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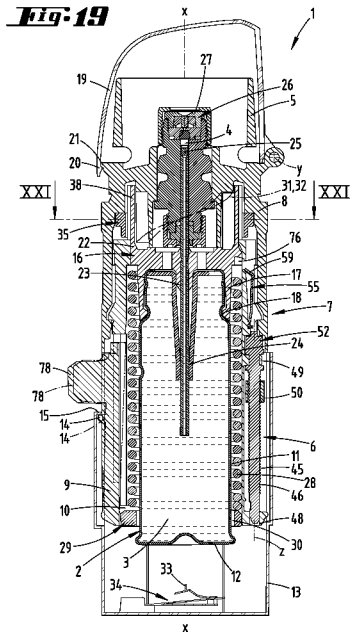
(54) Title: NEBULIZER FOR A FLUID CONTAINED IN A CONTAINER



(57) Abstract: The invention relates to an nebulizer (1) for a fluid (3) located in a container (2), with a housing (7), wherein the housing (7) has a first housing part (8) with a mouthpiece (5) and a second housing part (9) has a receiving space (10) for the container (2), which container (2) is insertable into the housing (7), wherein further for the preparation of an atomizing process the first and the second housing part are rotatable relative to one another, wherein moreover in the second housing part (9) a counter (6) is provided and the rotation of the housing parts (8, 9) can be used to count the atomization processes, the first housing part (8) furthermore being designed to act on a retaining part (16) for the container (2), which retaining part (16) can be displaced axially relative to the first and second housing parts when it is connected fixedly in terms of rotation to the second housing part (9), the retaining part (16) furthermore having an axial groove (76) which is open in an inner surface (70) of the axially overlapping second housing part (9). In order to further improve the design of an nebulizer of the type in question, it is proposed that a locking part (55) is accommodated in the second housing part (9), which locking part (55) can be moved into the axial groove (76) as a function of a number of atomization operations detected by the counter (6), in order to block the axial movability of the retaining part (16) relative to the second housing part (9).

WO 2024/209254 A1

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Description

Nebulizer for a fluid contained in a container

Field of technology

[0001] The invention relates to an nebulizer for a fluid located in a container, having a housing, the housing having a first housing part with a mouthpiece and a second housing part having a receiving space for the container, which container can be inserted into the housing, the first and second housing parts further being rotatable relative to one another for preparing an atomization process, a counter being furthermore provided in the second housing part, for counting atomizing operations carried out with an inserted container, and the rotation of the housing parts relative to one another can be used for counting the atomizing operations, wherein furthermore the first housing part is designed to act on a holding part for the container, which holding part can be displaced axially relative to the first and second housing parts when connected in a rotationally fixed manner to the second housing part, wherein furthermore the holding part has an axial groove which is open in the direction of an inner surface of the axially overlapping second housing part.

Prior art

[0002] Nebulizers of the type in question are known, for example, from WO 2007/022898 A2 (US 7 823 584 B2) and further, for example, from WO 2012/160052 A1 (US 9 827 384 B2) or also from WO 2017/080895 A1 (US 2017/0128681 A1).

[0003] The container thereby forms, whereby this description also concerns possible parts and modes of operation of the nebulizer according to the invention, a reservoir for an atomizing fluid, whereby such a container is insertable into the receiving space of the nebulizer prior to an initial use of the nebulizer. In this

regard, the container may have a rigid outer shell, for example made of a metal material, such as further for example aluminum, and an inner bag in which the fluid is stored. Preferably, the fluid is stored in the container without pressure, i.e. without propellant gas or the like.

[0004] Specifically, as a result of the rotational displacement of the housing parts relative to each other, the container within the housing is lowered, together with a hollow piston located therein. During the lowering, a spring acting on the container is tensioned. At the same time, fluid flows into a pressure chamber located outside the vessel. This can be achieved by a vacuum created in the pressure chamber. By means of a release actuation, the container together with the hollow piston located therein can be released for an upward pressure movement. Here, the fluid in the pressure chamber is pressurized and then ejected as a spray mist. For this purpose, the hollow piston can preferably be provided with a check valve at its end associated with the pressure chamber so that it can act as a piston.

[0005] Thus, by the preferred rotational displacement of the first and the second housing part relative to each other, a predetermined fluid quantity (dosing quantity) is brought into a chamber, from which the divided fluid quantity is voluntarily expelled by user intervention and atomized into an aerosol for inhalation by the user. The expulsion of the fluid dose takes place according to a pressurization, which pressure is built up in the course of the relative rotation of the first and the second housing part to each other due to tension of a spring. Thereby a pressure of for example about 1 to 40 MPa, further for example 10 to 25 MPa can act on the fluid to be expelled, whereby with each stroke a fluid delivery of about 5 to 50 µl, further for example about 10 to 20 µl, so further for example about 15 µl can take place. When atomized into an aerosol, droplets with an aerodynamic diameter of, for example, up to 20 µm, preferably between about 3 and 10 µm, can be created.

[0006] A counter is provided for recording and displaying the atomization operations performed. In the nebulizer as known from one or more of the mentioned publications, the counting is essentially carried out at a moment when the fluid dose atomization occurs due to pressurization or in the course of a twisting of the housing parts relative to each other.

[0007] In addition, the atomizers known from the above-mentioned publications, as is also preferred in the present invention, are designed in such a way that they can no longer be used after a predetermined maximum number of atomization processes has been carried out, so if necessary - at least theoretically - with complete emptying of the container, and are disposed of. When the predetermined maximum number of atomization processes is reached, a means comes into effect that prevents further use of the nebulizer.

Summary of the invention

[0008] In view of the prior art described above, the invention presents the task of further improving the design of an nebulizer of the type in question, in particular with regard to the aforementioned prevention of further use when the maximum number of atomization operations has been reached.

[0009] According to a first idea of the invention, a possible solution of the problem is given in an nebulizer, in which it is intended that a locking part is accommodated in the second housing part, which is movable into the axial groove in dependence on a number of atomizing operations detected by the counter, for blocking the axial movability of the retaining part relative to the second housing part.

[0010] According to the proposed embodiment, a blocking of the nebulizer is achieved in the sense that upon reaching a predetermined number of atomizing

operations, for example, as well as preferably, upon reaching a maximum number of atomizing operations, the further use of the nebulizer is prevented. This prevention is achieved by a specific engagement of a locking part accommodated in the second housing part, which interacts in a locking manner with the axial groove of the retaining part holding the container. The locking part thereby preferably directly prevents the axial displacement of the retaining part together with the container, which is necessary for the preparation of an inhalation process, by corresponding interaction with the axial groove. Accordingly, the decisive component of the nebulizer which must be displaced in order to expel the fluid is directly blocked in an advantageous manner, since each fluid expulsion process or inhalation process is necessarily preceded by an axial displacement of the retaining part - preferably triggered by a relative rotational displacement of the housing parts with respect to one another - in order to convey a partial fluid quantity via this into an expulsion chamber or into the said pressure chamber.

[0011] In the course of the preparation for a fluid ejection process, a count is performed in an advantageous manner, whereby preferably the relative rotation of the first and second housing parts with respect to each other is registered and accepted as a count value. Further, the corresponding counting, i.e. the corresponding action on the counter, can take place immediately at the beginning of the relative rotation, alternatively at the end of the preferably stop-limited relative rotation. In this respect, counting is also possible when an intermediate position is reached between the beginning and the end of the relative rotation of the housing parts with respect to each other.

[0012] The counting, corresponding to a change in the display of the counted atomization processes, can take place at each preferred relative rotation of the housing parts to each other by, for example, 180°, but alternatively also, for example, only at every second atomization process, so further, for example, at each relative rotation of the housing parts to each other over a total of 360°.

[0013] The immediate blocking of the axial displaceability of the retaining part, which is preferably triggered automatically when the specified number of atomization processes is reached, can also indirectly block the rotatability of the housing parts relative to one another, which can also haptically indicate to the user that the nebulizer has reached its end-of-use position. Accordingly, the nebulizer can no longer be used.

[0014] Hereinafter, the first housing part is often also described as the fixed and/or upper housing part and the second housing part is often described as the rotatable and/or lower housing part relative to this first housing part.

[0015] Further features of the invention are explained below, also in the figure description, often in their preferred assignment to the subject matter of claim 1 or to features of further claims. However, they may also be significant in an assignment only to individual features of claim 1 or of the respective further claim or independently in each case.

[0016] According to a preferred further development of the object of the invention, the locking part can be displaced between a release position and a locking position. The release position is preferably the position of the locking part which is assumed during the usual use of the nebulizer, i.e., for example, beginning with the first use, further, for example, with insertion of the container into the housing, until the predetermined maximum number of atomization processes is reached. This release position can also, as is also preferred, already be predetermined and assumed during manufacture.

[0017] The locking part can be moved from this release position further preferably only via means on the nebulizer side, further in particular only via a means on the counter side, into the locking position, whereby further preferably no non-

destructive or tool-free resetting of the locking part from the locking position into the release position is possible.

[0018] With reference to a cross-section through the locking part, in which cross-section a geometric axis of rotation about which the housing parts can rotate relative to one another is represented as a line, the locking part can be hook-shaped, with an angled section facing the retaining part, in the end of the locking part facing the mouthpiece. Preferably, the locking part engages with this angled portion in the locking position in the axial groove of the retaining part and thereby interacts in a locking manner with a boundary wall of the axial groove aligned transversely to the axial displacement direction of the retaining part.

[0019] In a further embodiment, as is also preferred, the locking part can be spring-loaded. Thus, when the maximum number of atomization processes is reached and detected, the locking part can spring from the release position into the locking position. The locking position is secured by the spring force.

[0020] The locking part can also be provided with a retaining section. This retaining section can, as is also preferred, be formed in one piece and further preferably of the same material as the aforementioned angled section. Thus, further as a whole, the locking part may be a stamped-bent part, further preferably made of a metal material, such as further for example spring steel.

[0021] In a further preferred embodiment, the locking part can be held on the second housing part so that it can move in the axial direction by means of the retaining section. This axial movability of the locking part can be limited to a stop in one direction, but if necessary also in both directions. The axial movability of the locking part allows it to be moved as a whole from the release position to the locking position. The retaining section of the locking part provides captive retention on the second housing part over the entire displacement path.

[0022] The locking part can be spring-loaded in the release position. Accordingly, the locking part remains in a spring-loaded standby position in the release position, so that after an overall axial displacement of the locking part when the maximum number of atomization processes is reached, the locking part automatically falls into the blocking position with spring support as it is angled away. This spring bias can, as is also preferred, be provided solely by the selected design and choice of material of the locking part (for example, spring steel). Alternatively, however, a separate spring element, which is supported, for example, with one end region on the lower housing part and with the other end region on the locking part, can be provided to act on the locking part, in particular on its angled section.

[0023] In particular, to secure the locking part in the release position until the maximum number of atomization operations is reached and the locking part is thus displaced into the locking position, the locking part can be latched to the second housing part in the release position. This latching position of the locking part is preferably already in place before the nebulizer is used for the first time and can only be overcome once the maximum number of atomization processes has been reached for the corresponding displacement of the locking part.

[0024] For this purpose, the locking can be released by means of a release part, which, when the maximum number of atomization processes is reached, acts on the locking part in such a way that the locking is released. The release part can also be used to actively act on the locking part in such a way that the locking part is displaced in the axial direction into the locking position.

[0025] In an advantageous embodiment, the release part can be acted upon by the counter, so that according to a further preferred embodiment, there is a direct connection between the mechanics of the counter and the release part. Thus, the release part can be acted upon by the counter during the entire counting cycle,

starting from the initial use until the maximum number of atomization processes is reached. Only when the maximum number of atomization processes has been reached is a position reached in which the release part can act on the locking part accordingly.

[0026] As a result of the spring preload, the locking part can be moved automatically into the locking position after disengagement. By a preferred active displacement of the locking part, e.g. by the release part which at the same time also cancels the latching, in axial direction, the locking position is automatically assumed due to the spring preload.

Brief description of the drawings

[0027] The invention is explained in more detail below with reference to the accompanying drawing, which is merely an example of an embodiment. It shows:

Fig. 1 the nebulizer in perspective view;

Fig. 2 the nebulizer in a further perspective view, after opening a cover cap exposing a mouthpiece;

Fig. 3 the nebulizer in a perspective exploded view;

Fig. 4 is a perspective exploded view of a spindle-shaped transmission part with a counter pointer having a release part and a locking part;

Fig. 5 an individual perspective view of the counter pointer with release part;

Fig. 6 the counter pointer with release part in a side view;

Fig. 7 the counter pointer with release part in a plan view;

Fig. 8 the transmission part in a single perspective view;

Fig. 9 the transmission part in top view;

Fig. 10 the locking part in a single perspective view;

Fig. 11 the locking part in a side view;

Fig. 12 the locking part in another view;

Fig. 13 the locking part in a further individual perspective view;

Fig. 14 a second housing part of the nebulizer with the counter arranged in a detailed perspective view;

Fig. 15 view of the illustration according to Fig. 14;

Fig. 15a a sectional view of figure 15;

Fig. 16 the section along line XVI-XVI in Fig. 15;

Fig. 17 the section along line XVII-XVII in Figure 15;

Fig. 18 the section along line XVIII-XVIII in Figure 15;

Fig. 19 the section along section plane XIX-XIX Figure 1;

Fig. 20 an another sectional view according to Fig. 19, concerning the preparation position of the nebulizer;

Fig. 21 the section along line XXI-XXI in Figure 19;

Fig. 22 an enlarged view of area XXII in Fig. 21, relating to an intermediate position with the sectional plane offset;

Fig. 23 the section along line XXIII-XXIII in Figure 22;

Fig. 24 a continuation of Fig. 20, concerning the atomization position;

Fig. 25 an exploded perspective view of a release ring with release button and associated mounting part;

Fig. 26 an additional explosion perspective view of the components according to Fig. 25;

Fig. 27 a first housing part in perspective view;

Fig. 28 the first housing part in a sectional view along sectional plane XXVIII in Fig. 27;

Fig. 29 the section according to the line XXIX-XXIX in Fig. 15; concerning a release position of the locking part;

Fig. 30 a cut along line XXX-XXX in Fig. 15a through the area of the locking part;

Fig. 31 the section along line XXXI-XXXI in Fig. 15a through the area of the locking part;

Fig. 32 a sectional view according to Fig. 29, concerning a release position for cancelling the release position of the locking part;

Fig. 33 a subsequent illustration to the illustration in Fig. 32, concerning a temporary intermediate position after the release position has been triggered;

Fig. 34 a subsequent illustration to the illustration in Fig. 33, concerning the locking position of the locking part.

Description of the embodiments

[0028] Shown and described, first with reference to the illustrations in Figures 1 to 3, is an nebulizer 1 for spraying dispensing of a fluid 3 stored in a container 2.

[0029] The nebulizer 1 is preferably designed as a portable inhaler 1, further preferably having an elongated design, round or oval in cross-section, with a length of 80 to 200 mm, considered in the direction of a longitudinal housing axis x, further preferably about 100 to 150 mm, and a width or diameter of 20 to 60 mm, considered transversely thereto, further preferably about 25 to 50 mm. Accordingly, the nebulizer 1 can be guided and used with one hand, in particular when carrying out an inhalation process.

