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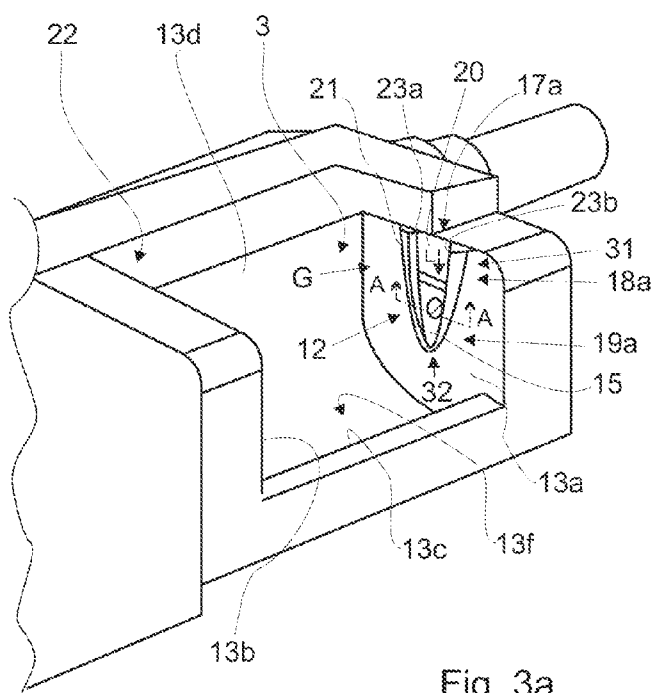


Fig. 3a

(57) Abstract: A medical delivery device (1) comprises a battery compartment (3) for inserting a battery having a first side (5a) with an electrically positive first battery terminal conduit element (5d) centrally protruding therefrom and a second side (5b) comprising an electrically negative terminal conduit element located directly opposed to the first side (5a), a first contact (15) of an electric circuit of the medical delivery device (1) for contacting with the positive terminal (5a), a second contact (11) of the electric circuit of the medical delivery device (1) for contacting with the negative terminal (5a) of the battery (5), the battery compartment (3) having an outer area (22) through which a battery can be inserted, and being defined by side walls (13a, 13b, 13c, 13d), wherein at least two side walls (13a, 13b) located opposite two each other are respectively provided with first and second through openings (16, 12) for exposing the first and second contacts (15, 11) of the circuit of the medical delivery device, wherein the side wall (13) provided with the first contact (15) comprises a guiding recess (17) with a first end located near the outer area (22) of the battery compartment and a second terminal end near the first through opening (12), the guiding groove (17) provides guiding surfaces (23a, 23b) oppositely located to each other, the guiding surfaces (23a, 23b) are extending with an angular direction with regard to each other such that the distance between the guiding surfaces nearby the outer area (22) is greater than the distance of the guiding surfaces (23a, 23b) nearby the first through opening (12).

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Description

MEDICAL DELIVERY DEVICE WITH BATTERY COMPARTMENT HAVING ELEMENTS FACILITATING BATTERY INSERTION AND REMOVAL

- 5 The present invention relates to medical delivery devices for dispensing one or more doses of a medicament to a patient, and in particular but not exclusively to electronically controlled auto-injectors for dispensing insulin. The medical delivery device comprises a battery compartment for driving functions of the medical delivery device.
- 10 Medical delivery devices are known for administration and in particular for self-administration of a medicament by patients. Batteries are used to provide power to electrical devices for a variety of purposes. Although integrated rechargeable batteries are becoming more commonly used within electrical devices, conventional user-replaceable alkaline batteries are still desirable in a number of cases, particularly
- 15 where a device requires a relatively small amount of power over a large number of uses and/or days for example in electronically controlled auto-injectors for administering diabetes.

One characteristic of many conventional alkaline batteries is their cylindrical form. The majority of conventional alkaline batteries feature positive and negative terminals at

20 opposite ends of the cylindrical body. The positive terminal generally comprises a projection which protrudes from one surface end and the negative terminal forms a generally flat opposing end. Electrical devices require correct placement of the battery terminals to the corresponding terminals in the device to complete the electric circuit and provide power to the device. The device terminals are often exposed to the user

25 and do not provide clear distinction between the positive and negative terminal, other than with a visual aid. In spite of such visual indications, the problem of inadvertent insertion of the battery the wrong way round remains with the risk of connecting the battery to the wrong terminals. This is a particular problem for users suffering from impaired faculties.

In the event of incorrect insertion, the battery may overheat and leak within the device. Incorrect insertion may also permanently damage the device components or require provisions to allow for the incorrect insertion, for example diodes. This problem is especially dangerous for electrical devices that are intended for medical delivery as malfunctioning circuitry or components may result in the delivery of an incorrect dose of medicament for the user or failure of the device. Although additional safety features can be employed to correct for incorrect polarity of the battery, these increase the complexity of the electrical circuitry within the device and also reduce the power and the supply voltage from the battery to the device.

10 If the battery is incorrectly inserted into the battery compartment, some conventional battery contacts may not result in electrical contact with the device terminals. However, sometimes due to the close fitting nature of battery compartments the battery is jammed in incorrect as well as in correct position and is difficult to remove without damaging the compartment. Consequently, the user may attempt to use a tool, for example a screwdriver or a knife, to lever the battery out of the compartment. This leads to a significant risk of inadvertent completion of the electrical connection between the battery and device terminals with the incorrect battery polarity. This contacting can damage the device electronics, the battery and potentially the user. Moreover, if a user tries to remove the correctly inserted battery with a tool, the contacts and/or any other part of the device can be damaged. Above all, by using tools for removing the battery, in particular with respect to sharp tools like scissors, cutters or knives, the risk occurs that the user gets injured by slipping off the device with the tool.

25 It is an aim of the present invention to provide a battery compartment that avoids the above deficiencies. In particular, it is an aim of the current invention to prevent damage to a medical delivery device in the event of incorrect as well as correct insertion of a battery into the battery compartment by preventing inadvertent electrical connection of the battery during attempts to remove the incorrectly installed battery or other damages in the case of a correctly installed battery.

30 According to the invention, a medical delivery device is provided, comprising:

- a battery compartment for inserting a battery having a first side with an electrically positive or negative first battery terminal element centrally protruding therefrom and a second side comprising an electrically negative or positive terminal element, respectively, located directly opposed to the first side, the battery
5 compartment being defined by an upper area having an opening through which a battery can be inserted and a bottom surface disposed opposite to the upper area and the battery compartment being defined by inner side walls, a first and a second side wall or a first and a second side surface thereof being disposed opposite to each other,
- a first contacting means of an electric circuit of the medical delivery device for
10 contacting the electric circuit with the positive first battery terminal element, wherein within a central area of the first inner side wall a recess is formed, the first contacting means forming at least partly a bottom surface of the recess,
- a second contacting means of the electric circuit of the medical delivery device
15 for contacting the electric circuit with the electrically negative terminal element of the battery.

The medical delivery device comprises a housing part in which the compartment is integrated and which comprises a front plate, one side thereof forming the first inner side wall. In particular, the recess of the first side wall comprises a guiding groove
20 extending along a longitudinal direction, the groove being formed by guiding surfaces extending along the longitudinal direction and being oppositely located to each other and the guiding groove, when seen along the longitudinal direction, comprising a first open end located near the opening of the battery compartment, through which the first battery terminal element can be moved when the battery is inserted into the battery
25 compartment through the opening, and a second closed end located near the bottom surface, the guiding groove comprising guiding surfaces, the course of the guiding surfaces, when seen in a topview onto the guiding groove, are running curved or straight lined towards each other such that for guiding the first battery terminal element when inserting the battery, when seen in a direction across the longitudinal direction,
30 the distance between the guiding surfaces located near the first open end is greater than the distance of the guiding surfaces near the second closed end.

The guiding recess according to the invention supports a user to insert a battery in the correct direction since the guiding recess indicates and supports the correct direction for inserting and for guiding the protruding positive projection of the battery. Another advantage of the guiding recess is, when the battery was inserted in the wrong
5 direction, it prevents the electric circuit of the medical delivery device to be damaged since the guiding recess only allows the protruding positive terminal of the battery to establish an electrical contact with the circuit of the medical delivery device. If the battery was inserted in the wrong direction the negative terminal of the battery cannot come into contact with the contact of the electric circuit of the medical delivery device
10 since it is spaced from this contact by means of the guiding recess.

In another advantageously embodiment of the medical delivery device the guiding recess is formed by a protruding ridge which can in particular be integrally formed in the first side wall. This means that the guiding groove is defined by at least one ridge protruding from the first side wall, the at least one ridge comprising the guiding
15 surfaces.

The guiding groove formed by the ridge provides a haptical help for people having a visual impairment. With the guiding recess they can use their tactile sense for inserting the battery in the correct position. When the guiding recess is integrally formed within the side wall a jamming of the battery in the battery compartment can be almost
20 excluded.

The medical delivery device comprises a housing part comprising a front plate. According to another embodiment of the medical delivery device, the medical delivery device comprises a housing part comprising a front plate, one side thereof forming the first inner side wall, wherein the guiding groove is formed as indentation in the front
25 plate. The bottom part of the indentation in the front plate which is located near the bottom surface can be formed as a shoulder comprising a flank or surface extending transversely to the longitudinal direction and merging with the guiding surfaces of the guiding groove.

In a further embodiment of the edge portion of the second through opening is
30 chamfered on the side of the side wall diametrically opposed to the side in proximity to

the first contact. According to an embodiment of the invention, the guiding surfaces being oppositely located to each other are each chamfered such that both are oriented symmetrically to each other with regard to the longitudinal direction and such that each is forming, at least sectionally with regard to the longitudinal direction, a ramp running
5 form the protruding tip of the respective ridge to the bottom surface of the recess.

Due to the inclined chamfered surface, the user of a device according to the present invention does not need to be as accurate when inserting the battery as it is necessary with known devices. The inclined chamfered surface keeps the contact positioned within or behind the recess in a position which avoids incorrect contacting in the case
10 of incorrect insertion of the battery and further assists the user in moving the battery into the correct position for electrical contact with the contact. Moreover, the inclined chamfered surface assists the user also in the situation of removal of a correctly inserted battery, for example to replace an empty battery by a new one. The inclined chamfered surface offers, due to the inclined relationship to the contact surface of the
15 protruding terminal, a sliding surface for the protruding terminal to get in place for the electrical contact with the contact. Also, in the other direction, the inclined chamfered surface offers less resistance against displacement of the protruding terminal for removal of the battery. In some embodiments, the resistance against displacement can be reduced to an absolute minimum, in particular when other elements, like clamping
20 projections, of the device keep the battery in place.

