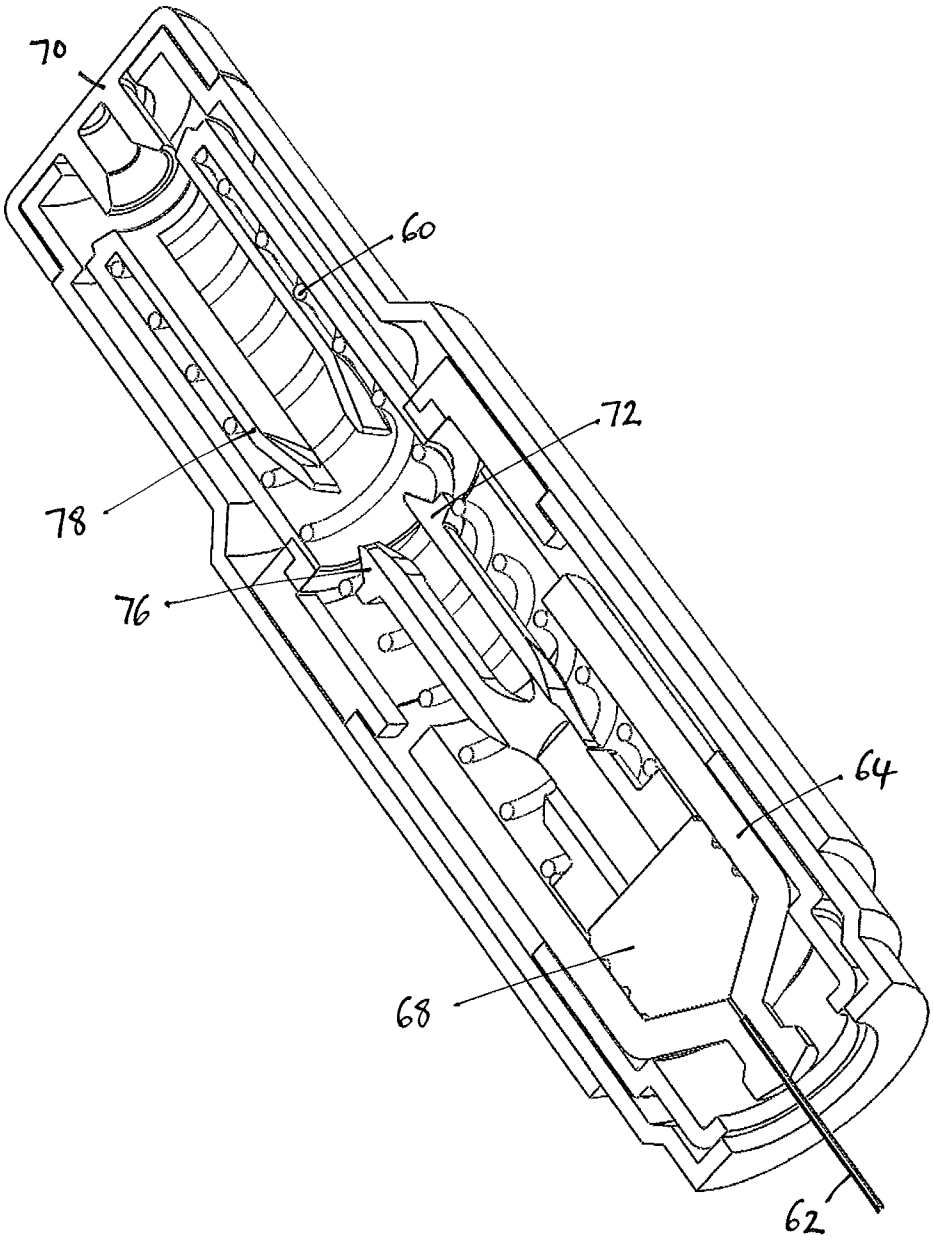

Fig. 13

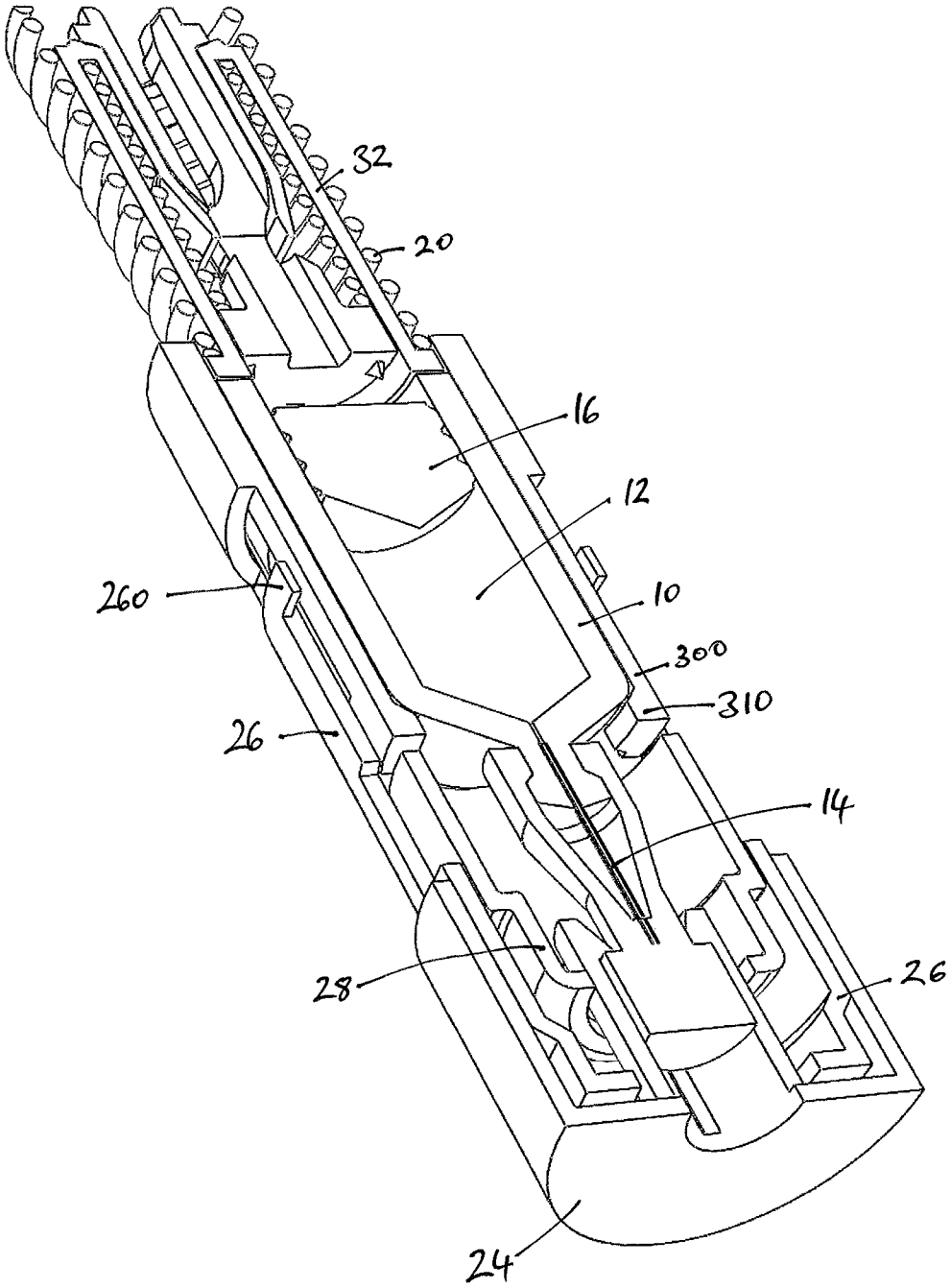