[0030] The fluid 3 is preferably a therapeutic or pharmaceutical product to be inhaled by the user in the course of an inhalation process. Preferably, such inhalation is performed without propellant gas. Rather, the fluid 3 is preferably sucked from the container 2 into a pressure chamber 4 and, as a result of pressurization, expelled in an atomizing manner via a mouthpiece 5. The atomization processes carried out are preferably counted using a counter 6 arranged on the housing side.

[0031] The nebulizer 1 has a housing 7 which is essentially divided into a first (upper) housing part 8 and a second (lower) housing part 9 (compare essentially Figure 3), which housing parts 9 and 8 can be rotated relative to one another about the longitudinal housing axis x to a limited extent. For the description of the drawings, the first housing part 8 with the mouthpiece 5 formed thereon is defined as a stationary housing part, to which the second housing part 9 is rotatable relative to it about the longitudinal housing axis x (see direction of rotation a in Figure 1).

[0032] The container 2 is received or is receivable in the housing 7 of the nebulizer 1, in particular in a receiving space 10 in the second housing part 9. Thereby, the container 2 has a substantially circular-cylindrical or cartridge-like shape, wherein in an outer rigid casing, substantially comprising a circumferential container wall 11 and a container bottom 12, a collapsible, collapsible bag, in which the fluid 3 is held, is preferably accommodated.

[0033] A sleeve-shaped closure housing part 13 is non-rotatably connected to the second housing part 9 in the usual position of use, as shown for example in Figures 1 and 2. After removal of the closure housing part 13 with release of a latch between a housing-side latching projection 14 and a facing latching shoulder 15 of the closure housing part 13, which release can preferably be carried out without tools if required by the user, the container 2 can be inserted from below

into the housing 7, in particular into the second housing part 9 or into the receiving space 10, before initial use.

[0034] To release the latch between the second housing part 9 and the closure housing part 13, the user actuates a key projection 78 formed on the housing part 9 and projecting freely outwardly there from a slot opening 79 of the closure housing part 13, which, while yielding resiliently inwardly (see dash-dot-like illustration in Figure 19), clears the way for the closure housing part 13 to be pulled off along the x axis.

[0035] In the area of an end region facing the mouthpiece 5, the container 2 is snap-fitted to a retaining part 16 guided in the second housing part 9 linearly along the longitudinal housing axis x of the housing and non-rotatably relative to the second housing part 9.Spring-loaded, radially inwardly directed latching projections 17 of the retaining part 16 engage in a circumferential latching groove 18 of the container 2 in the area of its container neck (compare Figure 19).

[0036] In a non-use position, as shown for example in Figure 1, the mouthpiece 5 is preferably covered by a cover cap 19. The cover cap 19 can be pivotally displaceably mounted on the housing 7, here in particular on the first housing part 8. The geometric pivot axis y enabling this pivotal displacement can extend essentially perpendicular to the longitudinal axis x of the housing. In the cover cap closed position shown, for example, in Figure 1, the cover cap 19 can engage behind a counter latching section 21 provided on the housing side by means of a latching section 20 to secure the closed position.

[0037] The retaining part 16 serves in particular for dispensing and atomizing the fluid 3, preferably in a defined metered quantity. For this purpose, the retaining part 16 has, in addition to the holder 22 for the container 2, which has the latching projections 17, a suction tube 23 which, when the container 2 is latched

to the holder 22, dips into the interior of the container, in particular into the interior of the bag accommodated in the container 2, while piercing a passage opening 24 of the container 2.

[0038] The end of the suction tube 23 facing away from the container 2 and pointing upwards in the illustrations can be provided at the end with a non-return valve 25, this end region of the suction tube 23 being inserted in the pressure chamber 4 formed in a nozzle body 26 so as to be linearly displaceable along the longitudinal axis x of the housing. Viewed in the direction of extension of the longitudinal axis x of the housing, an ejection nozzle 27 can be formed associated with the mouthpiece 5 at the end of the pressure chamber.

[0039] The retaining part 16 can be spring-loaded in the direction of the mouthpiece 5, preferably with a limited stop. For this purpose, as is also preferred, a compression spring 28, for example in the form of a cylinder compression spring, can be provided, which preferably extends concentrically to the longitudinal axis x of the housing. The compression spring 28 is supported in the region of one end on the underside of the retaining part 16, surrounding the holder 22, and in the region of the opposite and, according to the illustrations, downwardly pointing end on a base part 29 latched to the second housing part 9. This base part 29 is provided with a central opening 30, through which the container 2 can project downwardly into the region of the closure housing part 13 or through which opening 30 the container 2 can be inserted for latching to the holder 22.

[0040] In preparation for an atomization or inhalation process, the compression spring 28 is tensioned, i.e. compressed in its axial extension. For this purpose, the second housing part 9 is rotated relative to the first housing part 8 about the longitudinal housing axis x, preferably by an angle of rotation of about 180°. In the process, an inclined screw surface 31 formed on the underside of the first housing

part 8, facing away from the mouthpiece 5, interacts with a counter inclined surface 32 which likewise slopes or rises in the circumferential direction. so that in the course of the rotation of the second housing part 8 relative to the stationary first housing part 9, a linear displacement of the retaining part 16 with the container 2 fixed thereto is achieved along the longitudinal housing axis x of the housing with reference to the representation in Figure 20 downwards in the direction of the base part 29 against the restoring force of the compression spring 28 (compare Figure 22). In the course of this linear displacement, fluid 3 is simultaneously sucked or conveyed from the container 2 via the suction tube 23 into the pressure chamber 4, which successively enlarges in the course of the displacement of the retaining part 16.

[0041] To equalize the pressure in the container 2, the container base 12 is pierced, in particular in the course of initial use of the container 2 during the downward displacement described above for clamping the system, for which purpose a piercing needle 33 is provided on the base side of the closure housing part 13, preferably spring-supported in the direction of the longitudinal axis x of the housing (compare Figure 20). The piercing needle 33 can, as shown, be part of a spring plate member 34 held and formed in the closure housing part 13, so that the piercing needle 33 is spring-biased in the direction of the container base 12.

[0042] The tensioned position of the retaining part 16 is initially secured. In particular, a trigger ring 35 arranged in the first housing part 8 serves this purpose, which can be acted upon from the outside by the user via a trigger button 36. For this purpose, the trigger button 36 is exposed in a window 37 of the first housing part 7 (compare Figures 3 and 21).

[0043] The trigger button 36 may be covered by the cover cap 19 in a non-use position of the nebulizer 1 and held in a protected hidden position.

[0044] The trigger ring 35 initially and substantially surrounds a wall 38 of the retaining part 16 surrounding the area of the counter inclined surface 32, with an increase in the thickness of the ring measured in the radial direction on both sides viewed in the circumferential direction from the area of the trigger button 36 (compare Figure 21). In the region substantially diametrically opposite the trigger button 36, the trigger ring 35 has a receptacle 39 (see also Figure 3) for a housing-side rib, which opens upwards in a U-shape with respect to an orientation of the nebulizer 1 according to Figure 19, whereby a rotationally secure retention of the trigger ring 35 as a whole in the first housing part 8 is provided.

[0045] With reference to the illustrations, the receptacle 39 is formed on the top side of the trigger ring 35. A control projection 40 is formed on the underside of the trigger ring 35 approximately overlapping in the direction of the longitudinal housing axis x with respect to the receptacle 39. During preparation of the nebulizer 1 by relative rotation of the housing parts 8 and 9 in the circumferential direction, this projection interacts with a counter control projection 41 of the second housing part 9, which rotates in the course of the rotation relative to the stationary trigger ring 35, in such a way that loading of the trigger ring 35 in the region of the control projection 40 in a radially inward direction is achieved via sloping surfaces of the projections sliding against one another.

[0046] Due to the relative rotation of the housing parts 8 and 9 with respect to each other, a relative rotation of the retaining part 16 with respect to the fixed trigger ring 35 is also achieved in this position, so that the control projection 40 can enter radially inwardly into a recess 42 formed on the end face of the wall 38 of the retaining part 16.

[0047] If necessary, with overrunning of the counter control projection 41, the control projection 40 can partially engage in the recess 42 in order to lock the clamped position, thereby supporting itself on a shoulder of the retaining part 16

which delimits the recess 42 in the circumferential direction, as well as, if necessary, further or alternatively thereto, with a radial shoulder of the projection spaced in the circumferential direction of the trigger ring 35 from the inclined surface of the control projection 40, on an associated radial shoulder of the counter control projection 41, which shoulder can be reached after overrunning (compare figures 21 to 23).

[0048] This firstly provides a safeguard to prevent reverse rotation and/or further rotation of the second housing part 9 relative to the first housing part 8 in the clamped position.

[0049] In the clamping direction, the ring-side control projection 40 is overlapped by the counter control projection 41.

[0050] In addition, the tension of the release ring 35 when the retaining part 16 is displaced downwards, possibly supported by the radial displacement of the control projection 40 by the counter control projection 41, may result from the design of the trigger ring 35 with different thicknesses in the circumferential direction, in particular in this region diametrically opposite the trigger button 36 and having the control projection 40, an inward displacement of the trigger ring 35 - preferably together with the control projection 40 - in a radially inward direction, so that the relevant section of the trigger ring 35 lies in front of the facing end face of the wall 38 of the retaining part 16 in a locking manner in the axial direction and engages in the recess 42, respectively engages in the recess 42 and locks in front of the bottom of the recess 42 (compare Figures 22 and 23).

[0051] For inhalation, the user moves the cover cap 19 to a position exposing the mouthpiece 5 as shown in Figure 16 and surrounds the mouthpiece 5 with the lips. With the subsequent unlocking of the compression spring 28, the fluid dose divided in the pressure chamber 4 is expelled via the ejection nozzle 27 (compare

Figure 24). The user can inhale the emerging aerosol 43, for which purpose air can be sucked in via at least one ventilation opening 44 at the foot side of the mouthpiece 5.

[0052] Unlocking is effected by a pressure actuation of the release button 36 by the user, whereby the trigger ring 35 is loaded in such a way that its area essentially opposite the trigger button 36, in particular having the control projection 40, is displaced back radially outward again, which leads to a release of the retaining part 16. Accordingly, this can spring back into the initial position as a result of the release of the restoring force of the compression spring 28, whereby the fluid is expelled from the pressure chamber 4 and via the ejection nozzle 27 via the now closed non-return valve 25, which serves quasi as a piston in the course of this process. This can result in a nozzle jet fan of the aerosol 43 as shown in Figure 24, with an opening angle of about 30 to 150°, further about 75 to 115°.

[0053] An atomizing operation can be registered and counted using the counter housed in the housing 7. The counting takes place with the rotation of the housing parts 8 and 9 relative to each other, i.e. with the preparation of the nebulizer 1 for carrying out a fluid discharge. In this connection, it is not necessary for an action on the counter 6 in the sense of a count to take place with every rotation of the housing parts 8 and 9 relative to one another. For example, only every second or even every fourth rotation can lead to an action on the counter 6 in the sense of a count.

[0054] Part of the counter 6 is first of all a spindle-like transmission part 45 with a geometrical spindle axis z, which transmission part 45, when aligned parallel to the longitudinal housing axis x, has a thread 46 running around the outside which rises along the spindle axis z.

[0055] The transmission part 45 lies freely rotatable about its spindle axis z in a bead-like recess 47 of the housing wall 68 of the second housing part 9, wherein further the transmission part 45 is held on the second housing part 9 substantially rotatably and captively at each end. For this purpose, the transmission part 45 can engage in a bore 48 provided on the foot side of the recess 47 and, opposite the latter, be gripped in a region of a waist formation 80 by clip projections 49 formed on the housing side (compare Figures 14, 15 and 17).

[0056] Along the shaft axis z, a counter pointer 50 meshing with the thread 46 of the transmission part 45 is movable. Starting from a position in which the counter pointer 50 is assigned to the end of the second housing part 9 facing away from the mouthpiece 5, this pointer moves successively in the direction of the end region of the transmission part 45 enclosed by the clip projections 49. Accordingly, with reference to the illustration in Figure 19, for example, there is a successive movement of the counter pointer 50 from bottom to top (see arrow r in Figure 14).

[0057] The counter pointer 50 points with its pointer tip directed transversely to the shaft axis z to a scale 51 arranged on the outside of the wall of the second housing part 9 (see Figures 14 and 15). The value to which the pointer tip of the counter pointer 50 points can, as is preferred, indicate the number of possible atomization processes still available or, alternatively, the number of atomization processes already performed.

[0058] This count value of the scale 51 is preferably visible to the user through a transparent portion of the closure housing part 13.

[0059] The transmission part 45 is rotationally driven by the relative rotational displacement of the housing parts 8 and 9 with respect to each other, which is carried out in the course of the inhalation preparation, for which purpose the

transmission part 45 has a tooth formation 52 in the region of the end enclosed in the bore 48, with, for example, four radially aligned teeth 53 distributed uniformly in the circumferential direction, as also shown in Figure 16.

[0060] On the inside of the wall of the first (upper) housing part 8, in the region of a free end facing away from the mouthpiece 5 and further essentially in the plane of the tooth formation 52, two diametrically opposite drivers 54 are formed, in a plane transverse to the longitudinal axis x of the housing (compare enlarged sectional view in Figure 16), for cooperation with the tooth formation 52 when the housing parts 8 and 9 are rotated relative to one another (compare direction of rotation arrow a of the housing part and direction of rotation arrow b of the transmission part in Figure 16). Due to this diametrical arrangement of two drivers 54, a rotational effect on the transmission part 45 and thus a linear displacement on the counter pointer 50 along the spindle axis z is achieved for each inhalation preparation.

[0061] When a maximum number of atomization processes has been reached, i.e., when a predetermined maximum use of nebulizer 1 has been reached, the nebulizer 1 is not to be usable any further, since in this situation it cannot be ensured that container 2 still contains a sufficient amount of fluid to carry out proper inhalation. A supposed inhalation without or with reduced fluid output is to be prevented.

[0062] For this purpose, the nebulizer 1 has a locking part 55 which, in the locked position, prevents the axial displaceability of the retaining part 16 for building up the tension of the compression spring 28 and for filling the pressure chamber 4.

[0063] The locking part 55, the details of which are shown, for example, in Figures 10 to 13, initially has a plate-like base section 56 with a window-like latching

opening 57. The base section 56 is thereby bounded on one side by a section with an impact surface 58 projecting from the base section 56 in a cross-section perpendicular to the longitudinal extension of the locking part 55.

[0064] Opposite this loading surface 58, the base section 56 merges, preferably in one piece and of the same material, into two arms which are essentially adjacent to one another and determine the elongated design of the locking part 55 in the direction of the spindle axis z, of which a shorter arm 61 forms a hook-shaped bend 59 in the region of the free end and the other (longer) arm 62 bears a retaining section 60.

[0065] In a cross-section in which the spindle axis z is shown as a line, for example according to the representation in Figure 29, the bend 59 assumes an obtuse angle α to the arm 61 carrying the bend 59, which angle α can be about 115 to 150°, further for example about 135°, wherein further with respect to the cross-section the bend 59, starting from the arm 61, runs in the opposite direction to the section of the base section 56 forming the impact surface 58.

[0066] A bead-like embossing 63 in the transition area of the arm 61 into the angled bend 59 and further in the area of the angled bend 59 itself provides a high degree of stability and rigidity in this area of the locking part 55.

[0067] The finger-like projecting angled bend 59 forms a blocking edge 64 in the region of the free end.

