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(71) Applicant: **PIUSI S.p.A.**
46029 Suzzara (MN) (IT)

(72) Inventor: **VARINI, Otto**
46029 SUZZARA MN (IT)

(74) Representative: **Modiano, Micaela Nadia et al**
Modiano & Partners
Via Meravigli, 16
20123 Milano (IT)

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(54) **APPARATUS FOR DISPENSING AQUEOUS SOLUTIONS OF UREA FOR THE TREATMENT OF EXHAUST GASES IN VEHICLES WITH A DIESEL ENGINE**

(57) An apparatus (1) for dispensing aqueous solutions of urea for the treatment of exhaust gases in vehicles with a diesel engine, which comprises a tank (2) that contains an aqueous solution of urea to be dispensed and is connected, by way of the interposition of a pump, to a delivery duct (4); the delivery duct (4) is provided, at its output end, with a dispensing connector (6) that defines an outlet (6a) for the aqueous solution of urea; the dispensing connector (6) is provided with an overflow sensor that comprises at least one pair of detection electrodes (9a, 9b); means for preventing the presence of a film of liquid between the detection electrodes (9a, 9b) being provided.

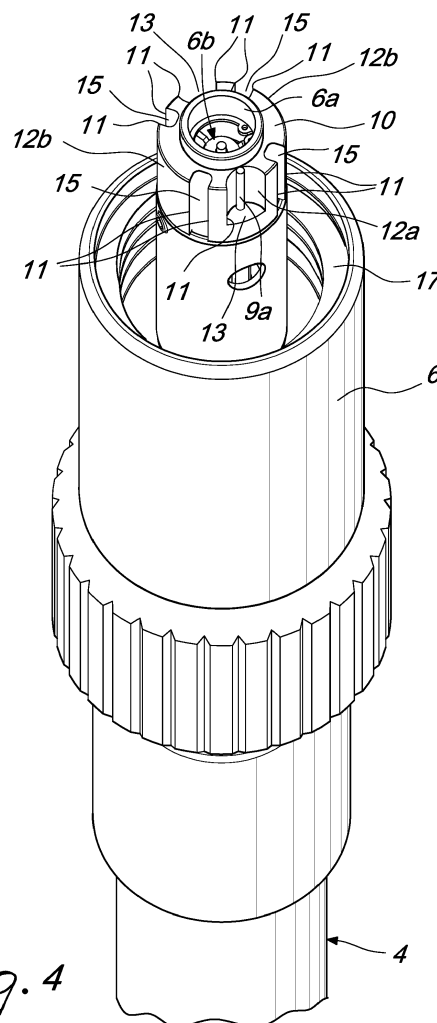


Fig. 4

Description

[0001] The present invention relates to an apparatus for dispensing aqueous solutions of urea for the treatment of exhaust gases in vehicles with a diesel engine.

[0002] The use is currently known, in diesel-engine vehicles, of aqueous solutions of urea, commercially known with the brand AdBlue® or with the acronym AUS32, for the purpose of reducing the emission of pollutant substances by way of a chemical process called "selective catalytic reduction" or "SCR".

[0003] In particular, AdBlue is loaded into suitable containment tanks, which are provided on board diesel-engine vehicles, so that it can be added to outgoing exhaust gases, so as to convert the NO_x to water vapor and nitrogen.

[0004] In order to carry out the replenishment of the containment tanks with AdBlue, apparatuses are used that are constituted by a mobile drum of AdBlue with an associated pump that makes it possible to introduce the contents of the drum into the containment tank of the vehicle by way of a delivery pipe fitted, at its output end, with a dispensing connector that is at least partially insertable into the access port of the containment tank.

[0005] In particular, the dispensing connector is provided with an overflow sensor, which makes it possible to detect the maximum filling condition of the containment tank, during replenishment, in order to prevent the risk of the AdBlue overflowing from the containment tank through its access port.

[0006] Typically, the overflow sensor is constituted by a pair of electrodes that are mutually opposite with respect to an AdBlue exit opening defined in the dispensing connector.

[0007] In particular, the overflow sensor is capable of detecting the presence of liquid at the electrodes by way of the detection of the variation of resistance at the terminals of those electrodes following the transition from a situation where there is air between the electrodes to a situation where there is AdBlue or vapor saturated with AdBlue between the electrodes.

[0008] These overflow sensors, while conceptually valid, are, however, often subject to errors owing to false positive readings caused by the fact that traces of AdBlue remain between the electrodes.

[0009] The aim of the present invention is to provide a solution to the problems of the known art, by providing an apparatus for dispensing aqueous solutions of urea for the treatment of exhaust gases in vehicles with a diesel engine, in which the detection of the filling of the tank to be replenished is not affected by error owing to false positive readings.

[0010] Within this aim, an object of the present invention is to provide an apparatus for delivering aqueous solutions of urea that can be simple and convenient to use for the operator.

[0011] Another object of the present invention is to provide an apparatus for delivering aqueous solutions of

urea that, owing to its particular implementation characteristics, is capable of offering the highest guarantees of reliability and safety during its use.

[0012] Another object of the present invention is to provide an apparatus for delivering aqueous solutions of urea that can be provided at low cost so as to be competitive from a purely economic viewpoint as well.

[0013] This aim and these and other objects which will become better apparent hereinafter are achieved by an apparatus for dispensing aqueous solutions of urea for the treatment of exhaust gases in vehicles with a diesel engine, according to the invention, according to claim 1.