Fig. 14

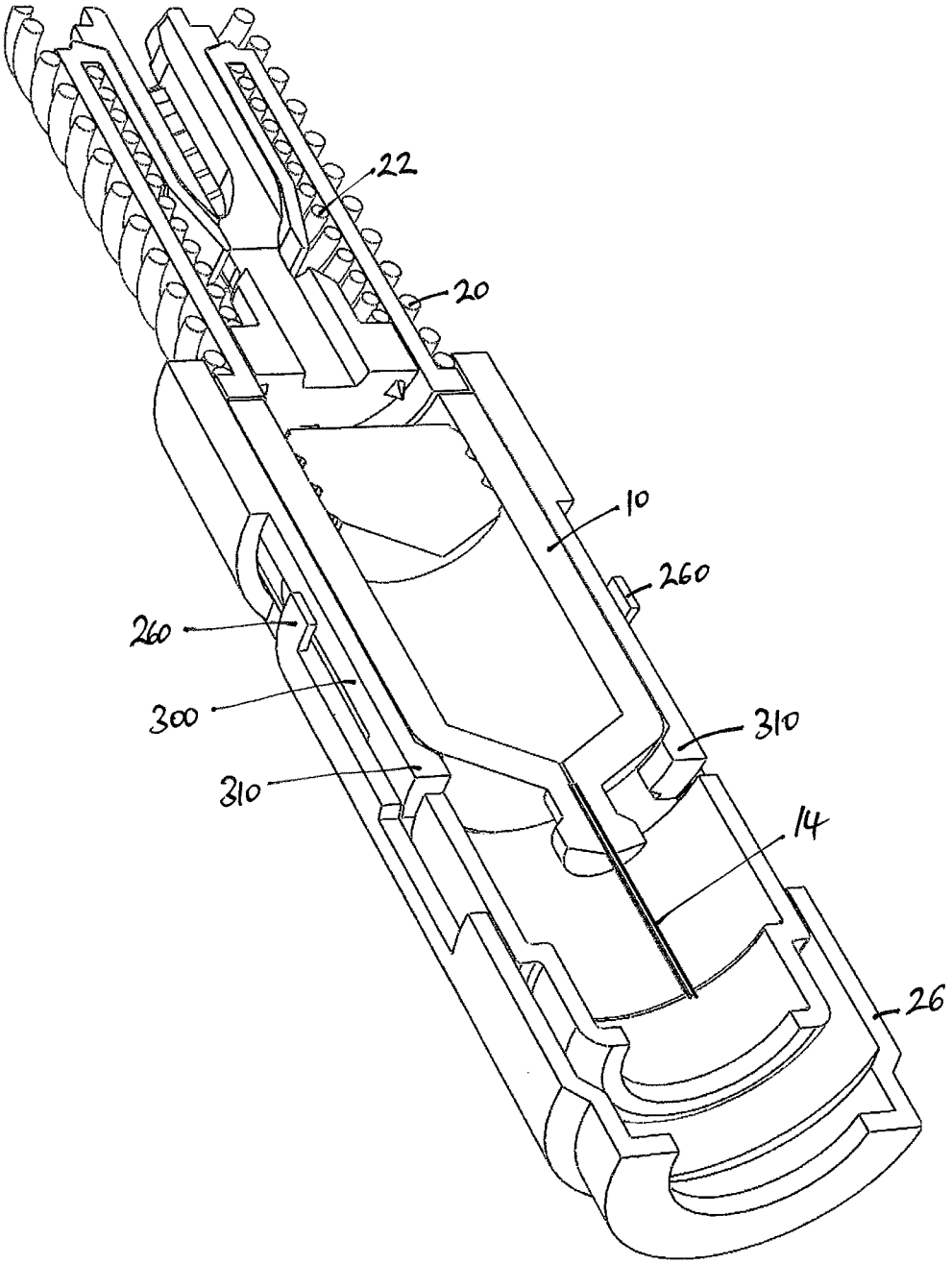