As to their functionality, the inclined chamfered surface acts as a sliding ramp for the protruding terminal of the battery. The protruding terminal of the battery can slide in both directions, namely during insertion of the battery as well as during removal of the battery. Thereby, the inclined chamfered surface acts in particular in an area and a
25 situation, where the removal or insertion of the battery is at its crucial point. To remove the battery out of the battery compartment, the first part of such removal movement is crucial. After the battery has reached a certain distance from the inserted position, it can be grasped by the hand of a user and moved. During insertion of the battery, the end part of the insertion movement is crucial, namely the part of the movement when
30 the electrical contact between the contact surface of the protruding terminal and the contact within or behind the recess is established. While this part of the insertion

movement is carried out, the battery is already in a position in which it can not or only with difficulty be grasped by the hand of a user. Thereby, the inclined chamfered surface of an inventive medicament delivery device assists the user during insertion as well as during removal of the battery by acting as a ramp for sliding the protruding terminal of the battery.

According to another embodiment, the course of the contour lines of the chamfered side surface along the longitudinal direction have the form of straight lines and/or convex lines and/or concave lines. This is to achieve even better sliding properties. However, to further increase the sliding properties, the inclined chamfered surface can further be polished or manufactured in any other way to reduce friction between the inclined chamfered surface and the protruding terminal of the battery.

According to a preferred embodiment the guiding recess is formed by a ridge which partially surrounds the through opening such that the end surface of the positive terminal is spaced with a distance from the contact surface of the first contact corresponding with the length of the projection of the positive terminal to establish an electrical contact between the same, when the battery is correctly inserted into the battery compartment. With such a ridge it is ensured that the battery can establish an electrical contact with the contact of the medical delivery device when the battery is inserted within the battery compartment in the correct position.

The battery compartment may additionally include a cover for enclosing the battery within the delivery device. In this embodiment, the cover may comprise clamping projections that urge against the battery to hold it firmly within the medicament delivery device.

The contact(s) within the device may be cantilever type contacts that effect electrical contact with the terminals of the battery and also assist in holding the battery securely within the compartment. This can be achieved by biasing the contact towards the battery compartment, for example by use of springs or by biasing the contacts themselves. Alternative contacts, for example coiled springs, may also be used.

In a preferred embodiment of the invention, the medicament delivery device is an auto-injector.

The term "medical delivery device" according to the current invention shall mean a
5 single-dose or multi-dose or pre-set dose or pre-defined, disposable or re-useable
device designed to dispense a user selectable or pre-defined dose of a medicinal
product, preferably multiple doses, e.g. insulin, growth hormones, low molecular weight
heparins, and their analogues and/or derivatives etc. Said device may be of any
shape, e.g. compact or pen-type. Dose delivery may be provided through an electrical
10 drive mechanism or stored energy drive mechanism, such as a spring, etc. Dose
selection may be provided through a manual mechanism or electronic mechanism.
Additionally, said device may contain components designed to monitor physiological
properties such as blood glucose levels, etc. Furthermore, the said device may
comprise a needle or may be needle-free. In particular, the term "medical delivery
15 device" shall mean a needle-based device providing multiple doses having an
electrical drive mechanism, which is designed for use by persons without formal
medical training such as patients. Preferably, the drug delivery device is of the
automated-type, i.e. an auto-injector.

The term "case" according to instant invention shall preferably refer to any exterior
20 housing ("main housing", "shell") or interior housing ("insert", "inner body"). The case
may be designed to enable the safe, correct, and comfortable handling of the drug
delivery device or any of its mechanism. Usually, it is designed to house, fix, protect,
guide, and/or engage with any of the inner components of the drug delivery device
(e.g., the drive mechanism, cartridge, plunger, piston rod) by limiting the exposure to
25 contaminants, such as liquid, dust, dirt etc. In general, the case may be unitary or a
multipart component of tubular or non-tubular shape. Usually, the exterior housing
serves to house a cartridge from which a number of doses of a medicinal product may
by dispensed.

Devices embodying the invention may be usefully deployed in re-useable medical delivery devices that comprise replaceable medicament cartridges and may also be deployed within an auto-injector device.

5 The invention will now be further described by way of example with reference to the accompanying drawings, wherein

Figure 1 shows a perspective overview of a medical delivery device that embodies the present invention;

Figure 2a shows a battery, intended for use within the medical delivery device of figure 1.

10 Figure 2b is a perspective front end view of the medical delivery device as shown in figure 1, with the battery and covering door omitted in figure 2b for clarity;

Figure 3a is a perspective view of a part of the medical delivery device comprising the battery compartment, the view showing from the rear of the medical delivery device a first embodiment of a guiding device for guiding an electrically positive first battery terminal element protruding from a battery when the battery is inserted into the
15 compartment in order to bring the electrically positive first battery terminal element into contact with a first contacting means of an electric circuit of the medical delivery device;

20 Figure 3b is a perspective view of a part of the medical delivery device comprising the battery compartment as figure 3a and shows a second embodiment of a guiding device;

Figure 3c is a perspective view of a part of the medical delivery device comprising the battery compartment as figure 3a and shows a third embodiment of a guiding device;

25 Figure 3d is a perspective view of a part of the medical delivery device comprising the battery compartment as figure 3a and shows a fourth embodiment of a guiding device;

Figure 4a is a cross sectional view according to cutting line A-A showing a chamfered surface and the guiding device of figure 3a of an embodiment of the present invention;

Figures 4a-1 , 4a-2, and 4a-3 respectively illustrate different embodiments of the edge portion defining a through opening in a side wall of the battery compartment;

Figure 4b is a cross sectional view according to cutting line B-B showing a chamfered surface and the guiding device of figure 3b of an embodiment of the present invention;

Figure 5 is a cross sectional view of the embodiment of figure 4 during removal of the battery;

Figure 6 is a cross sectional view of the embodiment of figure 4 during removal of the battery;

Figure 7 is a cross sectional view of the embodiment of figure 4 during removal of the battery;

Figure 8 is a cross sectional view showing the inclined chamfered surface according to a further embodiment of the present invention.

Figure 1 illustrates a medical delivery device 1 comprising a case or housing 2, a battery compartment 3 with a battery 5 which is inserted into the compartment 3 and a cover 7 for covering the battery compartment 3 in an open position. The case 2 of the medical delivery device may additionally contain a medicament cartridge, control means and dosing means (all not shown). Further, the case 2 includes an electrical circuit which can particularly be provided for controlling the amounts of the medicament to be delivered. The case 2 comprises a first contacting means 15 and a second contacting means 11 both of which are electrically connected to the electrical contacts 11 for receiving electrical power of the battery 5 (see Figures 2 and 3). A threaded needle attachment 8 is provided to which a needle can be attached for dose delivery and subsequently removed and discarded. A cover or jacket (not shown) may

be provided to fit over the lower portion of the case 2 to assist in protecting the device from the ingress of particles and fluid when the device is not in use for injection.

The battery compartment 3 is located within an opening 26 in the case 2 and may preferably be formed of a single component that additionally supports the internal electronics of the device. The battery compartment 3 is configured to receive a battery 5 and may be covered by the cover 7. Although the opening 26 is shown exposing the top and side of the case 2, it may be appreciated that the opening may be within one face of the medical delivery device 1 only and may be located at any position within the case 2. In the case of the opening 26 for the battery compartment 3 only exposing one face of the case 2, the cover 7 would also be suitably adapted to cover the battery compartment 3. It may also be appreciated that the case 2 may comprise several components that may be welded or snap-fitted together, wherein the battery compartment 3 may constitute or be formed by one or more components of the case 2. Advantageously, the case 2 and the battery compartment 3 are formed of an insulating material.

The medical delivery device 1 in particular comprises a battery compartment 3 for inserting a battery 5 having a first side 5a with an electrically positive or negative first battery terminal element 5d protruding therefrom and a second side 5b comprising an electrically negative or positive terminal element, respectively, located directly opposed to the first side 5a, the battery compartment 3 being defined by an upper area 13e having an opening 26 through which a battery 5 can be inserted and a bottom surface 13f disposed opposite to the upper area 13e and the battery compartment 3 being defined by inner side walls 13a, 13b, 13c, 13d, a first and a second side wall 13a, 13b thereof being disposed opposite to each other. The medical delivery device 1 comprises a housing part 40 comprising a front plate 41, one side thereof forming the first inner side wall 13a. In the embodiment of the medical delivery device 1 of figures 3a, 3b, 3c, 3d the housing part 40 is the front part of the housing 2 to which delivery means like a needle can be mounted or is fixedly disposed. The upper area can be defined by an edge 13g or frame of the case 2 surrounding the compartment 3. The medical delivery device 1 comprises first contacting means 15 of the electric circuit of the medical delivery device 1 for contacting the electric circuit with the positive first

battery terminal element 5d, wherein within a central area of the first inner side wall 13a a recess or through opening 12 is formed, the first contacting means 15 forming at least partly a bottom surface 13f of the recess 12. Further, the medical delivery device 1 comprises a second contacting means 11 of the electric circuit of the medical
5 delivery device 1 for contacting the electric circuit with the electrically negative terminal element of the battery 5. The compartment 3 can be formed such that when the battery 5 is inserted into the compartment 3, the battery is maintained and enclosed within the battery compartment 3 by the cover 7. The cover 7 can in particular be made of a plastics material, nominally the same material as the case 2. The cover 7 is shown as
10 a captive cover and is held in place by protrusions (not-shown) that engage with corresponding grooves (e.g. a snap-fit) in the case 2 and form a hinge to allow the cover to expose the battery 5 when moved by a user in an open-position, like illustrated in figure 1. Alternatively, or in addition, the cover 7 may be free to be detached from the device when open, for example during battery replacement. The
15 cover 7 may be designed to be fully detachable from the case 2 or may releasably detach when a greater than threshold force for maintain the cover within is closed position is applied to the cover. An advantage of a detachable cover 7 is that it can be replaced without damage to the cover or the case 2. Providing a detachable cover 7 also improves access to the battery 5 and/or the battery compartment 3. This
20 improved access is advantageous for users of the device with reduced manual dexterity.

The underside of the cover 7 comprises one or more clamping projections 9 that, when the cover is closed, act against the battery 5 and prevent, limit or minimise radial movement of the battery within the battery compartment 3. The cover 7 can be
25 securely closed over the battery 5 and the battery compartment 3 by one or more snap fit protrusions 10 that connect with corresponding grooves (not shown) within the case 2. Alternative means for the securing the battery cover 7 may also employed, for example screw means, snap-fit projections, .