[0014] Further characteristics and advantages of the present invention will become better apparent from the description of a preferred, but not exclusive, embodiment of the apparatus, according to the invention, which is illustrated by way of non-limiting example in the accompanying drawings wherein:

Figure 1 is a perspective view of the apparatus according to the invention;

Figure 2 is a schematic view of the use of the apparatus according to the invention;

Figure 3 is a longitudinal cross-sectional view of a delivery duct, with corresponding dispensing connector, of the apparatus according to the invention;

Figure 4 is a perspective view of the dispensing connector of the delivery duct;

Figure 5 is a side view partially cutaway, along a different cross-sectional plane from the one of Figure 3, of the dispensing connector;

Figure 6 is a longitudinal cross-sectional view of the dispensing connector with a cap coupled;

Figure 7 is a side view of the dispensing connector and the corresponding cap;

Figure 8 is a side view of the dispensing connector;

Figure 9 is a plan view of the dispensing connector;

Figure 10 is a cross-sectional view taken along the line X-X of Figure 8.

[0015] With reference to the figures, the apparatus for dispensing aqueous solutions of urea for the treatment of exhaust gases in vehicles with a diesel engine, according to the invention, which is generally designated with the reference numeral 1, comprises a tank 2 containing an aqueous solution of urea to be dispensed, such as, for example, AdBlue.

[0016] As shown in Figure 1, the tank 2 can be, conveniently, installed on a trolley 3 in order to facilitate its transport and it is connected to a delivery duct 4, by way of the interposition of a pump, which is accommodated, for example, in a body shell 5, which is integral with the trolley 3.

[0017] At its output end, the delivery duct 4 is provided with a dispensing connector 6, which, as shown in Figure 2, is intended to be introduced into the access port of a containment tank 7, arranged on board a diesel-engine vehicle 8, in order to carry out the replenishment of the

containment tank 7 with the aqueous solution of urea contained in the tank 2.

[0018] In particular, the dispensing connector 6 is provided with an outlet 6a for the aqueous solution of urea and it is provided with an overflow sensor, which comprises at least one pair of detection electrodes 9a and 9b, which are conveniently arranged substantially on mutually opposite sides with respect to the outlet 6a.

[0019] Conveniently, the outlet 6a is controlled by a valve 6b and is connected to a delivery channel 4a, which is defined in the delivery duct 4, coaxially to which, in a same flexible tube, a return duct 4b is advantageously defined for returning the air from the containment tank 7 of the vehicle 8 to the tank 2.

[0020] The peculiarity of the invention consists in that it comprises prevention means the function of which is to prevent, between the detection electrodes 9a, 9b, the presence or formation of a film or patina of liquid, in general, and of aqueous solution of urea, in particular, so as to prevent the risk of false positive readings on the part of the overflow sensor.

[0021] More specifically, such prevention means comprise, advantageously, at least one protection body 10 which is interposed between the detection electrodes 9a, 9b and which has, on its outer lateral surface, one or more sharp-edged regions 11 that are adapted to break the surface tension of the aqueous solution of urea, so as to prevent the possibility that a continuous film of aqueous solution of urea could form between the detection electrodes 9a, 9b which would be capable of altering the readings of the overflow sensor.

[0022] As illustrated, the protection body 10 has, for example, a substantially cylindrical shape structure and is axially passed through by the dispensing port 6a.

[0023] Conveniently, the aforementioned sharp-edged regions 11 extend substantially parallel to the detection electrodes 9a, 9b and, advantageously, they have, in transverse cross-section, a cusp-like shape, as shown, for example, in Figure 10.

[0024] More specifically, the sharp-edged regions 11 are, conveniently, defined by the intersection of at least one respective first curved portion 12a of the outer lateral surface of the protection body 10, which has a concavity that is directed outward, and of at least one respective second curved portion 12b of the outer lateral surface of the protection body 10, which is provided, in turn, with a convexity that is directed outward.

[0025] Preferably, the protection body 10 has, on its outer lateral surface, at least one sharp-edged region 11 proximate to each one of the detection electrodes 9a, 9b and, more preferably, it has, proximate to each one of the detection electrodes 9a, 9b, at least one pair of sharp-edged regions 11, which are arranged so as to be mutually opposite with respect to the corresponding detection electrode 9a, 9b.

[0026] In more detail, the pair of sharp-edged regions 11 located proximate to each detection electrode 9a, 9b is defined by the intersection of a corresponding first

curved portion 12a of the outer lateral surface of the protection body 10, which is concave outward and which defines a receptacle 13 for the corresponding detection electrode 9a, 9b, with respective second curved portions 12b of the outer lateral surface of the protection body 10, which are convex outward and which join with the receptacle 13 of the other detection electrode 9a, 9b.

[0027] Conveniently, on the outer lateral surface of the protection body 10 there can be sharp-edged regions 11 also along the second curved portions 12b which extend between the two receptacles 13 of the detection electrodes 9a, 9b. These sharp-edged regions 11 are formed by the intersection of the second curved portions 12b with outwardly-concave curved surfaces provided by longitudinal grooves 15 defined in the protection body 10.

[0028] Advantageously, the detection electrodes 9a and 9b are powered by alternating current electric power supply means, so that cathodic inversion ensures cleaning of the electrodes.

[0029] As can be seen in Figures 6 and 7, the dispensing connector 6 can, conveniently, be closed by a cap 16, which makes it possible to prevent, during non-use, contact between the oxygen present in atmosphere and any aqueous solution of urea remaining on the dispensing connector 6, so as to prevent the consequent formation of crystals.

[0030] For example, the cap 16 can be screwed in a threaded region 17 that is defined on the dispensing connector 6 and which extends about the axis of the delivery duct 4.

[0031] Advantageously, the cap 16 can be associated with the trolley 3, so that the connection of the dispensing connector 3 to the cap 16 makes it possible to connect the dispensing connector 6 to the trolley 3 during non-use.

[0032] For completeness, it should be added that at the body shell 5 defined on the trolley 3 there is a control panel 18, which comprises, for example, one or more buttons 19 for activating or deactivating the pump and a display 20 for showing the volume of aqueous solution of urea dispensed.

[0033] Optionally, the control panel 18 can also comprise an acoustic or luminous signaling device, connected to the overflow sensor and designed to emit alarm signals, as a function of the readings of the overflow sensor.

