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(71) Applicant (for all designated States except DE, US): **F. HOFFMANN-LA ROCHE AG** [CH/CH]; Grenzacherstrasse 124, CH-4070 Basel (CH).

(71) Applicant (for DE only): **ROCHE DIAGNOSTICS GMBH** [DE/DE]; Sandhoferstrasse 116, 68305 Mannheim (DE).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **ZIHLMANN, Rudolf** [CH/CH]; Schosserüti, CH-3550 Langnau (CH). **SCHEURER, Simon** [CH/CH]; Thunstrasse 116, CH-3006 Bern (CH). **HAUETER, Ulrich** [CH/CH]; Kirchgasse 2, CH-3506 Grosshöchstetten (CH).

HEUTSCH, Ivan [CH/CH]; Kirchgasse 2, CH-3506 Grosshöchstetten (CH). **OBERLI, Markus** [CH/CH]; Meisenweg 5, CH-3422 Kirchberg (CH). **REMDE, Axel** [DE/CH]; Dorfstrasse 42a, CH-3432 Lützelflüh-Goldbach (CH). **HORISBERGER, Ronny-Patrick** [CH/CH]; Rain 12, CH-3424 Oberösch (CH).

(74) Agent: **E. BLUM & CO. AG**; Vorderberg 11, CH-8044 Zürich (CH).

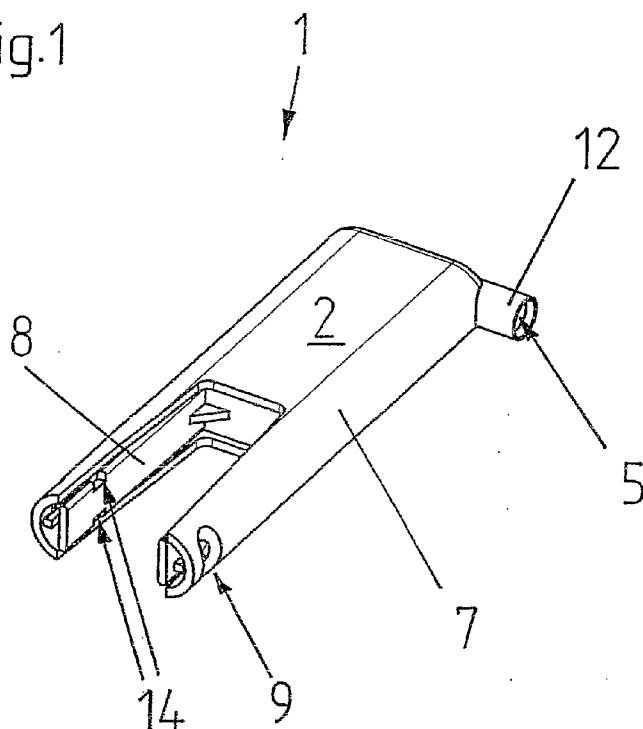
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(54) Title: MEDICINE RESERVOIR AND DEVICE FOR THE AUTOMATED RELEASE OF A LIQUID MEDICAMENT

Fig.1



(57) Abstract: The invention relates to a medicine reservoir (1) with a container (2) to receive a liquid medicament which has a medicine outlet (5) on its front wall (4). The interior of the container (3) is separated from the outside in a fluid-tight manner by a longitudinally displaceable displacement piston (6), wherein the displacement piston (6) is longitudinally displaceable inside the container (2) such that, with the container interior (3) filled with a liquid medicament it is possible, by moving the displacement piston (6), to displace liquid medicament from the container interior (3) into the medicine outlet (5). In this case, the container (2) is designed such that the displacement piston (6) in the displacement end position which it assumes at the end of delivery of medicament at a fully discharged medicine reservoir (1), abuts the front wall (4) of the respective container (2) from which the common medicine outlet (5) leads to the outside. The exit direction out of the medicine outlet (5) runs orthogonal to the displacing direction of the displacement piston (6). The medicine reservoir (1) according to the invention enables the provision of devices for the automated release of liquid medicaments which have a significantly reduced overall length in comparison to those

devices currently known with an established structure.



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**Medicine reservoir and device for the
automated release of a liquid medicament**

5 Cross References to Related Applications

 This application claims the priority of
European patent application 07 007 306.9, filed April 10,
2007, the disclosure of which is incorporated herein by
10 reference in its entirety.

15 Technical Field

 The present invention relates to a medicine
reservoir, a device for the automated release of a liquid
medicament with a medicine reservoir of the
aforementioned type and a set which includes that type of
20 medicine reservoir and a filling aid in accordance with
the preambles of the independent patent claims.

Background Art

25 Devices for the automated release of liquid
medicaments normally are used with patients who have a
continuous and in the course of the day varying need of a
medicine which can be administered subcutaneously.
Specific applications are, for example, certain pain
30 therapies and the treatment of diabetes, in which
computer controlled medicine pumps, such as insulin
pumps, which can be carried on the body, are used, which
often contain amounts of medicine sufficient for several
days in a medicine reservoir and supply the liquid
35 medicament to the patient's body from the medicine
reservoir through an infusion cannula in accordance with
a pre-programmed daily profile. This increasingly entails

the need to carry the pump invisibly, and to this end its dimensions and in particular its overall length should be as small as possible in order not be evident through clothing and to be carried as comfortably as possible.

5 The medicine pumps which are known today and which can be carried on the body have a medicine reservoir with a cylindrical ampoule in which there is a displacement piston which can be pushed into the ampoule by a piston rod or threaded spindle in order to deliver
10 the medicine. The connection of a medicine conveying conduit or of a connection adapter of said medicine conveying conduit is made along the longitudinal axis of the ampoule or along the displacement axis of the displacement piston, respectively. These known designs
15 have the disadvantage of having an overall length that is longer than that desired and which is detrimental to the provision of compact medicine pumps.

20 Disclosure of the Invention

 This presents the task of making available a medicine reservoir and a device for the automated release of a liquid medicament which do not have the
25 disadvantages of the prior art or which at least partially avoid them.

 This task is solved by the medicine reservoir and the device according to the independent patent claims.

30 A first aspect of the invention relates to a medicine reservoir with one or more containers which is or are designed to receive a liquid medicament or which does or do already contain a liquid medicament. Liquid medicaments are understood to refer to, for example,
35 liquid painkillers or insulin. Each container has an interior with a front wall from which a medicine outlet leads outside either directly or through one or several

other containers. The medicine outlet can, for example, be closed by a septum which must be perforated by a cannula to allow a release of the liquid medicament such that the latter gains a passage to the outside. The interior of the container is sealed in a fluid tight manner from the outside by a displacement piston which can move longitudinally. The displacement piston is bounded, fluid-tight over its entire periphery, in the radial direction by the boundary walls of the container, wherein the container is designed such that the displacement piston can move longitudinally within the container while remaining fluid-tight against the boundary walls. This enables the volume of the interior of the container to be reduced by displacing the displacement piston inside the container while fluid is being displaced from the container interior. Accordingly, with such container interior filled with a liquid medicament and the medicine outlet open to the outside, it is possible to displace a liquid medicament from the container interior and to transport it to the medicine outlet by displacing the displacement piston. In addition, each container is designed such that, at the end of its stroke, which it assumes on having completed the supply of the medicine and when the medicine reservoir is totally empty, the displacement piston abuts the front wall of the container from which the medicine outlet leads to the outside, wherein preferably the full face of said piston abuts said front wall. At the same time, the design exit direction from the medicine outlet or outlets, or in the case of several containers with a common medicine outlet, from that common medicine outlet, is transverse, i.e. at an angle, for example, of 100° , preferably orthogonal to the displacing direction of the displacement piston assigned to the respective container, or in the case of several containers with a common medicine outlet, is transverse or orthogonal to the

displacing direction of at least one of the displacement pistons.

The medicine reservoir according to the invention makes possible the provision of devices for the automated release of liquid medicaments whose overall length is reduced significantly compared with those currently known devices of established structure.

In a preferred embodiment of the medicine reservoir, the surface of the respective displacement piston operative in displacement, thus, its surface when projected in the displacing direction, is the entire surface which is surrounded by its outer circumference and by the boundary walls surrounding its outer circumference, respectively. This type of medicine reservoir is cost effective in manufacture, has a maximum volume of medicine for a given displacement path and in addition is preferable from the point of view of hygiene since only a circumferential seal is required between the displacement piston and the boundary walls of the container, which seal can be produced in a simple and proven way.

In still a preferred embodiment of the medicine reservoir, a medicine conveying conduct can be joined directly to the medicine outlet of the medicine reservoir or is connected to it permanently or in removable manner. This enables the medicine reservoir to be produced together with the infusion set as a cost effective and, from a hygienic point of view optimal disposable part.

In still a further preferred embodiment of the medicine reservoir, in embodiments having a single container, the displacement piston of the medicine reservoir is designed such that the smallest extent of its surface operative in displacement is less than the diameter of a cylinder, the volume of which is, at a height corresponding to the design displacement path of the displacement piston provided for the delivery of

medicine, corresponding to the design volume of supply of the medicine reservoir. In embodiments with several containers, the displacement pistons of the medicine reservoir are designed such that the largest of the
5 respective smallest extents of said surfaces of the displacement pistons operative in displacement is less than the diameter of a cylinder which has, at a height corresponding to the largest of the design displacement paths of the displacement pistons for the delivery of
10 medicine, a volume corresponding to the design volume of supply of the medicine reservoir. This makes possible the provision of devices for the automated release of liquid medicaments which are extremely flat and at the same time meet high sanitary requirements.

15 In still a further preferred embodiment of the medicine reservoir, it has exactly one container for receiving a liquid medicament or which contains a liquid medicament, respectively. Such medicine reservoirs are cost effective to produce and due to their simple
20 structure are particularly reliable in operation.

In another preferred embodiment of the medicine reservoir, it comprises several in particular identical containers, and, in particular, exactly two or exactly three preferably identical containers. By
25 deliberately choosing a specific configuration, for a given volume of medicine the dimensions of the medicine reservoir and thus the dimensions of a medicine pump to receive the reservoir can be influenced to a great degree. In this way, for example, extremely flat medicine
30 reservoirs can be made available which can also be extremely compact, for example, in the case of identical containers with a rectangular cross section which are arranged parallel beside each other.

In still a further preferred embodiment of
35 the medicine reservoir, at least one container, and preferably all the containers of the medicine reservoir, each has a displacement piston whose surface operative in

displacement is circular. This design is preferred since it fulfils highest requirements regarding leak-tightness and hygiene and production can in addition be simple and cost effective.

5 In still a further preferred embodiment of the medicine reservoir at least one container, and preferably all the containers of the medicine reservoir, have a displacement piston whose surface which is operative in displacement is not circular in area, but is
10 preferably an oval, bone-shaped, elongated hole-shaped, rectangular, triangular or hexagonal area, wherein the last named preferably has a flat or extended hexagonal shape. This provides the advantage that, for a given volume of medicine, by deliberately selecting a specific
15 structure and configuration, the thickness of the medicine reservoir and thus the dimensions of a medicine pump to receive the reservoir can be influenced to a great degree. In this arrangement, to stabilise the container, its walls, which abut the longer sides of the
20 surface of the displacement piston operative in displacement, are provided with supporting ribs running transversely to the displacing direction of the displacement piston or with an increased wall thickness such that the walls can provide a higher bending moment
25 to counter the outward bowing under internal pressure. This is of particular advantage in displacement pistons with a bone-shaped surface operative in displacement because this measure can be applied here without increasing the total thickness of the medicine reservoir.

30 In still a further preferred embodiment of the medicine reservoir, it has at least two containers in which the displacement pistons of the containers are mechanically connected to each other such that their displacement must occur inevitably at the same time. This
35 is advantageous because it is possible to provide a supply from all containers by means of a drive unit engaged at a common force transmission point, thus saving

costs and installation space when providing a medicine pump with this type of medicine reservoir.

In addition, in medicine reservoirs according to the invention which comprise several containers, it is preferred that said containers are arranged with their longitudinal axes parallel to each other, thus with the displacement axes of the displacement pistons, in particular such that the longitudinal axes of all containers are arranged in one plane. This allows designs with specific dimensions to be realised.