Fig. 15

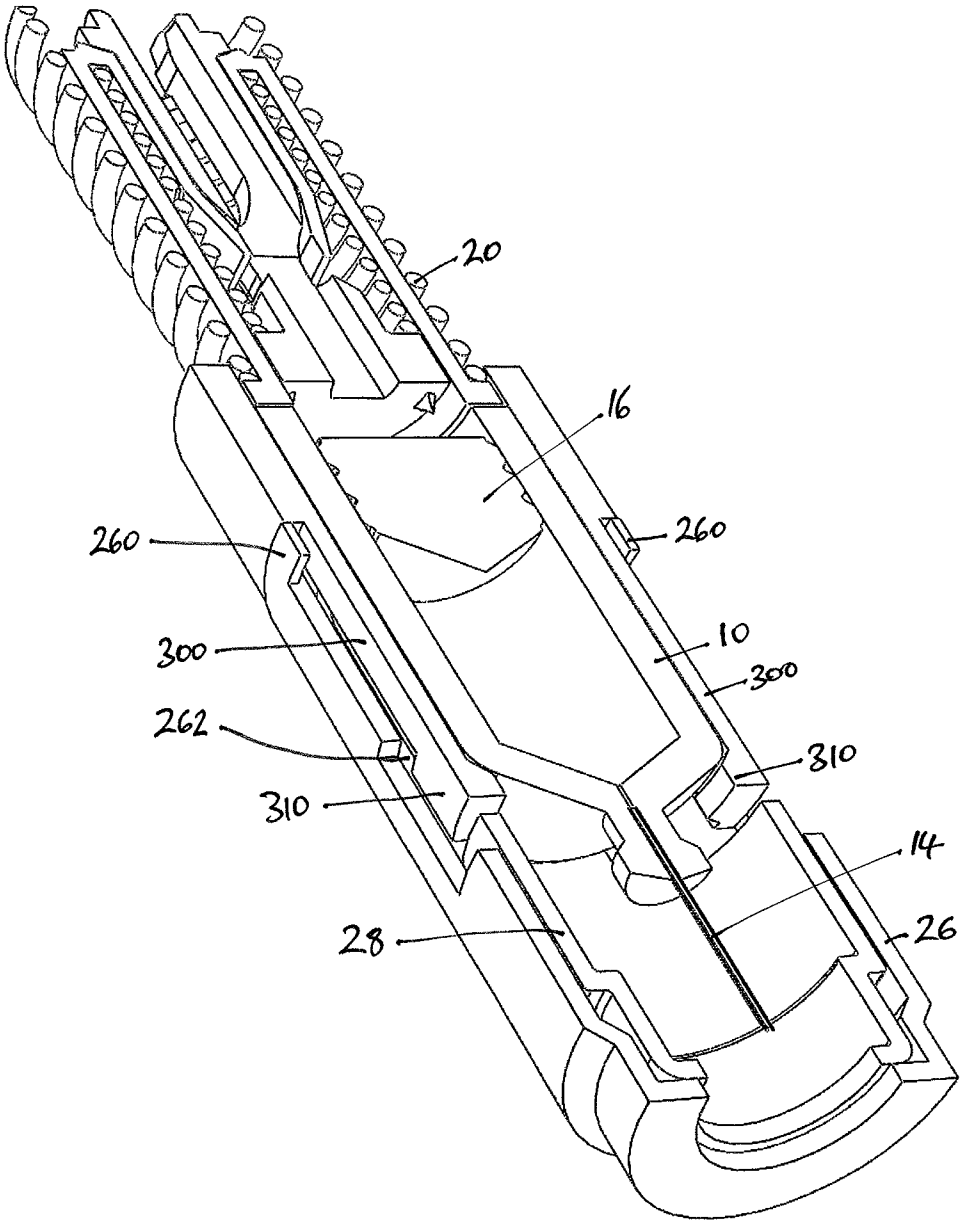

Fig. 16