[0034] Use of the apparatus according to the invention is the following.

[0035] The operator, after having uncoupled the cap 16 from the dispensing connector 6, inserts the dispensing connector 6 into the access port of the containment tank 7 of the vehicle 8 and actuates the pump, by pressing a suitable button 19 arranged on the control panel 18, so as to dispense the aqueous solution of urea into the containment tank 7.

[0036] The pump is automatically deactivated upon detection by the overflow sensor of the completely full condition of the containment tank 7.

[0037] Alternatively, the pump can also be manually deactivated by the operator by way of actuating a deactivation button 19 following an alarm signal, emitted by the signaling device of the control panel 18 in response to the signal that arrives from the overflow sensor upon reaching the completely full condition of the containment tank 7.

[0038] At this point, the operator will disconnect the dispensing connector 6 from the containment tank 7 of the vehicle 8 and close it by way of the cap 16.

[0039] It should be noted that, during the dispensing of the aqueous solution of urea by the dispensing connector 6 and even after using the dispensing connector, the formation is prevented, by the sharp-edged regions 11 of the protection body 10, between the detection electrodes 9a and 9b of the overflow sensor, of a film or patina of liquid by the dispensed portion of aqueous solution of urea that may have remained on the dispensing connector 6, so as to prevent false positive readings on the part of the overflow sensor.

[0040] All the characteristics of the invention, indicated above as advantageous, convenient or similar, may also be missing or be substituted by equivalent characteristics.

[0041] The individual characteristics set out in reference to general teachings or to specific embodiments may all be present in other embodiments or may substitute characteristics in such embodiments.

[0042] The invention, thus conceived, is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims.

[0043] In practice the materials employed, provided they are compatible with the specific use, and the dimensions and shapes, may be any according to requirements.

[0044] Moreover, all the details may be substituted by other, technically equivalent elements.

[0045] The disclosures in Italian Patent Application No. 102016000061872 (UA2016A004425) from which this application claims priority are incorporated herein by reference.

[0046] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. An apparatus for dispensing aqueous solutions of urea for the treatment of exhaust gases in vehicles with a diesel engine, which comprises a tank (2) that contains an aqueous solution of urea to be dispensed and is connected, by way of the interposition of a pump, to a delivery duct (4) that is provided, at

its output end, with a dispensing connector (6) that defines an outlet (6a) for the aqueous solution of urea and is provided with an overflow sensor that comprises at least one pair of detection electrodes (9a, 9b), **characterized in that** it comprises means for preventing the presence of a film of liquid between said detection electrodes (9a, 9b).

2. The apparatus according to claim 1, **characterized in that** said prevention means comprise at least one protection body (10) that is substantially interposed between said detection electrodes (9a, 9b) and has, on its outer lateral surface, at least one sharp-edged region (11) that is adapted to break the surface tension of said aqueous solution of urea.
3. The apparatus according to one or more of the preceding claims, **characterized in that** said at least one sharp-edged region (11) extends substantially parallel to said detection electrodes (9a, 9b).
4. The apparatus according to one or more of the preceding claims, **characterized in that** said at least one sharp-edged region (11) has, in transverse cross-section, a cusp-like shape.
5. The apparatus according to one or more of the preceding claims, **characterized in that** said at least one sharp-edged region (11) is defined by the intersection of at least one respective first curved portion (12a) of the outer lateral surface of said protection body (10), which has a concavity that is directed outward, and of at least one respective second curved portion (12b) of the outer lateral surface of said protection body, which has a convexity that is directed outward.
6. The apparatus according to one or more of the preceding claims, **characterized in that** said protection body (10) has, on its outer lateral surface, at least one sharp-edged region (11) proximate to each of said detection electrodes (9a, 9b).
7. The apparatus according to one or more of the preceding claims, **characterized in that** said protection body (10) has, on its outer lateral surface, proximate to each one of said detection electrodes (9a, 9b), at least one pair of sharp-edged regions (11), which are arranged so as to be mutually opposite with respect to the corresponding detection electrode (9a, 9b).
8. The apparatus according to one or more of the preceding claims, **characterized in that** said pair of sharp-edged regions (11) located proximate to each detection electrode (9a, 9b) is defined by the intersection of a corresponding first curved portion (12a), which is concave outward, of the outer lateral surface

of said protection body (10), which is adapted to define a receptacle (13) for the corresponding detection electrode (9a, 9b), with respective second curved portions (12b), which are convex outward, of the outer lateral surface of said protection body (10) that joins with the receptacle (13) of the other detection electrode (9a, 9b). 5

9. The apparatus according to one or more of the preceding claims, **characterized in that** said protection body (10) is crossed axially by said dispensing port (6a). 10

10. The apparatus according to one or more of the preceding claims, **characterized in that** it comprises means for the AC electric power supply of said detection electrodes (9a, 9b). 15