Figure 2a shows a type of a battery 5 for which the battery compartment can be
30 designed in detail. The battery 5 comprises a first side 5a having an essentially flat

surface 22 and a projection 5d protruding therefrom and having a contact surface 5c and a negative terminal surface 5b.

The battery 5 further comprises a second side 5b comprising an electrically negative terminal element located directly opposed to the first side 5a so that the battery
5 comprises opposing positive and negative terminals 5a, 5b. The positive terminal 5a includes the projection 5d protruding from one end face and the opposed negative terminal 5b is the surface of the second end face of the battery. This negative terminal surface may be slightly provided with recesses, depending upon the battery type and manufacturer used. This type of battery is well known and is the terminal arrangement
10 used in standard AA, AAA and CR2 battery types, amongst others. The battery 5 is generally a standard alkaline battery, although other battery technologies, including rechargeable battery technologies may be used.

It may be possible that the polarity of the terminals may be reversed, and/or the relative positions of the terminals rearranged, for example the negative terminal
15 surface 5b may be recessed within the case of the battery 5.

Figure 2b shows a front end perspective view of the medical delivery device 1 of figure 1. For clarity the cover 7 has been omitted and the device 1 is shown with the battery 5 removed. The battery compartment 3 is defined by the side walls 13a, 13b, 13c, and 13d. The location of these side walls corresponds with the size of the battery 5 or
20 power source to be inserted. The surface of the side wall 13d defines an opening 22 at the outer area of the delivery device 1. The outer area is extending such that the same is surrounding the cover 9 when the cover 9 is closed. As may be seen from figure 2a, a second contact 11 of the electrical circuit of the medical delivery device is located within the battery compartment 3. The second contact 11 is preferably a cantilever
25 type contact and is configured to establish an electrical contact with the negative terminal of the battery 5. For example the second contact is biased towards the side wall 13a. Any other known contact, for example a coil spring, may alternatively be used. The contact 11 may be partially embedded between the compartment 3 and the case 2 to secure the contact 11 in the required position.

Figure 3a shows an end perspective view of the medical delivery device 1 of figure 1. Again, for clarity, the cover 7 has been omitted and the device 1 is shown with the battery 5 removed. As may be seen from figure 3a, a guiding device G comprising a guiding groove or guiding recess 17a is defined within the side wall 13a. A through opening 12 can be formed in the side wall 13a and the first contacting means 15 can be located behind the first side wall 13a when seen from the inner space of the compartment 3 so that the first battery terminal element 5d can extend through the through opening 12 when the battery is inserted in the compartment 3. The recess 12 of the first side wall 13a comprises a guiding groove 17a extending along a longitudinal direction L. The groove 17a is being formed by guiding surfaces 23a, 23b extending along the longitudinal direction L and being oppositely located to each other and the guiding groove 17a, when seen along the longitudinal direction L, comprising a first and in particular open end 31 located near the opening 22 of the battery compartment, through which the first battery terminal element 5d can be moved when the battery 5 is inserted into the battery compartment 3 through the opening 22, and a second and in particular closed end 32 located near the bottom surface 13f. The guiding groove 17a comprises guiding surfaces 23a, 23b, the course of the guiding surfaces 23a, 23b, when seen in a topview onto the guiding groove 17a, are running curved or straight lined towards each other such that the distance between the guiding surfaces 23a, 23b located near the first open end 31 is larger than the distance of the guiding surfaces 23a, 23b near the second closed end 32. In this regard, the distance between the guiding surfaces 23a, 23b located near the first open end 31 and near the second closed end 32 is defined in a direction across the longitudinal direction L. By providing this shape of the guiding surfaces 23a, 23b, the guiding surfaces 23a, 23b are provided for guiding the first battery terminal element 5d when inserting the battery 5 into the compartment 3. The guiding surfaces 23a, 23b define a bottom part 20 of the first side wall 13a, wherein the bottom part 20 is extending between the guiding surfaces 23a, 23b.

Figure 3a illustrates an embodiment of the guiding device G and the guiding groove 17a. The guiding recess 17a is defined by a ridge 21 following an essential V-shaped course when seen from side wall 13b towards side wall 13a. The groove 17a is defined by at least one ridge 21 protruding from the first side wall 13a, the at least one ridge 21

comprising the guiding surfaces 23a, 23b. According to an embodiment of the invention, two ridges can be provided (not shown in the figures) which are not connected to one continuous ridge but are running separately along each other and are converging to each other from the first end 31 to the second end 32. In this
5 embodiment, the guiding device G comprises two open ends with regard to the longitudinal direction L but still form an essentially V-shaped ridge construction for guiding the first battery terminal element 5d of the battery during insertion of the battery 5 into the compartment 3. The ridge or ridge construction 21 therefore defines on its sides guiding surfaces 23a, 23b facing to the through opening 12 which might be
10 chamfered especially near the region of the through opening 12. Further, the space between the opposing guiding surfaces 23a, 23b is wider near the opening 22 than near the through opening 12. This makes it easier to insert the battery 5 since the projection 5d can be caught by the wider spaced guiding surfaces 23b, thus, forming a receiving portion 18a. Near the through opening 12 the distance between the opposing
15 guiding surfaces 23a, 23b becomes narrower for forming a guiding portion 19a for guiding the projection 5d of the positive terminal 5b of the battery into the through opening 12.

The thickness of the protruding ridge 21 with respect to a direction from the side wall 13a towards the side wall 13b corresponds with the length of the projection 5d of the
20 battery 5 such that the contact surface 5c of the positive terminal of the battery can come into electrical contact with the contact 15 of the electrical circuit, when the battery 5 is correctly inserted into the battery compartment 3.

Figures 3b, 3c, and 3d illustrate further embodiments of the guiding recess 17 for guiding the projection 5d of the positive terminal 5a of the battery into electrical contact
25 with the first contact 15 of the electrical circuit of the medical delivery device 1.

As illustrated in figure 3b the guiding groove 17b is also defined by a protruding ridge 21. In contrast to the guiding groove 17a shown in figure 3a the ridge 21 of guiding groove 17b illustrated in figure 3b follows a more U-shaped course when seen from side wall 13b towards side wall 13a. This means, the receiving portion 18b and the
30 guiding portion 19b of the guiding enclose a more obtuse angle than theses of figure 3a. Further, the ridge 21 does not extend up to the outer area 22.

The guiding recesses 17c, 17d, respectively illustrated in figures 3c and 3d are defined by the side wall 13a itself. As the guiding grooves 17a, 17b shown in figures 3a and 3b the distance of the opposing guiding surfaces 23a, 23b is wider near the outer area 22 and inclines toward the through opening 12 for defining a receiving portion 18c, 18d and a guiding portion 19c, 19d, respectively, as shown in figures 3c and 3d and described above with respect to figures 3a and 3b. In figure 3c the guiding recess 17c is incorporated in a protruding portion 24 of the side wall 13a such that a step surface 25 is formed. Thus, the recess 17c of figure 13c does not extend up to the surface of the outer area.

Figures 3c and 3d both show an embodiment of the medical delivery device which comprises a guiding groove 17c and 17d, respectively, which is formed as indentation in the front plate 41. The indentation can comprise a bottom part which is located near the bottom surface 13f and which is formed as a shoulder comprising a flank 43 extending transversely to the longitudinal direction L and merging with the guiding surfaces 23a, 23b of the guiding groove 17a, 17b, 17c, 17d so that flank 43 and surfaces 23a, 23b all form an unitary surface or shoulder. The longitudinal size of the step 43 and the distance between the guiding surfaces 23a, 23b can be provided such that a first battery terminal element 5b can be deposited onto the flank 43.

The embodiment of the guiding groove 17d is also incorporated into the side wall 13a and extends up to the surface of the outer area 22 such that no step surface 25 as shown in the embodiment of figure 3c is formed in the mid part of the compartment or the first inner wall 31a when seen from the top side of the compartment. Further, the angle enclosed by the guiding surfaces 23a, 23b of the guiding recess 17d is smaller than the angle enclosed by the guiding surfaces of the guiding recess 17c.

As shown in figures 4a to 8, the first contacting means 15 is located either within or behind the through opening 12 and is configured not to protrude into the battery compartment 3 to prevent the formation of an electrical connection with the negative terminal 5b of the battery 5 in case of incorrect insertion of the battery 5. The contacting means 15 is configured to form an electrical connection with the protruding projection of the positive terminal 5a of battery 5 when correctly inserted into the battery compartment 3. The contacting means 15 is also preferably a cantilever-type

contact, although any means for forming an electrical connection with the protruding terminal 5a of the battery 5, that does not protrude into the battery compartment 3 may be employed. The contacting means 11, 15 might be also actively biased against the respective terminals 5a, 5b of the battery 5 when the cover 7 is closed over the opening in the case 2. In order to bias the contacts, there might be additional structural devices (not shown) in the cover receiving slot within the case 2 and which might act against the contacts 11, 15 to bias these contacting means against the terminals 5a, 5b of the battery to support the establishment of sufficient electrical connection.

Since the first contacting means 15 of the electrical circuit of the medical delivery device is located within or behind the through opening 12 it is ensured that an electrical connection can only be established with the protruding projection 5d of the positive terminal 5a of the battery 5. If the battery 5 is incorrectly inserted, the terminal surface 5b of the battery does not protrude into the through opening 12 and is unable to create an electrical connection.

The through opening 12 is preferably fully surrounded by the side wall 13a of the case 2 and/or the housing of the battery compartment 3 (i.e. the wall of the case and/or battery compartment housing is configured around the through opening) such that, in the event that the battery 5 is incorrectly inserted into the device, any attempt to remove the battery 5 using an additional implement, for example a small metal screwdriver, would allow removal of the incorrectly fitted battery 5 whilst preventing contact between the negative terminal surface 5b of the battery and the positive contact 15 of the device 1 via the screwdriver. By preventing an electrical contact from being made between the positive contact 15 of the device 1 and the negative terminal 5b of the battery 5, the risk of damage to the device and/or the battery resulting from the incorrect insertion is minimised.

