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— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

[Continued on next page]

(54) Title: CARTRIDGE ADAPTER FOR USE IN AN INFUSION SYSTEM

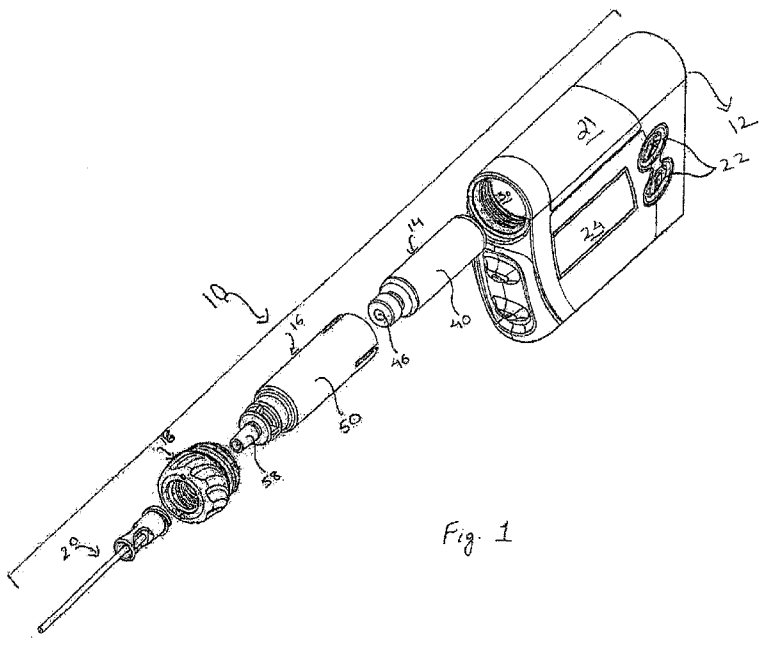

Fig. 1

(57) Abstract: The present invention generally relates to an infusion system (10) for pumping fluid into a body of a user. The infusion system has an infusion pump (12), wherein the infusion pump (12) has a housing (21), where the housing includes a cavity (30). A fluid storing means (15) is removably inserted into the cavity (30) of the housing. The fluid storing means (15) comprises a cartridge (140) and an adapter (16) that is connected to the cartridge (14) such that the adapter encases the cartridge. In addition the infusion system has an infusion set (20) removably connected to the fluid storing means (15).

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CARTRIDGE ADAPTER FOR USE IN AN INFUSION SYSTEM

RELATED APPLICATION

[0001] This application claims priority to US Provisional application No 60/976500 filed on October 1, 2007.

TECHNICAL FIELD

[0002] The present invention generally relates to an infusion pump for dispensing medication. More specifically it relates to an adapter that can be attached to a fluid cartridge for dispensing medication from the infusion pump.

BACKGROUND

[0003] Medical devices that pump medication into an individual is known and commonly used in the medical industry. Typically the medication that is delivered from such medical devices depends on the medical condition that is sought to be treated. For example, it is getting increasingly common to deliver insulin using an insulin pump to treat a diabetic patient.

[0004] Typically, the medical pump devices use a reservoir or a cartridge that contains the medicine to be delivered. Depending on the size of the cartridge that needs to be used may determine the overall size of the medical pump system. Since manufacturing of a medical pump device is expensive, manufactures typically decide which size cartridge they are going to use and design their medical pump system based on such consideration. This limits the ability of patients receiving treatments to only use medication that is pre-determined by the manufacture of the medical pump system.

[0005] Therefore, there is a need in the medical industry to have the flexibility to use any sized cartridge in any medical pump device. In other words there is a need to reduce the interdependency of the size of the cartridge and medical pump device of choice.

SUMMARY

[0006] It is against the above background that the present invention proves certain unobvious advantages and advancements over the prior art.

[0007] In accordance with one embodiment of the present invention comprises an infusion system for pumping fluid into a body of a user, the infusion system has an a infusion pump with a housing, the housing includes a cavity. The cavity is designed to receive a fluid storing means, such that the a fluid storing means can be removably inserted into the housing. The fluid storing means comprises a cartridge and an adapter, such that the adapter removably encases the cartridge. In addition, the infusion system also has a cap that is attached to the housing of the infusion system for holding the fluid storing means in place inside the housing of the infusion pump.

[0008] The adapter comprises a hollow housing such that the cartridge can be snapped into the interior of the housing of the adapter. The adapter may also comprise a canula or a needle that can pierce the septum of the cartridge when the adapter encases the cartridge. The adapter is designed such that it can receive different size cartridge, but can fit into the infusion pump.

[0009] The adapter in addition to the needle also includes the connection means to connect an infusion set. The connection means may be the industry standard luer connection or as proprietary connection to the infusion set.