[0068] The arm 62, which is approximately 1.3 to 1.8 times longer than the arm 61, merges in the region of its end remote from the impact surface 58 into a U-connecting web 65, which in turn carries the aforementioned retaining section 60, which in cross-section preferably extends approximately parallel to and at a distance from the arm 62. The free edge 66 of the retaining section 60 is directed

towards the base section 56, the retaining section 60 projecting with its free end in the cross-section and with respect to a projection perpendicular to the cross-sectional plane beyond the blocking edge 64 of the bend 59 (compare Figure 12).

[0069] The locking part 55 is preferably made of a stamped and bent spring plate.

[0070] Further preferably, the locking part 55 is held on the outer wall side of the second housing part 9. For this purpose, a radially outwardly open pocket 67 can be provided in the housing wall 68 substantially as an extension of the bead-like recess 47 for receiving the spindle-shaped transmission part 45, in which pocket 67 the locking part 55 is axially displaceable to a limited extent and captive (compare Figures 15 and 29).

[0071] The locking part 55 is held essentially by enclosing the edge 69 of the second housing part 9 facing the mouthpiece 5 by the U-connection web 65 and the adjoining retaining section 60, which preferably rests against the inner surface 70 of the housing wall 68 (compare Figures 29 and 30). The selected length of the retaining section 60 provides limited axial displaceability of the locking part 55 while retaining the retaining means on the second housing part 9.

[0072] In a release position according to, for example, Figures 29 to 30, in which the aforementioned maximum number of atomization operations has not yet been reached, the locking part 55 lies locked in the pocket 67. A latching projection 81 formed on the bottom side of the pocket 67 dips into the window-like latching opening 57 of the base section 56 to prevent displacement. In this release position, the angled bend 59, spring-loaded due to the selected design and choice of material of the locking part 55, rests with its blocking edge 64 on the facing bottom surface of the pocket 67.

[0073] To assume the locking position, the pointer 50 of the counter 6, which moves in the direction of the locking part 55 in the course of the atomization processes, is firmly connected to a finger-like release part 72. This release part 72 moves essentially in the direction of the spindle axis z and has at its upper end, as shown in Figure 29, a control finger 73 provided with a lift-out bevel 74.

[0074] When the maximum number of atomization processes is reached, the release part 72, which is displaced together with the counter pointer 50 in the direction of the arrow r, reaches the impact surface 58 of the locking part 55 with its control finger 73 and lifts the latter as a result of the lift-off bevel 74 formed on the control finger 73 in such a way that the latching between the housing-side latching projection 71 and the latching opening 57 of the locking part 55 is cancelled. The locking part 55 can now, in the course of the further displacement of the release part 72 in the direction of arrow r, be displaced in the axial direction to such an extent that ultimately the angled bend 59 with its blocking edge 64 loses its support on the bottom of the pocket and falls with spring support through an opening 75 formed in the bottom of the pocket 67, in order to engage through this opening into an axial groove 76 of the retaining part 16, which is open radially outwards in the direction of the inner surface 70 of the second housing part 9, which overlaps the retaining part 16.

[0075] The axial groove 76 is bounded on the mouthpiece side by a locking shoulder 77. According to the illustration in Figure 34, this locking shoulder 77 extends in the locking position essentially directly above the blocking edge 64 of the locking part 55, so that the retaining part 16 as a whole, correspondingly together with the container 2, is prevented from axial movement, preferably permanently, in the stop-limited basic position according to Figure 19. The nebulizer 1 cannot be used any further in this locking position, which cannot be undone without causing damage.

[0076] Due to the given spring bias, under which the locking part 55 is preferably in the release position as well as in the locking position and in any intermediate position, the locking position is particularly secured. Even vibrations which could, if necessary, cancel support of the locking position by contact of the release part 72 with the locking part 55 would not lead to cancellation of the locking position. Rather, in this case, the locking part 55, which is not further raised by the release part 72 in the region of the base section 56, would completely lay down against the facing bottom surface of the pocket 67 as a result of the spring load. Irrespective of this, the angled bend 59 with its blocking edge 64 remains permanently engaged in the axial groove 76 of the retaining part 16.

[0077] The foregoing is intended to explain the inventions covered by the application as a whole, which also independently advance the prior art at least by the following combinations of features in each case, two, more or all of which combinations of features may also be combined, namely:

An nebulizer 1 characterized in that a locking part 55 is received in the second housing part 9, which is movable into the axial groove 76 in response to a number of atomizing operations detected by the counter 6, for blocking axial movability of the retaining part 16 relative to the second housing part 9.

An nebulizer 1 characterized in that the locking part 55 is displaceable between a release position and a locking position.

An nebulizer 1 characterized in that the locking part 55 is hook-shaped, with a bend 59 facing the retaining part 16 at the end of the locking part 55 facing the mouthpiece.

An nebulizer 1 characterized in that the locking part 55 is resiliently formed.

An nebulizer characterized in that the locking part 55 is provided with a retaining section 60.

An nebulizer characterized in that the locking part is movably held on the housing part 9 in the axial direction by means of the retaining section 60.

An nebulizer characterized in that the locking part 55 is spring biased in the release position.

An nebulizer characterized in that the locking part 55 latches to the second housing part 9 in the release position.

An nebulizer which is characterized in that the latching can be released by means of a release part 72 which can be acted upon by the counter 6.

An nebulizer of the characterized in that the locking part 55 is moved to the locking position according to the spring bias after the latch is released.

[0078] All disclosed features are essential to the invention (individually, but also in combination with each other). The disclosure of the application hereby also includes the full disclosure content of the associated/attached priority documents (copy of the previous application), also for the purpose of including features of these documents in the claims of the present application. The subclaims characterize, even without the features of a referenced claim, with their features independent inventive further developments of the prior art, in particular in order to make divisional applications on the basis of these claims. The invention indicated in each claim may additionally have one or more of the features indicated in the foregoing description, in particular with reference numerals and/or in the list of reference numerals. The invention also relates to forms of design in which individual features mentioned in the above description are not realized, in

particular insofar as they are recognizably dispensable for the respective intended use or can be replaced by other means having the same technical effect.

Reference list

1	Nebulizer	30	Opening
2	Container	31	Inclined bevel
3	Fluid	32	Counter inclined surface
4	Pressure chamber	33	Piercing needle
5	Mouthpiece	34	Spring plate member
6	Counter	35	Trigger ring
7	Housing	36	Trigger button
8	First housing part	37	Window
9	Second housing part	38	Wall
10	Receiving space	39	Receptacle
11	Container wall	40	Control projection
12	Container base	41	Counter control projection
13	Closure housing part	42	Recess
14	Latching projection	43	Aerosol
15	Latching shoulder	44	Ventilation opening
16	Retaining part	45	Transmission part
17	Latching projection	46	Thread
18	Latching groove	47	Recess
19	Cover cap	48	Bore
20	Latching section	49	Clip protrusion
21	Counter latching section	50	Counter pointer
22	Holder	51	Scale
23	Suction tube	52	Tooth formation
24	Passage opening	53	Tooth
25	Non-return valve	54	Driver
26	Nozzle body	55	Locking part
27	Ejection nozzle	56	Base section
28	Compression spring	57	Latching opening
29	Base part	58	Impact surface

59	Bend
60	Retaining section
61	Arm
62	Arm
63	Embossing
64	Blocking edge
65	U-connecting web
66	Edge
67	Pocket
68	Housing wall
69	Edge
70	Inner surface
71	Latching projection
72	Release part
73	Control finger
74	Lift-off bevel
75	Opening
76	Axial groove
77	Locking shoulder
78	Key projection
79	Slot opening
80	Waist formation

x	Longitudinal axis of housing
y	Pivot axis
z	Spindle axis
α	angle

a	Direction of rotation
b	Direction of rotation
r	Arrow

Claims

1. Nebulizer (1) for a fluid (3) located in a container (2), having a housing (7), the housing (7) having a first housing part (8) with a mouthpiece (5) and a second housing part (9) having a receiving space (10) for the container (2), which container (2) can be inserted into the housing (7), the first and the second housing part (8, 9) are rotatable relative to one another, wherein furthermore a counter (6) is provided in the second housing part (9) for counting atomization processes carried out with an inserted container (2), and the rotation of the housing parts (8, 9) relative to one another can be used for counting the atomization processes, the first housing part (8) further being designed to act on a retaining part (16) for the container (2), which retaining part (16) is axially displaceable relative to the first and second housing parts (8, 9) when rotationally fixedly connected to the second housing part (9), the retaining part (16) furthermore having an axial groove (76) open in an inner surface (70) of the axially overlapping second housing part (9), characterized in that a locking part (55) is accommodated in the second housing part (9), which locking part (55) can be moved into the axial groove (76) as a function of a number of atomization operations detected by the counter (6), for blocking the axial movability of the retaining part (16) relative to the second housing part (9).

2. Nebulizer according to claim 1, characterized in that the locking part (55) is displaceable between a release position and a locking position.

3. Nebulizer according to one of the preceding claims, characterized in that the locking part (55) is hook-shaped, with a bend (59) pointing towards the retaining part (16) at the end of the locking part (55) facing the mouthpiece (5).

4. Nebulizer according to one of the preceding claims, characterized in that the locking part (55) is of springy design.

5. Nebulizer according to any one of the preceding claims, characterized in that the locking part (55) is provided with a retaining portion (60).

6. Nebulizer according to any one of the preceding claims, characterized in that the locking part (55) is movably held on the second housing part (9) in the axial direction by means of the retaining section (60).

7. Nebulizer according to one of the preceding claims, characterized in that the locking part (55) is under spring bias in the release position.

8. Nebulizer according to one of the preceding claims, characterized in that the locking part (55) is latched to the second housing part (9) in the release position.

9. Nebulizer according to one of the preceding claims, characterized in that the latching can be released by means of a release part (72) which can be acted upon by the counter (6).

10. Nebulizer according to any one of the preceding claims, characterized in that the locking part (55) is moved into the locking position according to the spring bias after the latch is released.