In addition to prevent accidental electrical contact in the event of incorrect insertion of the battery 5, locating the contacting means 15 within the through opening 12 and surrounding the through opening 12 by the battery compartment housing 3 and/or the case 2 in the direction of battery insertion by the wall 13a prevents the battery 5 from being inserted incorrectly unless the battery is inserted in a direction that is not

substantially transverse relative to the through opening 12. If an attempt is made to insert the battery 5 from a direction substantially transverse to the through opening 12, the protruding projection 5d abuts against the ridge 21 or the side wall 13a of the case 2, making entry of the battery 5 into the battery compartment 3 difficult. Further, the guiding recess 17a, 17b, 17c, 17d allows more or less only an insertion or replacing of the battery in the direction of the course of the guiding surfaces 23a, 23b, from the receiving portion towards the guiding portion. This supports a correct inserting of the battery 5 into the compartment 3 and minimises the chance of incorrect insertion.

Figure 4a is a cross section according to cutting line A-A of figure 3a which illustrates details of the region of the through opening near the first contacting means 15 of the electrical circuit of the medical delivery device. The through opening 12 can be of round or oval shape and forms an access for the projection of the battery in the side wall 13a. One side surface of the side wall 13a is facing the battery 5, while the other side surface of the side wall 13a is facing the first contact 15 which is positioned behind the through opening 12. The through opening 12 itself is defined by an edge portion 27 of the side wall 13a comprising a chamfered surface 12a, which partially follows the round or oval shape of the through opening 12. The portion of the inclined chamfered surface 12a is in general in the form of a truncated cone. The chamfered surface 12a defines a ramp angle 12b, which is defined between the contact surface 5c of the protruding terminal 5a of the battery 5 in inserted position and the inclined chamfered surface 12a. It has to be noted, that the chamfered surface 12a does not necessarily need to be inclined all over the through opening 12, but is at least inclined in the direction of insertion and removal movement of the battery 5. In the embodiment shown in figure 4a, the chamfered surface 12a is inclined all over the through opening 12, which is due to easier manufacturing of the through opening 12 and its chamfered surface 12a. Additionally, figure 4a shows in cross section the guiding ridge 21 defining the guiding recess 17a. The ridge 21 is located at both sides of the through opening 12 adjacent to the chamfered surface 12a. The ridge 21 protrudes from the side wall 13a towards the battery compartment 5 wherein the protruding length l of the ridge 21 together with the side wall thickness s as a whole must be smaller than the protruding length v of the projection 5d of the positive terminal 5a of the battery

to ensure an electrical contact between the first contact of the electrical circuit of the medical delivery device and the contact surface 5c of the projection 5d of the battery 5.

Figures 4a-1 , 4a-2, 4a-3 illustrate different embodiments of the inclination of the chamfered surface 12a facing towards the battery compartment 3.

5 As also illustrated in figure 4a, the minimum diameter d_{min} of the through openingl 2 is greater than the maximum diameter d_{bat} of the protruding terminal 5a of the battery 5. In particular, the minimum diameter of the through openingl 2 is approximately 50% greater than the maximum diameter of the protruding terminal 5a of the battery 5. However, also different correlations between the two diameters, like 10%, 15%, 20%,
10 25%, 30%, 35%, 40%, 45% or anything in-between such values can be of advantage for different embodiments. The minimum diameter d_{min} of the through openingl 2 is defined by the minimum opening diameter of the chamfered surface 12a. The chamfered surface 12a and the side surfaces of the side wall 13a are in contact with each other at two edges. As to the two opposite side surfaces of the side wall 13a, also
15 one of such edges is facing the battery 5, while the opposite edge is facing the contact 15. Due to the feature of the present invention that the ramp angle 12b has to be obtuse, the edge 12c of the side surface facing the contact 15 defines the minimum diameter of the through openingl 2.

In the embodiment shown in figure 4a the contacting means 15 of the electrical circuit
20 of the medical delivery device defines a contact surface 15a for electrical contact with the contact surface 5c of the protruding terminal 5a of the battery 5 and is positioned behind the through openingl 2. This means that the contact surface 5c, formed by an electrically conductive sheet or plate, is located with a certain distance behind the side of the side wall 13a facing the electrical contact surface 15a of the contact 15 of the
25 electrical circuit of the medical delivery device. By means of the distance a slot b is formed behind the through openingl 2, which keeps the protruding terminal 5a of the battery 5 in place while the medication delivery device 1 is used. The certain distance can for example be 50% of the extension of the protruding terminal 5b along the main axis of the battery 5, but also other values, like 10%, 15%, 20%, 25%, 30%, 35%, 40%
30 or 45% or any value in-between ca be of advantage. However, it has to be noted, that also clamping projections 9, which have been described with respect to other

embodiments above, can be used for the primary locking of the battery 5 in the present embodiment of figure 4.

The chamfered surface 12a of the through opening 12 of the embodiment of figure 4a is inclined with a ramp angle 12b of approximately 140° . The greater the ramp angle becomes, the more space may be needed for the inclined chamfered surface 12a. However, also lower ramp angles, for example like 135° , 130° , 125° , 120° , 115° , 110° , 105° or 100° are possible within the scope of the present invention. The inclined chamfered surface 12a has, due to the ramp angle 12b, the functionality of a ramp for the protruding terminal 5a of the battery 5. This ramp-effect can be supported by the use of a convex or concave course of the chamfered surface 12a.

To support the guiding of the projection 5d towards and into the first through opening 12 the chamfered surface 12a can be linearly shaped as illustrated in figure 4, convexly shaped as illustrated in figure 4a-1, or concavely shaped as illustrated in figure 4a-2. The different chamfered surfaces 12a can be combined with each other. For example the one chamfered surface at guiding surface 23a is convexly shaped and the other chamfered surface of guiding surface 23b is concavely shaped.

Finally figure 4a-3 shows a further embodiment of the edge portion defining the through opening 11. In this embodiment the ridge is located directly at the edge portion 27 defining the through opening 11. This ensures a proper guiding of the projection 5d of the positive terminal 5a of the battery into the through opening 11 and into contact with the first contact 15 of the electric circuit of the medical delivery device.

Figure 4b illustrates a further cross section according to cutting line B-B of figure 3b which illustrates details of the region of the through opening 12 near the contact 15 of the electrical circuit of the medical delivery device. In contrast to the embodiment shown in figure 4a the ridges 21 are located with a predetermined distance from the edge portion 27 defining the through hole. This greater distance between the ridges 21 ensures that the projection 5d of the battery 5 can be easier inserted into the through hole 12.

The figures 5, 6 and 7 show different steps of the removal of the battery according to the embodiment illustrated in figure 4a.

According to the embodiment illustrated in the figures 4a, 5, 6 and 7, to remove the battery 5, this battery 5 is pushed by a user in general perpendicular to its main axis.

5 Due to the fact that the opposite end of the battery 5 with the negative terminal 5b is general flat and fixed with its outer geometry or the respective opposite contact, the battery reacts to the pushing with a pivot movement around the opposite end of the battery 5. The first step of such pivot movement is illustrated in figure 5. Due to the pivot movement, the protruding terminal 5a is lifted partly from the contact surface 15a
10 of contact 15, namely in figure 5 at its upper end. This partly lifting of the contact 15 enables the protruding terminal 5a of the battery 5 to overcome the certain distance between the contact surface 15a of contacting means 15 and the edge 12c of the inclined chamfered surface 12a. The ridge 21 assists with the replacing of the battery as it acts as a bearing point which helps to support the removing of the battery 5, as
15 shown in figure 5.

The result of the lifting and a further pushing of the battery 5 can be seen in figure 6. The battery 5 is moved away from a position of electrical contact with the contact surface 15a of contact 15 positioned behind the recess 12. This happens by sliding the protruding projection 5d of the positive terminal 5a of the battery 5 along the inclined
20 chamfered surface 12a of the recess 12. The sliding is possible due to the obtuse ramp angle 12b. After the sliding process, namely when the projection 5d of the positive terminal 5a of the battery 5 has left the inclined chamfered surface 12a, the battery 5 is free and can be taken out of the battery compartment 3. To carry out the afore-described removal of the battery 5, a user does not need any tool beside his
25 finger to push the battery 5. During insertion of the battery 5, the afore-described steps are carried out in the opposite order.

Figure 7 shows the battery 5 which has only contact with the guiding surface 23a of the ridge 21. In such position, the battery 5 can be easily grasped by the users palm to finish the removal movement of the battery 5 out of the battery compartment 3.

In figure 8, a further embodiment of the present invention is illustrated, wherein such embodiment is very similar to the embodiment of figures 4a to 7 with respect to the inclined chamfered surface 12a. However, contrary to the embodiment of figures 4a to 7, the presently discussed embodiment has a contact 15 with a contact surface 15a which is positioned within the recess 12. Such a position within the recess 12 can further be described that the contact surface 5c of the protruding terminal 5a of the battery 5 in inserted position is coplanar with the edge 12c of the inclined chamfered surface 12a on the side which faces the contact surface 15a of contact 15. Due to this coplanar configuration, the removal of the battery 5 can be carried out even more easily. The removal of the battery 5 is similar to the removal as described with regard to figures 6 to 7.

Reference Signs:

	1	medical delivery device
	2	case /housing
5	3	battery compartment
	5	battery (power source)
	5a	first side
	5b	second side
	5c	contact surface
10	5d	first battery terminal end/projection
	7	cover
	8	threaded needle attachment
	9	clamping projection
	10	snap fit protrusion
15	11	second contacting means
	12	recess/through opening
	12a	chamfered surface/bottom surface
	12b	ramp angle
	12c	edge of the side facing the contact
20	13a	side wall
	13b	side wall
	13c	side wall
	13d	side wall
	13e	upper area
25	13f	bottom surface
	13g	edge/frame
	15	first contacting means / contact
	15a	contact surface of the contact
	16	through openingl 7a guiding recess
30	17b	guiding recess
	17c	guiding recess

	17d	guiding recess
	18a	receiving portion
	18b	receiving portion
	18c	receiving portion
5	18d	receiving portion
	19a	guiding portion
	19b	guiding portion
	19c	guiding portion
	19d	guiding portion
10	20	bottom part
	21	ridge
	22	outer area
	23a	guiding surface
	23b	guiding surface
15	24	protruding portion
	25	step surface
	26	opening
	27	edge portion
	31	first end
20	32	second end
	40	housing part
	41	front plate
	43	flank/step
	d	distance
25	v	length (of projection 5d)
	l	thickness of ridge
	s	thickness of side wall
	dbat	diameter of projection
	dmin	diameter of through hole
30	b	slot
	L	longitudinal direction
	G	guiding device