[0010] In yet another embodiment of the present invention comprises an infusion system for pumping fluid into a body of a user, the infusion system has an a infusion pump with a housing, the housing includes a cavity. A fluid storing means is removably inserted into the cavity of the housing. The fluid storing means comprises a cartridge and an adapter, such that the adapter removably encases the cartridge. In addition, the infusion system also has a cap that is attached to the housing of the infusion system for holding the fluid storing means in place inside the housing of the infusion pump.

[0011] The adapter comprises a housing that is formed of two parts. One part of the housing is placed into the cavity of the infusion pump. This part of the housing may be removably or fixedly attached into the cavity. The second part comprising

the canula and the connecting means is coupled to the first part after the cartridge is inserted into the adapter.

[0012] In yet another embodiment of the present invention the adapter is designed such that it is possible to use a kind of pen cartridge which has a code cap.

[0013] In yet another embodiment, the adapter can be designed such that it works as a spring or a shock absorbing element to cover the tolerances between the cartridge and the housing of the insulin pump. In order to achieve that the hollow interior of the adapter may be provided with a spring mechanism or any shock absorbing material.

[0014] In yet another embodiment where the adapter is formed of two parts, the shock absorbing element is provided in the part that is attached to the pump housing.

[0015] In yet another embodiment, the adapter may be provided with a valve between the canula and the connecting means to prevent free flow of the medication from the cartridge into the infusion set when the plunger is not connected to the drive mechanism.

[0016] In yet another embodiment, the adapter is provided with a mechanism to transfer torque from the adapter onto the cartridge. For example, such mechanism could include a plurality of ribs provided in the interior of the housing of the adapter.

[0017] These and other features and advantages of the present invention will be more fully understood from the following detailed description of the invention taken together with the accompanying claims. It is noted that the scope of the claims is definitely by the recitations therein and not by the specific discussion of the features and advantages set forth in the present description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] The following detailed description of the embodiments of the present invention can be best understood when read in conjunction with the following drawings, where like structure is indicated with like reference numerals and in which:

[0019] FIGURE 1 is an exploded view of the infusion delivery system in accordance with the teachings of the present invention;

[0020] FIGURE 2 is a perspective view of the cartridge and the adapter in the infusion pump of Fig 1;

[0021] FIGURE 3 is a perspective view of the cartridge and the adapter in accordance to the teachings of the current invention;

[0022] FIGURE 4 is a perspective view of the adapter in accordance with the teachings of the current invention;

[0023] FIGURE 5 is a cross-sectional view of the adapter along lines A-A in Figure 4;

[0024] FIGURE 6 is an end view of the adapter along line B in Figure 4; and

[0025] FIGURE 7 is a perspective view of the cartridge and the two part adapter housing in the infusion pump of Fig 1.

[0026] Skilled artisans appreciate that elements in the figures are illustrated for simplicity and clarity and have not necessarily been drawn to scale. For example, the dimensions of some of the elements in the figure may be exaggerated relative to other elements to help improve understanding of the embodiment(s) of the present invention.

DETAILED DESCRIPTION

[0027] The following description of the preferred embodiment is merely exemplary in nature and is in no way intended to limit the invention or its application or uses.

[0028] Referring in particular to Figure 1, an infusion delivery system is generally represented by reference numeral 10. As can be seen in the drawing, the infusion delivery system comprises an infusion pump 12, a fluid storing means 15, a cap 18 to hold the fluid storing means 15 in place and an infusion set (not completely shown) 20 that is connected to the fluid cartridge through the cap 18. The infusion pump shown in the drawings is an insulin pump 12 such as the one sold by Disetronic Medical System under the name Accu-Chek Spirit ®. Although an insulin pump is shown, it must be understood that this invention is not limited to insulin pumps but to any pump that can be used to deliver medication.

[0029] The infusion pump 12 comprises a housing 21 that has at least one control 22 to control the infusion of medication from fluid storing means 15. The

infusion pump 12 also includes a display 24 to display information relevant to the operation of the infusion pump 12. Alternatively, the infusion pump 12 may have no display and only controls or be void of both display and controls. Although not shown in the drawings, the infusion pump 12 may have additional controls or buttons to effectively operate the infusion pump 12. Although not shown in the drawings the infusion pump 12 may be controlled remotely to dispense medication using a remote control device such as a smart phone, a PDA or any other mobile devices. Although not specifically mentioned, the infusion pump 12 may be a one time use pump such that after the dispensing of the medication the pump is disposed.

[0030] With reference to Figures 1 and 2, the fluid storing means 15 comprises a cartridge 14 and an adapter 16. The housing 21 of the infusion pump 12 has a cavity 30 for receiving the fluid storing means 15. In one embodiment, the fluid storing means 15 can be removably inserted into the cavity such that after the medication is over, a new fluid storing means 15 can be inserted into the cavity 30. The fluid storing means 15 when inserted into the opening 30 cooperates with a drive system 32 that advances a plunger 34 so as to dispense medication thereform. The drive system 32 and the plunger 34 are well known in the art and are not explained in detail. In operation, when the infusion pump 12 is given the required commands/instructions, the drive system 32 moves the plunger such that the medication is dispensed from the cartridge 14 through the infusion set 20.