Fig: 1

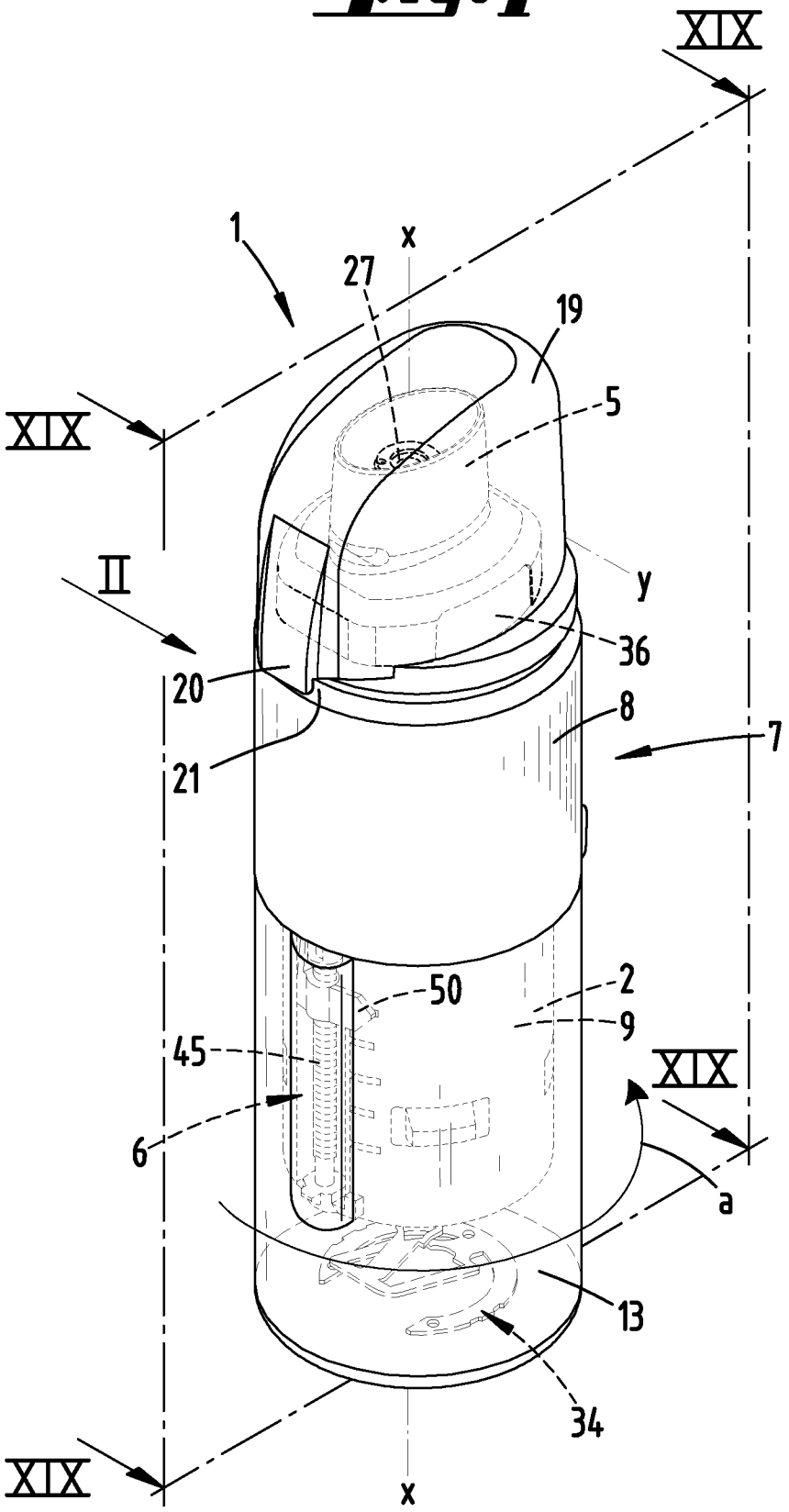
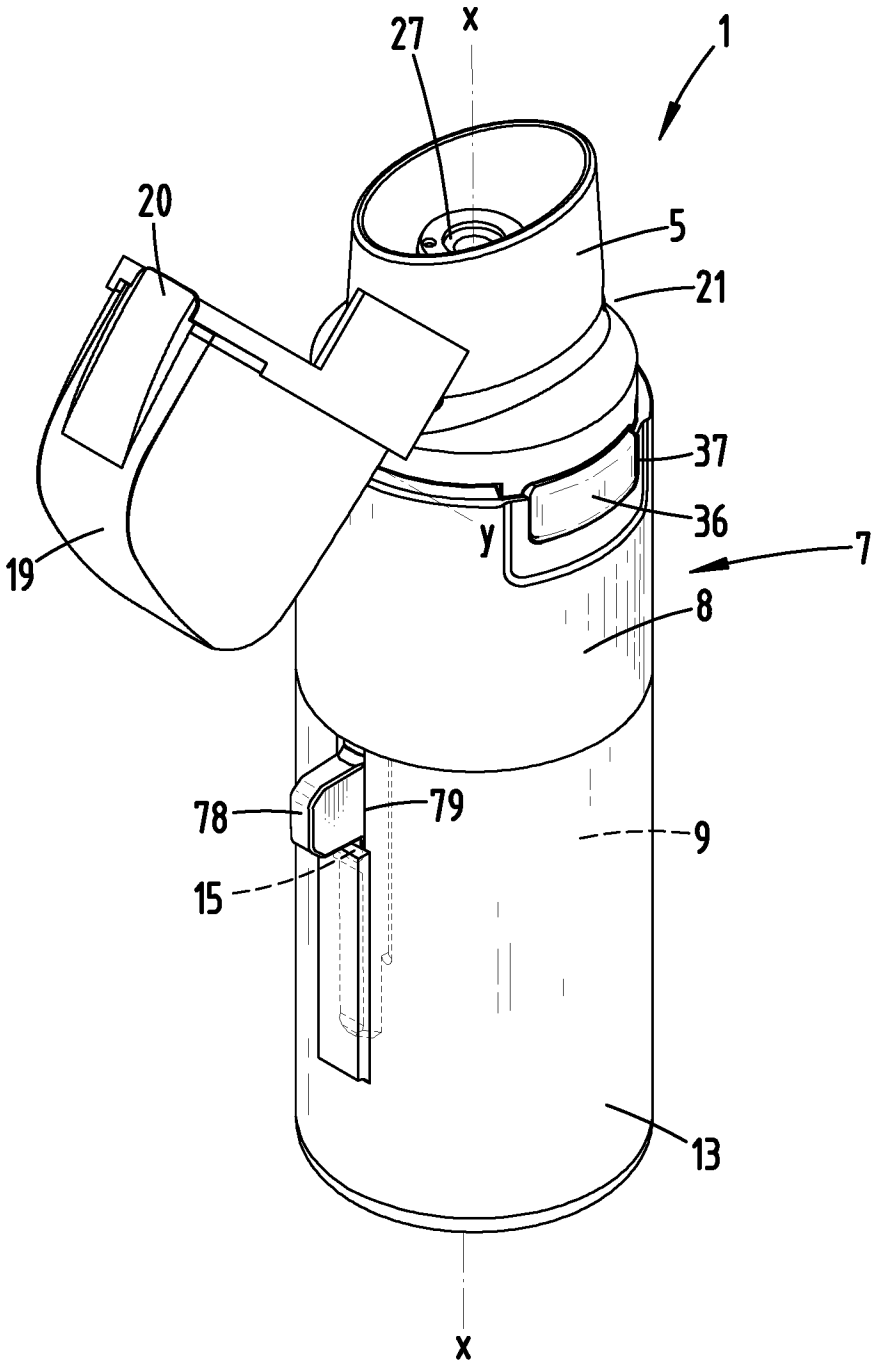
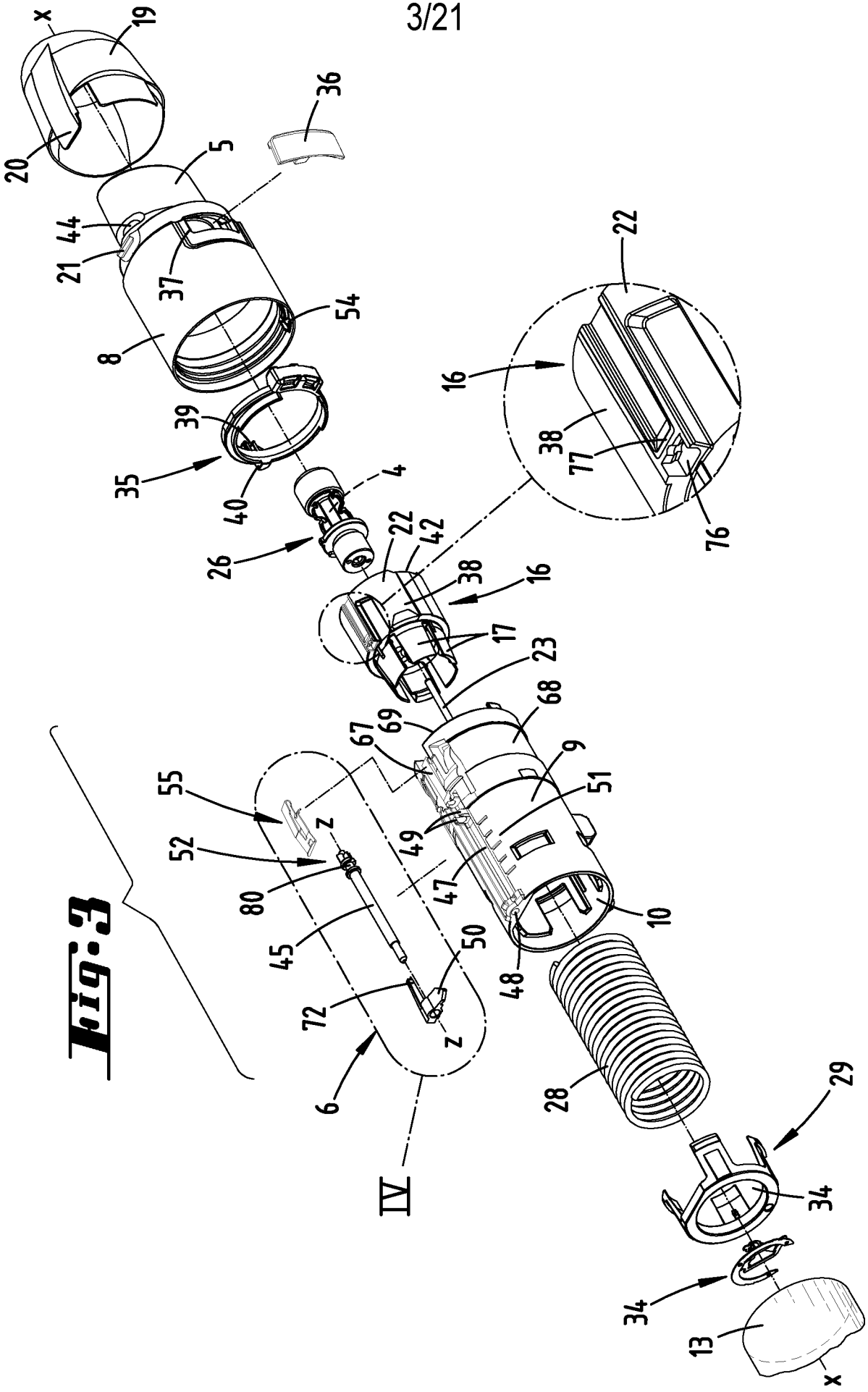