Claims

1. A medical delivery device (1) comprising:

- 5 ▪ a battery compartment (3) for inserting a battery (5) having a first side (5a) with an electrically positive or negative first battery terminal element (5d) protruding therefrom and a second side (5b) comprising an electrically negative or positive terminal element located directly opposed to the first side (5a), the battery compartment (3) being defined by an upper area (13e) having an opening (26) through
10 which a battery (5) can be inserted and a bottom surface (13f) disposed opposite to the upper area (13e) and the battery compartment (3) being defined by inner side walls (13a, 13b, 13c, 13d), a first and a second side wall (13a, 13b) thereof being disposed opposite to each other,
- a first contacting means (15) of an electric circuit of the medical delivery
15 device (1) for contacting the electric circuit with the positive first battery terminal element (5d), wherein within a central area of the first inner side wall (13a) a recess (12) is formed, the first contacting means (15) forming at least partly a bottom surface (12a) of the recess (12),
- a second contacting means (11) of the electric circuit of the medical
20 delivery device (1) for contacting the electric circuit with the electrically negative terminal element of the battery (5),

characterised in that

the recess (12) of the first side wall (13a) comprises a guiding groove (17a, 17b, 17c, 17d) extending along a longitudinal direction (L), the groove (17a, 17b, 17c, 17d) being
25 formed by guiding surfaces (23a, 23b) extending along the longitudinal direction (L) and being oppositely located to each other and the guiding groove (17a, 17b, 17c, 17d), when seen along the longitudinal direction (L), comprising a first open end (31) located near the opening (26) of the battery compartment, through which the first battery terminal element (5d) can be moved when the battery (5) is inserted into the battery

compartment (3) through the opening (26), and a second closed end (32) located near the bottom surface (13f), the guiding groove (17a, 17b, 17c, 17d) comprising guiding surfaces (23a, 23b), the course of the guiding surfaces (23a, 23b), when seen in a topview onto the guiding groove (17a, 17b, 17c, 17d), are running curved or straight lined towards each other such that for guiding the first battery terminal element (5d) during insertion of the battery (5), when seen in a direction across the longitudinal direction (L), the distance between the guiding surfaces (23a, 23b) located near the first open end (31) is larger than the distance of the guiding surfaces (23a, 23b) near the second closed end (32).

10

2. A medical delivery device (1) according to claim 1 characterised in that the guiding groove (17a) is defined by at least one ridge (21) protruding from the first side wall (13a), the at least one ridge (21) comprising the guiding surfaces (23a, 23b).

15

3. A medical delivery device (1) according to any of the previous claims characterised in that the guiding surfaces (23a, 23b) oppositely located to each other are each chamfered such that both are oriented symmetrically to each other with regard to the longitudinal direction (L) and such that each is forming, at least sectionally with regard to the longitudinal direction (L), a ramp running from the protruding tip of the respective ridge to the bottom surface (12a) of the recess (12).

20

4. A medical delivery device (1) according to claim 3, characterised in that the course of the contour lines of the chamfered side surface along the longitudinal direction (L) have the form of straight lines and/or convex lines and/or concave lines.

25

5. A medical delivery device (1) according to any of the previous claims, wherein the medical delivery device (1) comprises a housing part (40) comprising a front plate (41), one side thereof forming the first inner side wall (13a), wherein the guiding groove (17a, 17b, 17c, 17d) is formed as indentation in the front plate (41),

30

6. A medical delivery device (1) according to claim 5, wherein the bottom part of the indentation in the front plate (41) being located near the bottom surface (13f) is

formed as a shoulder comprising a flank (43) extending transversely to the longitudinal direction (L) and merging with the guiding surfaces (23a, 23b) of the guiding groove (17a, 17b, 17c, 17d).

5

7. A medical delivery device according to one of the preceding claims, wherein the medical delivery device comprises a cover (7) for opening and closing the battery compartment (3).

10

8. A medical delivery device (1) according to anyone of the preceding claims, wherein the battery compartment (3) is formed such that the cover (7) in its closing position is located above the guiding groove (17a, 17b, 17c, 17d) of the medical delivery device (1).

15

9. A medical delivery device (1) according to claim 8, wherein the cover (7) comprises clamping projections (9) that act against the battery (5) to limit radial movement of the battery relative to the medical delivery device (1).

20

10. A medical delivery device (1) according to any previous claim wherein the first contacting means (15) is formed by a plate which is biased towards the second side wall (13b).

11. A medical delivery device (1) according to any previous claim wherein the medical delivery device is an auto-injector.

25

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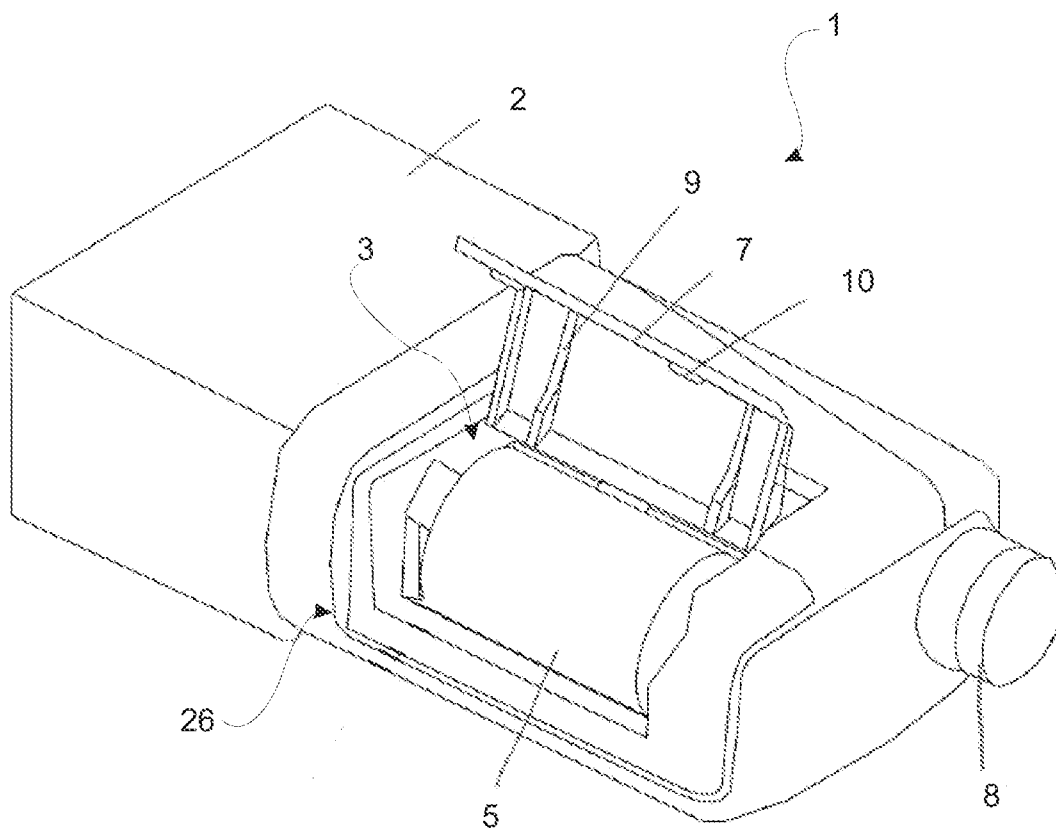


Fig. 1

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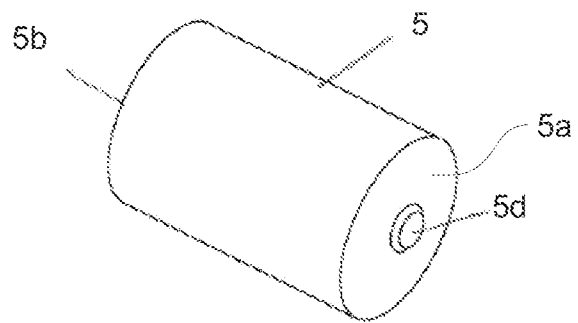