Furthermore, in medicine reservoirs according to the invention comprising several containers, it is preferable that there is a fluid connection between said containers, i.e. the container interiors are interconnected. In this way the containers interact as if they were a single container.

Furthermore, in medicine reservoirs according to the invention which comprise several containers, it is preferable for these containers to be formed as a single piece, wherein it is preferably for them to have one common medicine outlet which is integral with them. Such medicine reservoirs are robust, reliable in operation and cost effective to produce.

As an alternative to the aforementioned embodiment, it is preferable in medicine reservoirs according to the invention which comprise several containers for the containers to be designed as separate components, wherein it is preferred that there is a fluid connection between said containers established by a further component preferably such that their medicine outlets are interconnected. This enables a large number of different medicine reservoirs according to the invention to be assembled from a limited number of different containers and coupling adapters.

In a further preferred embodiment, it is preferable for medicine reservoirs comprising several containers to have a space between two adjacent

containers. In this way it is possible in designing medicine pumps with such medicine reservoirs to locate components, in particular of the drive unit to actuate the displacement pistons, such as, for example, a motor
5 with a drive spindle and/or transmission, between the containers, thus saving overall length. In addition, this enables the containers to be symmetrically arranged around the force transmission point of the drive unit, thus helping to avoid tilting of the displacement
10 arrangement formed by drive unit and displacement piston.

In still a further preferred embodiment of the medicine reservoir, each displacement piston, preferably by one piece design, is rigidly connected to an assigned piston rod.

15 Here, it is preferable for the piston rod in the medicine reservoir or in the respective container holding the assigned displacement piston to be guided radially by the container walls, so that the overall length of the actual displacement piston can be reduced
20 to an amount that it merely serves for sealing functions but is not prevented from tipping due to its overall length. The latter function in this case is assumed by the guided piston rod. Again, this allows the overall length to be reduced.

25 Also, it is preferable in the two aforementioned embodiments for the piston rod to be manufactured from a harder material than the displacement piston in order to allow for their different functions. Here it is advantageous if the piston rod and the
30 displacement piston are formed with each other as one piece produced by multi-component injection moulding. In this way said components can be manufactured as large scale high quality components at minimum unit cost.

Furthermore, it is also preferable in
35 medicine reservoirs with at least two containers according to the invention for the piston rods of the displacement pistons preferably to be joined to each

other as one piece such that any displacing of the displacement pistons must take place inevitably at the same time by the same amount. In this way a cost effective medicine reservoir, reliable in operation, can
5 be made available which, from the viewpoint of the medicine pump to be formed with it, requires only a minimum number of components inside the pump to drive the displacement piston.

In yet a further preferred embodiment of the
10 medicine reservoir, it comprises one or more stops which by positive locking restrict the displacement path of the displacement piston or pistons in a direction opposite to the design displacing direction for delivery of medicine. This prevents the displacement piston from being drawn
15 out of the container when it is retracted inside the container, for example, when the medicine reservoir is being filled, which would present a hygiene problem.

In yet another preferred embodiment, the medicine reservoir is filled with insulin, preferably
20 with an amount of insulin corresponding to at least 150 IU (units of insulin), even more preferably corresponding to 300 IU (units of insulin). With insulin U100 which is currently normal for such pumps, this corresponds to a filling volume of at least 1.5 ml or, respectively, 3 ml
25 of insulin. Such medicine reservoirs represent preferred articles of trade, in particular in the form of disposable packs.

A second aspect of the invention relates to a device for the automated release of a liquid medicament,
30 also designated as a medicine pump, or in the case of the release of insulin, as an insulin pump. The device according to the invention comprises a medicine reservoir according to the first aspect of the invention, to supply a liquid medicament, and a drive unit provided with a
35 preferably electronic control by means of which the displacement piston, or, in a medicine reservoir with several displacement pistons, the displacement pistons

of the medicine reservoir can be moved in the respective container holding them in order to effect the delivery of liquid medicament from the container.

Such medicine pumps according to the invention can be produced in very compact form and at the same time meet high hygiene requirements.

In a preferred embodiment of the device, the direction of the connection for joining a medicine conveying conduct to the device runs transversely, preferably orthogonal to the displacement path of the displacement piston or, in the case of several displacement pistons, orthogonal to the displacement path of at least one of the displacement pistons. It is preferable in this case for the device to be designed such that the medicine conveying conduct can be or is connected directly to the medicine outlet of the medicine reservoir. This provides the advantage that costs can be saved since only a minimum number of components is required to connect the medicine conveying conduct.

In a further preferred embodiment, the device according to the invention comprises a medicine reservoir with at least two containers, wherein the displacement pistons in the containers are mechanically connected to each other such that their displacement must inevitably occur simultaneously, preferably by the same amount. This construction enables such devices to be produced cost effectively and in a robust design.

In still a further preferred embodiment, the device comprises a medicine reservoir with at least two containers wherein there is a space between two adjacent containers in which at least one part of the drive unit is located; preferably a drive motor, a drive spindle and/or a transmission of the drive unit. In this way the overall length can be reduced and it is possible to arrange the containers symmetrically around the force transmission point of the drive unit, thus helping to prevent tilting.

In still a further preferred embodiment of the device, the device is an insulin pump which can be carried on the patient's body. In such embodiments of the invention, the advantages of the invention are particularly evident.

A third aspect of the invention relates to a set comprising a medicine reservoir according to the first aspect of the invention and a filling aid which can be connected to the medicine reservoir for retracting the displacement piston or pistons in order to fill the medicine reservoir. This significantly facilitates the filling of the medicine reservoir with liquid medicament from a bulk pack.

Brief Description of the Drawings

Further preferred embodiments of the invention arise from the dependent claims and from the following description with the aid of the illustrations, which show:

Fig. 1: a perspective top view of a first medicine reservoir according to the invention;

Fig. 2: a longitudinal cross-section through the medicine reservoir from Fig. 1 with the displacement piston in the rear displacement end position;

Fig. 3: an illustration as in Fig. 2 with the displacement piston in a front displacement position;

Fig. 4: a perspective top view of the displacement piston of the medicine reservoir from Fig. 1;

Fig. 5: a cross-section through A-A in Fig. 2;

Figures 5a and 6 to 8: illustrations as in Fig. 5 of preferred embodiment variants of the medicine reservoir from Fig. 1 according to the invention;

Fig. 9: an illustration as in Fig. 4 of a preferred embodiment variant of the displacement piston of the medicine reservoir from Fig. 1;

Fig. 10: a perspective top view of a filling aid for a medicine reservoir according to the invention with the displacement piston from Fig. 9;

Fig. 11: a perspective top view of the filling aid from Fig. 10 and the displacement piston from Fig. 9 in the connected condition;

Fig. 12: a perspective top view of a medicine reservoir according to the invention with the displacement piston from Fig. 9 after the displacement piston has been moved into the front displacement end position and the filling aid from Fig. 10 has subsequently been connected;

Fig. 13: a longitudinal cross-section through the arrangement from Fig. 12;

Fig. 14: a perspective top view of the medicine reservoir from Fig. 12 after the displacement piston has been retracted to the rear displacement end position by the filling aid;

Fig. 15: a longitudinal cross-section through the arrangement from Fig 14;

Fig. 16: a perspective top view of a second medicine reservoir according to the invention;

Fig. 17: a longitudinal cross-section through the medicine reservoir from Fig. 16 with the displacement piston arranged in a front displacement position;

Fig. 18: an top view as in Fig. 17 with the displacement piston arranged in a rear displacement position;

Fig. 19: a perspective top view of the displacement piston of the medicine reservoir from Fig. 16;

Fig. 20: a cross-section through B-B in Fig. 18;

Figures 21 to 23: illustrations as in Fig. 20 of preferred embodiment variants of the medicine reservoir from Fig. 16 according to the invention; and

Fig. 24: a longitudinal cross-section through
5 a third medicine reservoir according to the invention.

Modes for Carrying Out the Invention

10 A first preferred embodiment of a medicine reservoir according to the invention in the form of an insulin ampoule for an insulin pump is shown in Figures 1 to 5. As can be seen, the medicine reservoir 1 comprises a container 2 within the boundary walls 7 of which a
15 displacement piston 6 is arranged which can be moved longitudinally to displace fluid out of the interior 3 of said container. The container 2 has an oval cross-section and the displacement piston 6 has a correspondingly oval surface operative in displacement, wherein the smallest
20 extent of the piston surface operative in displacement corresponds to distance H of the two parallel boundary walls (see Fig. 5). The container interior 3 has a front wall 4 at which a medicine outlet 5 leads outside in a design exit direction which runs orthogonal to the
25 displacing direction of the displacement piston 6. The medicine outlet 5 leads to a connection adapter 12 to which a medicine conveying conduct (not shown) can be directly connected. The displacement piston 6 is made from a soft material, in this case from a thermoplastic
30 elastomer, to form a seal against the boundary walls 7 of the container 2, and is supported by a supporting structure, forming two piston rods 8, which is made from a relatively hard material, in this case from PP (polypropylene). The displacement piston 6 and the
35 supporting structure are produced in this case in one piece by multi-component injection moulding. It is, however, equally conceivable to manufacture a supporting

structure with a part of the piston made in hard material and to fit a seal on the periphery of the part of the piston, for example, an O-ring, to form a radial seal against the boundary walls 7. As can be seen by

5 considering Figures 2 and 3 together, which on the one hand show the piston 6 in its intended maximally retracted position (Fig. 2), in which the distance V between the front of the piston and the front wall 4 corresponds to the design displacement path V intended

10 for the supply of medicine and thus the container interior 3 has the design volume of supply of the medicine reservoir 1, and on the other hand in an almost fully inserted position (Fig. 3), in which the volume of the container interior 3 is almost zero, the displacement

15 piston 6 can be pushed into container 2 by means of the support structure or the piston rods 8 formed by the same, respectively, in order to displace a medicament from its interior 3 and through medicine outlet 5 to the outside. As this takes place, the supporting structure

20 inside container 2 is guided with the piston rods 8 on the boundary walls 7 such that any tilting or tipping of displacement piston 6 can be reliably prevented. As can be seen, each of the two piston rods 8 has a spring tab 13 in the area of its free end which in the fully

25 retracted position of displacement piston 6, as shown in Fig. 2, snap into assigned recesses 9 in the boundary walls 7, thereby positively constraining the displacement path of the displacement piston 6 in a direction opposite to the design direction for delivery of medicament, in

30 which direction said displacement piston is moved, for example, to fill the medicine reservoir. As can be further seen, in the area of their free ends, the two piston rods 8 furthermore in each case comprise two recesses 14 into which detent tabs of a filling aid (not

35 shown) can be snapped in order to connect the filling aid to the medicine reservoir 1.

Figures 5a and 6 to 8 show illustrations as in Fig. 5 of preferred embodiment variants of the medicine reservoir according to the invention from Fig. 1, which have other cross-sectional shapes. As can be seen, the embodiment according to Fig. 5a has a circular cross-section. The embodiments in Figures 6 and 8 have oval cross-sections which have, however, no parallel boundary walls 7. In the embodiment shown in Fig. 6, the boundary walls are exclusively concave towards the interior 3 which is advantageous in retaining a stable shape as pressure increases in the interior 3. In the embodiment shown in Fig. 8, the boundary walls are alternatively convex and concave with respect to interior 3, wherein it is preferable here to provide supporting ribs 15 on the outside of the convex boundary walls (shown as dotted lines) which counteracts a bulking of the walls towards the outside as pressure increases in the interior 3 of the container 2. The smallest extents H of the surfaces of the displacement pistons 6 operative in displacement in each case extend, in these two designs, along the shortest axis of symmetry of the respective cross-sectional shape. The embodiment in Fig. 7 has an extended hexagonal cross-sectional shape where the smallest extent H of the surface of the displacement piston 6 operative in displacement is the distance between the longest parallel boundary walls 7.

The rest of the design of this medicine reservoir is, apart from the other cross-sectional shape of the container 2, identical to that shown in Figures 1 to 5.

Fig. 9 shows a representation as in Fig. 4 of a preferred embodiment variant of the displacement piston 3 with a supporting structure. As can be seen, this arrangement has a threaded rod 16 which can engage with the female thread of a linear drive (not shown). By the connection to the linear drive, furthermore a piston

retention (free flow prevention) can be formed in a simple manner.