Fig: 2

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77
76

Fig.3

Fig:4

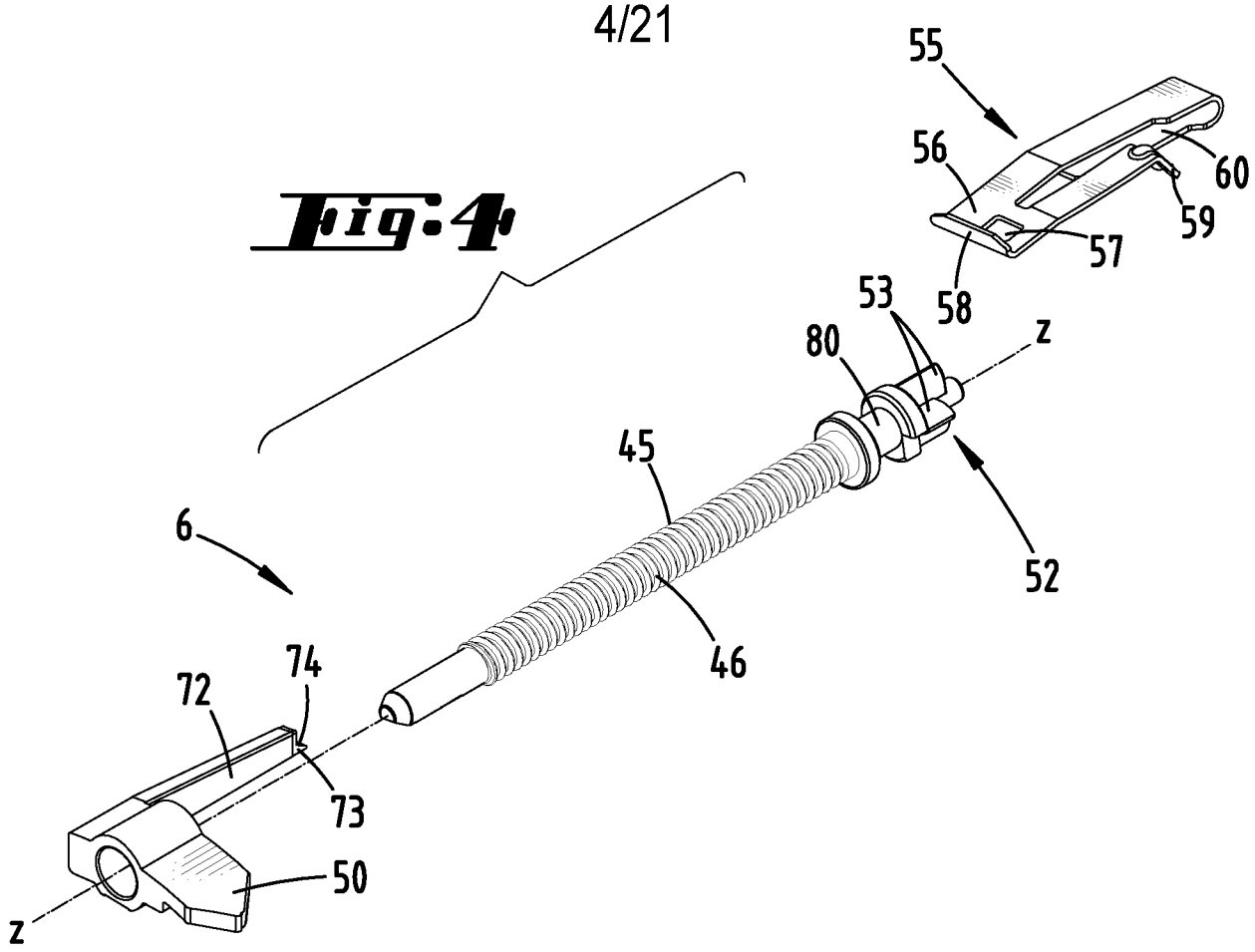

Fig:5

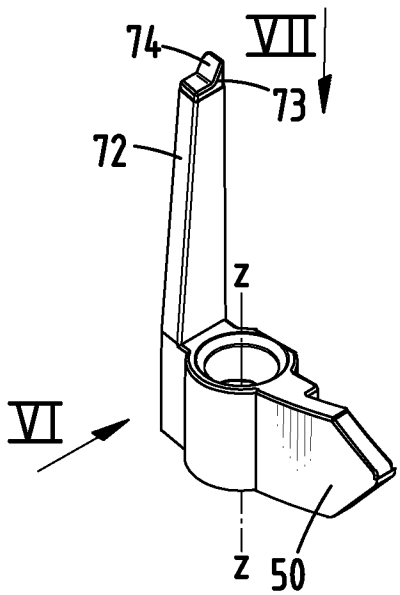

Fig:6

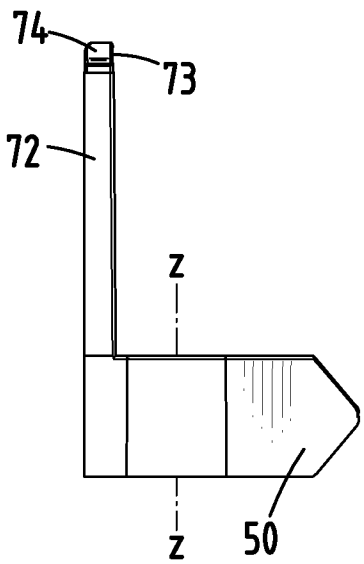

Fig:7

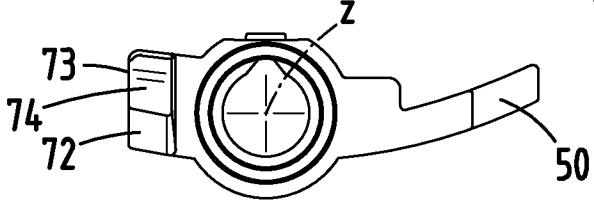

Fig: 8

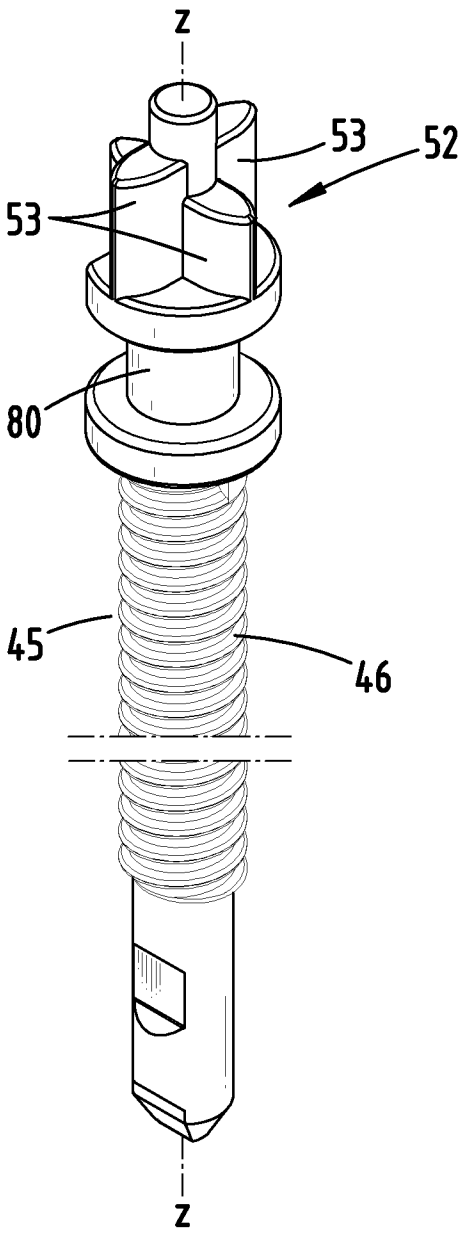

Fig: 9

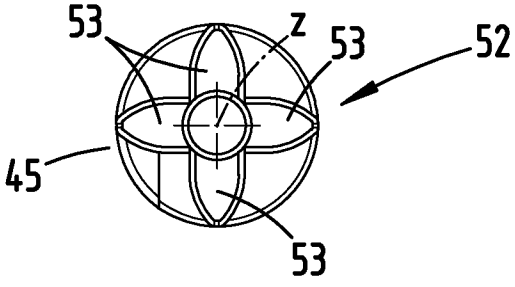

Fig: 10

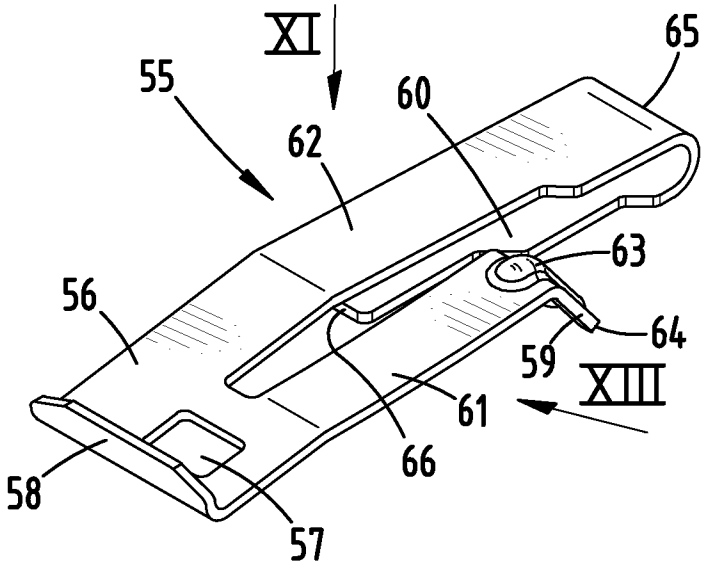

Fig: 11

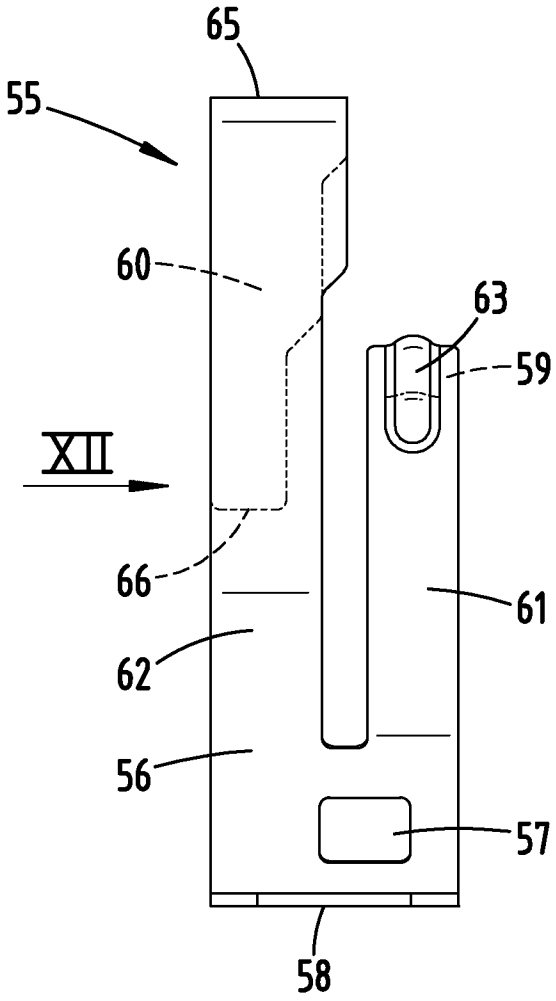

Fig: 12

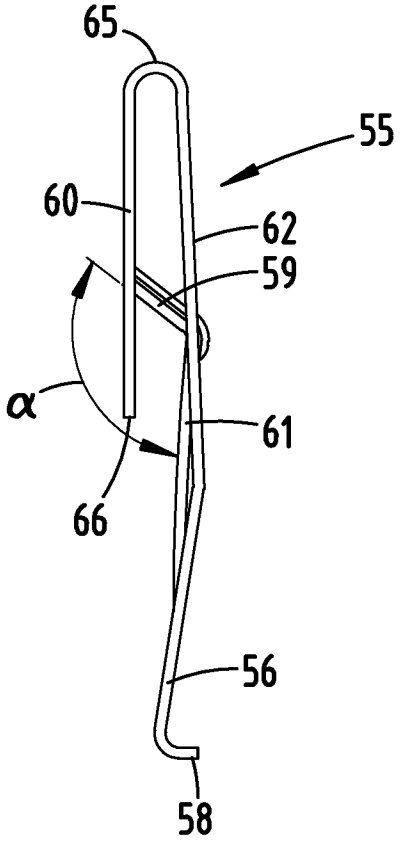

Fig: 13

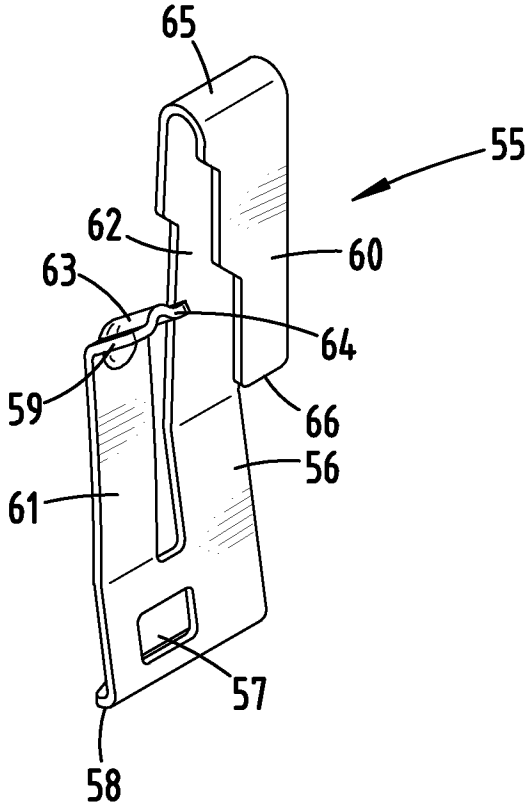

Fig: 14

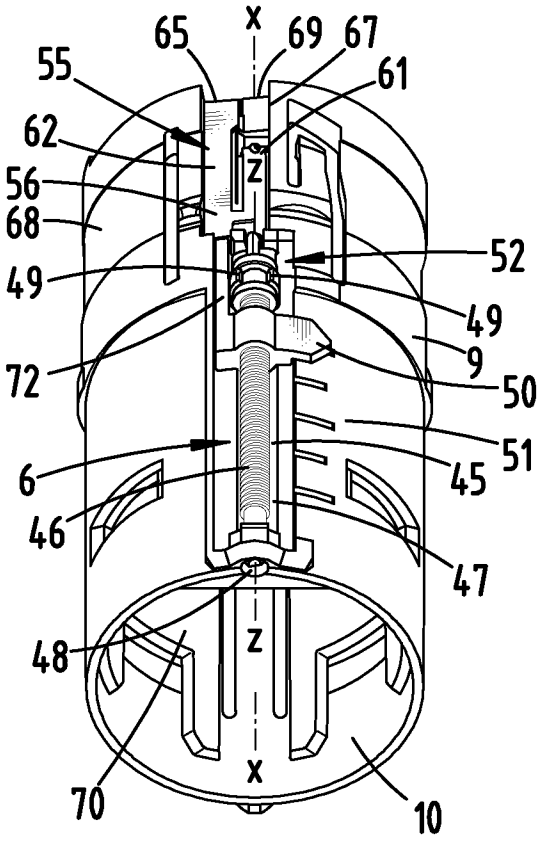

Fig: 15

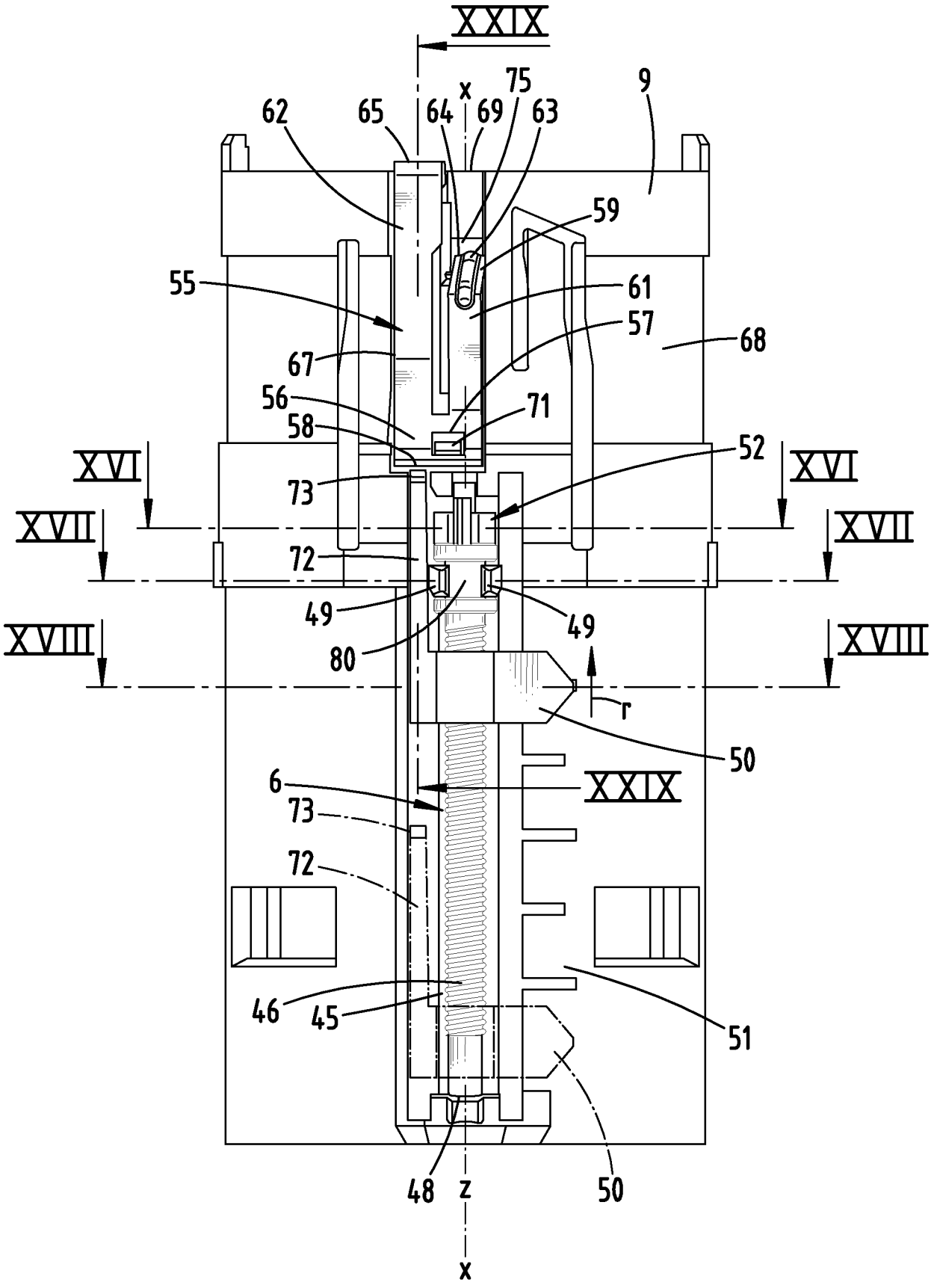
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Fig. 15a