Fig. 2a

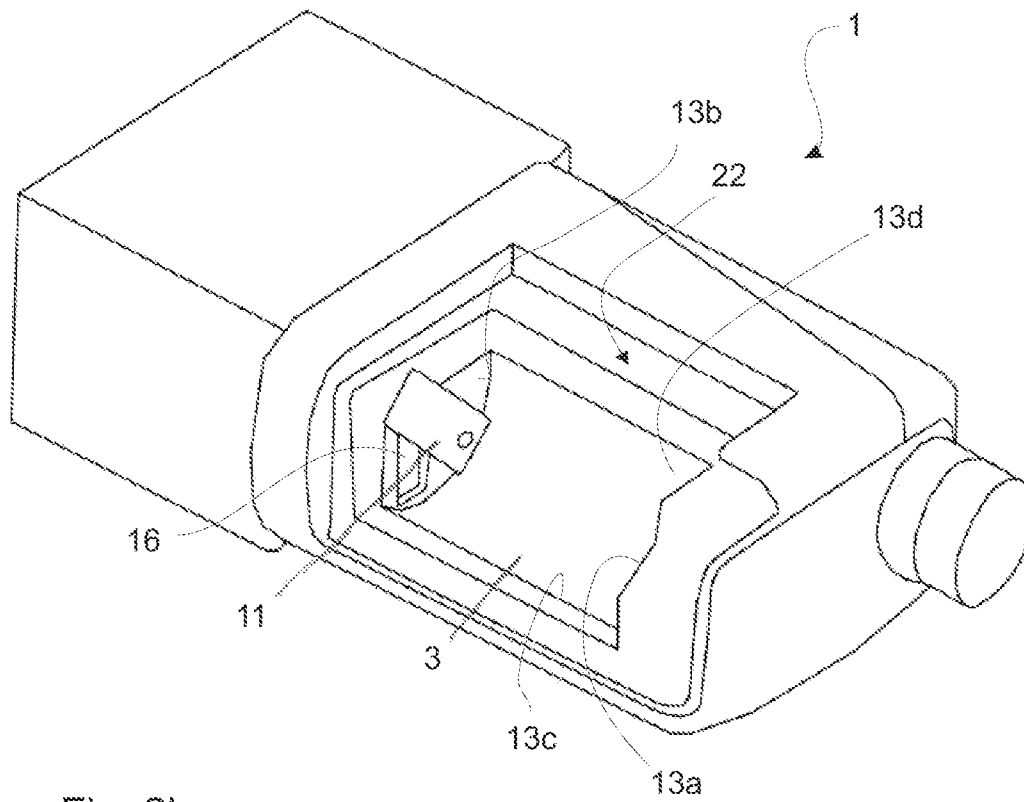


Fig. 2b

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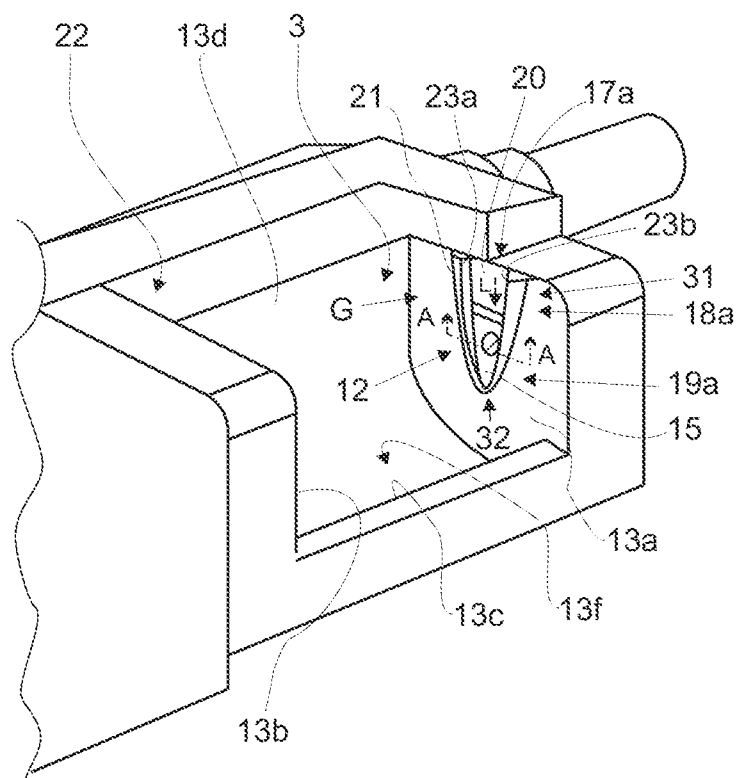


Fig. 3a

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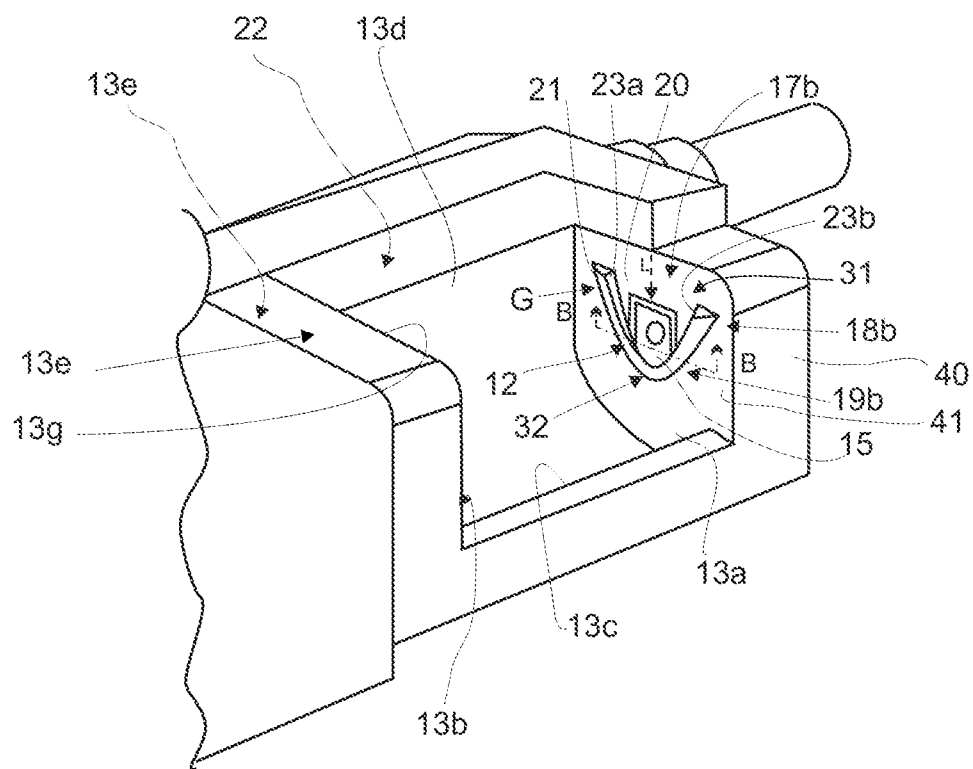


Fig. 3b

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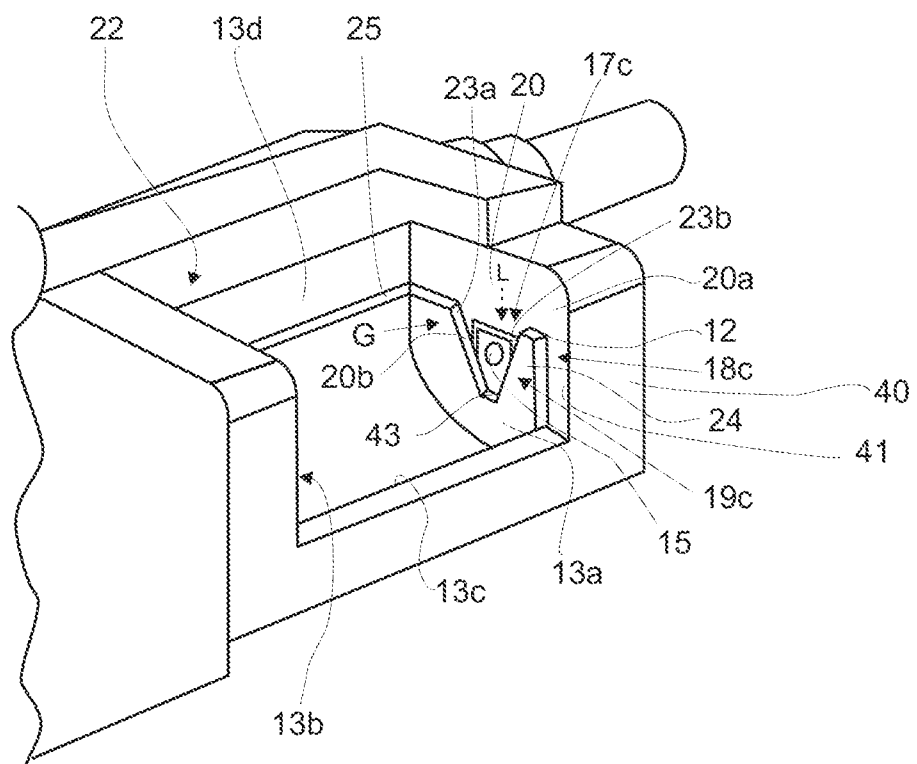


Fig. 3c

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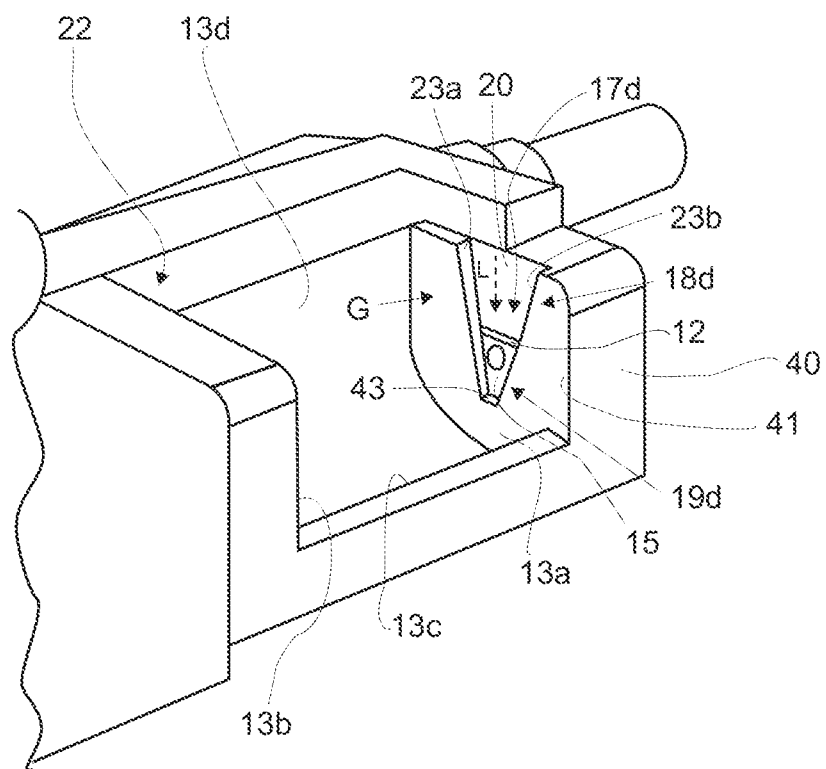