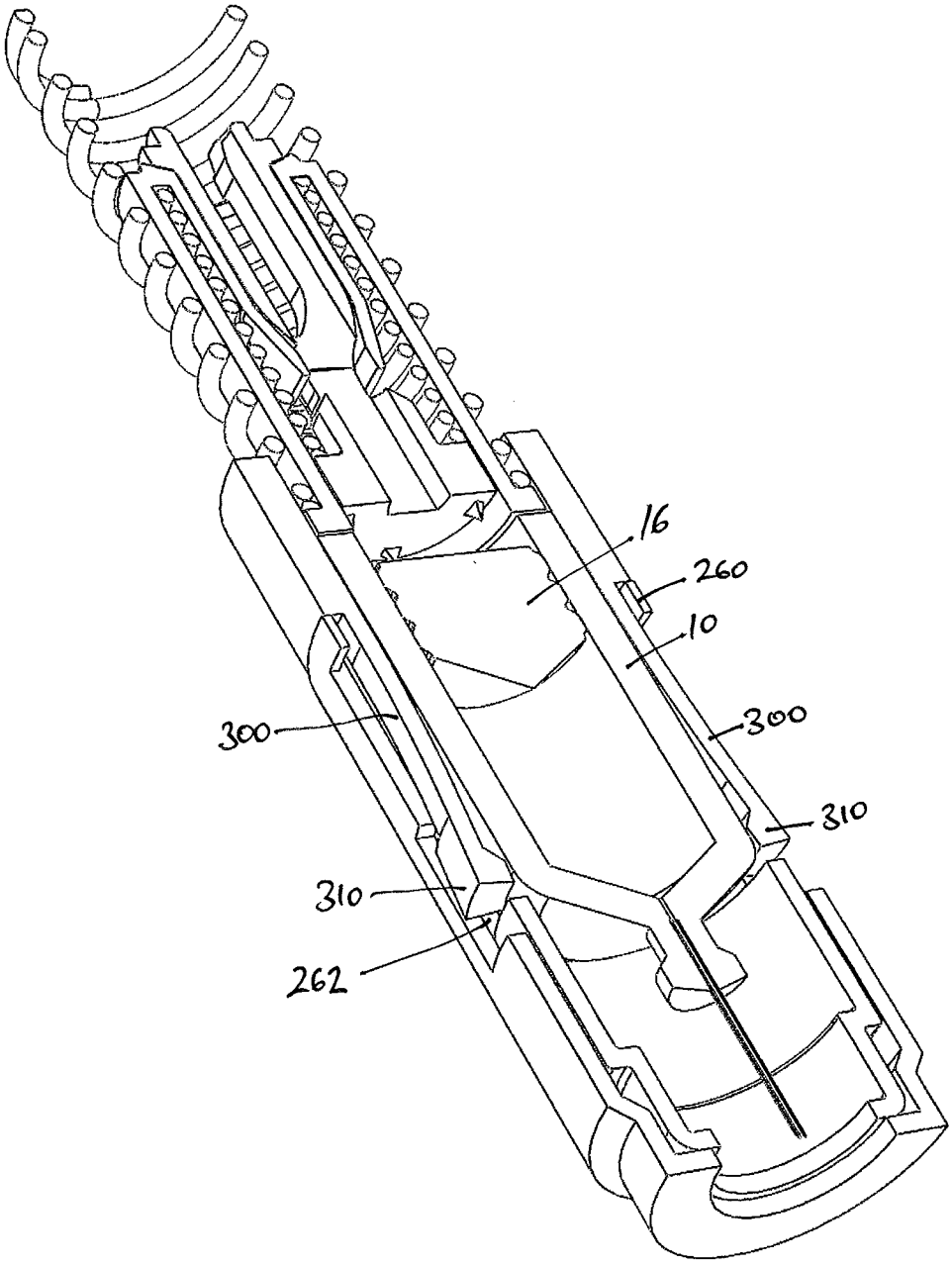

Fig. 17

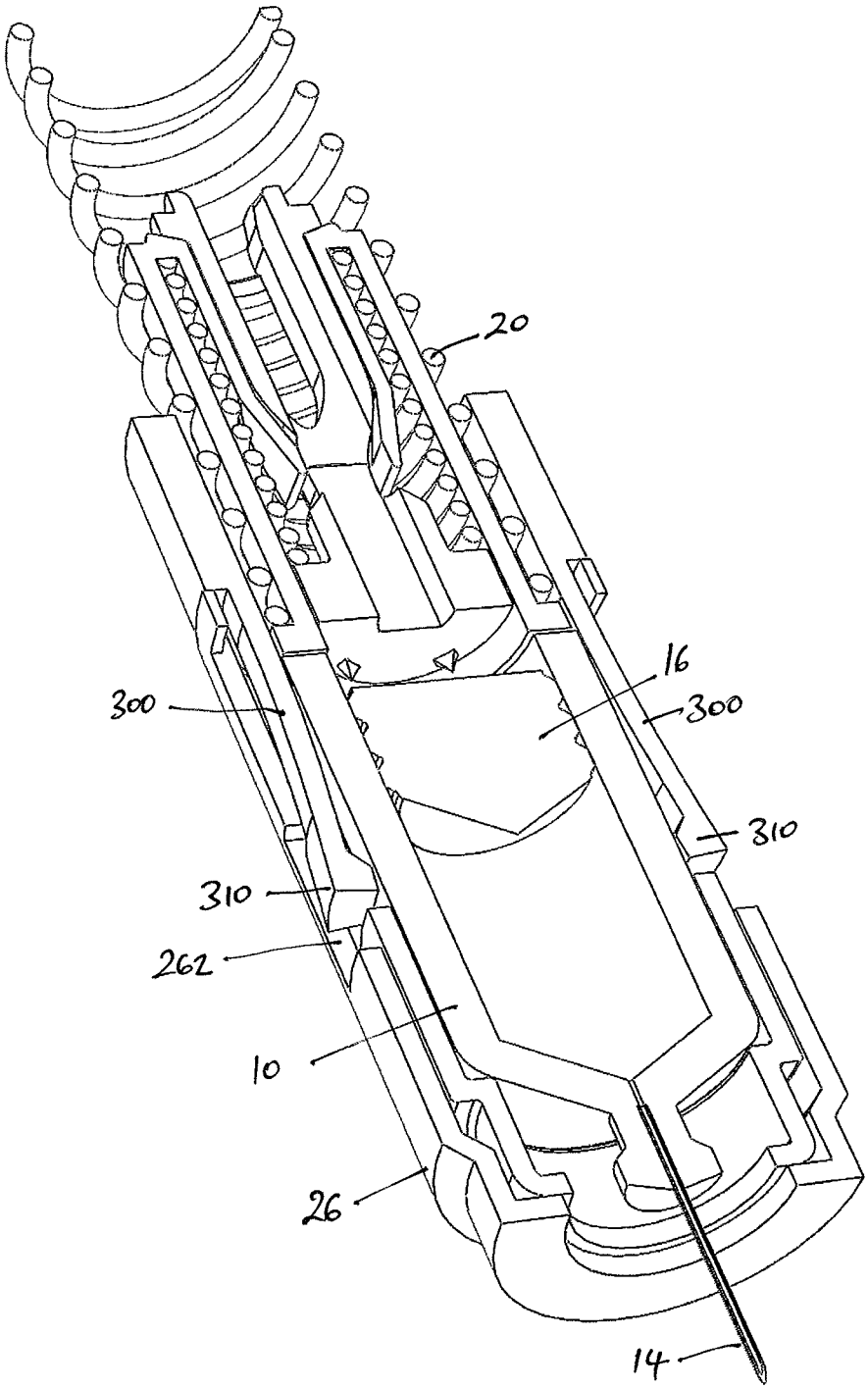

Fig. 18

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2011/052378

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61M5/20
ADD.