[0031] The cartridge 14 contains a medication (not shown) that needs to be dispensed. For example, if the infusion pump 12 is an insulin pump, then the cartridge 14 contains insulin. The medication may be prefilled into the cartridge such that when the medication is empty, the user throws the cartridge away. One such example of a pre-filled cartridge 14 is sold by Novo Nordisk A/S under the name Novolog® Alternatively, the cartridge 14 may be designed such as the user fills the required medication as needed from a vial provided by the manufacturer of the appropriate medication . As seen in the drawing, the cartridge 14 contains a housing 40 having a first end 42 and a second end 44. Depending on the medication used and its expected shelf life, the housing 40 can be made of plastic, glass or any other suitable material. In one embodiment, when the cartridge 14 is inserted into the cavity 30 the second end 44 cooperates with the drive system 32 of the infusion

pump 12. The first end 42 of the cartridge 14 comprises a sealable septum 46 into which a hollow needle from the adapter 16 can be removably inserted (as will be explained in detail). Alternatively, in another embodiment, the cartridge 14 and the adapter 16 are coupled together and then inserted as a unit into the cavity 30 of the infusion pump 12. In this embodiment, the distal end 44 of the cartridge 14 couples with the drive unit 32 such that medication from the cartridge 14 can be infused in a controlled manner.

[0032] With reference to Figures 2, 3 and 4, the adapter 16 comprises a housing 50 having a first end 52 and a second end 54. The housing 50 of the adapter 16 has a hollow interior 56 such that the cartridge 14 can be removably received in the interior 56. In such an arrangement, the adapter 16 encases the cartridge 14. The shape of the housing 50 is such that the adapter 16 can easily fit into the cavity 30 of the infusion system 12. In addition, the shape is compatible with the outer shape of the cartridge housing 40. As shown, the first end 52 of the adapter is open and the cartridge 14 can be inserted into the adapter 16 through this end. In the embodiment where the cartridge 14 is first inserted into the infusion pump 12, the adapter 16 is slidably engaged on top of the cartridge 14 such that it covers the cartridge 14. In the embodiment where the cartridge 14 and the adapter 16 are inserted as a unit into the infusion pump 14, the cartridge 14 slides into the hollow interior 50 of the adapter 16 thereby forming the fluid storing means that is then inserted into the cavity 30 of the housing 21.

[0033] With continued reference to the drawings, the second end 54 of the housing 50 comprises a connection means 58 for connecting the fluid storing means 15 to the infusion set 20. The connection means 58 can be a standard luer connection or can be a proprietary connection to connect the infusion set 20 to the infusion pump 12. The second end 54 of the adapter 16 also includes an integrated canula 60. As shown the canula 60 at one end 61 is fixedly connected to the interior of the adapter housing 50. The canula 60 at the opposite end has a sharp tip 62 that extends inside the body of the housing 50 of the adapter 16. When the cartridge 14 is inserted inside the adapter 16 or when the adapter 16 slides over the cartridge 14, the canula 60 pierces the septum 46 of the cartridge 14 such that it is in contact with the medication inside the cartridge 14. The canula 60 is hollow such that medication

can flow into the infusion set 20. The canula 60 can be formed from plastic or other materials such as steel.

[0034] Although not specifically shown in the drawing, the adapter 16 has attaching means for holding the cartridge 14 in place. Such attaching means may be provided at the first end 52 or the second end 54 of the adapter housing 50. The attaching means can be provided in the interior of the adapter housing 50 or can be provided at any other suitable place. For example, in order to ensure that the adapter 16 can receive different cartridge sizes into the hollow interior 56 , it is possible to design the interior housing 50 to have some spring means such that the cartridge 14 is snapped into the adapter 16. The attaching means to attach or snap fit the adapter 16 may include groves, ridges, recess or any other mechanism that will help a tight fit between the adapter 16 and the cartridge 14.

[0035] In operation once the adapter 16 and the cartridge 14 are connected with each other it may not be possible to separate them and reuse one or the other. In other words once the medication is over from the cartridge 14, they will be removed as a unit from the infusion pump and disposed as a unit. Alternatively, it may be possible to separate the adapter 16 from the cartridge 14 and dispose them off separately.

[0036] In another embodiment as shown in Fig. 7, the adapter 16 comprises a housing 50 that is formed of two parts 50a and 50b. One part 50a of the housing is placed into the cavity 30 of the infusion pump 12. This part of the housing may be removably or fixedly attached into the cavity 30 and around the plunger of the infusion pump. The second part 50b comprising the canula 60 and the connecting means 58 is coupled or mated to the first part 50a of the housing after the cartridge 14 is inserted into the adapter 16. The second part 50b can be coupled to the first part 50a by different method such as just placing the second part 50b on top of the first part 50a. alternatively, the first part 50a or the second part 50b can be connected by snapping the two parts together or fastening the two parts together.