Fig. 3d

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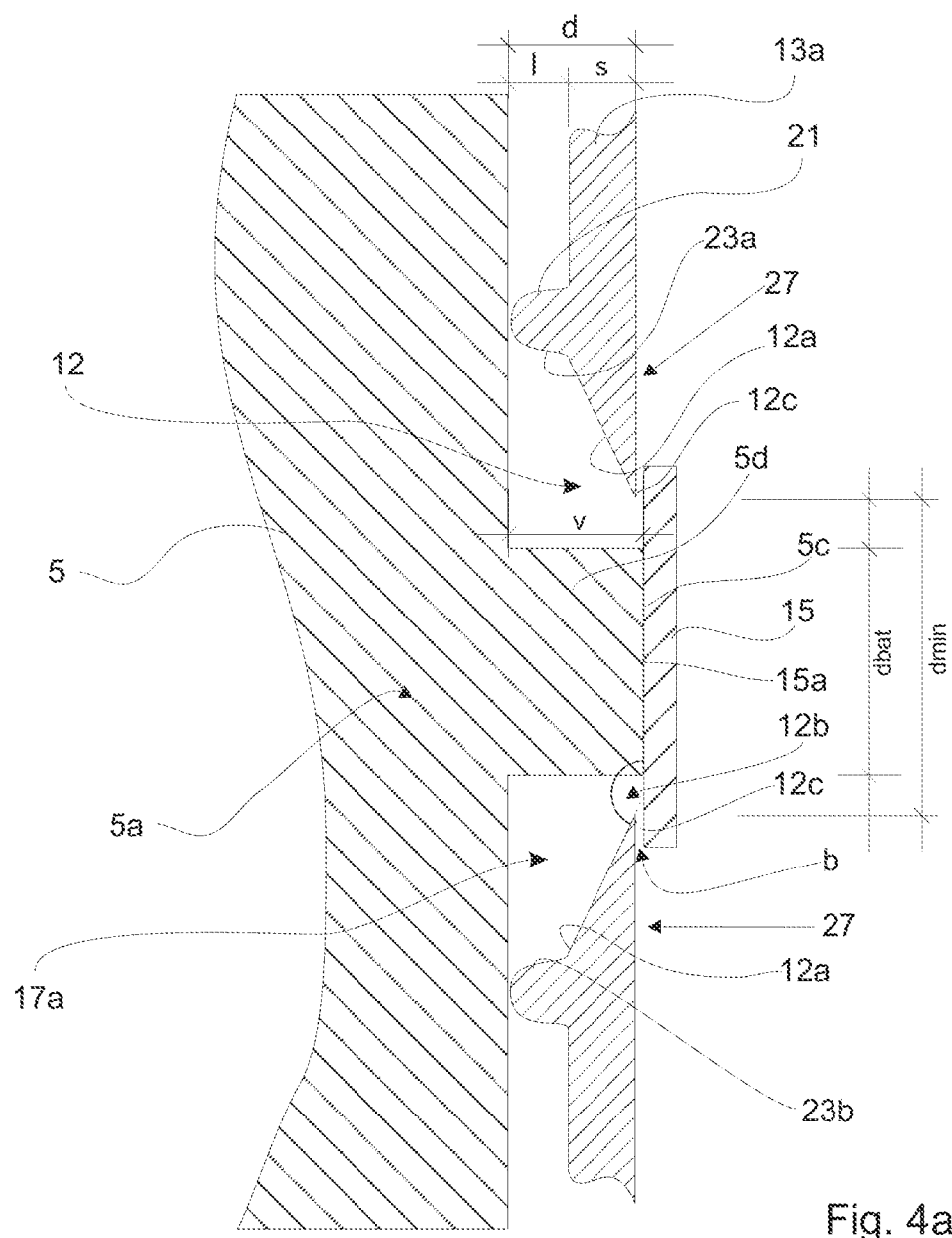


Fig. 4a

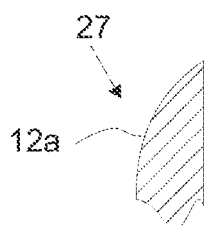


Fig. 4a-1



Fig. 4a-2

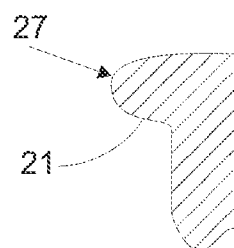


Fig. 4a-3

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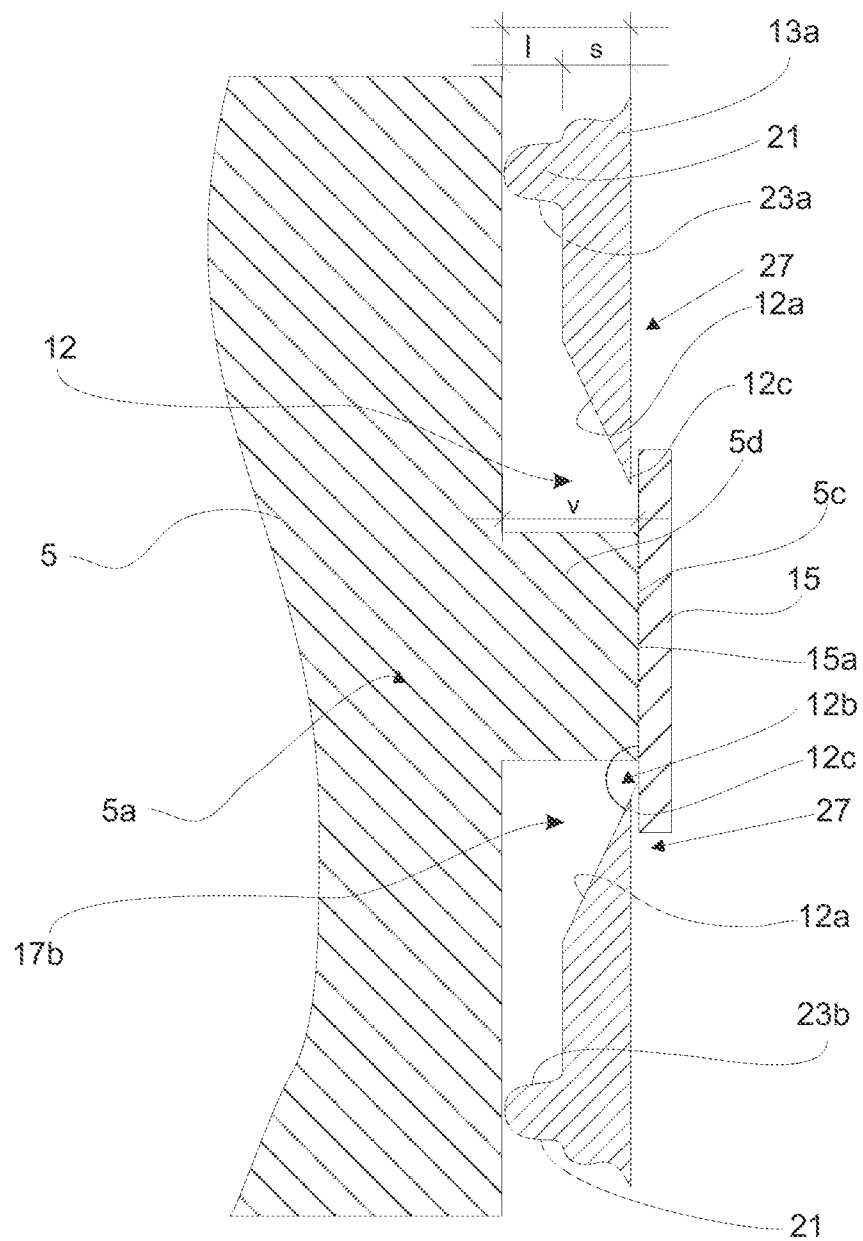


Fig. 4b

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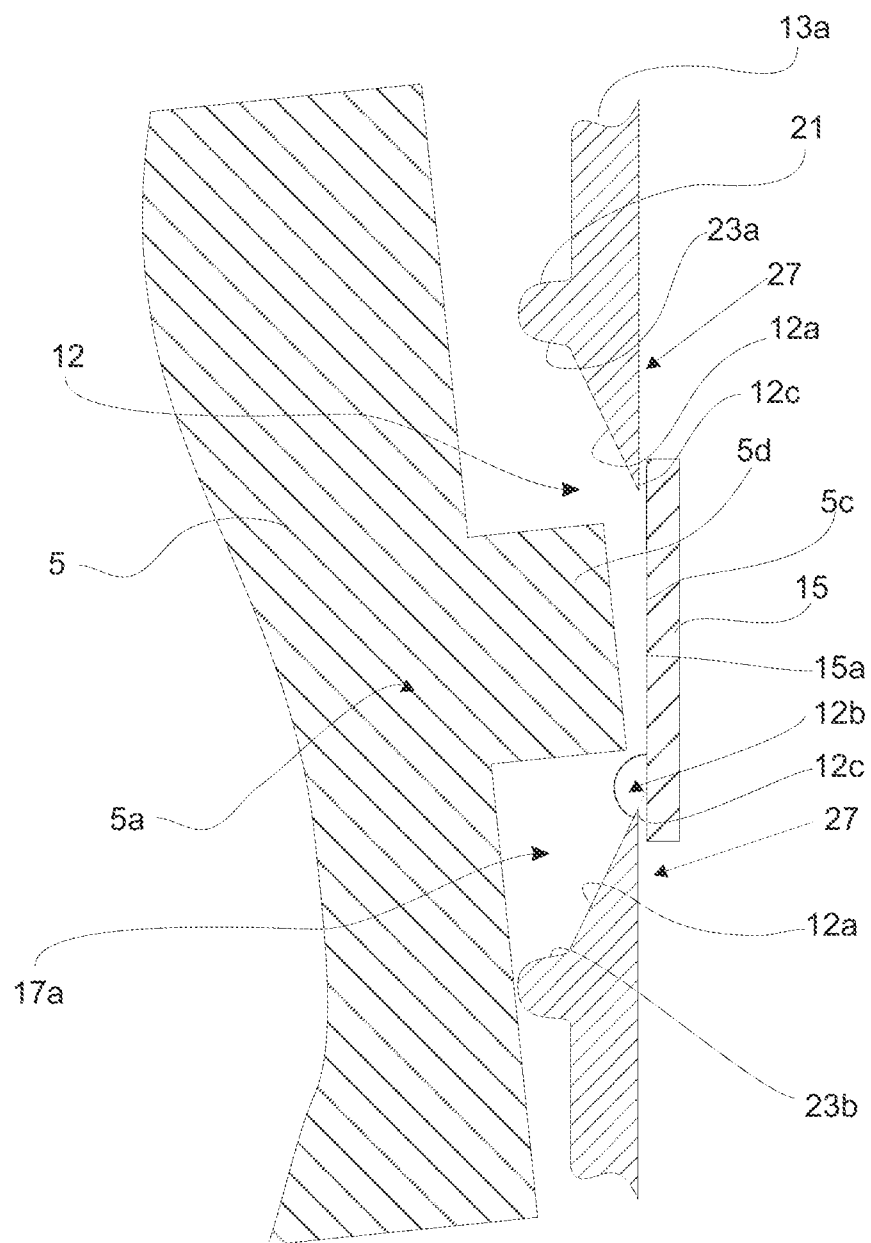