Fig. 10 shows a perspective top view of a filling aid 10 to fill the medicine reservoir according to the invention with the displacement piston according to Fig. 9. The filling aid 10 is produced as one piece by injection moulding and has a protective pipe 17 for the threaded rod 16 of the displacement piston 6. As can be seen, the filling aid 10 forms two spring arms, on the free ends of which there are two detent tabs 18 to snap into the recesses 14 in the piston rods 8. For connecting to the medicine reservoir 1, the filling aid 10 is pushed with the protective tube 17 onto the threaded rod 16 until the detent tabs 18 snap into the recesses. This connected condition is shown in perspective in Fig. 11 without the boundary walls, in perspective with complete medicine reservoir 1 in Fig. 12 and as a cross-section with complete medicine reservoir 1 in Fig. 13. For filling, the medicine reservoir 1 is then gripped with one hand and the filling aid 10 is gripped at its handle 19 with the other hand and the filling aid 10 is retracted with the displacement pistons 6, 8 connected to it out of the container 2 in a direction opposite to the design displacing direction for delivery until the spring tabs 13 of the piston rods 8 snap into the recesses 9 of the boundary walls 7 of the container 2, thereby positively constraining this movement. This situation is represented in perspective in Fig. 14 and as a cross-section in Fig. 15. The spring arms formed with the tabs 18 can be moved towards each other by pressing the disengaging buttons 20 between two fingers such that the tabs 18 are disengaged from the recesses 14 and the filling aid 10 can be removed.

The Figures 16 to 20 show illustrations as in Figures 1 to 5 of a second preferred embodiment of the medicine reservoir according to the invention, where Fig. 16 shows a perspective top view of the medicine

reservoir, Figures 17 and 18 show longitudinal sections through the medicine reservoir from Fig. 16, in one case with the displacement piston arranged in a front displacement position (Fig. 17) and in another case arranged in the rear displacement position (Fig. 18), Fig. 19 shows a perspective top view of the displacement piston of the medicine reservoir and Fig. 20 a cross-section along line B-B in Fig. 18. As can be seen, the medicine reservoir 1 here comprises two containers 2, within each of which boundary walls 7 a longitudinally movable displacement piston 6 is arranged to displace fluid from the container interior 3. The containers 2 are arranged parallel in relation to their longitudinal axes X and have circular cross-sections of the same size and correspondingly circular displacement pistons 6. In each container 2, the smallest extent of the piston surface operative in displacement corresponds here to the respective diameter of the container cross-section or to the diameter of the assigned displacement piston 6, respectively. Since the diameters of both containers 2 or displacement pistons 6, respectively, are identical, in this case the according to the claims largest of the smallest extents H of the surfaces of the displacement pistons 6 operative for displacement corresponds to the diameter of one of the two displacement pistons 6 or containers 2, respectively. The container interior 3 in each case has a front wall 4 at which a medicine outlet, being common to both containers 2, leads outside in a design exit direction which also runs orthogonal to the displacing direction of displacement piston 6 or to the longitudinal axes X of the containers 2, respectively. The medicine outlet 5 here also leads into a connection point 12, to which a medicine conveying conduit (not shown) can be directly connected. The displacement pistons 6 are here also made from a soft material and the respective piston rods 8 assigned to the displacement pistons 6 are manufactured from a hard material, wherein

also here, the hard 8 and the soft 6 components are manufactured together in one piece by multi-component injection moulding. It is, however, also conceivable here to produce a supporting structure with piston portion
5 from a hard material and to fit a seal on the circumference of the piston portion, for example an O-ring, for sealing against the boundary walls 7. As can further be seen, both piston rods 8 of the displacement pistons 6 are connected to each other by a bridge 22 to
10 form one piece in such a way that both pistons must move together inevitably at the same time and in the same manner. The containers 2 are also formed as one piece with each other and with the component that forms the medicine outlet 5, which has been accomplished by
15 injection moulding.

As can be seen by considering Figures 18 and 19 together, the displacement pistons 6 or their piston rods 8, respectively, each have a stop shoulder 23 which, when displacement piston 6 is moved opposite to the
20 design displacing direction of supply of the piston 6, meets a stop 9 on the boundary walls 7 of the assigned container 2 and thus positively constrains the displacement path of the respective piston 6 in a direction opposite to that of the displacement path
25 arranged for the delivery of medicine. At the same time, the stop shoulders 23 serve for guiding the arrangement consisting of the displacement pistons 6, the piston rods 8 and the bridge 22 on the boundary walls 7 of the containers 2 to prevent any tilting or tipping of the
30 displacement pistons 6. As can also be seen, the two piston rods 8 each have a spring tab 21 in the area of their free ends which can serve both to connect a filling aid as well as to connect a drive unit for the displacement pistons 6.

35 Figures 21 to 23 show illustrations as in Fig. 20 of preferred embodiment variants of the medicine reservoir 1 according to the invention in Fig. 16, which

have other configurations and/or cross-sectional shapes. As can be seen, in accordance with Figures 21 and 22, the embodiments each have three identical containers 2, in one case with circular cross-sectional shape (Fig. 21) and in the other case with oval cross-sectional shape (Fig. 22). Fig. 23 shows an embodiment in which four containers 2 with identical triangular cross-sectional shapes are arranged beside each other such that the apexes of the triangles alternately point upwards and downwards. In all the embodiments, the containers 2 are produced as one piece with each other and with the component forming the common medicine outlet 5. In these embodiments, the according to the claims largest of the respective smallest extents H of the displacement piston surfaces operative in displacement is given as, in one case, the diameter of one of the containers 2 or of the assigned displacement piston, respectively, (Fig. 21), in another case as the height of the cross-section of one of the containers 2 along the shortest axis of symmetry of the oval cross-sectional shape (Fig. 22) and, in another case, as the height of the triangular cross-section of one of the containers 2 (Fig. 23). The embodiment according to Fig. 7 displays an extended hexagonal cross-sectional shape in which the smallest extent H of the displacement piston surface operative in displacement is the distance between the longest parallel boundary walls 7. The rest of the design of these medicine reservoirs, apart from the other configuration or cross-sectional shape of the containers 2, respectively, is identical to that shown in Figures 16 to 20.

Fig. 24 shows a longitudinal section through a third medicine reservoir 1 according to the invention which only differs from that shown in Fig. 17 in that a space 11 is provided between the containers 2 to receive a drive unit (not shown) of an insulin pump and that both piston rods 8 have no spring tabs in the area of their free ends to connect a filling aid or a drive unit,

respectively. The rest of the design of these medicine reservoirs 1 is identical to that shown in Figures 16 to 20.

5 While there are shown and described presently preferred embodiments of the invention, it is to be distinctly understood that the invention is not limited thereto but may be otherwise variously embodied and practiced within the scope of the following claims.

10

Claims

1. Medicine reservoir (1), comprising one or
5 more containers (2) to receive a liquid medicament or
containing a liquid medicament, each container (2) of
which comprises an interior space (3), a medicine outlet
(5) on a front wall (4) of the interior space (3) of the
10 container leading outside and a displacement piston (6)
separating the container interior (3) from the outside,
which is bounded fluid-tight in a radial direction around
its entire periphery by the surrounding boundary walls
(7) of the container (2) and which is longitudinally
15 displaceable inside the container (2) while retaining a
fluid-tight contact with the boundary walls (7) for
enabling delivery of liquid medicament from the container
interior (3) into medicine outlet (5) through
displacement by means of the displacement piston (6),
20 wherein the displacement piston (6), in a displacement
end position which it assumes at the end of the medicine
delivery when the medicine reservoir has been fully
discharged, abuts said front wall (4) of the container
(2) at which the medicine outlet (5) leads outside,
wherein the design outlet direction (A) out of the
25 medicine outlet (5) runs transversely, in particular
orthogonal to a displacing direction of the displacement
piston or pistons (6).

2. Medicine reservoir (1) according to claim
1, wherein the surface operative for displacement of the
30 displacement piston or pistons (6) is in each case the
surface surrounded by the outer periphery of the
displacement piston.

3. Medicine reservoir (1) according to one of
the preceding claims, wherein a medicine conveying
35 conduit can be or is connected directly to the medicine
outlet (5) of medicine reservoir (1).

4. Medicine reservoir according to one of the preceding claims, wherein the smallest extent (H) of the surface operative in displacement of the displacement piston (6) or, with several containers (2), the largest
5 of the respectively smallest extents (H) of those surfaces operative in displacement of the displacement pistons (6) is smaller than the diameter of a cylinder which, at a height corresponding to the design displacement path (V) of the displacement piston (6), or,
10 with several containers (2), corresponding to the longest of the design displacement paths (V) of the displacement pistons (6) provided for the supply of medicine, has a volume corresponding to the design supply volume of the medicine reservoir (1).

15 5. Medicine reservoir (1) according to one of the preceding claims, wherein the medicine reservoir (1) has exactly one container (2).

6. Medicine reservoir (1) according to one of the claims 1 to 4, wherein the medicine reservoir (1)
20 comprises several, in particular identical containers (2), in particular two or three, in particular identical containers (2).

7. Medicine reservoir (1) according to one of the preceding claims, wherein at least one container (2),
25 in particular all containers (2) of the medicine reservoir (1) have a displacement piston (6) whose surface operative in displacement is circular.

8. Medicine reservoir (1) according to one of the preceding claims, wherein at least one container (2),
30 in particular all containers (2) of the medicine reservoir (1) have a displacement piston (6) whose surface operative in displacement is a non-circular surface, in particular an oval, bone-shaped, elongated hole-shaped, rectangular, triangular or hexagonal
35 surface.

9. Medicine reservoir (1) according to one of the preceding claims with at least two containers (2),

wherein the displacement pistons (6) of the containers (2) are mechanically connected to each other, in particular such that their displacement must occur inevitably at the same time.

5 10. Medicine reservoir (1) according to one of the preceding claims with at least two containers (2), wherein the containers (2) are arranged with their longitudinal axes (X) parallel to each other, in particular such that the longitudinal axes of all
10 containers (2) are arranged in one plane.

 11. Medicine reservoir (1) according to one of the preceding claims with at least two containers (2), wherein there is a fluid connection between the containers (2).

15 12. Medicine reservoir (1) according to one of the preceding claims with at least two containers (2), wherein the containers (2) are connected to each other by one piece design and, in particular, wherein they have a common medicine outlet (5) manufactured with them in one
20 piece design.

 13. Medicine reservoir (1) according to one of the preceding claims with at least two containers (2), wherein the containers (2) are designed as separate components and, in particular, wherein there is a fluid
25 connection between them such that their medicine outlets (5) are interconnected.

 14. Medicine reservoir (1) according to one of the preceding claims with at least two containers (2), wherein there is a space between two adjacent containers
30 (2).

 15. Medicine reservoir (1) according to one of the preceding claims, wherein each displacement piston (6) of the medicine reservoir (1) is, in particular through one-piece construction, coupled to an assigned
35 piston rod (8).

16. Medicine reservoir (1) according to claim 15, wherein the piston rod (8) is guided radially in the medicine reservoir (1).

17. Medicine reservoir (1) according to one
5 of the claims 15 to 16, wherein the piston rod (8) is manufactured from a harder material than the displacement piston (6) and, in particular, wherein the piston rod (8) and the displacement piston (6) are manufactured together as one piece by multi-component injection moulding.

10 18. Medicine reservoir (1) according to one of the claims 15 to 17 with at least two containers (2), wherein the piston rods (8) of the displacement pistons (6) are connected to each other, in particular through one piece design, in such a manner that any displacement
15 of the displacement pistons (6) inevitably must occur simultaneously by the same amount.

19. Medicine reservoir (1) according to one of the preceding claims, wherein the interlocking stops (9) are provided which positively constrain the
20 displacement path (V) of the displacement piston or pistons (6) in a direction opposite to the design displacing direction to deliver the medicine.

20. Medicine reservoir (1) according to one of the preceding claims, wherein it is filled with
25 insulin, in particular, with an amount of insulin corresponding to at least 150 IU, in particular corresponding to at least 300 IU.