[0037] In this embodiment, where the adapter housing 50 is formed of two parts 50a and 50b, it is possible to transfer some of the functionalities from the housing of the adapter to the part 50a that is attached to the cavity of the pump housing. For example, the part 50a may be provided with a spring or a shock

absorbing material to cover the tolerances between the adapter and the pump housing. In addition, the part 50a may be coded or provided with a coding mechanism such that it detects correct attachment of the cartridge and/or the adapter into the housing of the pump.

[0038] In yet another embodiment of the present invention the adapter is designed such that it is possible to use a kind of pen cartridge which has a code cap.

[0039] In yet another embodiment, the adapter 16 can be designed such that it works as a spring or a shock absorbing element to cover the tolerances between the cartridge 14 and the housing 21 of the infusion pump 12. In order to achieve that the hollow interior 56 of the adapter 16 may be provided with a spring mechanism or any shock absorbing material.

[0040] In yet another embodiment, the adapter 16 may be provided with a valve between the canula 60 and the connecting means 58 to prevent free flow of the medication into the infusion set if the plunger is not connected to the drive mechanism.

[0041] In yet another embodiment, the adapter 16 is provided with a mechanism to transfer torque from the adapter 16 onto the cartridge 14. For example, such mechanism could include a plurality of ribs 64 (as shown in Figure 5 and 6) provided in the hollow interior 56 of the adapter housing 50 .

[0042] The cap 18 is coupled to the infusion pump housing 21 after the fluid storage means 15 is inserted into the cavity 30. The cap 18 serves to retain the cartridge 14 in the infusion pump 12. In addition, the cap 18 also helps perform a number of functions for the infusion pump 12 to operate. For example, attachment of the cap 18 may lock the cartridge 14 in the pump housing 21 and ceasing or preventing the dispensation of medication if the cap 18 is not properly engaged with the insulin pump 12. In addition, the cap may serve to water proof the infusion pump 12. In cases where the infusion pump 12 is a one time disposable pump the cap may lock the fluid storage means such that it can not be reused by the user.

[0043] To operate the infusion delivery system, the user inserts the fluid storing means 15 into the cavity 30 such that the canula 60 integrated into the adapter 16 pierces the septum 46 of the cartridge 14 to create a fluidic path. The cap 18 is then coupled to the housing 21 such that the fluid storing means 15 is held

in place inside the cavity 30, thereby engaging the drive system 32. The connection means 58 on the adapter 16 is then connected to the infusion set 20. The user then initiates commands/instructions either using the controls on the infusion pump 12 or a remote device to pump the medication from the cartridge 14 into the body of the user.

[0044] It is noted that terms like "preferably", "commonly", and "typically" are not utilized herein to limit the scope of the claimed invention or to imply that certain features are critical, essential, or even important to the structure or function of the claimed invention. Rather, these terms are merely intended to highlight alternative or additional features that may or may not be utilized in a particular embodiment of the present invention.

[0045] For the purposes of describing and defining the present invention it is noted that the term "substantially" is utilized herein to represent the inherent degree of uncertainty that may be attributed to any quantitative comparison, value, measurement, or other representation. The term "substantially" is also utilized herein to represent the degree by which a quantitative representation may vary from a stated reference without resulting in a change in the basic function of the subject matter at issue.

[0046] Having described the invention in detail and by reference to specific embodiments thereof, it will be apparent that modification and variations are possible without departing from the scope of the invention defined in the appended claims. More specifically, although some aspects of the present invention are identified herein as preferred or particularly advantageous, it is contemplated that the present invention is not necessarily limited to these preferred aspects of the invention.

CLAIMS

What is Claimed is:

1. An infusion system (10) for pumping fluid into a body of a user, the system comprising:

   a infusion pump (12), wherein the infusion pump (12) has a housing (21), where the housing includes a cavity (30);

   a fluid storing means (15) removably inserted into the cavity (30) of the housing, where the fluid storing means (15) comprises a cartridge (140) and an adapter (16) connected to the cartridge (14) such that the adapter encases the cartridge;

   an infusion set (20) removably connected to the fluid storing means (15).
2. The system of claim 1, further comprising a cap (18) for holding the fluid storage means (15) in place inside the housing (21) of the infusion pump (12).
3. The system of claim 1, wherein the adapter comprises a housing (50) having an hollow interior (56), a connecting means (58) to connect the adapter (16) to the infusion set (20) and a canula (60) such that the canula (60) is positioned inside the cartridge (14) when the adapter (16) is attached to the cartridge (14).
4. The system of claim 3, wherein the hollow interior (56) is provided with a spring or a shock absorbing material to cover any tolerances between the adapter housing (50) and pump housing (21).
5. The system of claim 3, wherein the adapter housing (50) is formed of 2 parts, such that a first part (50a) is placed inside the cavity (30) of the infusion pump housing and the second part (50b) comprising the canula (60) is capable of

being coupled to first part after the cartridge (14) is connected to the adapter (16).