Fig. 5

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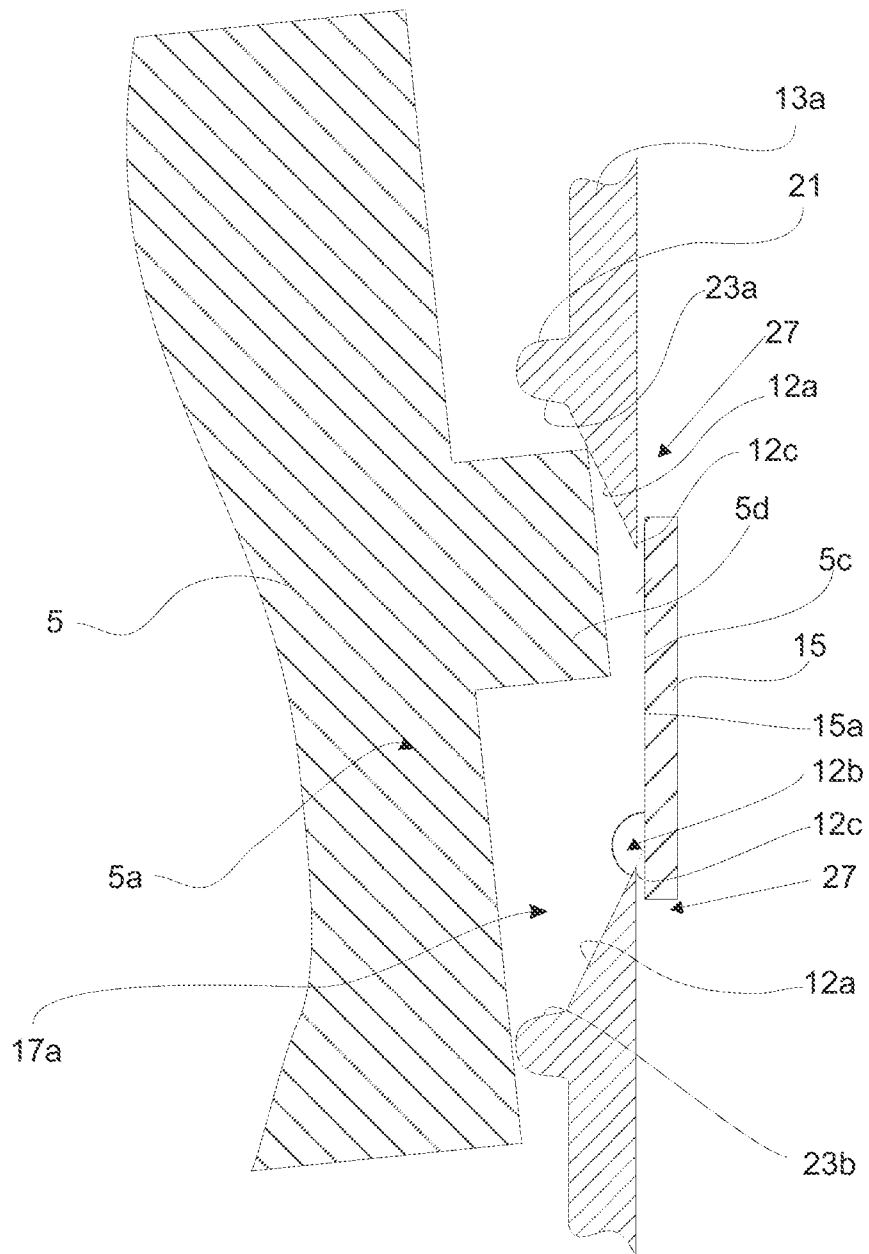


Fig. 6

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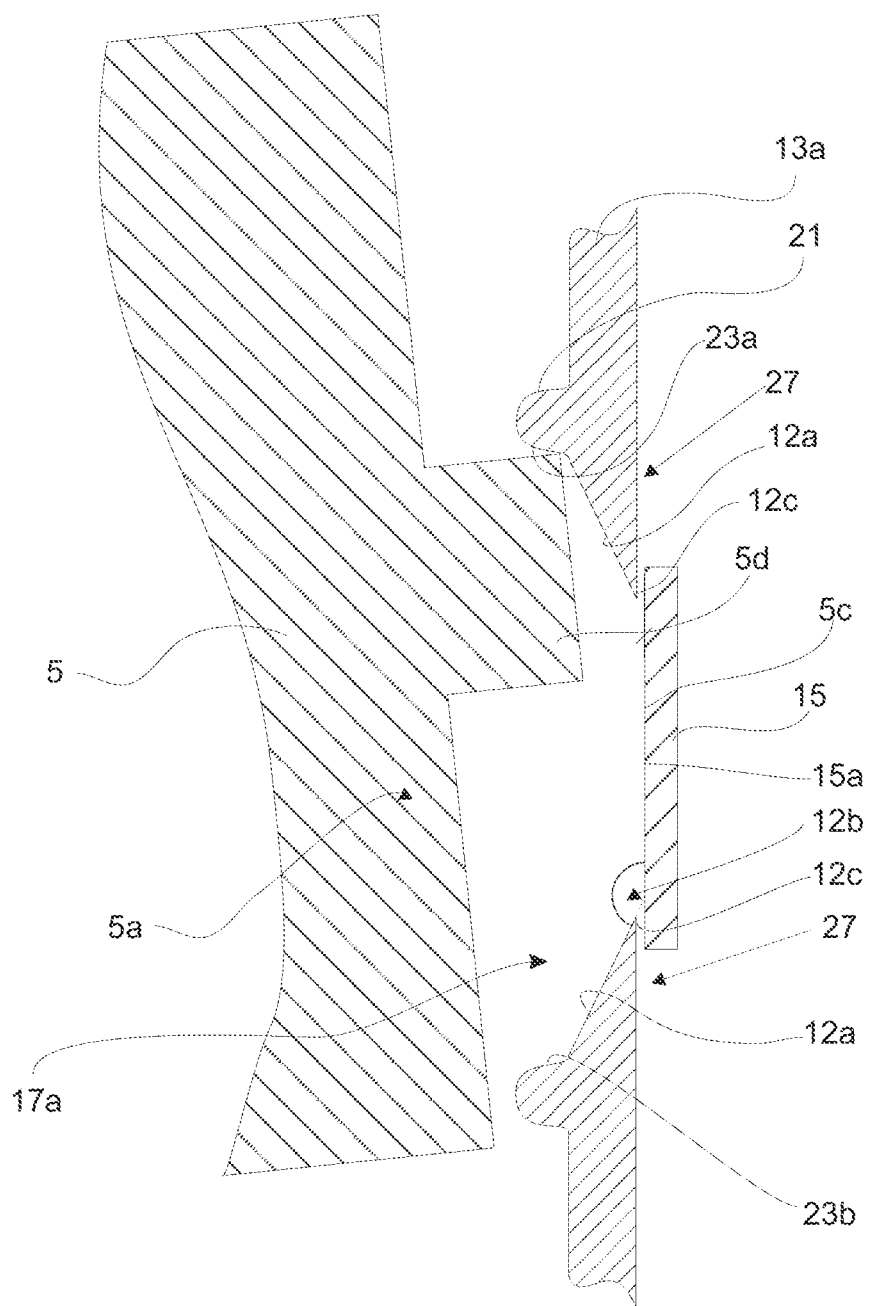
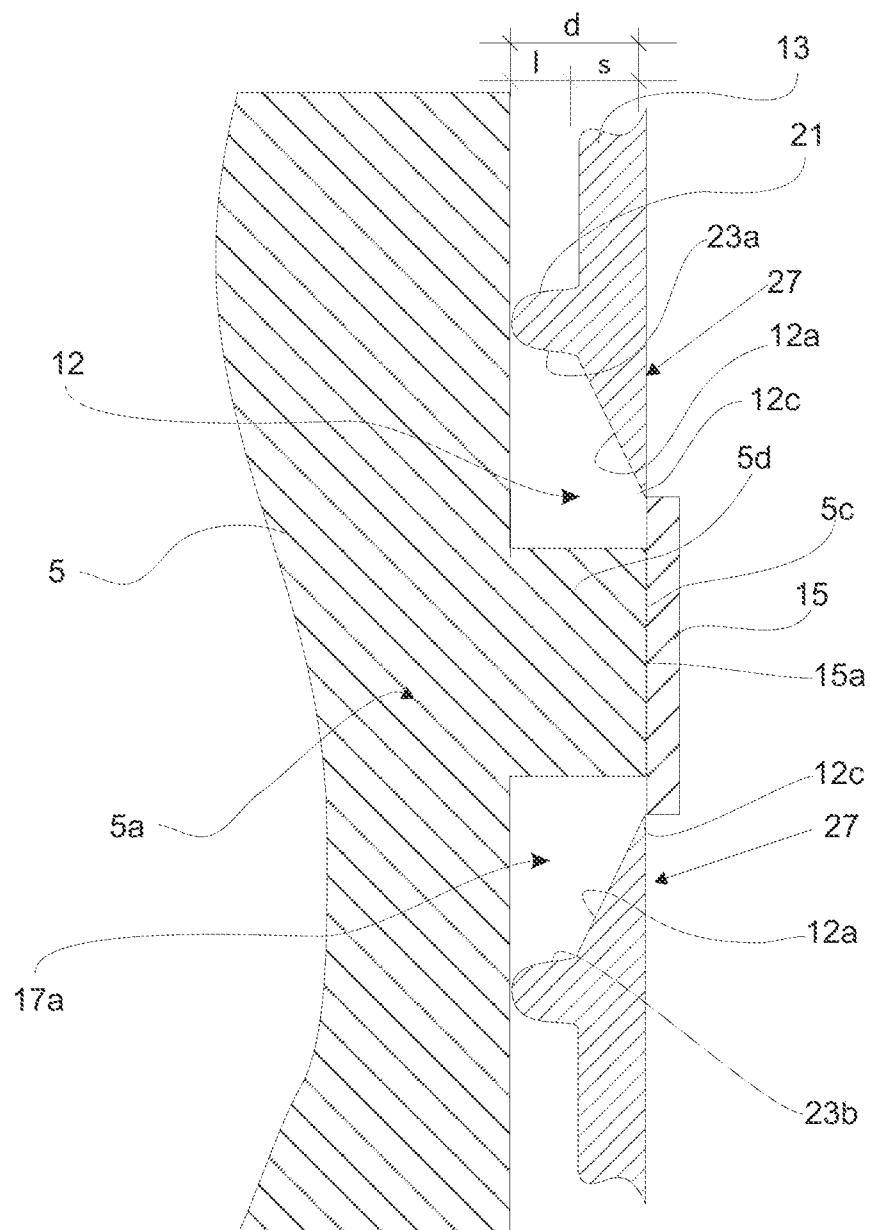


Fig. 7

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INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2010/070910

A. CLASSIFICATION OF SUBJECT MATTER
 INV. H01M2/10 H01M2/34
 ADD. A61M5/20 H01M6/50

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)

H01M 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

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X	US 2007/178776 A1 (ETTER PHILIP [CH] ET AL) 2 August 2007 (2007-08-02) * abstract figures 4-6 paragraphs [0010] , [0031] , [0032] , [0040] , [0044] ----- -/- .	1-11



Further documents are listed in the continuation of Box C.



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Date of the actual completion of the international search

29 March 2011

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Petersch , Bernhard

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2010/070910

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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