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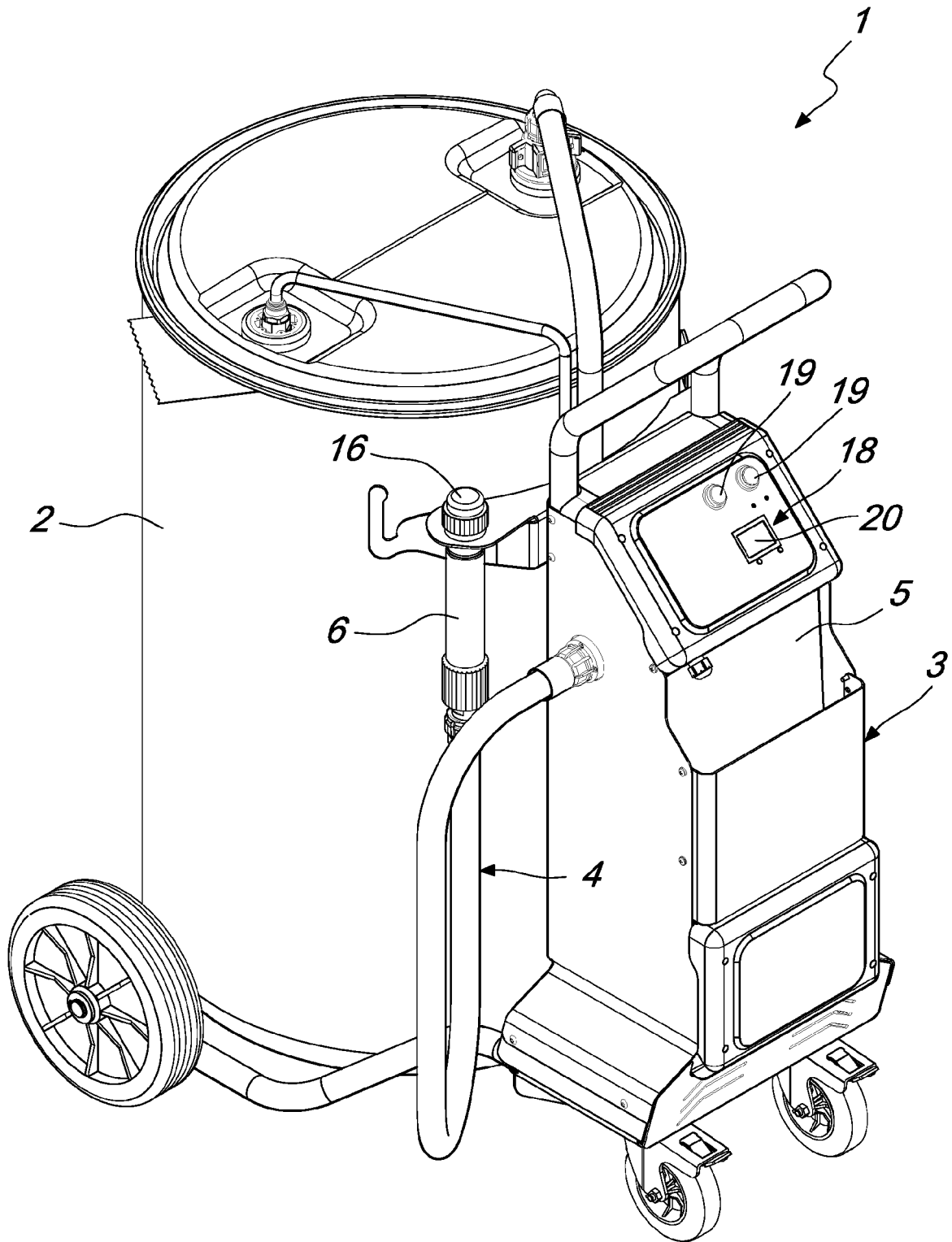