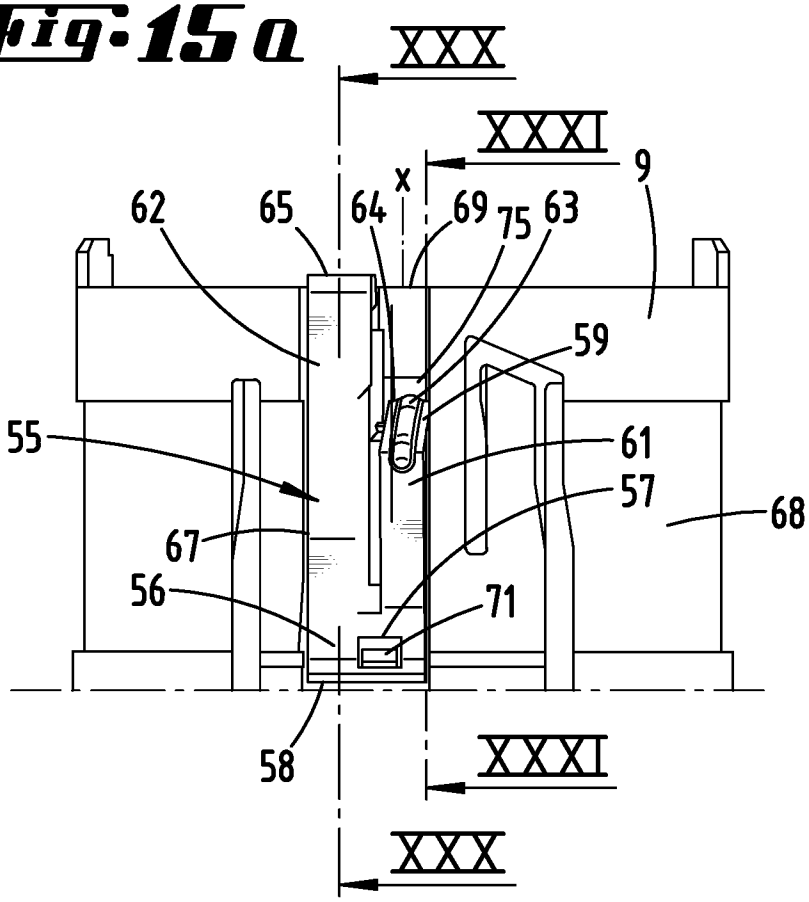

Fig. 16

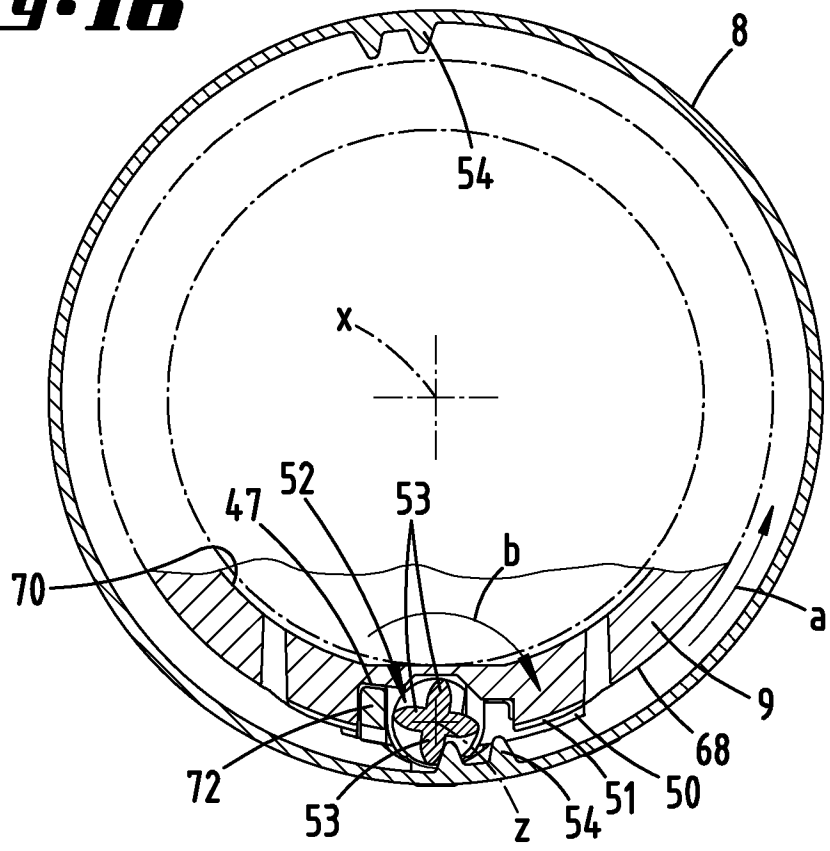

Fig:17

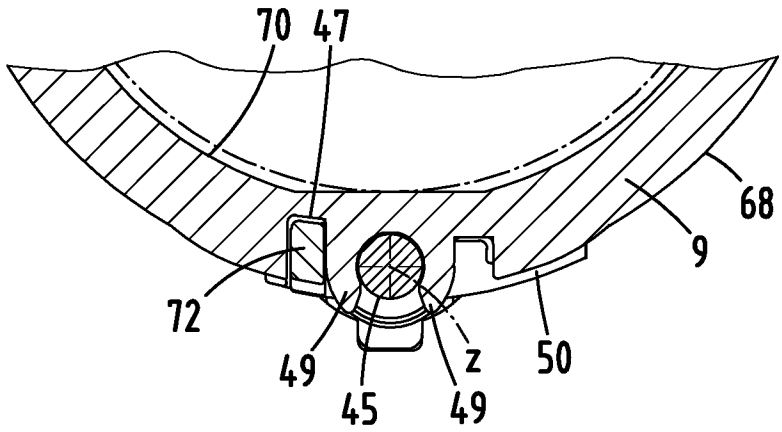

Fig:18

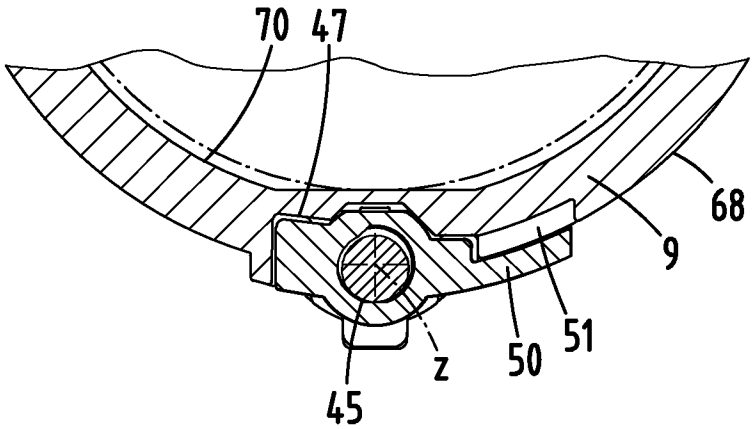

Fig: 19

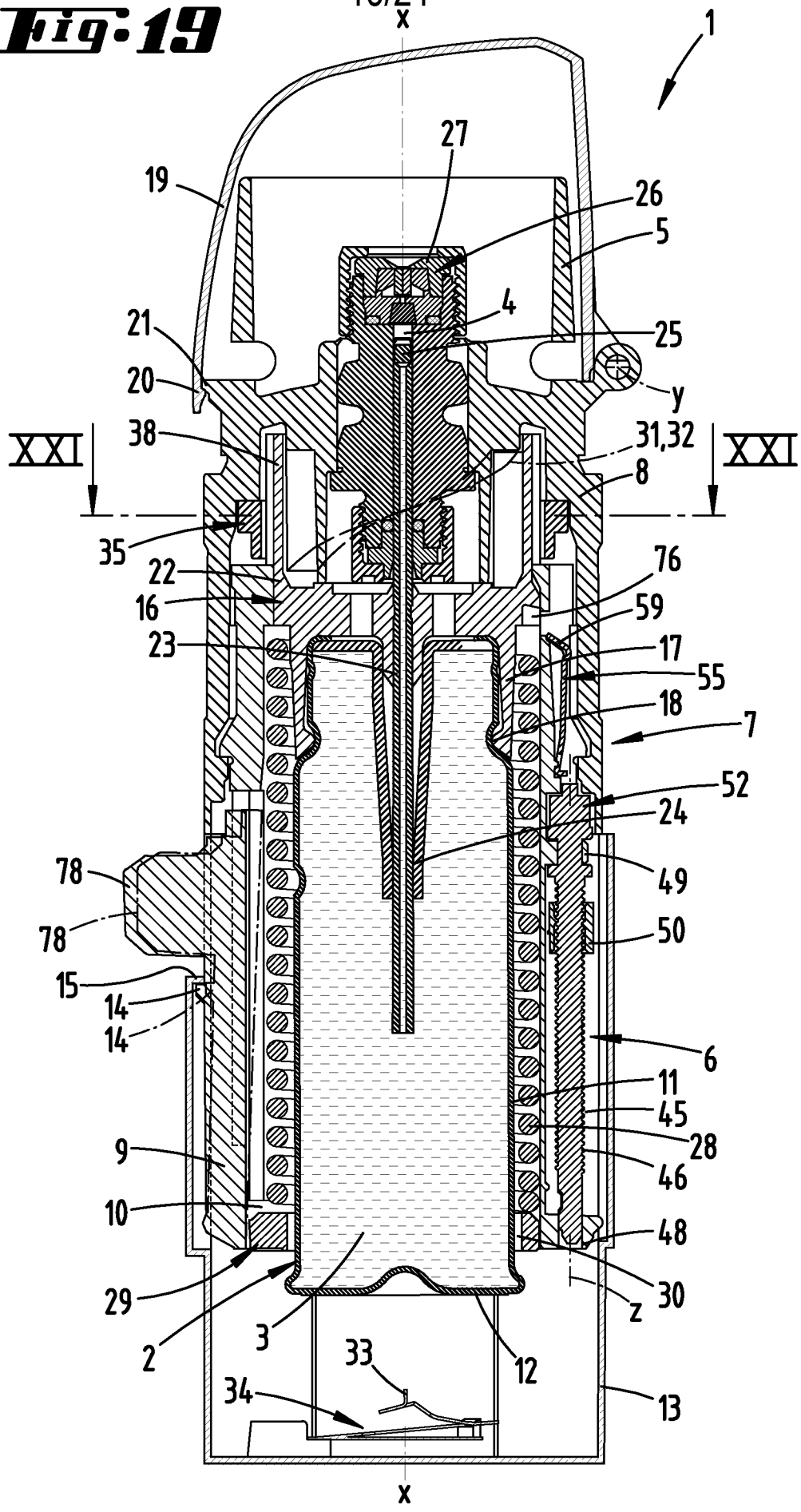
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Fig: 20

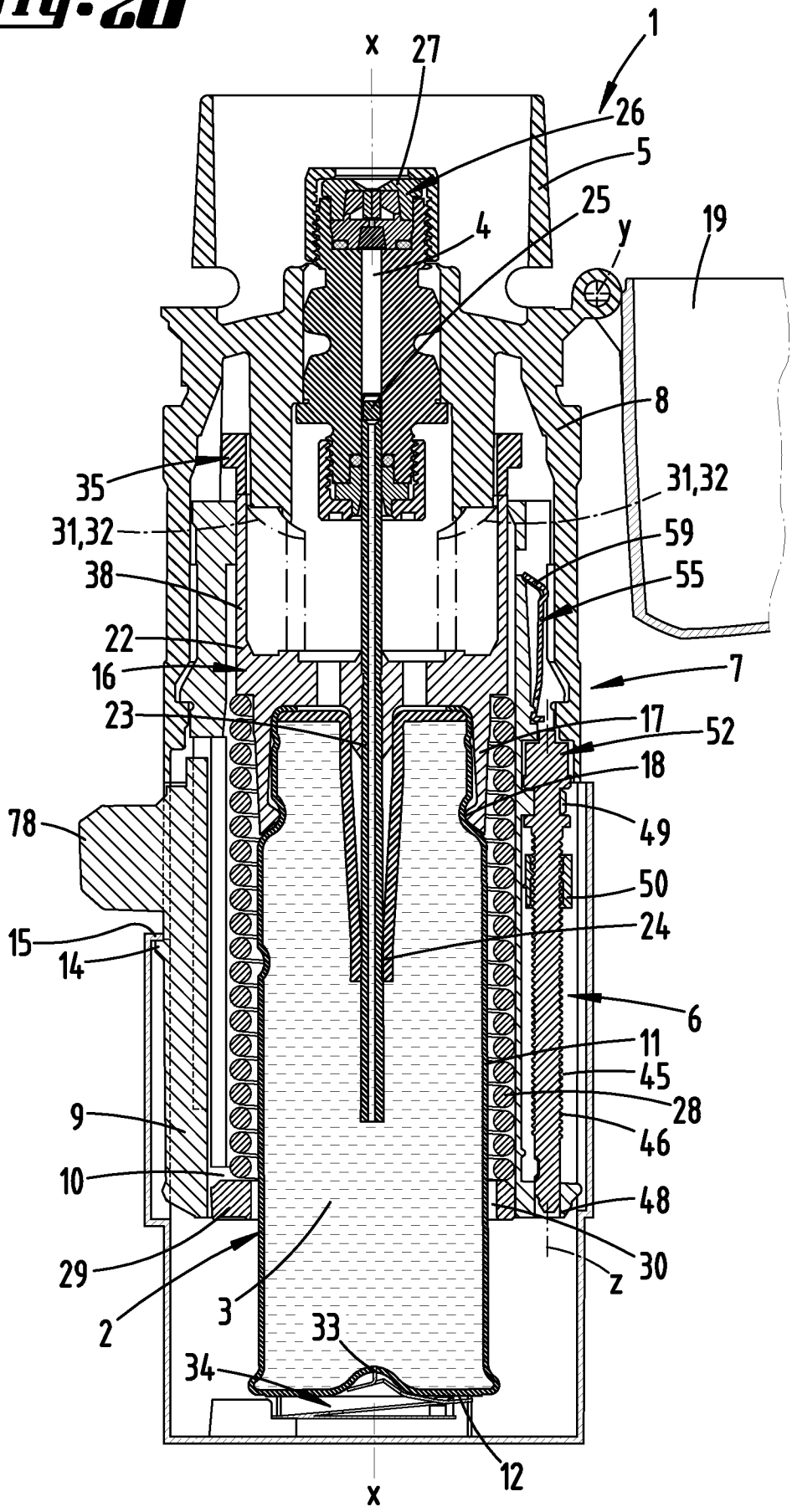
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Fig: 21