21. Device for the automated release of a liquid medicament, comprising a medicine reservoir (1),
30 according to one of the preceding claims, for providing a liquid medicament and a drive unit with a in particular electronic control, by means of which the displacement piston or pistons (6) of the medicine reservoir (1) can be displaced in the respective container (2) holding
35 them, to effect delivery of liquid medicament from the container (2).

22. Device according to claim 21, wherein the direction of the connection of a medicine conveying conduit to the device runs transversely, in particular orthogonal to the displacing direction of the displacement piston or pistons (6), and in particular that the medicine conveying conduit can be or is connected directly to the medicine outlet (5) of the medicine reservoir (1).

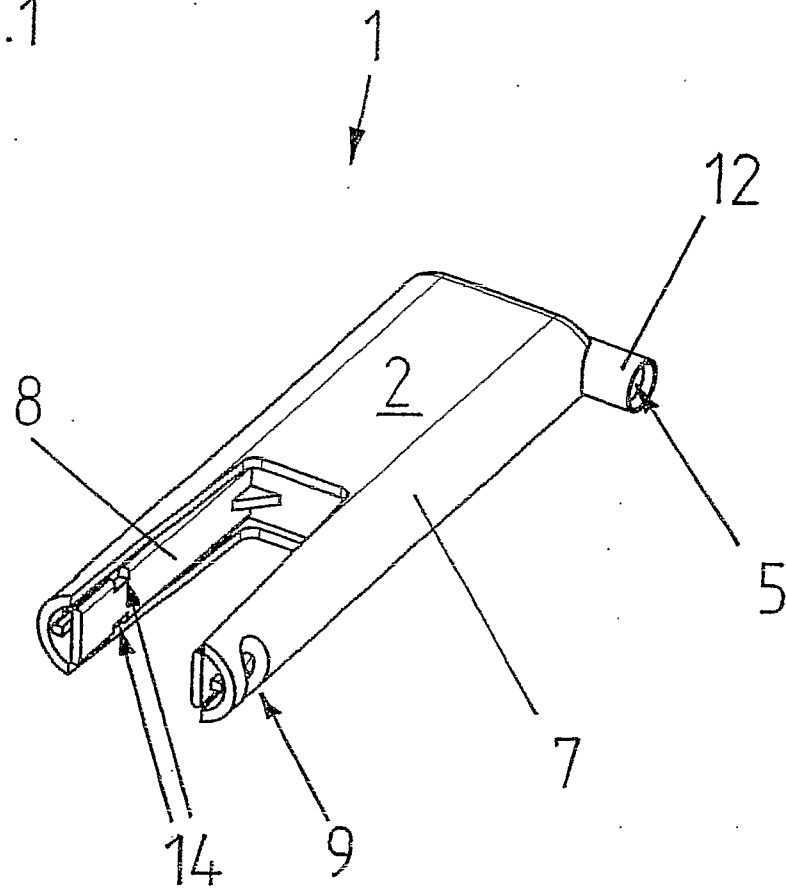
23. Device according to one of the claims 21 to 22 with a medicine reservoir (1) with at least two containers (2), wherein the displacement pistons (6) of the containers (2) are mechanically connected to each other such that their displacement must occur inevitably at the same time, in particular by the same amount.

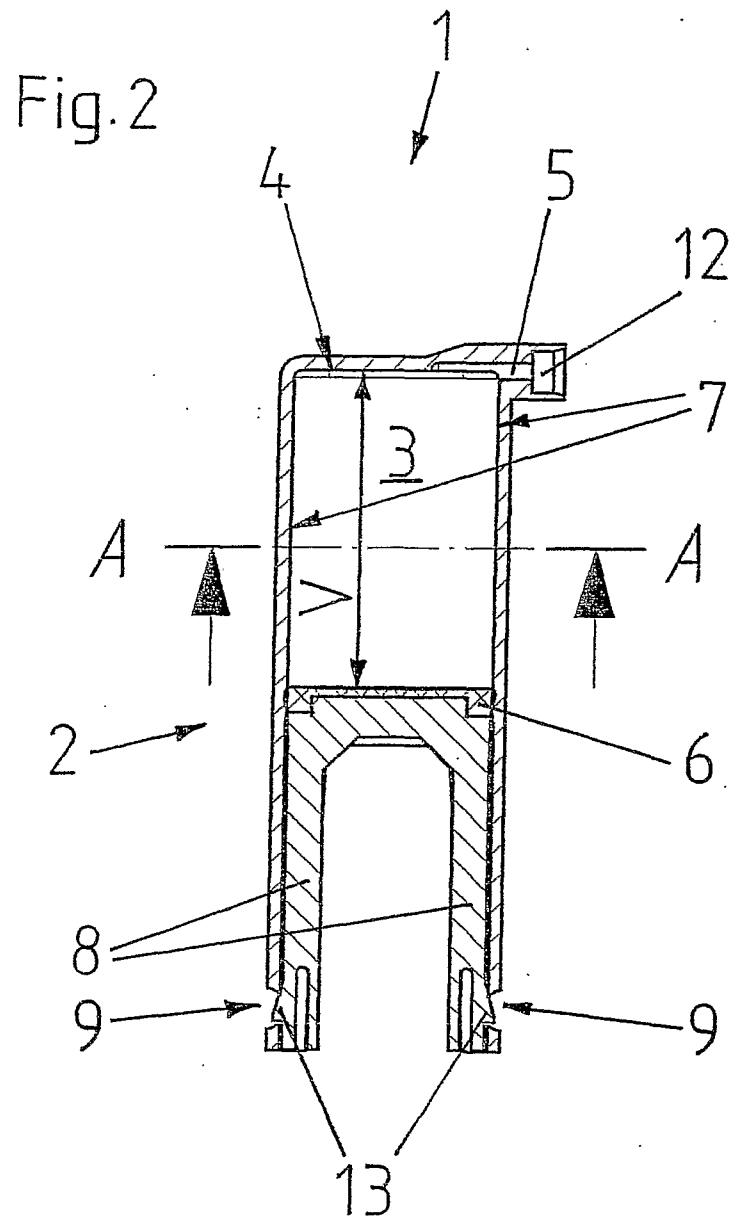
24. Device according to one of the claims 21 to 23 with a medicine reservoir (1) with at least two containers (2), wherein a space (10) is provided between two adjacent containers (2) of the medicine reservoir (1) in which at least part of the drive unit is arranged, in particular a drive motor and/or a transmission for the drive unit.

25. Device according to one of claims 21 to 24, wherein the device is an insulin pump which can be carried on the patient's body.

26. Set consisting of a medicine reservoir (1) according to one of the claims 1 to 20 and a filling aid (11) for connection to the medicine reservoir (1) in order to retract the displacement piston or pistons (6) for the purpose of filling the medicine reservoir (1).

Fig.1





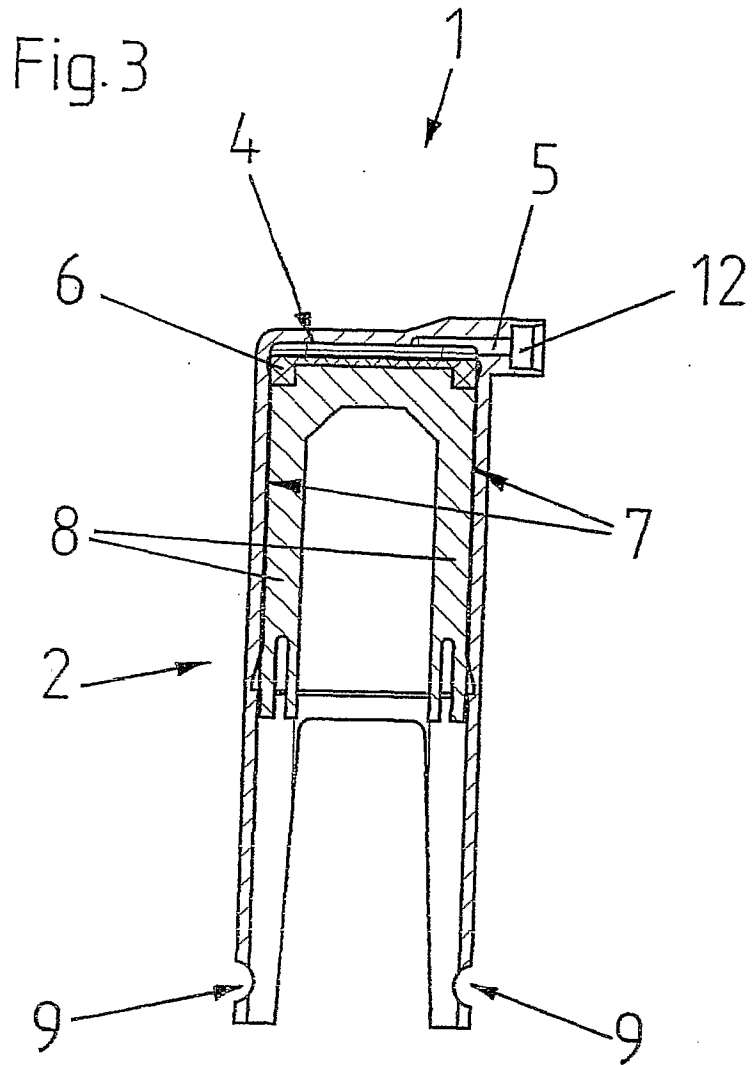


Fig. 4

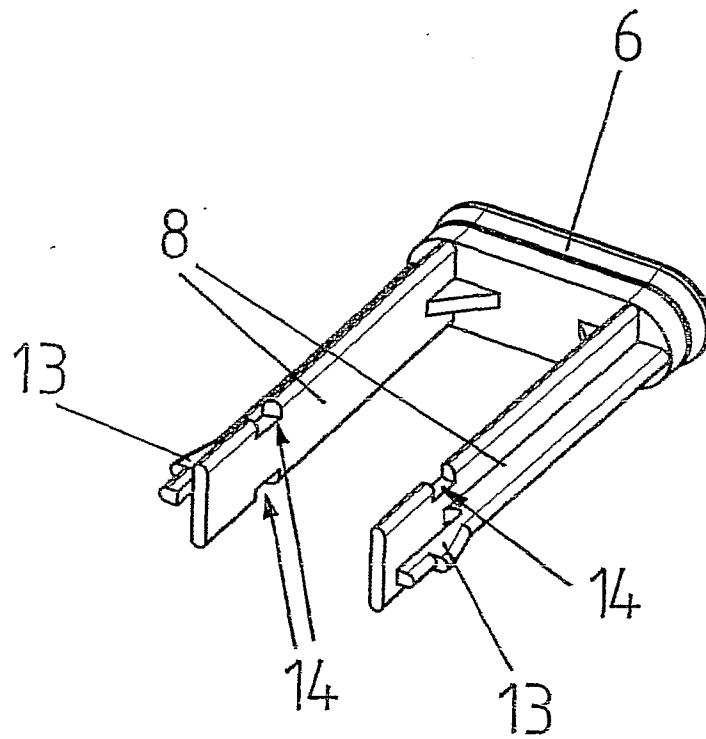
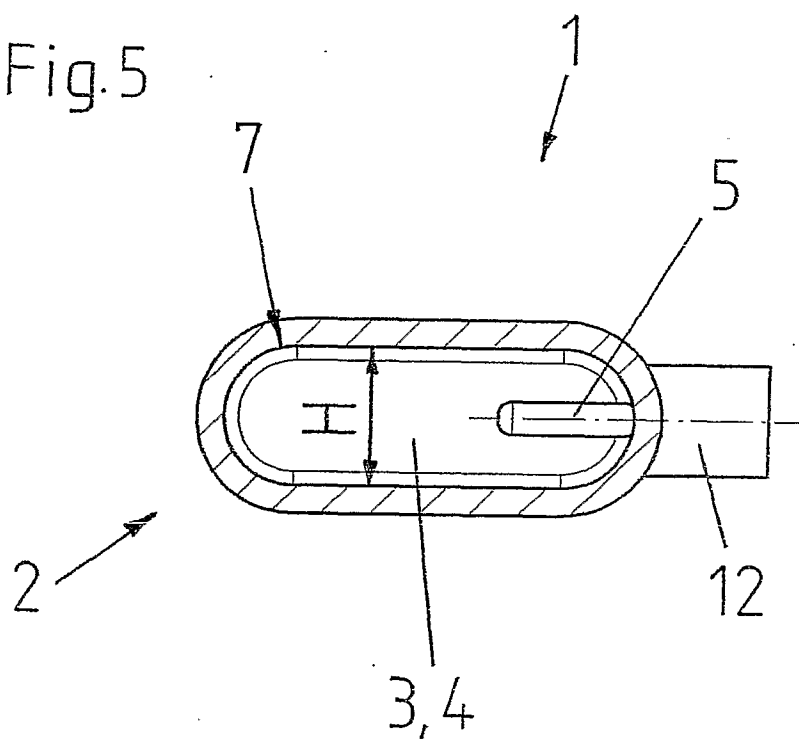