Fig. 1

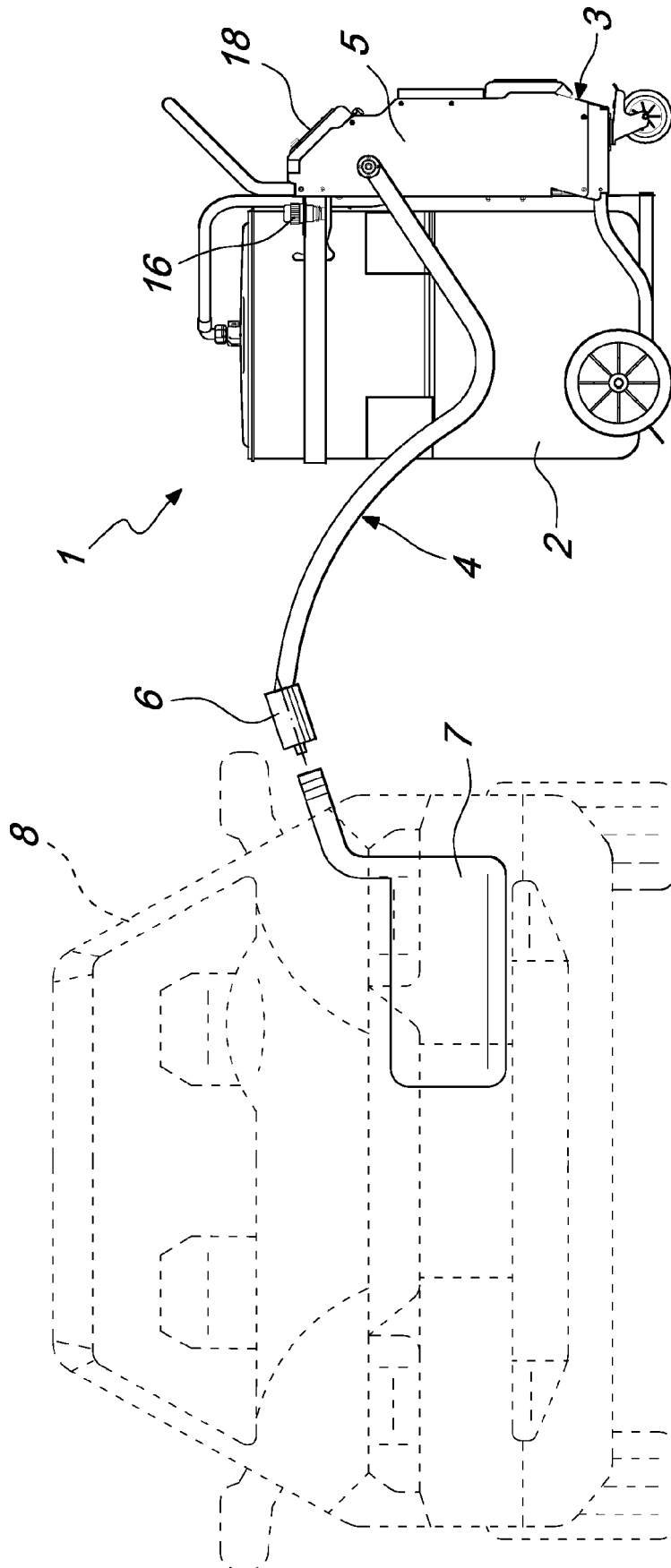


Fig. 2

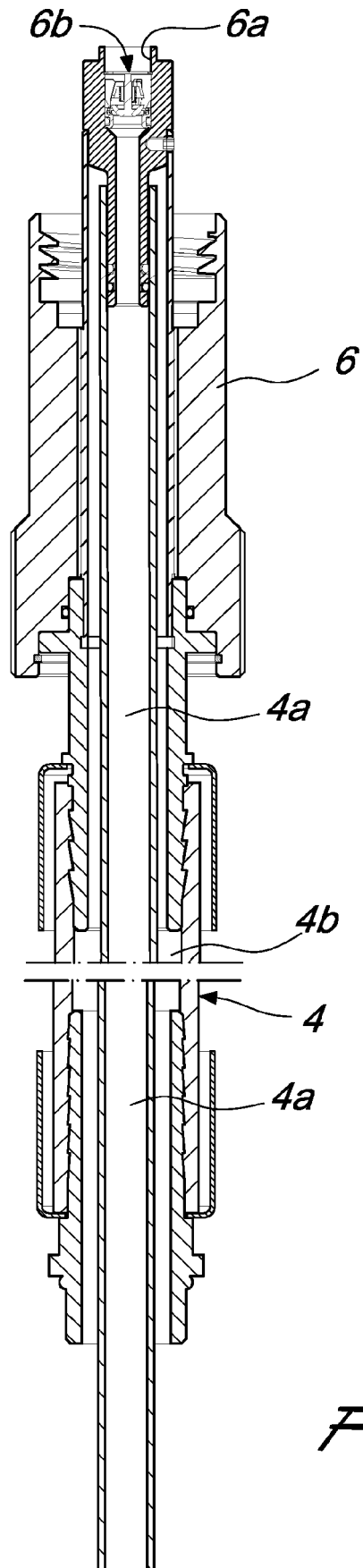