6. The system of claim 5, wherein the first part is provided with a spring or a shock absorbing material to cover any tolerances between the adapter housing and pump housing.
7. The system of claim 1, wherein the adapter (16) further comprises a valve between the connecting means (58) and the cannula (60) such that the valve prevents free flow of the fluid.
8. The system of claim 1, wherein the adapter (16) is provided with a torque transfer mechanism (64) to transfer torque from the adapter to the cartridge.
9. The system of claim 7, wherein the torque transfer mechanism comprises a plurality of ribs (64) in the adapter.
10. An infusion system (10) for pumping fluid into a body of a user, the system having an infusion pump housing (21) with a cavity (30), the system (10) comprising:

a cartridge (14); and

an adapter (16) connected to the cartridge (14) such that the adapter (16) encases the cartridge (14);

and wherein one end of the adapter (16) comprises a connecting means (58) and a canula (60), wherein the canula (60) is inside the cartridge (14) when the adapter (16) is connected to the cartridge (14) and the other end is connectable into the cavity (30) of the infusion pump housing (21).

11. The system of claim 10 further comprising a cap (18) for holding the cartridge (14) and adapter (16) in place inside the infusion pump housing and an

infusion set (20) removably connected to connecting means (58) of the adapter (16).

12. The system of claim 10, wherein adapter (16) is provided with a spring or a shock absorbing material to cover any tolerances between the adapter (16) housing and pump housing (21).

13. The system of claim 10, wherein the adapter (16) is formed of 2 parts, such that a first part (50a) is placed inside the infusion pump housing (21) and the second part (50b) comprising the canula and the connecting means is capable of being coupled to first part (50a) after the cartridge is attached to the adapter (16).

14. The system of claim 13, wherein the first part (50a) is provided with a spring or a shock absorbing material to cover any tolerances between the adapter housing and pump housing.

15. The system of claim 10, wherein the adapter (16) further comprises a valve between the connecting means (58) and the canula (60) such that the valve prevents free flow of the fluid.

16. The system of claim 10, wherein the adapter is provided with a torque transfer mechanism (64) to transfer torque from the adapter to the cartridge.

17. The system of claim 16, wherein the torque transfer mechanism comprises a plurality of ribs in the adapter.

18. A method of providing an infusion system for pumping fluid into a body of a user, the system having an infusion pump housing (21) with a cavity (30), the method comprising:

placing a cartridge (14) into the cavity (30) of the infusion pump housing (21);

connecting an adapter (16) to the cartridge (14) such the adapter (16) encases the cartridge (14);

providing one end (52) of the adapter (16) with a connecting means (58) and a canula (60); and

inserting the canula (60) into the cartridge (14) when connecting the adapter (16) to the cartridge (14).

19. The method of Claim 18, further comprising the step of providing the adapter (16) in two parts (50a, 50b) and placing the first part (50a) inside the cavity (30) of the pump housing (21) and coupling the second part (50b) having the canula (60) and connecting means (58) to the first part (50a) after connecting the cartridge (14).