Fig.5



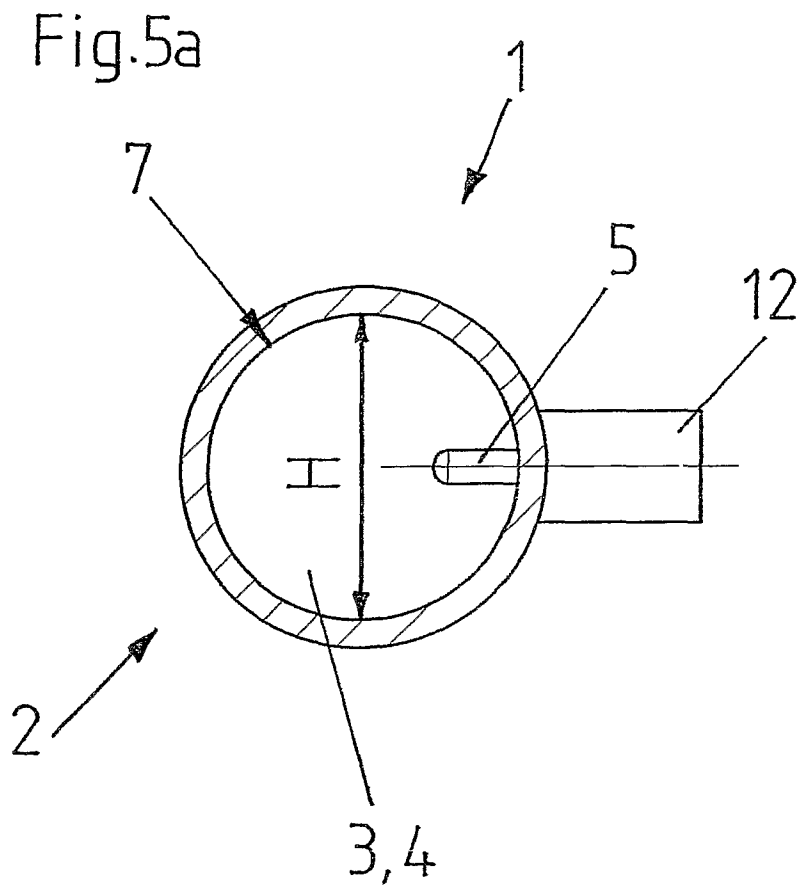
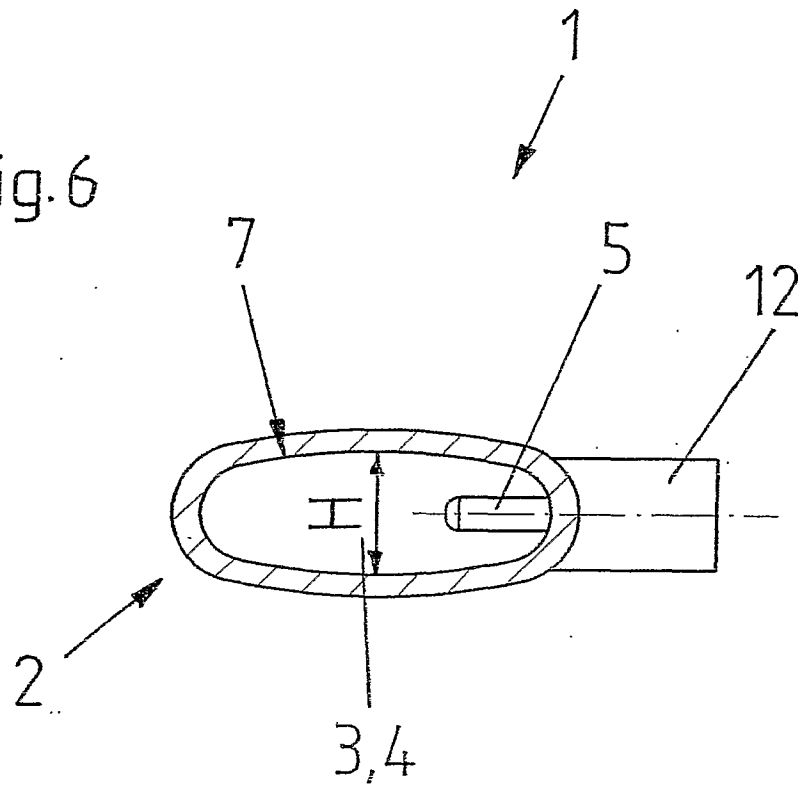
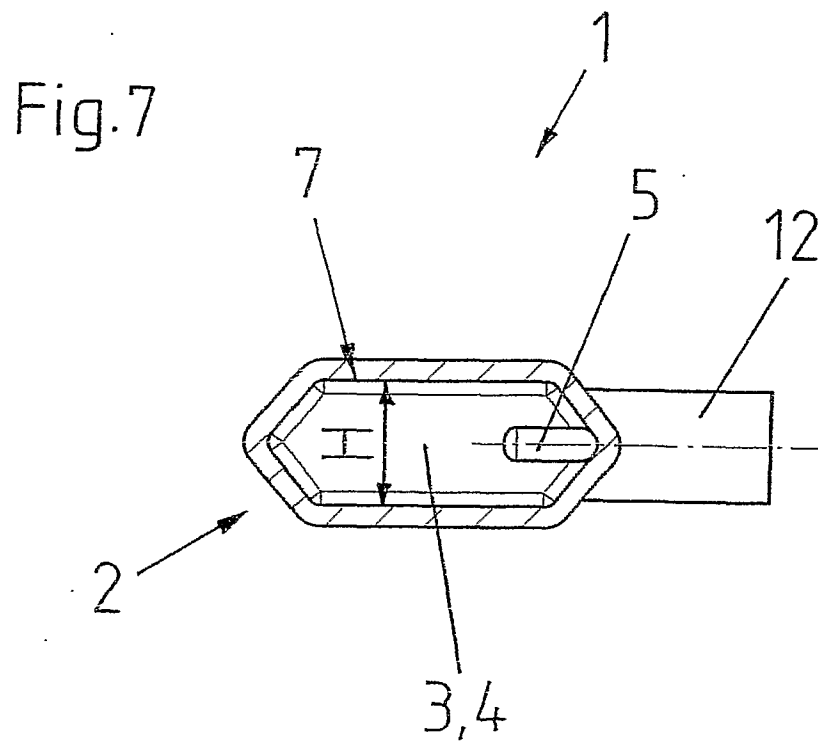


Fig.6





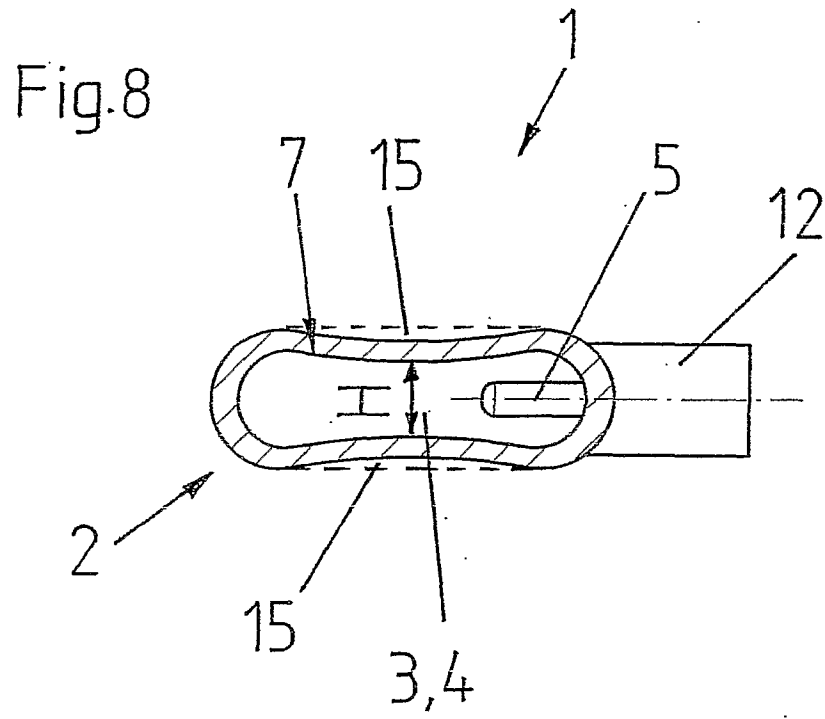
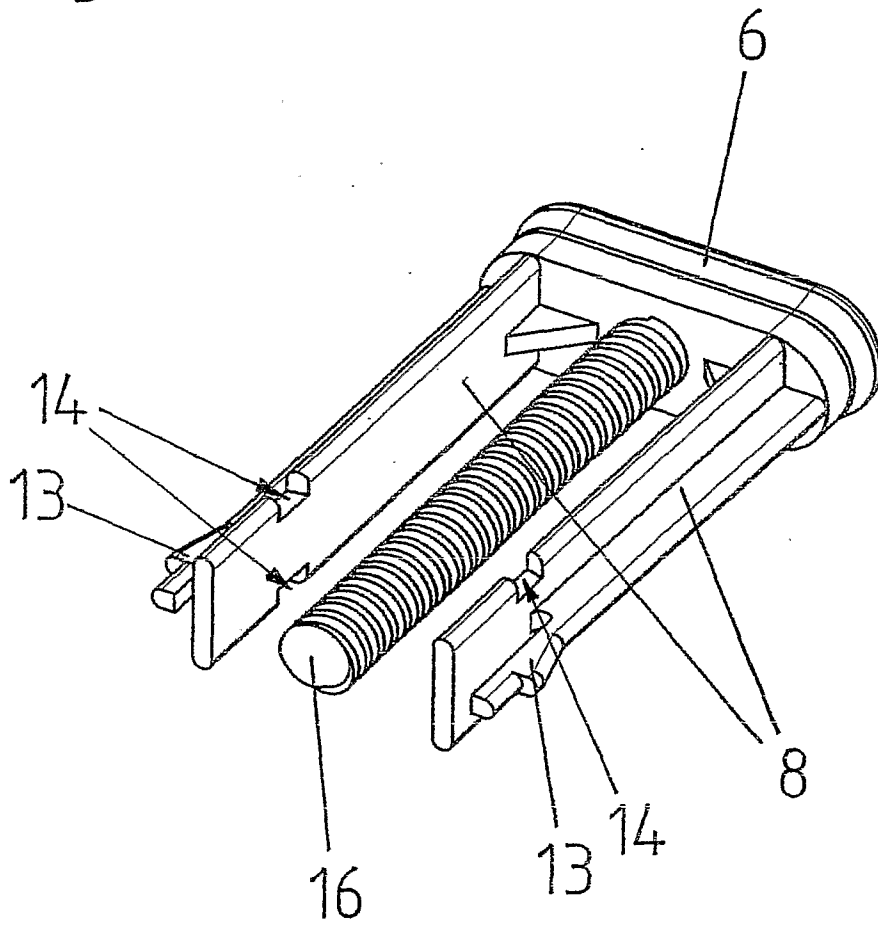
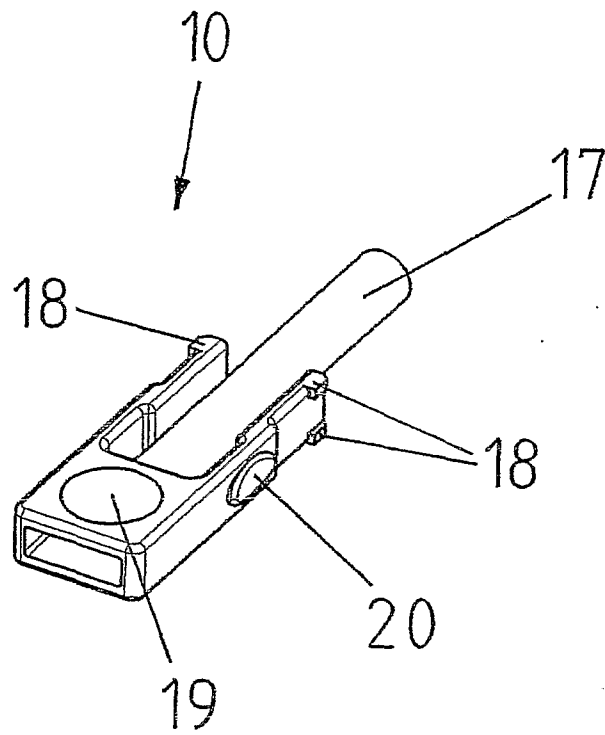