Fig. 3

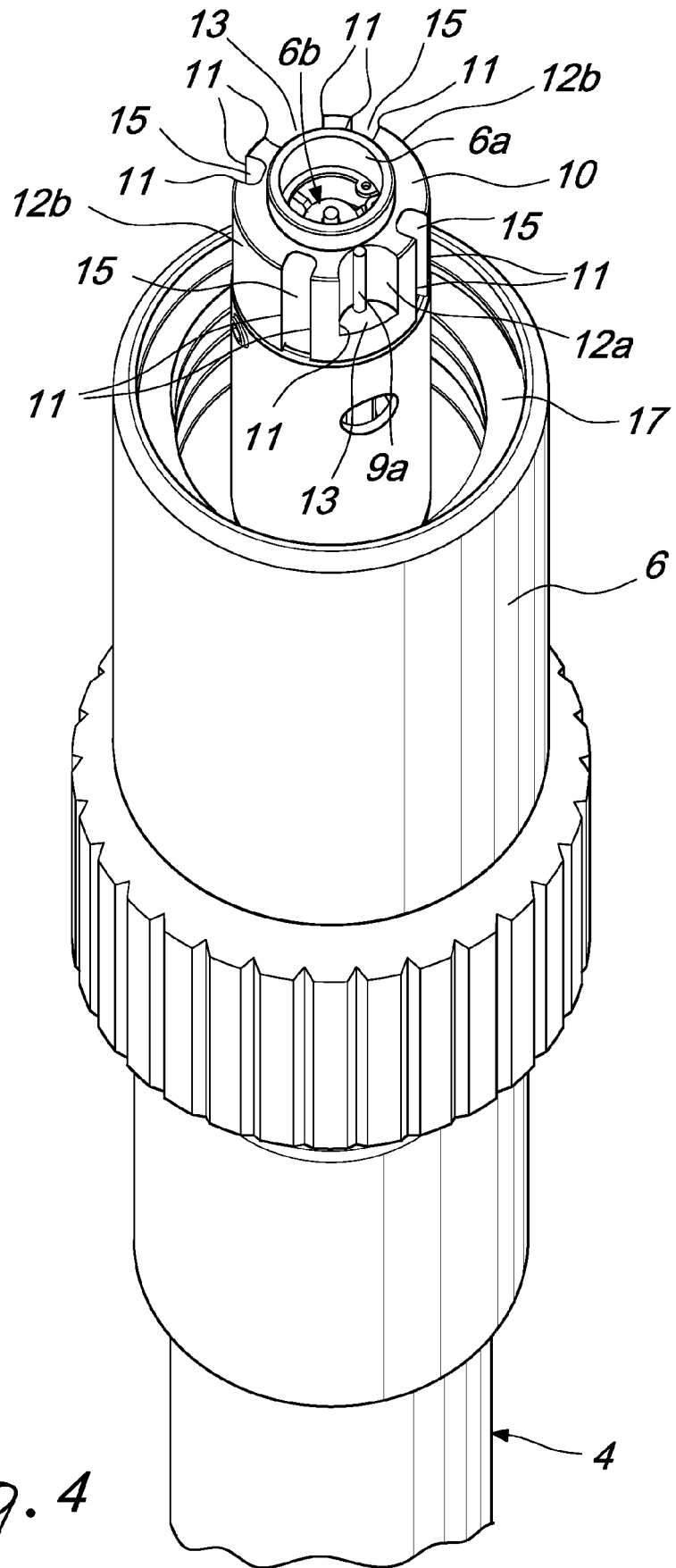


Fig. 4

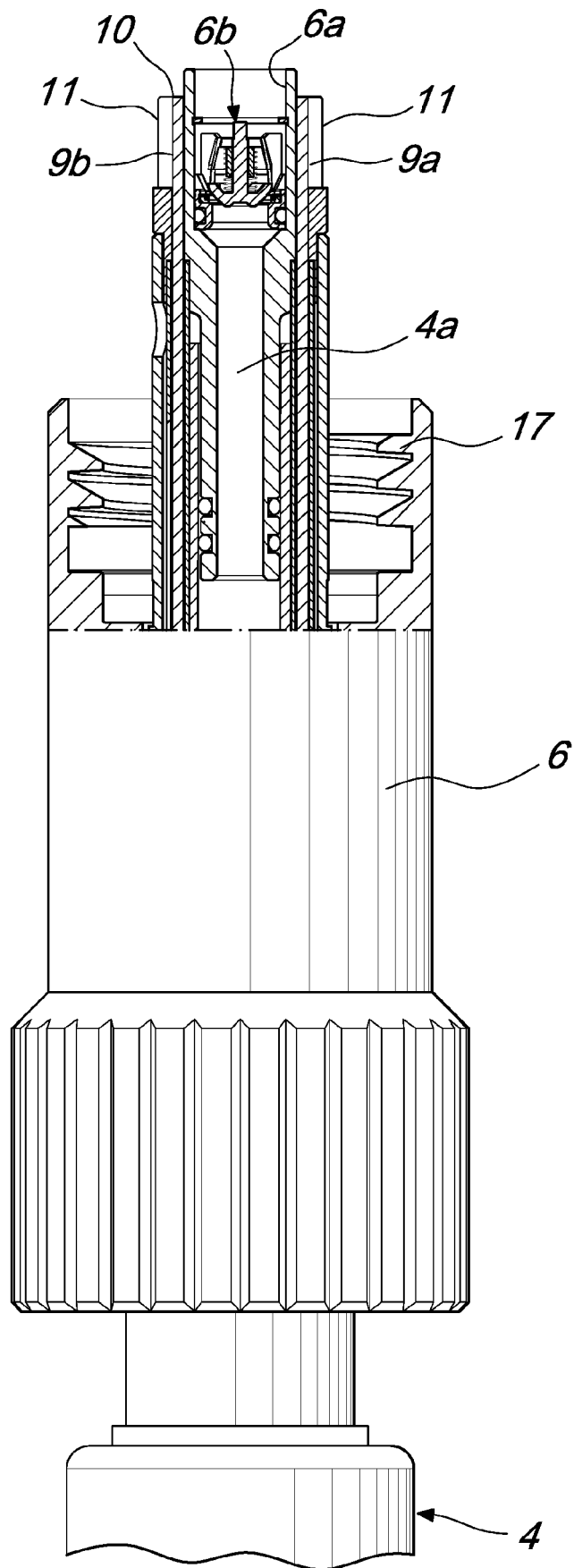