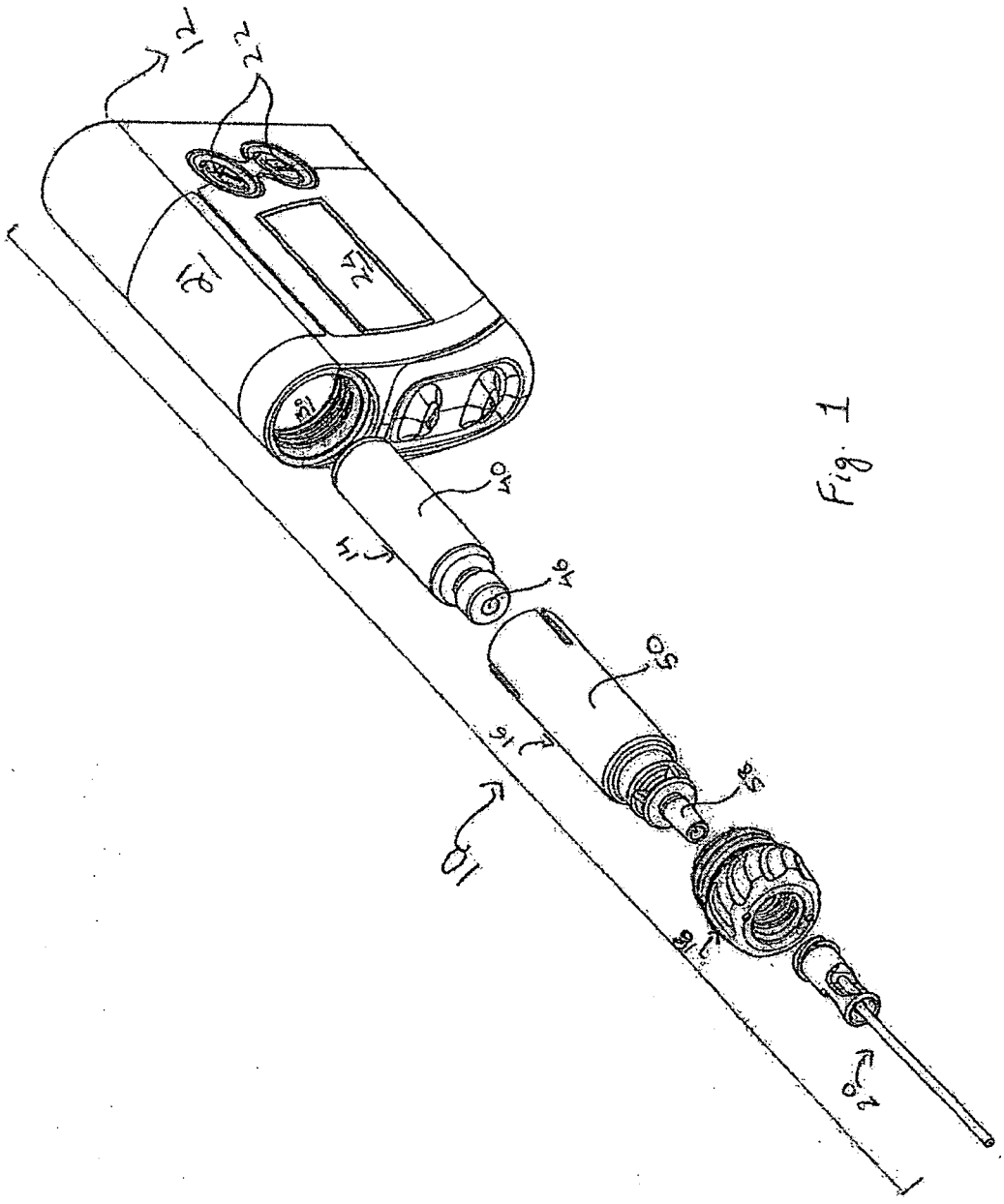

Fig. 1

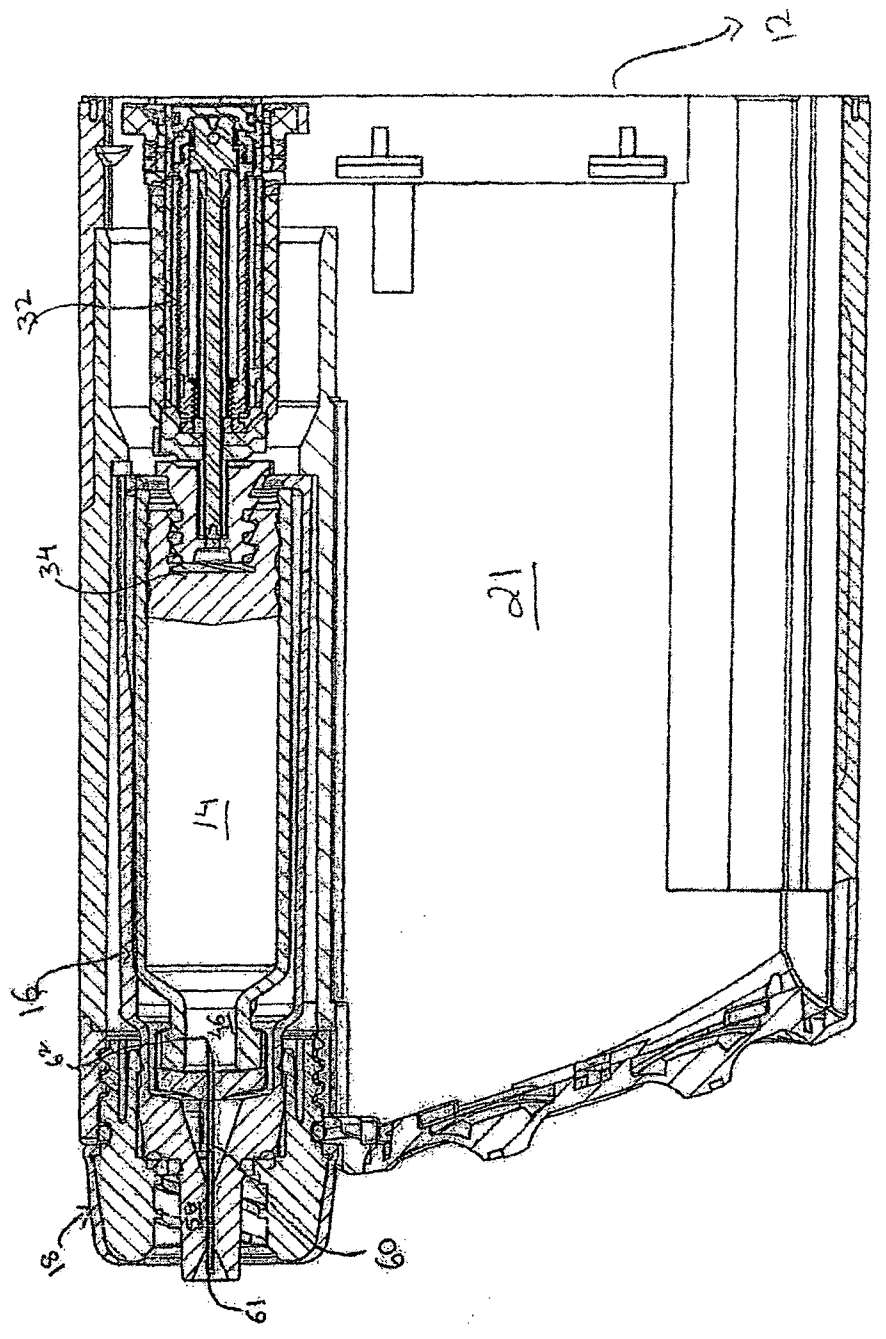

Fig. 2