Fig.9



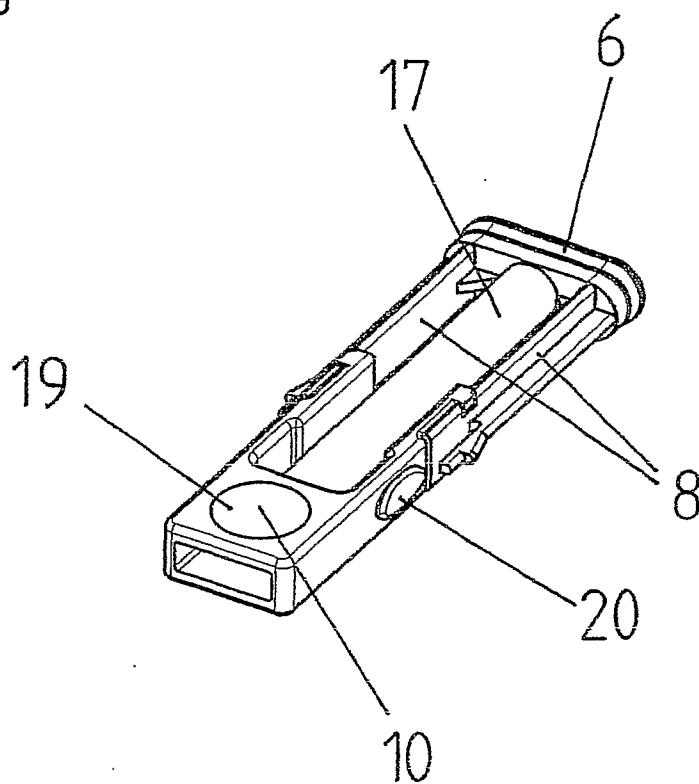
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Fig. 10



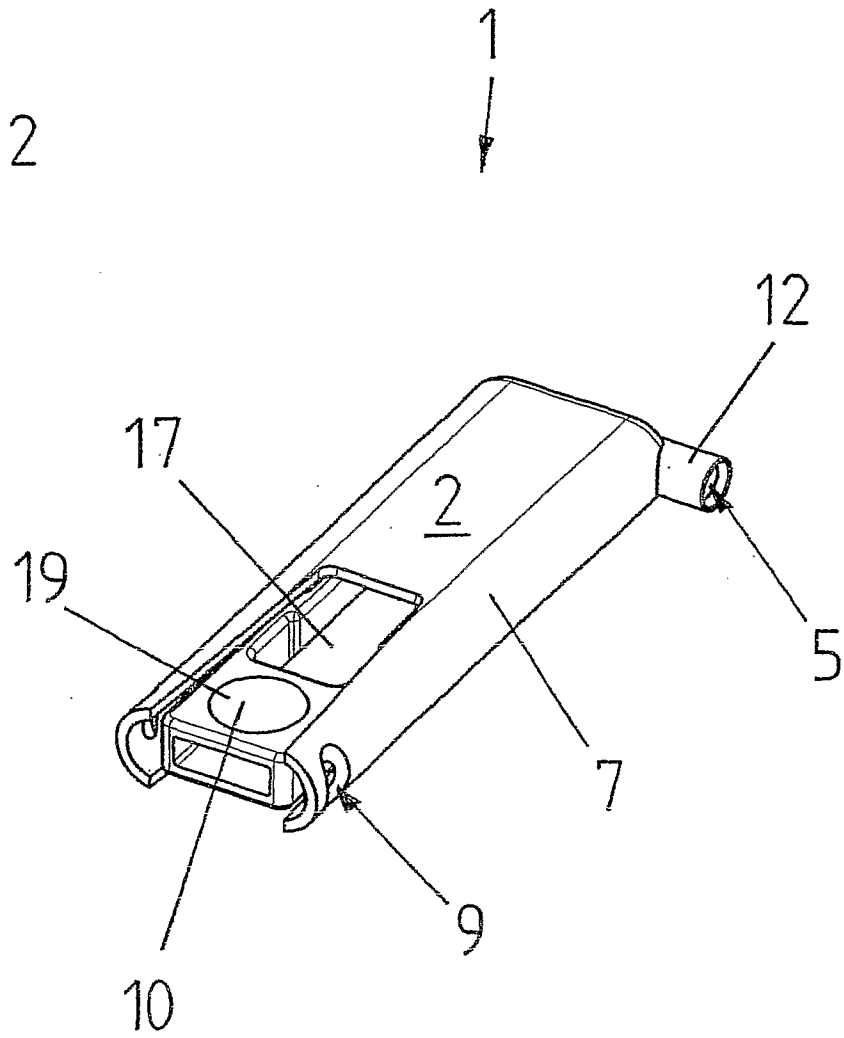
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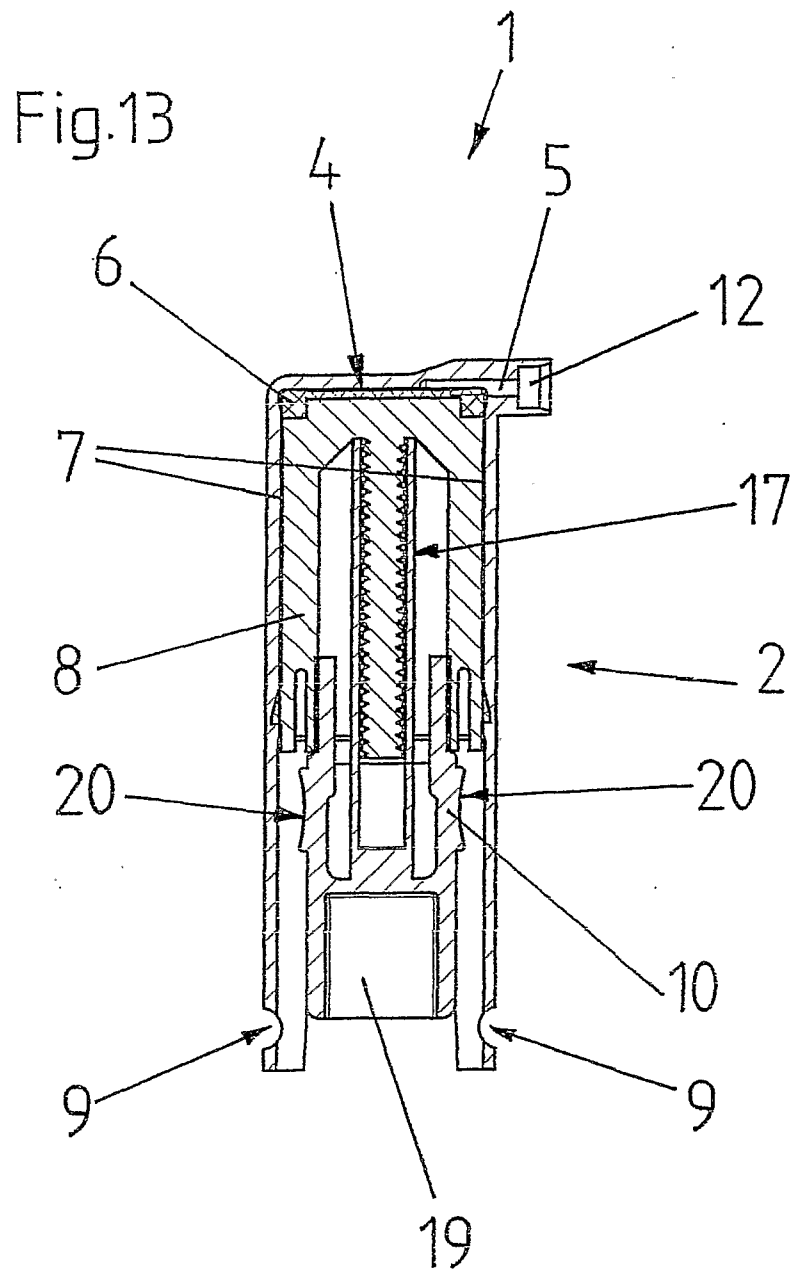
Fig.11



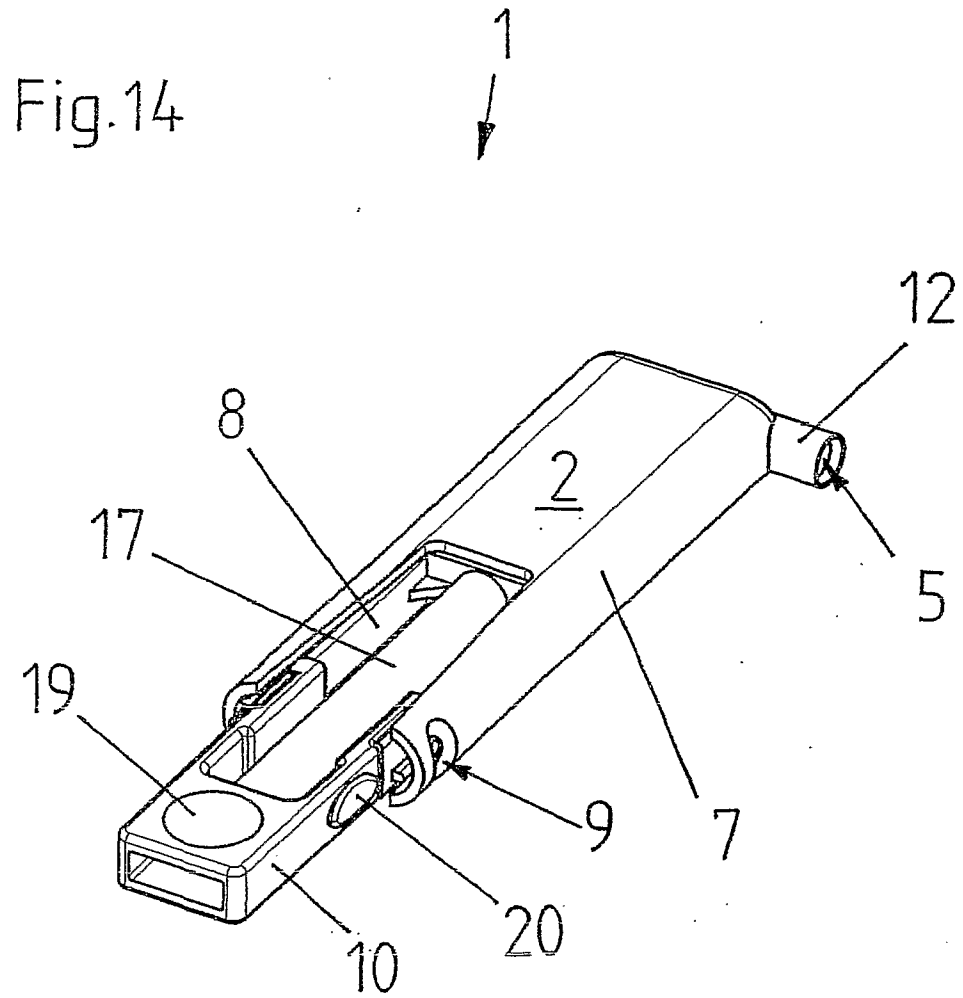
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Fig.12