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

B. FIELDS SEARCHED

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

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US 6 099 503 A (STRADELLA GIUSEPPE [IT]) 8 August 2000 (2000-08-08) abstract; figures 1-3	1-3, 29-31, 35,36 4-28, 32-34, 37-41
	----- WO 2004/047890 A1 (TECPHARMA LICENSING AG	
X Y	[CH]; HOMMANN EDGAR [CH]; SCHERER BENJAMIN [CH]) 10 June 2004 (2004-06-10) abstract; figures 1-3	1-3, 29-31, 35,36 4-28, 32-34, 37-41
	----- -/--	

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

[X] See patent family annex.

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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

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
27 February 2012	05/03/2012

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

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2009/063030 A1 (SHL GROUP AB [SE]; LIOSA JOHN [US]) 22 May 2009 (2009-05-22)	1-3, 29-31, 35,36
Y	abstract; figures 1a,1b	4-28, 32-34, 37-41

X	WO 2009/007229 A1 (SHL MEDICAL AB [SE]; KRONESTEDT VICTOR [SE]) 15 January 2009 (2009-01-15)	1-3, 29-31, 35,36
Y	abstract; figures 1a,1b,2a,2b	4-28, 32-34, 37-41

X	WO 2005/023342 A1 (TECPHARMA LICENSING AG [CH]; HOMMANN EDGAR [CH]) 17 March 2005 (2005-03-17)	1-3, 29-31, 35,36
Y	abstract; figures 1-3	4-28, 32-34, 37-41

X	WO 00/24441 A1 (PHARMACIA & UPJOHN AB [SE]; BERGENS THOMAS [SE]; AAMARK MIKAEL [SE]) 4 May 2000 (2000-05-04)	1-3, 29-31, 35,36
Y	figures 1-3	4-28, 32-34, 37-41

X,P	WO 2011/048422 A2 (OWEN MUMFORD LTD [GB]; COWE TOBY [GB]) 28 April 2011 (2011-04-28)	1-3, 29-31, 35,36
	figures 2,3,10-14	

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/GB2011/052378

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6099503 A	08-08-2000	DE 69606993 D1	13-04-2000
		DE 69606993 T2	26-10-2000
		EP 0825883 A1	04-03-1998
		FR 2733155 A1	25-10-1996
		JP H11503637 A	30-03-1999
		US 6099503 A	08-08-2000
		WO 9632974 A1	24-10-1996
WO 2004047890 A1	10-06-2004	AU 2003275893 A1	18-06-2004
		EP 1572268 A1	14-09-2005
		JP 4377880 B2	02-12-2009
		JP 2006507103 A	02-03-2006
		US 2005277886 A1	15-12-2005
		WO 2004047890 A1	10-06-2004
WO 2009063030 A1	22-05-2009	CN 101983079 A	02-03-2011
		EP 2237817 A1	13-10-2010
		US 2010298780 A1	25-11-2010
		WO 2009063030 A1	22-05-2009
WO 2009007229 A1	15-01-2009	AT 501749 T	15-04-2011
		AU 2008274425 A1	15-01-2009
		CN 101687078 A	31-03-2010
		DK 2162170 T3	14-06-2011
		EP 2162170 A1	17-03-2010
		JP 2010532189 A	07-10-2010
		US 2010249705 A1	30-09-2010
		WO 2009007229 A1	15-01-2009
WO 2005023342 A1	17-03-2005	AU 2004269839 A1	17-03-2005
		CN 1849148 A	18-10-2006
		DE 10342059 A1	28-04-2005
		EP 1667754 A1	14-06-2006
		JP 2007504867 A	08-03-2007
		US 2008009807 A1	10-01-2008
		WO 2005023342 A1	17-03-2005
WO 0024441 A1	04-05-2000	AT 285805 T	15-01-2005
		AU 1589300 A	15-05-2000
		DE 69922992 D1	03-02-2005
		DE 69922992 T2	15-12-2005
		EP 1124601 A1	22-08-2001
		ES 2234321 T3	16-06-2005
		JP 4375906 B2	02-12-2009
		JP 2002528182 A	03-09-2002
		TW 445156 B	11-07-2001
		WO 0024441 A1	04-05-2000
WO 2011048422 A2	28-04-2011	NONE	