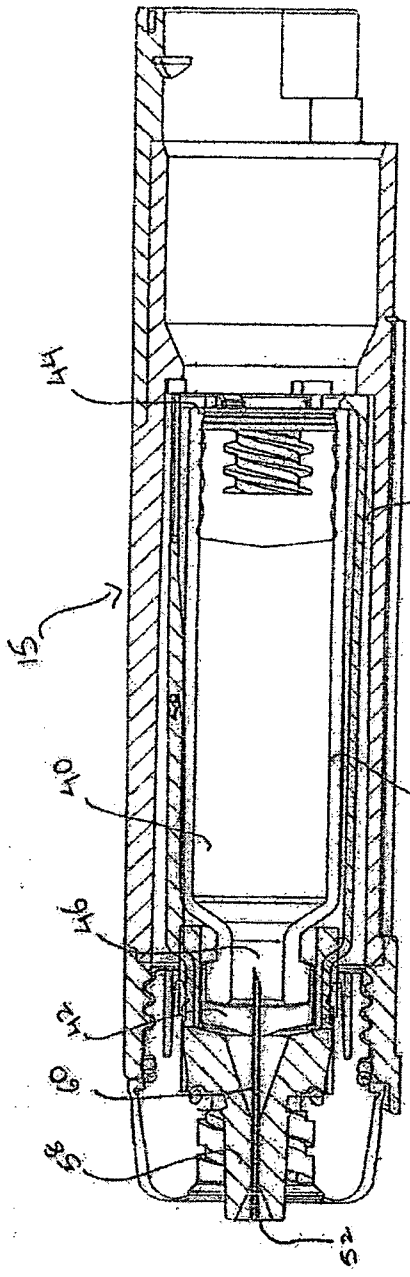

Fig 3.

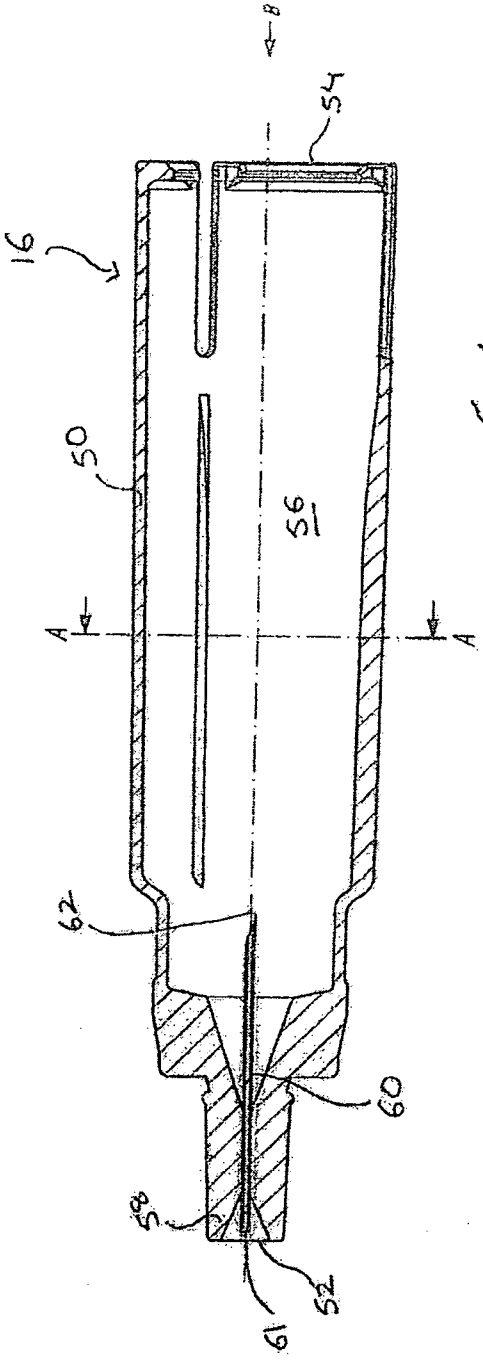

Fig 4.