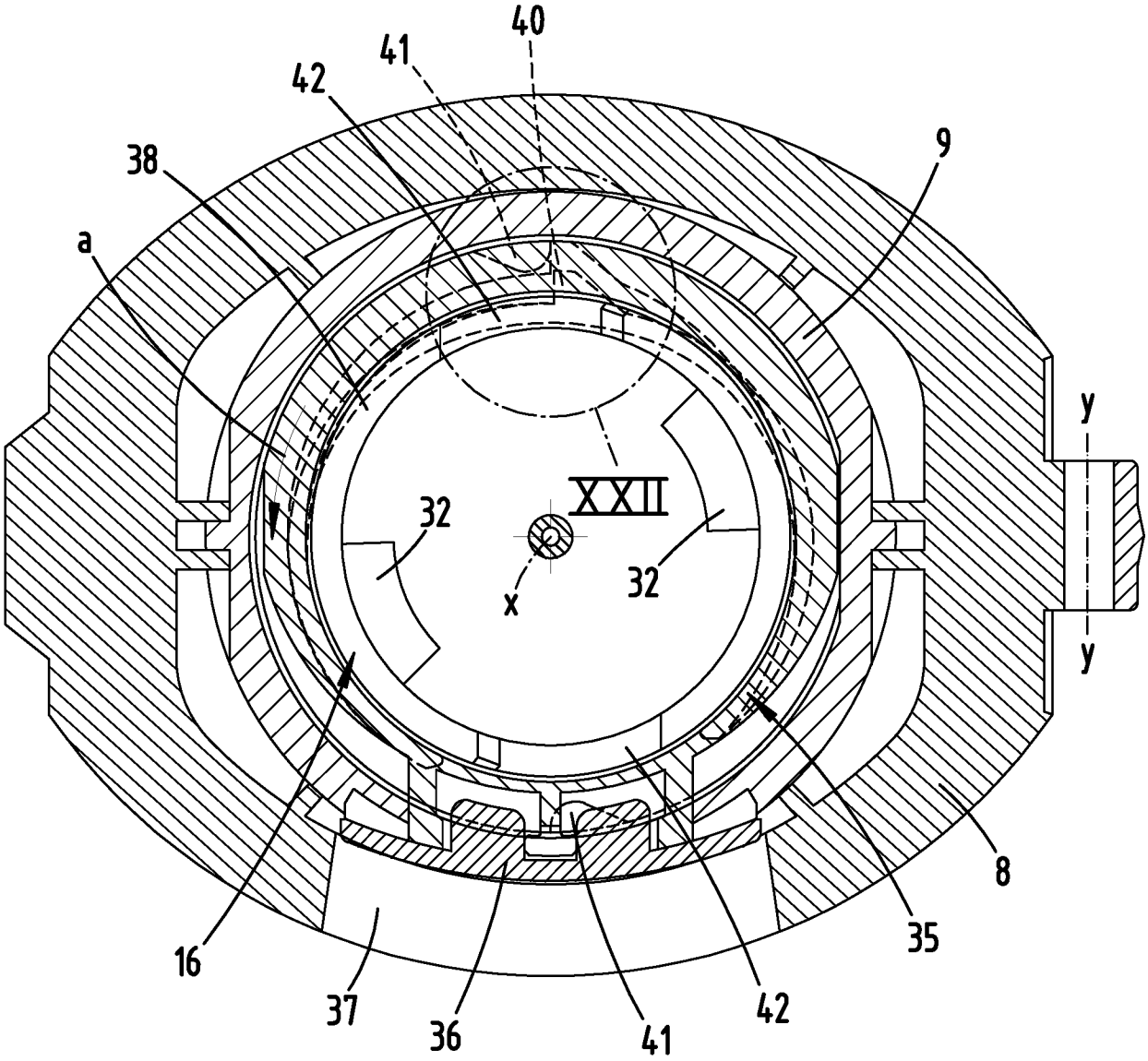


Fig: 22

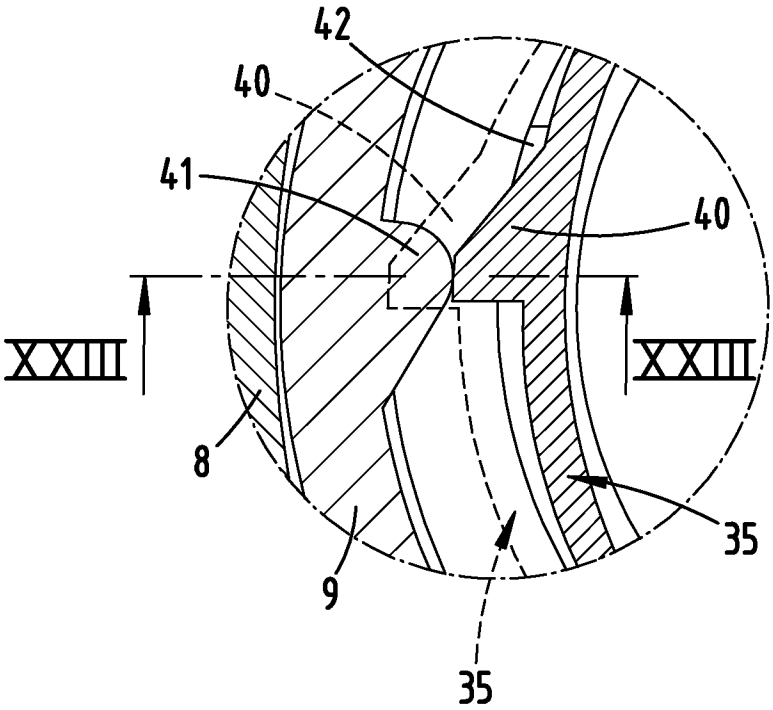


Fig: 23

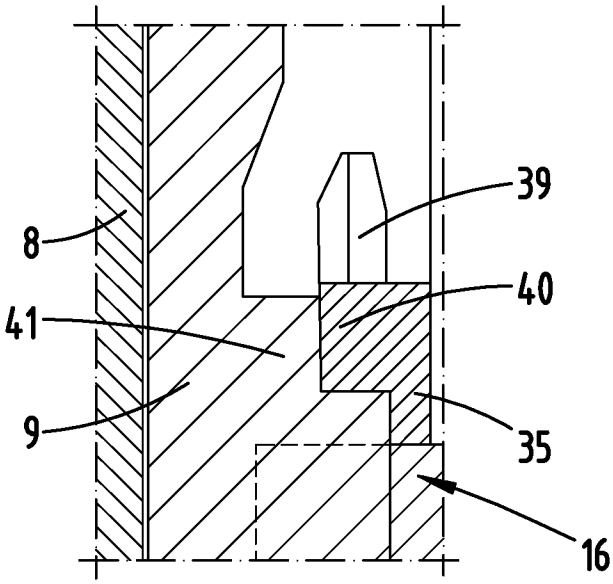
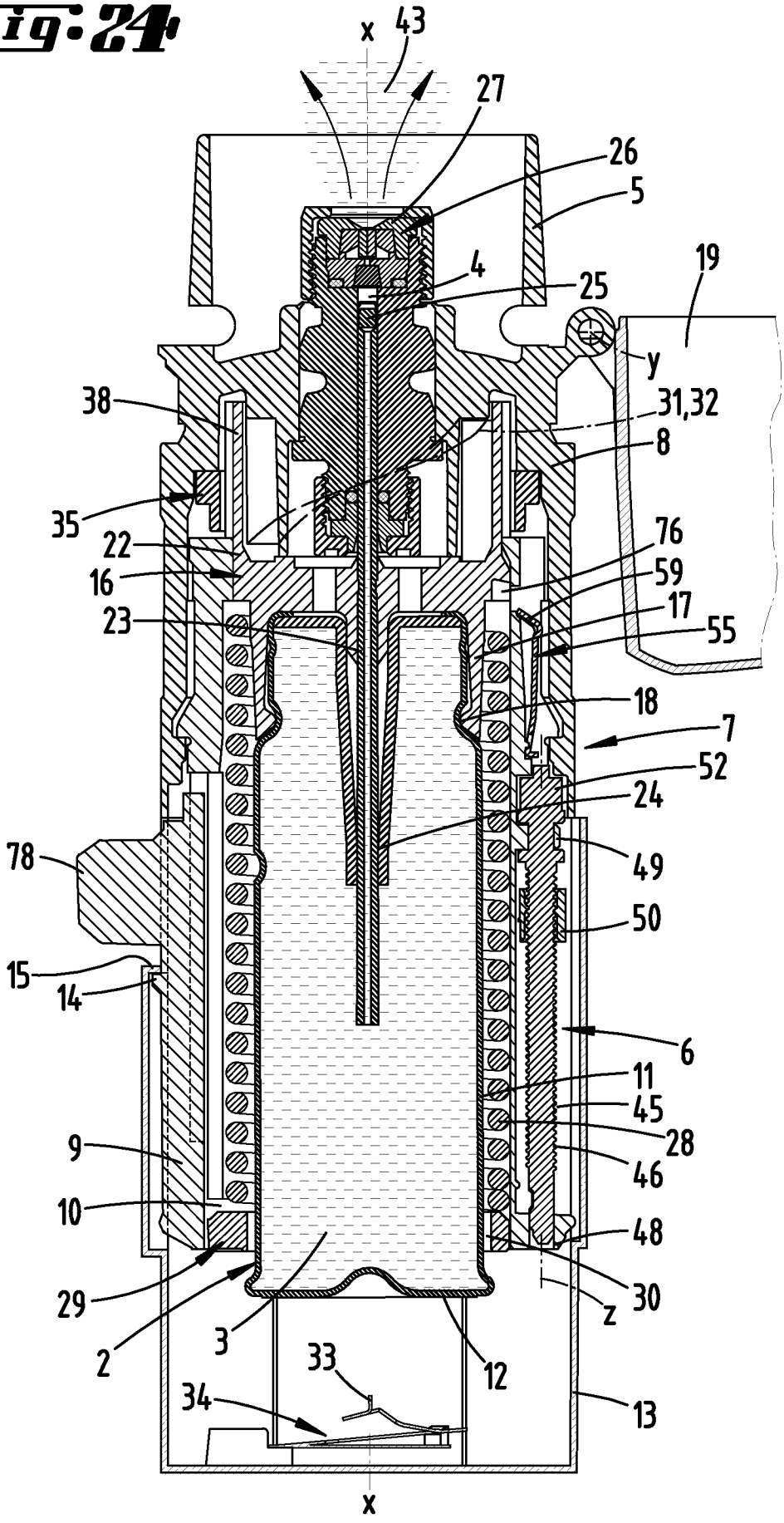


Fig: 24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z
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34
13
x

Fig: 25

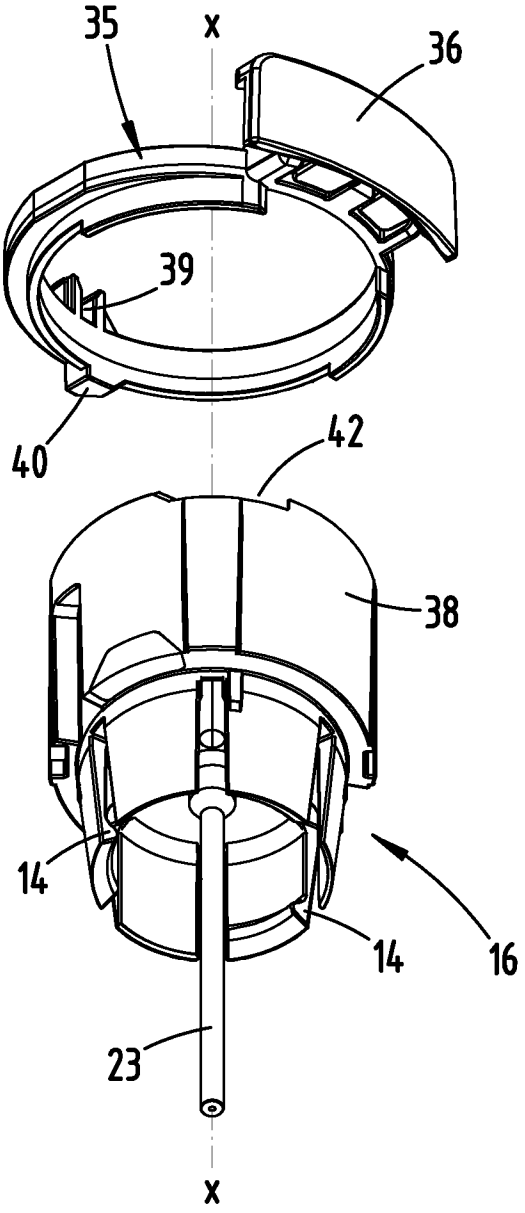
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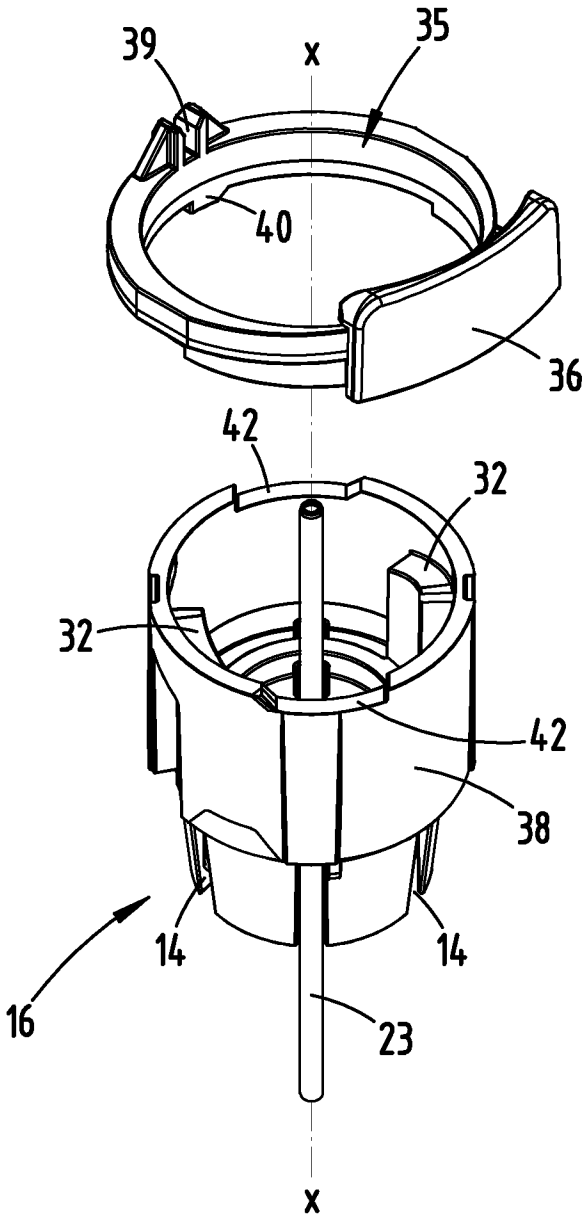
Fig: 26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23
x

Fig: 27

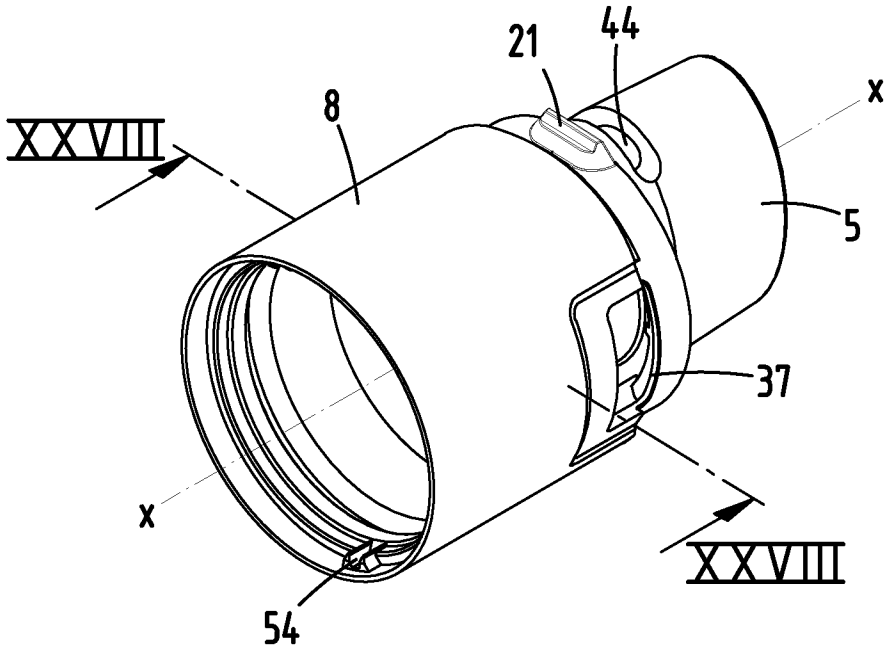

Fig: 28

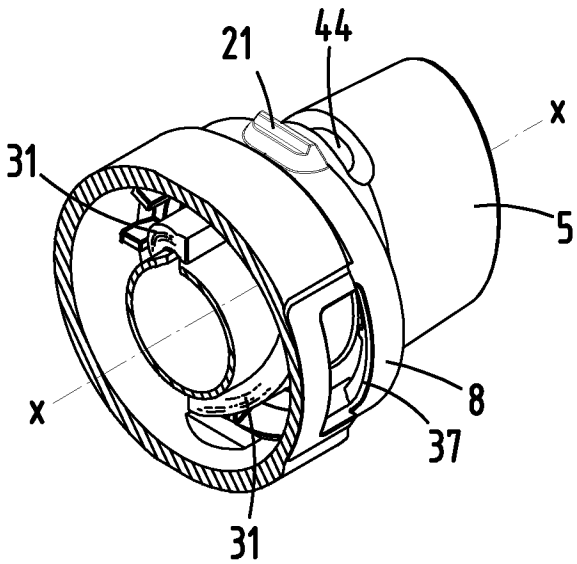

Fig: 29

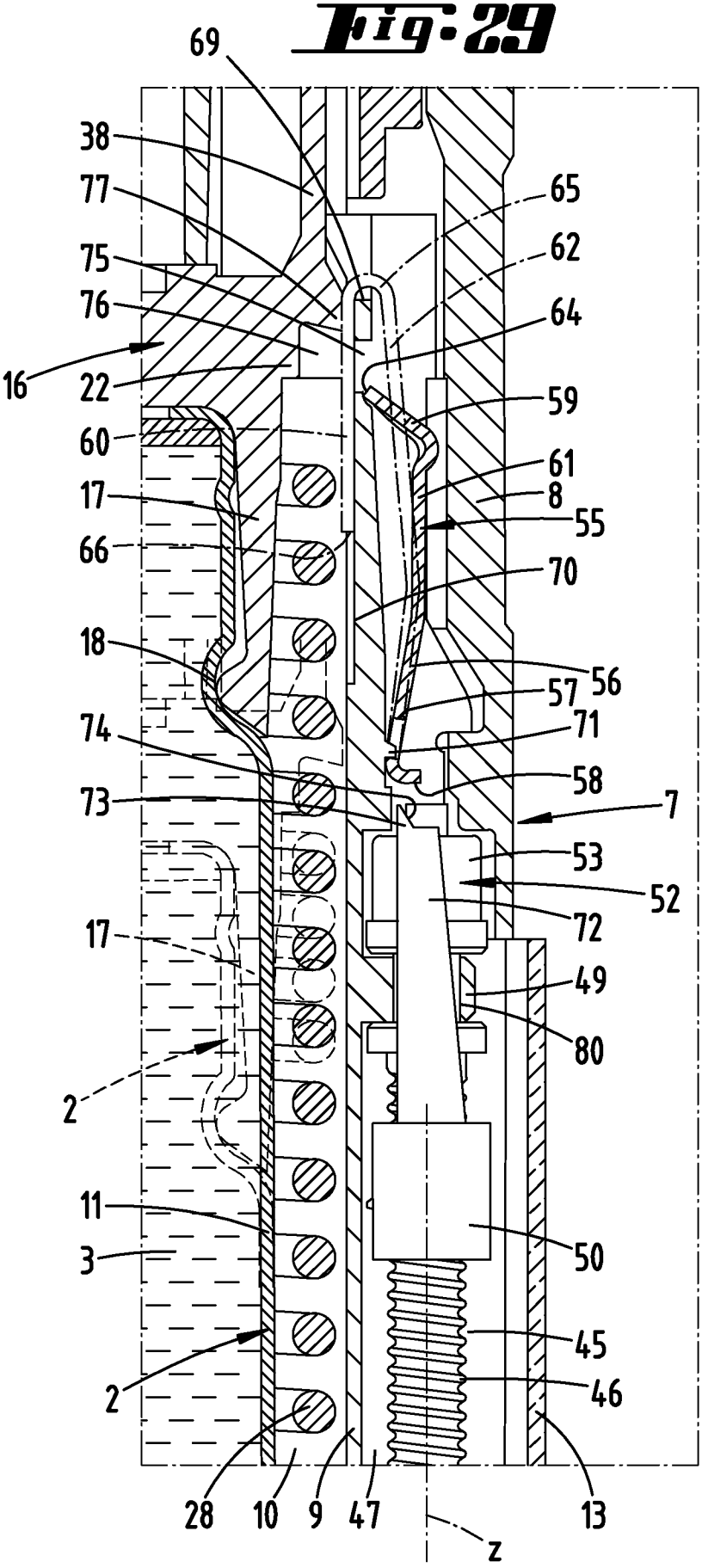
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Fig: 30