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Fig.15

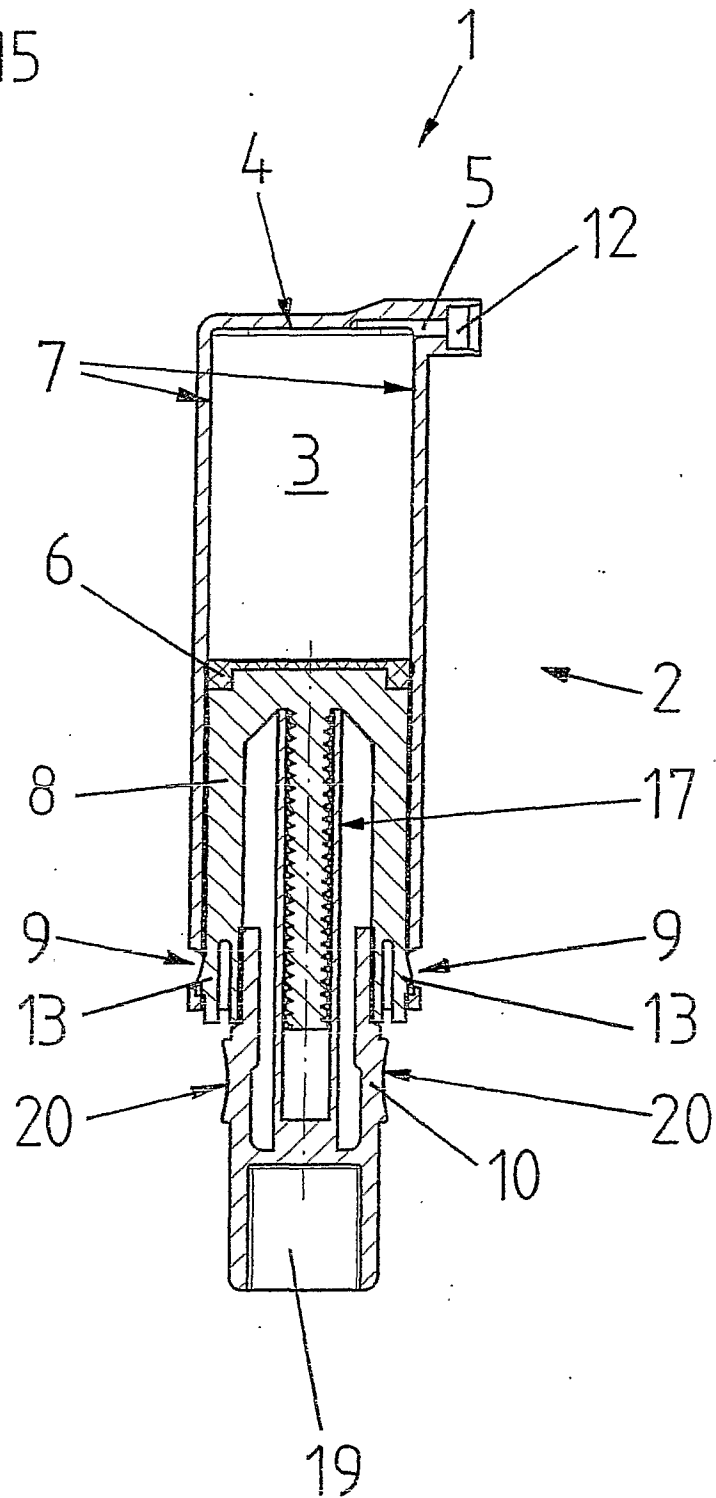
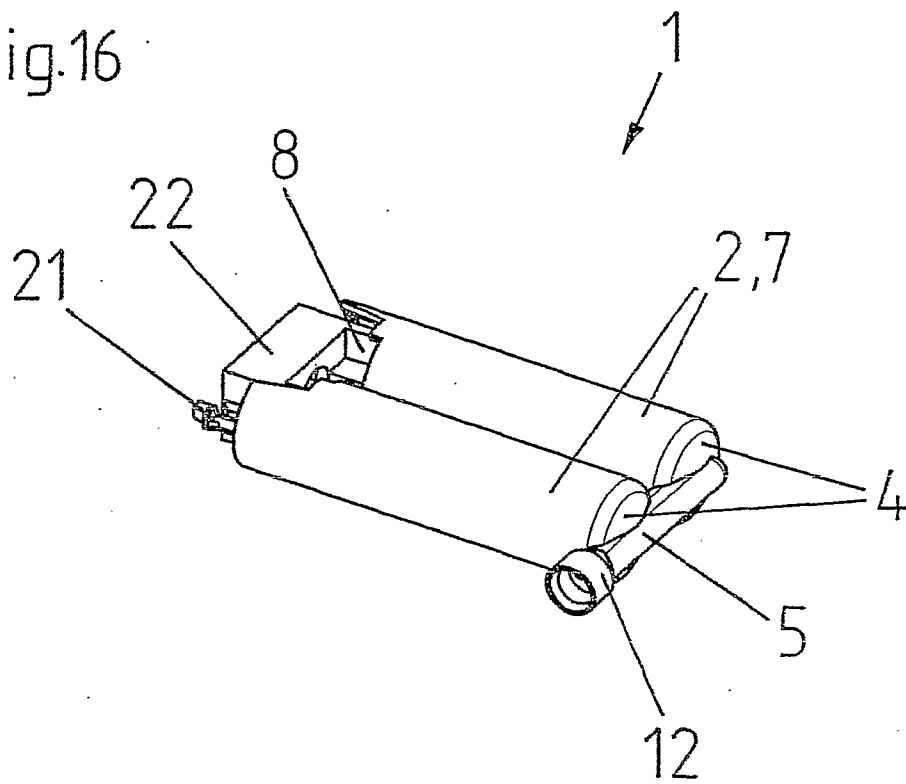