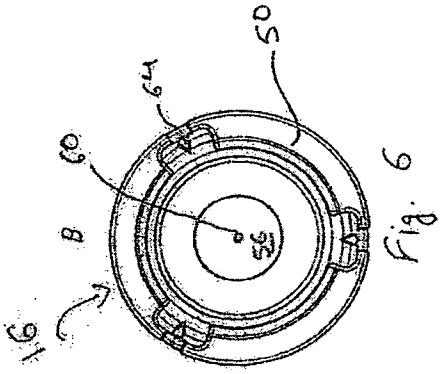

Fig. 6

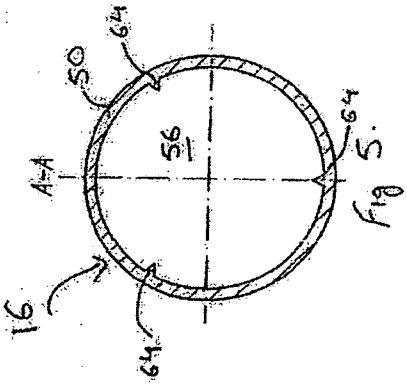

Fig 5.

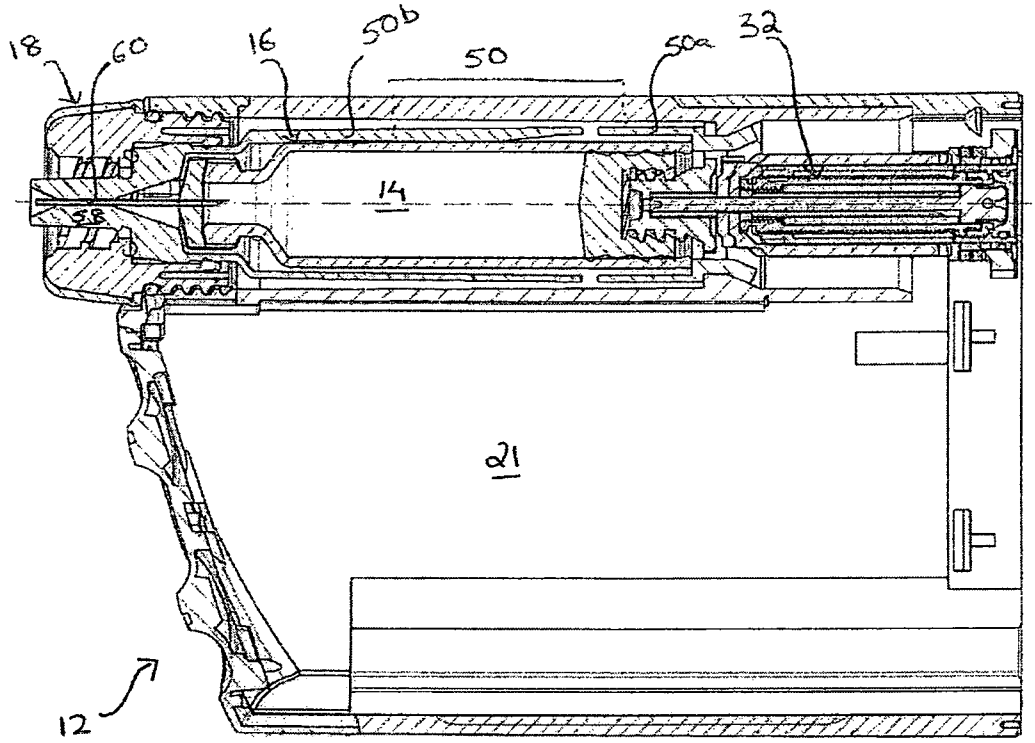

Fig. 7

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2008/008256

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61M5/145 A61M5/142

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	US 2003/130618 A1 (GRAY LARRY B [US] ET AL) 10 July 2003 (2003-07-10) paragraph [0026]; figures 7,8	1-19
A	US 5 776 116 A (LOPEZ GEORGE A [US] ET AL) 7 July 1998 (1998-07-07) figures 23,24	3,10,18
A	US 5 520 653 A (REILLY DAVID M [US] ET AL) 28 May 1996 (1996-05-28) column 5, line 60 - column 6, line 65; figures 3A-3D	1-19
A	US 6 277 095 B1 (KRIESEL MARSHALL S [US] ET AL) 21 August 2001 (2001-08-21) the whole document	1-19

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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INTERNATIONAL SEARCH REPORT

Information on patent family members

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