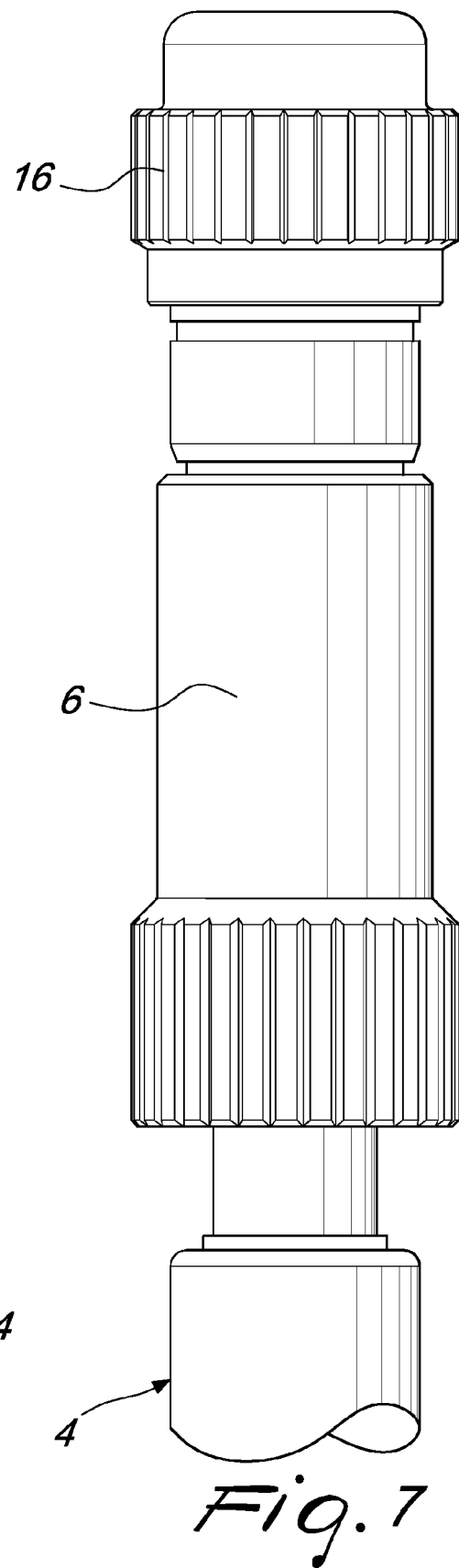
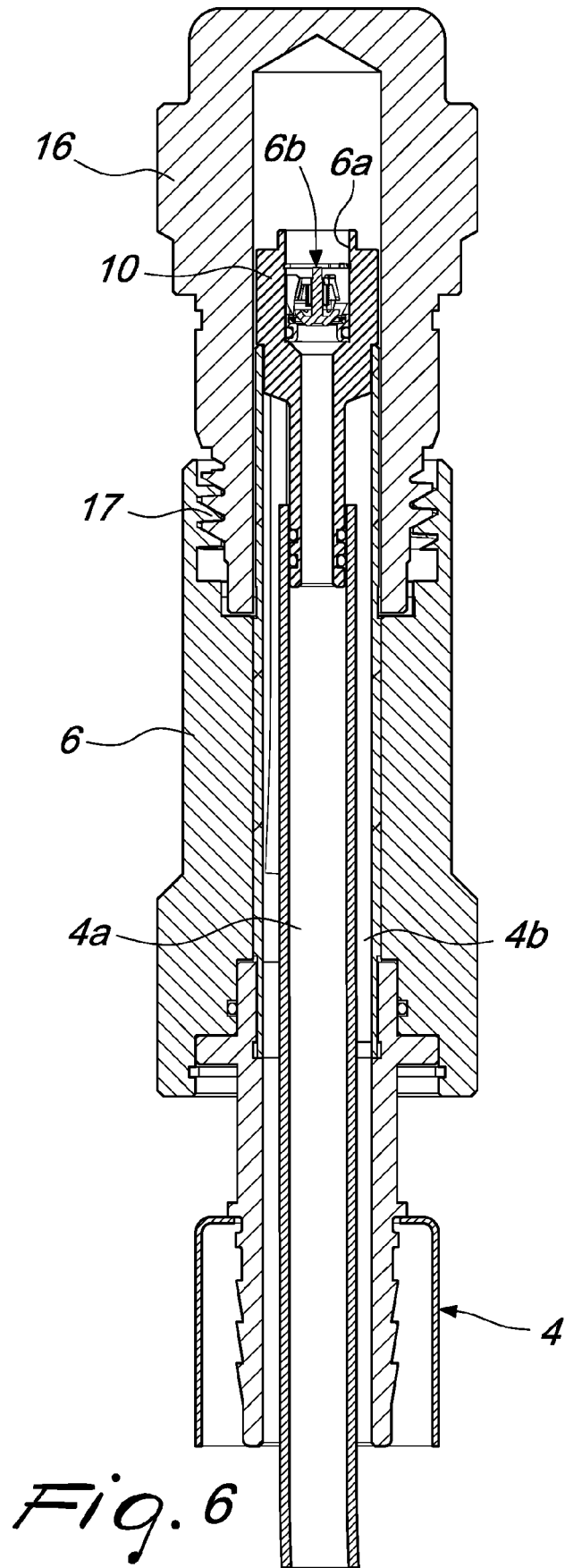