Fig.16



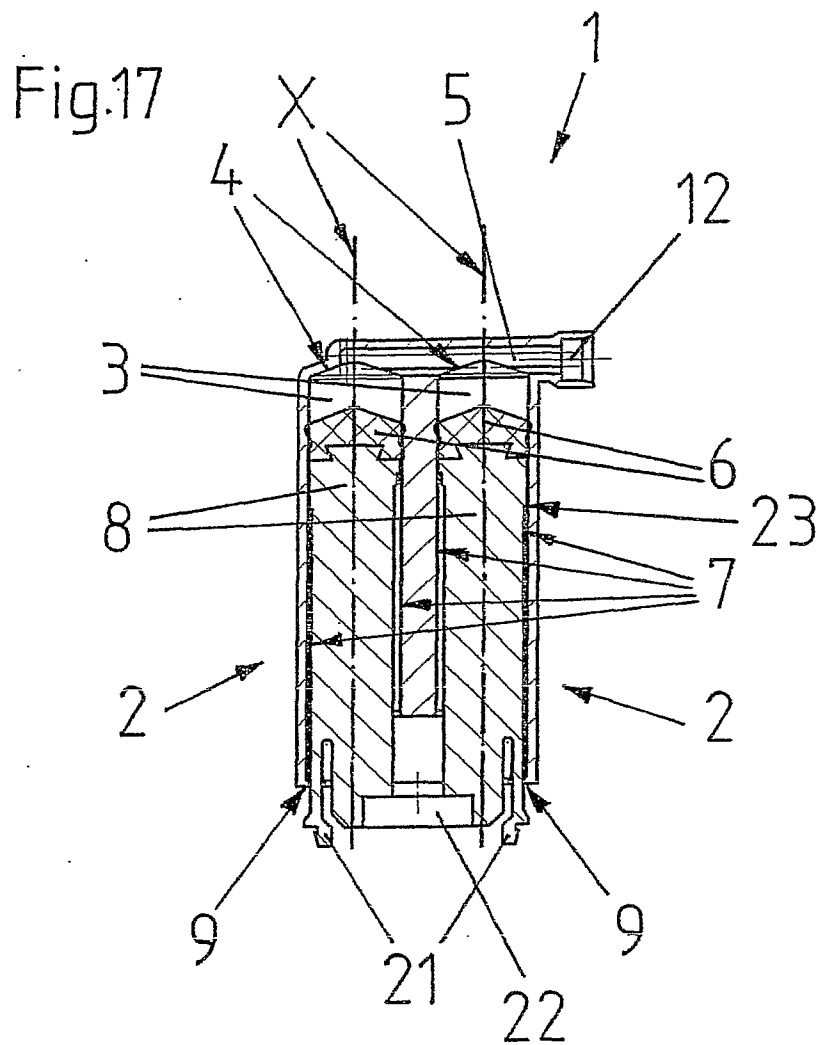


Fig.18

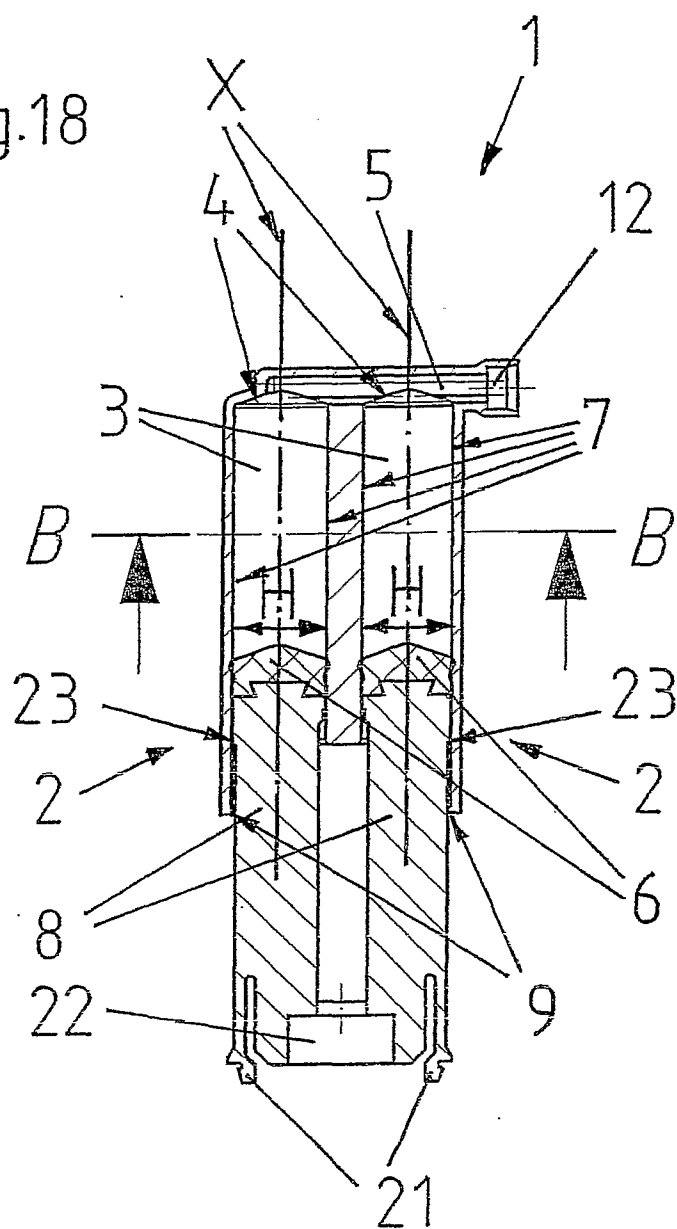


Fig. 19

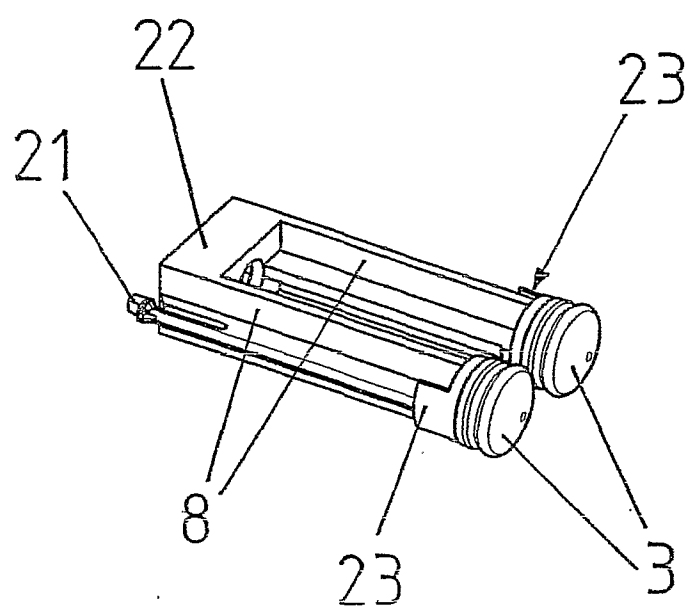
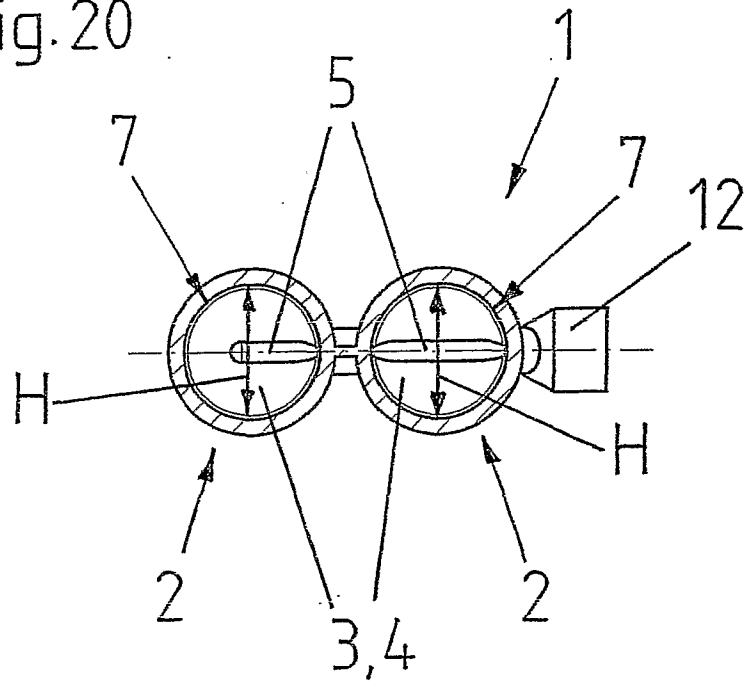
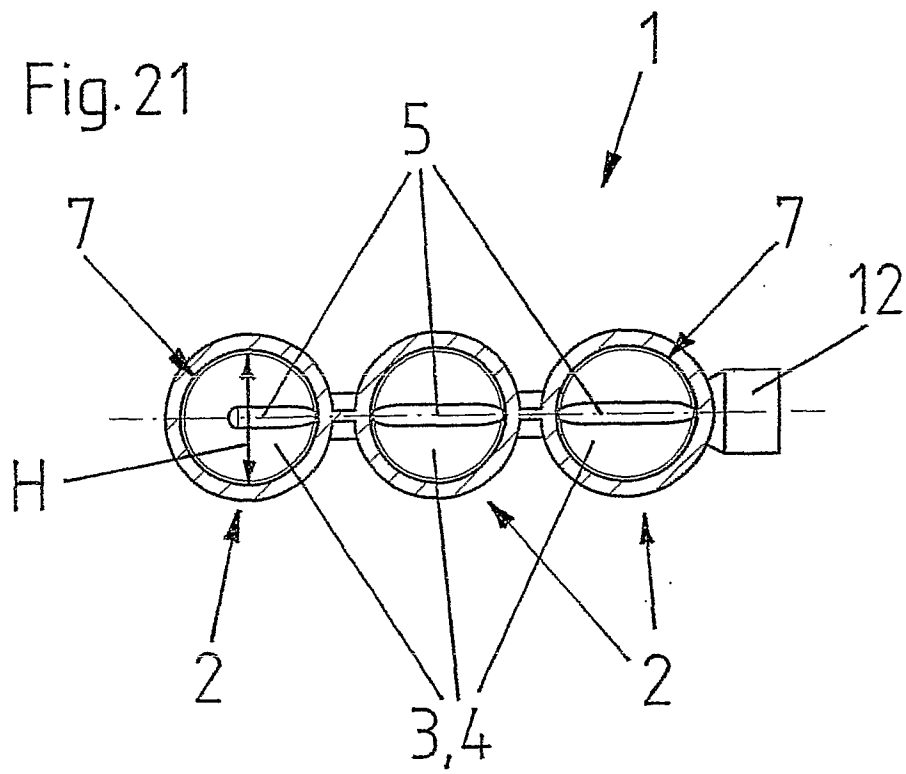


Fig. 20





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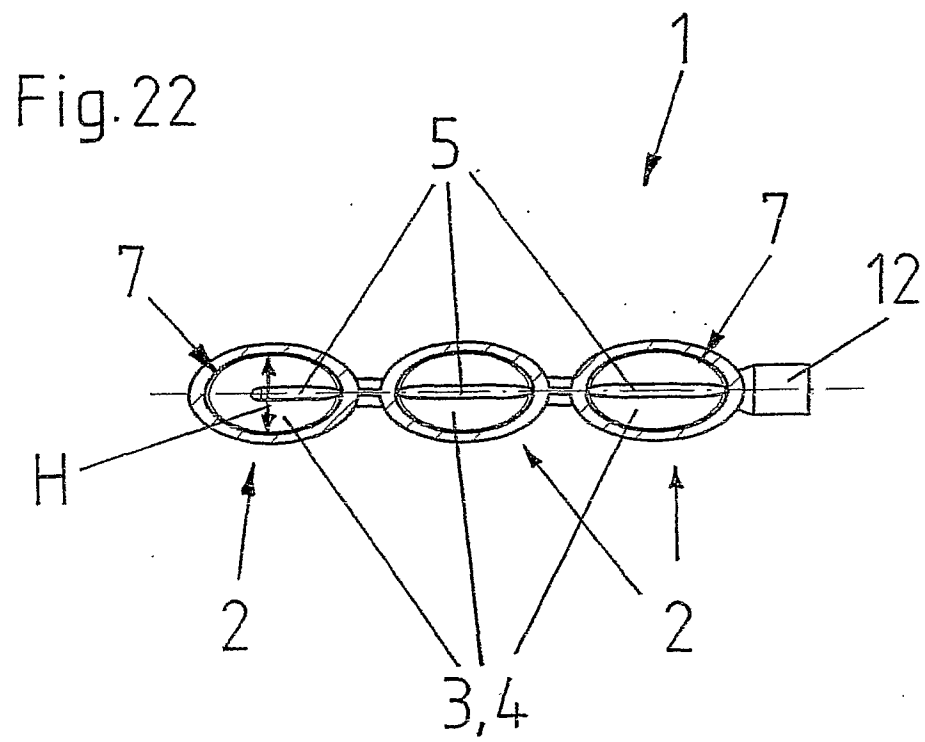
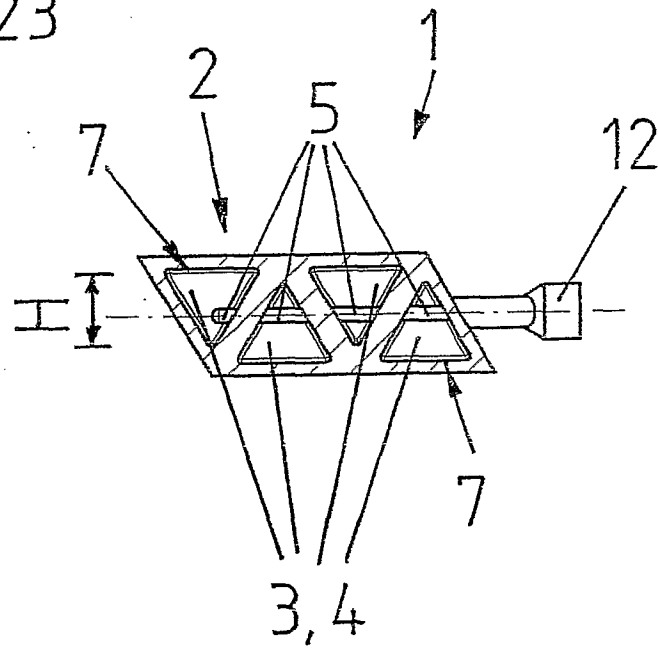
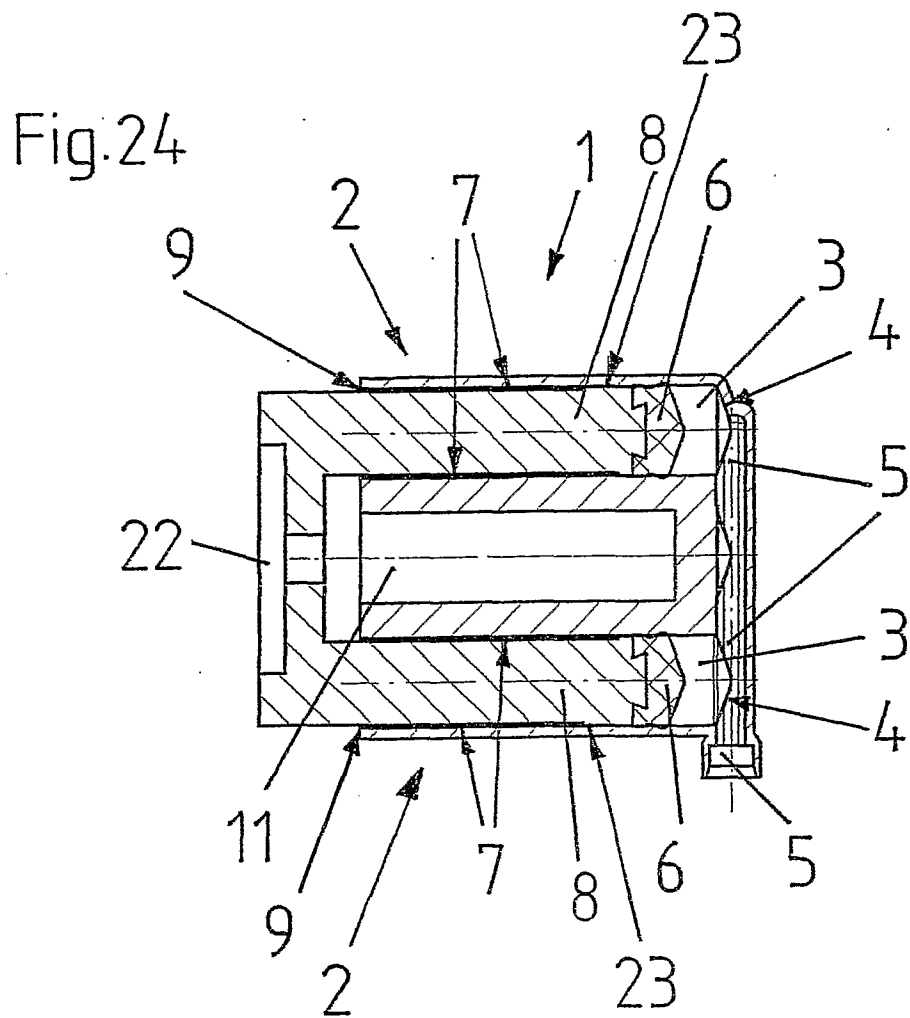


Fig.23





INTERNATIONAL SEARCH REPORT

International application No

PCT/CH2008/000137

A. CLASSIFICATION OF SUBJECT MATTER
INV. 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, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 01/30415 A2 (HILL FRANK C [US]) 3 May 2001 (2001-05-03)	1-5, 15-17, 21-26
Y	page 2, line 30 - page 4, line 6; figure 2	
Y	DE 102 33 925 A1 (MICHELER CLEMENS [DE]; RUHLAND BERND [DE]) 12 February 2004 (2004-02-12) figure 3	6-14, 18-20
Y	WO 99/22788 A (NOVONORDISK AS [DK]) 14 May 1999 (1999-05-14) figure 1	8
	-/--	

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

☒ See patent family annex.

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Date of the actual completion of the international search

28 July 2008

Date of mailing of the international search report

07/08/2008

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European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Neiller, Frédéric

INTERNATIONAL SEARCH REPORT

International application No

PCT/CH2008/000137

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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Information on patent family members

International application No

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