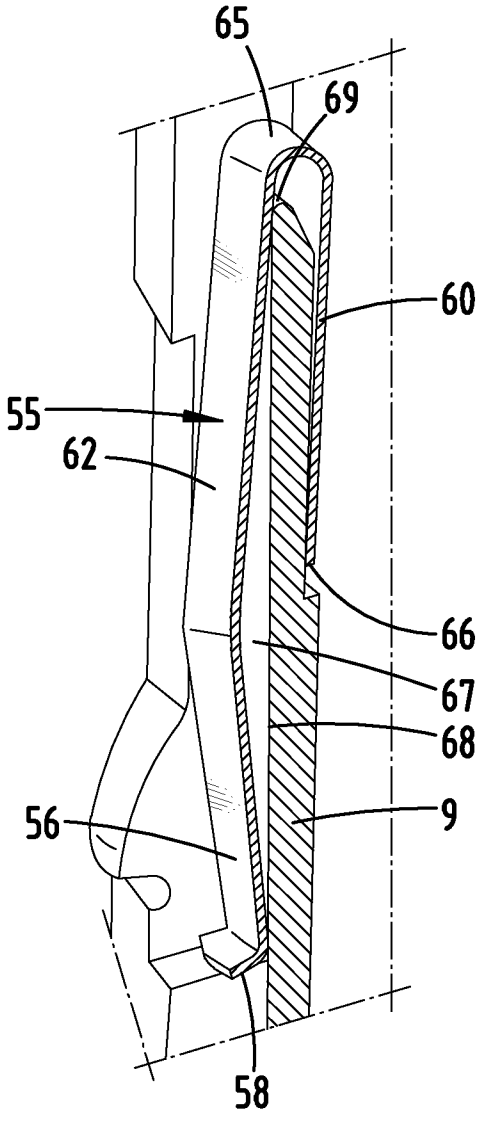

Fig: 31

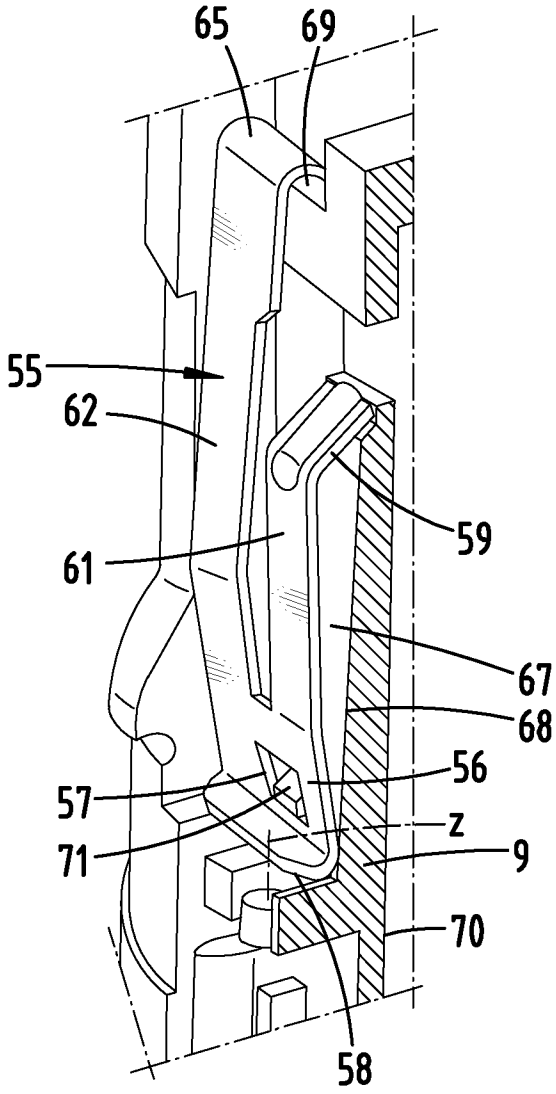

Fig: 32

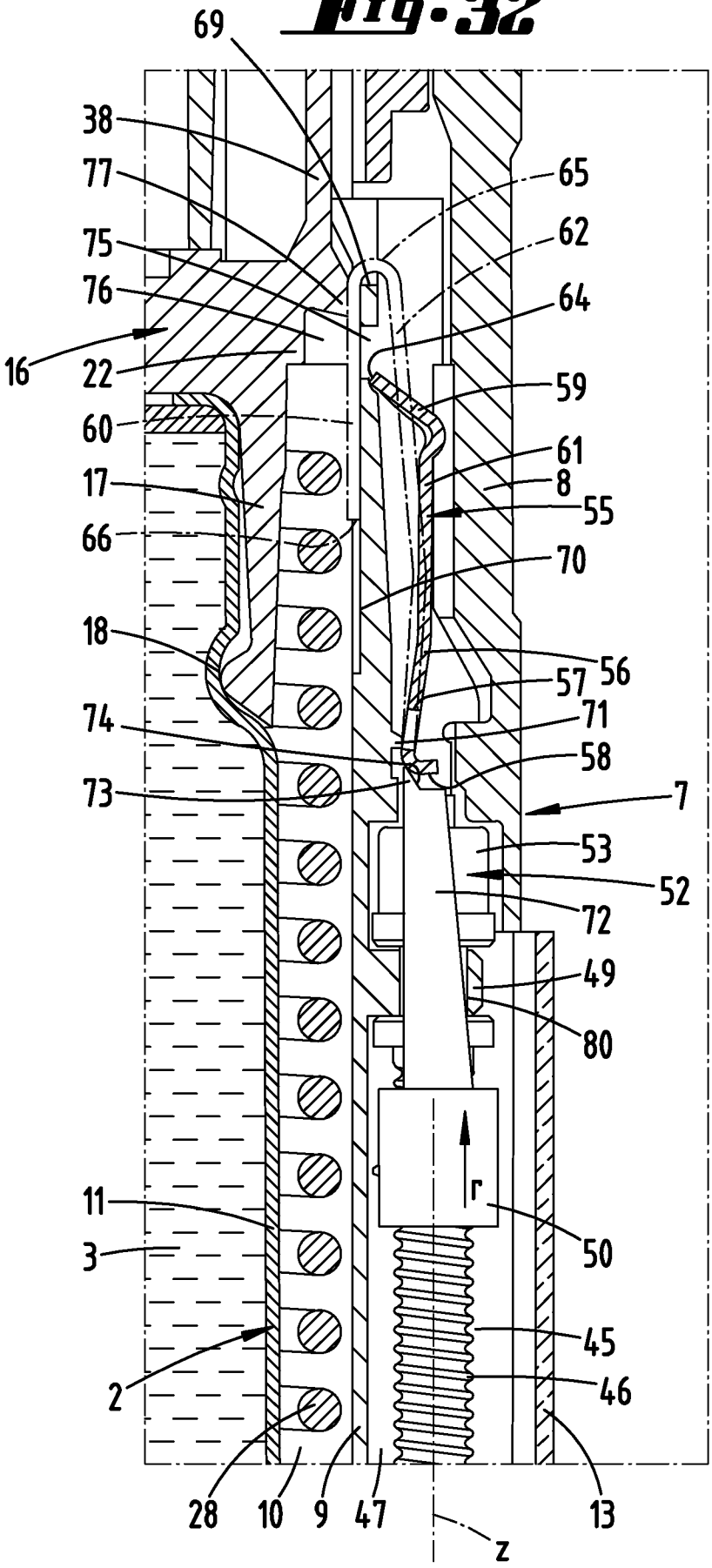
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Fig: 33

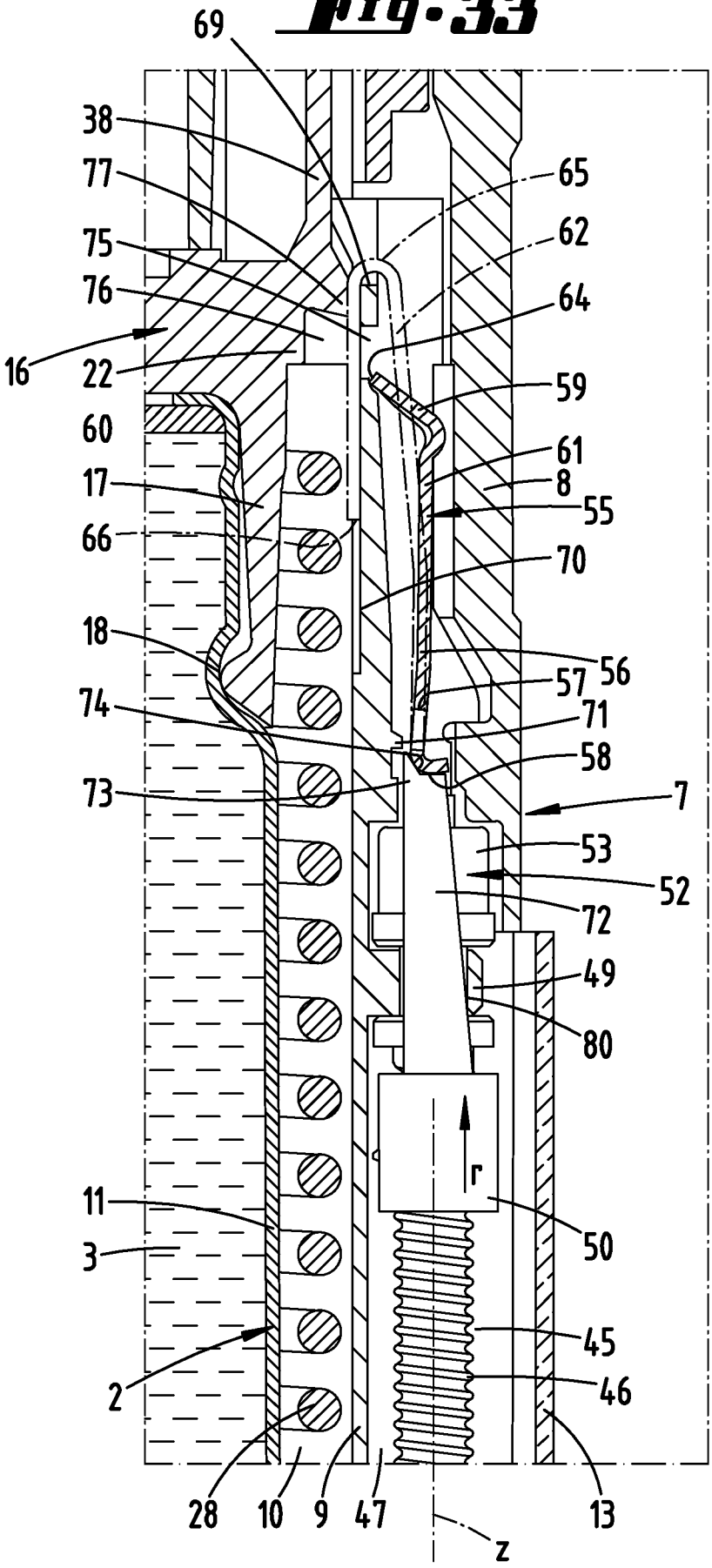
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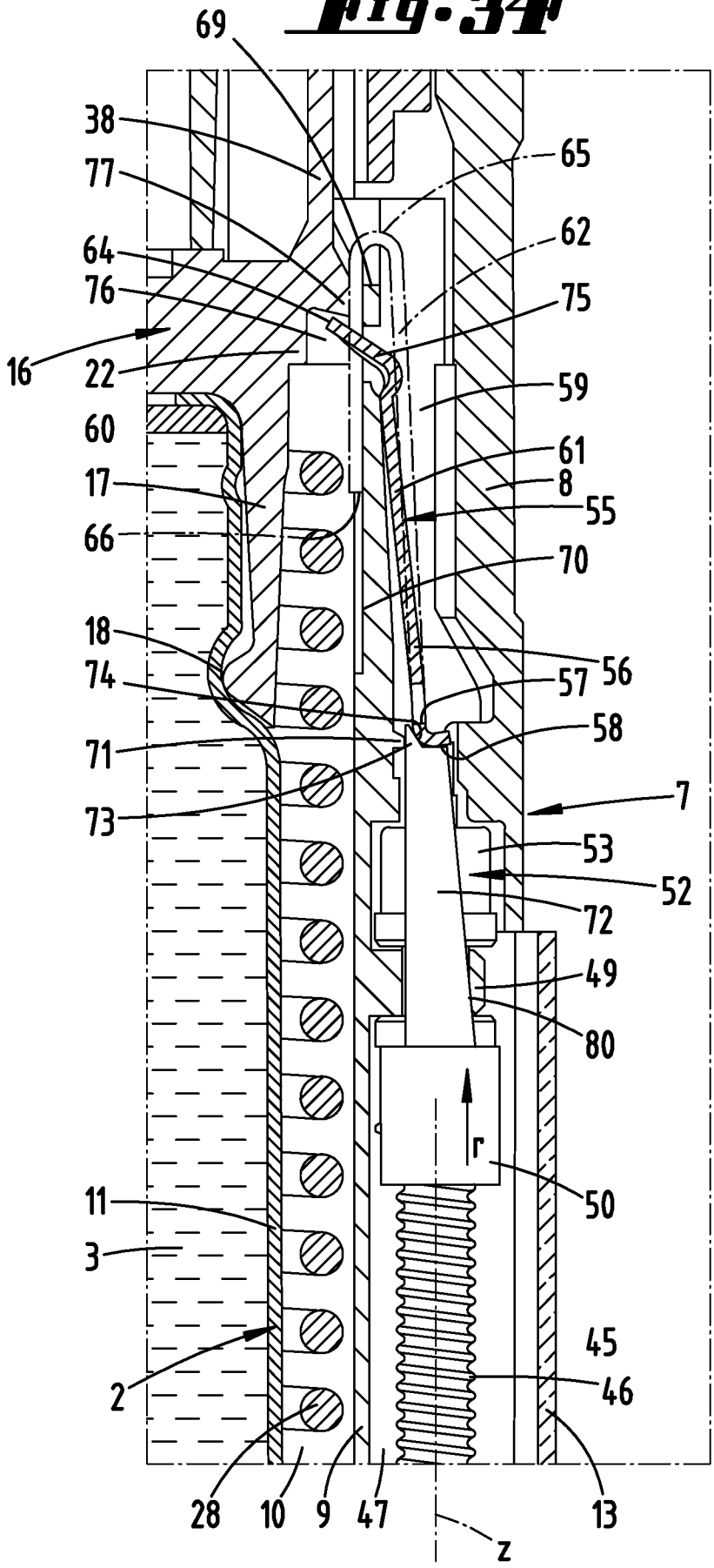
Fig: 34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INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2023/055905

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61M15/00 A61M11/00
ADD.

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

B. FIELDS SEARCHED

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

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2012/160047 A2 (BOEHRINGER INGELHEIM INT [DE]; HOLAKOVSKY HOLGER [DE] ET AL.) 29 November 2012 (2012-11-29) figures 1-7 page 6, line 11 - page 15, line 27	1-10
A	US 2020/215275 A1 (KLADDERS HEINRICH [DE] ET AL) 9 July 2020 (2020-07-09) figures 1-26 paragraph [0448] - paragraph [0462]	1-10
A	US 10 195 374 B2 (BOEHRINGER INGELHEIM INT [DE]) 5 February 2019 (2019-02-05) figures 1-20 page 16, line 19 - page 17, line 9	1-10

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

☒ See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
29 November 2023	12/12/2023

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

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IB2023/055905

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