Fig. 5



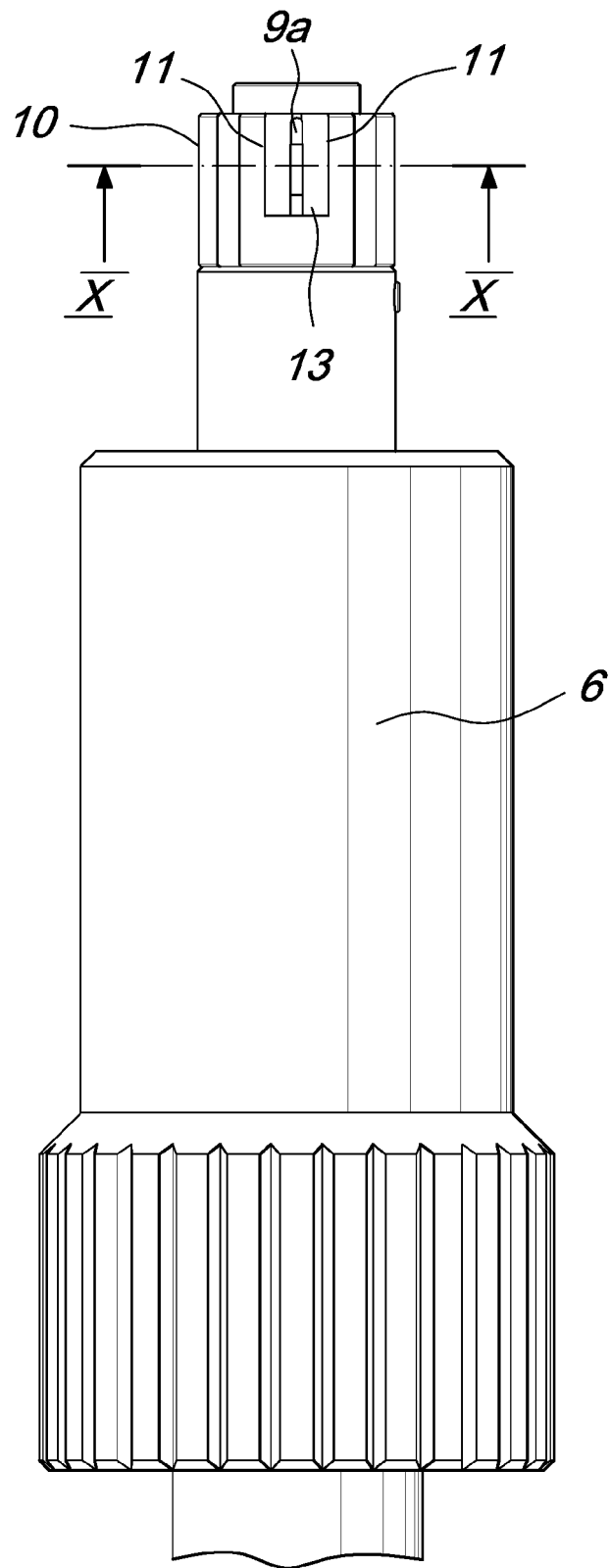
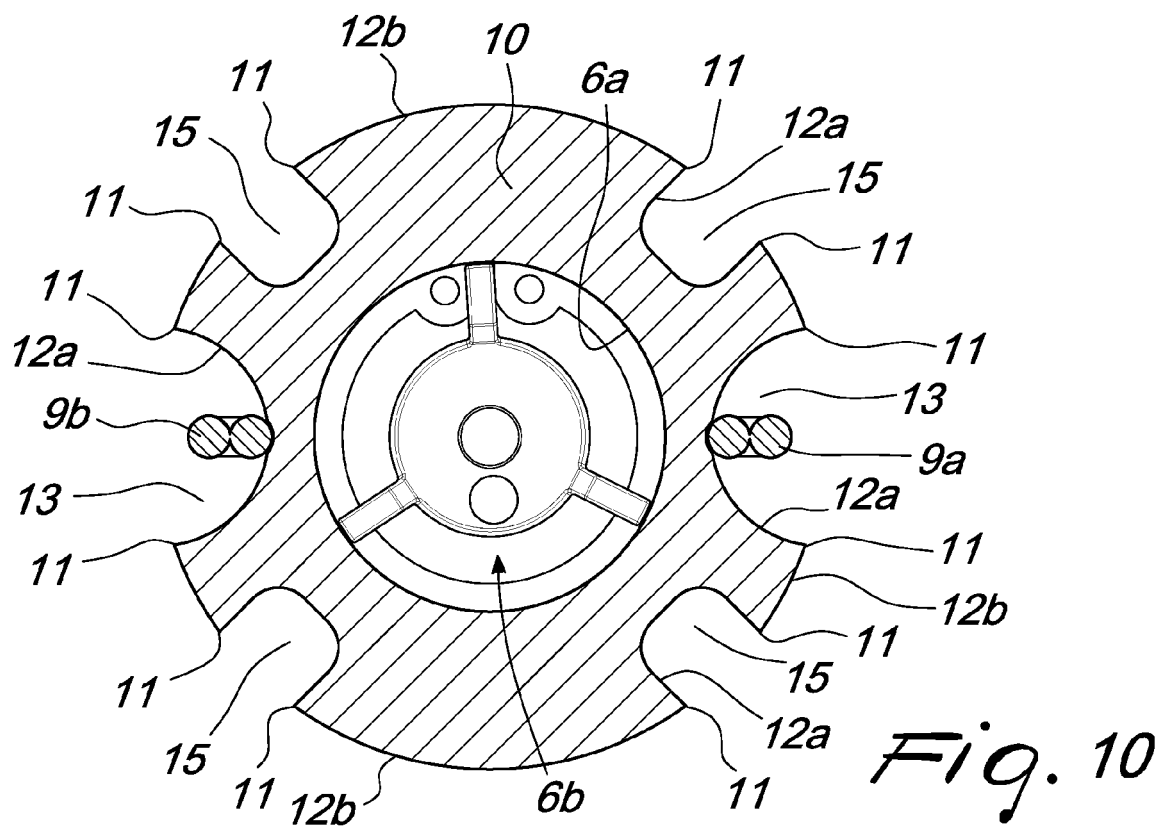
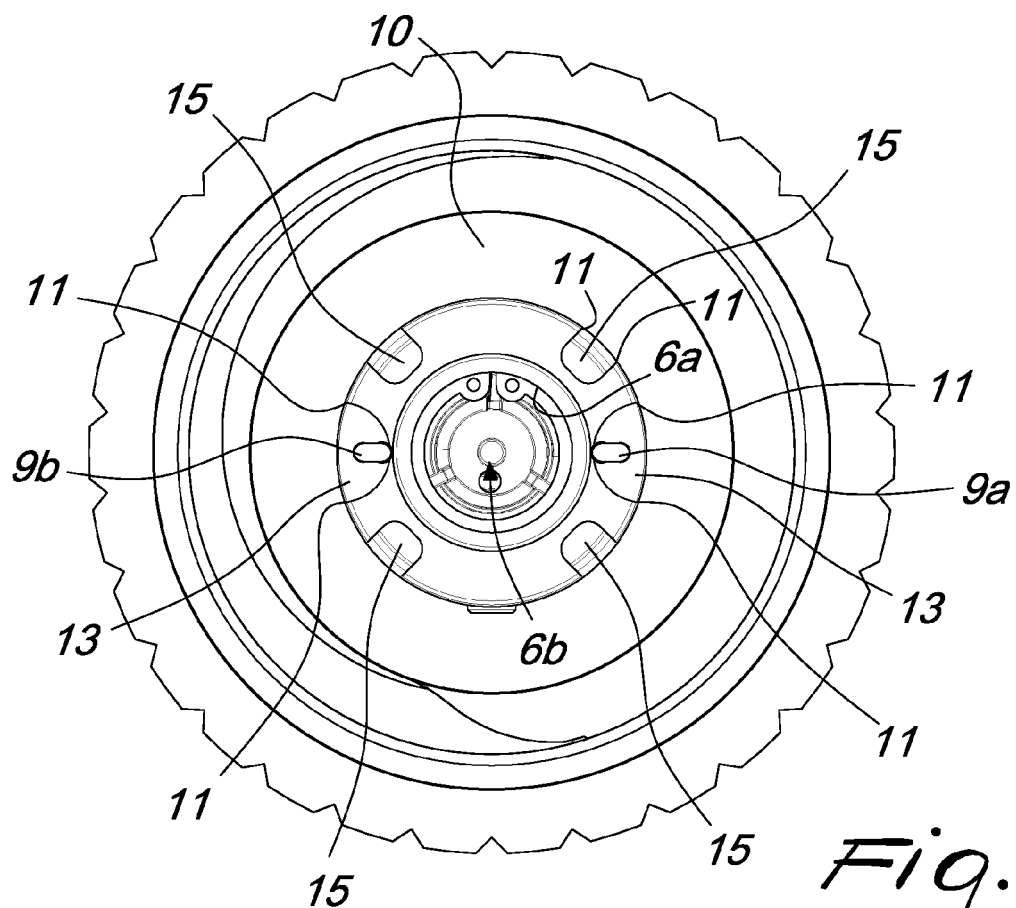


Fig. 8





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Application Number
EP 17 17 5507

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Place of search Munich		Date of completion of the search 24 October 2017	Examiner Schultz, Tom
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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