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(54) Filler valve

(57) Filler valve assembly (1) of the type comprising: a first conduit (2) for the flow of filling liquid to an underlying container (3) and a second conduit (4) inserted in sliding fashion in the first conduit (2) and having a shutter portion (4a) in correspondence with its own lower end. Said second conduit (4) is movable between a first operative configuration in which the shutter portion (4a) completely closes a dispensing outlet (2a) of the first conduit (2) and a second operative configuration in which said portion (4a) is disengaged from the dispensing outlet (2a). The assembly (1) comprises means (5) for bringing the second conduit (4) in the second operative configuration and means (6) for bringing it back to said first operative configuration. The assembly (1) comprises pneumatic means (7) connected to the second conduit (4) and at least a deflecting valve (15) for inhibiting the operation of the pneumatic means at the end of the filling operation.

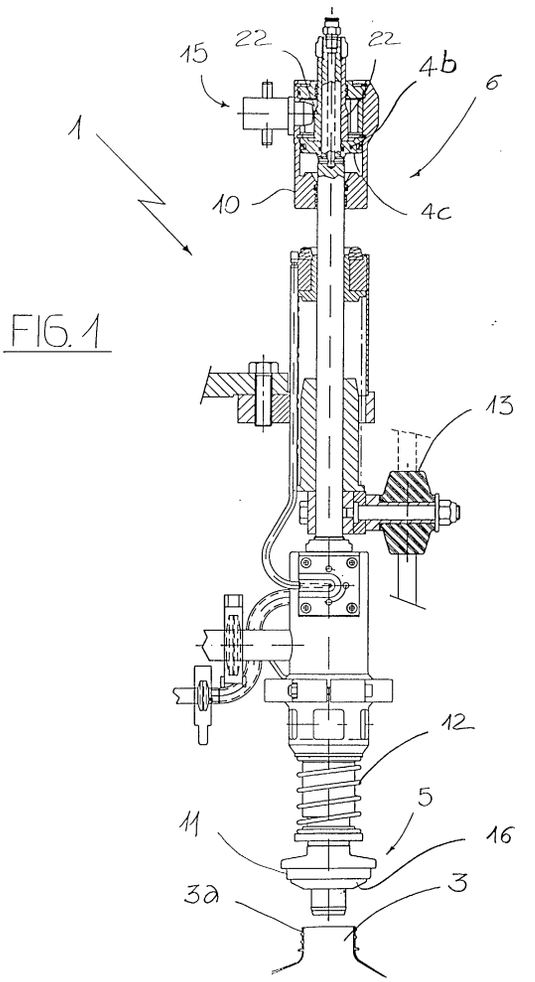

FIG. 1

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Description

[0001] The present invention relates to a filling valve assembly, in particular for a machine for filling containers with preferably flat liquids, such as water, of the type comprising at least a first conduit for the flow of the filling liquid to an underlying container and at least a second conduit inserted in sliding fashion in the first conduit and having a shutter portion in correspondence with its own lower end. Said second conduit is able to move between a first operative configuration in which the shutter portion completely closes a dispensing outlet of the first conduit and a second operative configuration in which said portion is disengaged from the dispensing outlet and allows the flow of liquid to the container, and vice versa. The filler valve assembly further comprises means for bringing the second conduit to the second, flowing, operative configuration, and means for bringing the second conduit back to the first closed operative configuration.

[0002] As is well known, in the bottling industry, containers, typically bottles but also cans or jars, are filled by means of filler machines usually provided with a plurality of filling heads positioned in correspondence with the periphery of a rotating platform, whereto is associated an equal number of filler valves.

[0003] As disclosed by patent IT1265531 by the same Applicant, each head comprises a valve assembly provided with a first conduit for the flow of liquid from a tank to a container positioned coaxially underneath the conduit itself and with a second conduit able to allow, during the filling phase, the escape of gas or air present in the container itself. In particular, said second conduit is inserted at least partially inside the liquid inflow conduit, in coaxial position, and it is movable in sliding fashion relative thereto, to insert itself inside the container.

[0004] The second conduit is provided, on the outer lateral surface in intermediate position between the two ends, with a projection serving as a shutter for the conduit for the inflow of the liquid. During the movement of the second conduit, said projection opens or closes a port for the passage of the liquid, sealing or not sealing on gasket placed in annular position to the second conduit and integral with inner lateral walls of the conduit for the inflow of the liquid.

[0005] The movement of the second conduit is commanded by a device that measures the pressure present in the conduit itself when a pre-set level of liquid is reached in the container, independently from the speed of the filler machine. In particular, when the filling liquid laps the lower end of the second conduit and the pressure is such as to thrust upwards the conduit itself, the hydraulic closure of the inflow conduit is achieved because of the interaction between shutter and gasket.

[0006] Generally, the filling of the containers is controlled by measuring the level reached by the product inside the container. Often, for commercial reasons, it is preferred to determine a filling level of the containers, especially if the containers are at least partially transparent.

[0007] In accordance with a different prior art, filler valve assemblies exist in which the interruption of the flow of liquid to the container occurs upon reaching a pre-set level, measured by means of a level tube inserted in the conduit for the inflow of the liquid itself, according to a coupling that is similar to the one described in the aforementioned patent, but without using a device that is based on the pressure existing between the two coaxial conduits.

[0008] In this case, when a pre-set level is reached, a certain quantity of liquid, as well as air or gas, escapes from the tube.

[0009] Other level measuring devices use magnetic sensors, or alternatively volumetric means are known which introduce a pre-set quantity of liquid. In this latter case, however, any slight deformation of the container entails the reaching of a different level of filling.

[0010] In accordance with the prior art, the second conduit or the tube are provided with a flow deflector positioned in correspondence with the portion that is inserted in the container, for the purpose of at least partially checking the degree of turbulence in correspondence with the centreline of the container in proximity to the end of the conduit itself or of the level tube.

[0011] The filling valve assemblies, briefly described above, have some drawbacks. First of all, in regard to filler valve assemblies provided with an annular gasket between the two conduits, such assemblies are not simple to build, as they require precise tolerances between gasket, inflow conduit and conduit for the escape of gas or air, and small geometric imperfections between the circuits cause the product to recirculate with the valve closed.

[0012] As to the level tube, it has the important drawback of causing liquid to escape, in addition to the air or gas present in the container, when the desired level of filling is reached. This drawback is particularly annoying, because it entails problems related to the recycling and/or disposal of the escaped liquid. The aim of the present invention is to eliminate the aforesaid drawbacks making available a filler valve assembly, in particular for machines for filling containers with liquids, that is easy to build and avoids the suction and the consequent escape of filling liquid from the container.

[0013] An additional aim of the present invention is to provide a filler valve assembly that is normally shut, i.e. that in the resting configuration prevents the escape of filler liquid.

[0014] Another aim of the present invention is to make available a filler valve assembly that allows rapidly to fill a container, precisely measuring the level reached by the liquid.

[0015] An aim of the present invention is also to make available a filler valve assembly that allows to reduce losses caused by the escape of the liquid (splash out) at the end of the filling operation, in particular for con-

tainers made of plastic and deformable material, preferably 5 - 20 litre containers, not excluding, however, smaller containers.

[0016] A further aim of the present invention is to obtain this in an extremely simple and economical manner.

[0017] Said aims are fully achieved by the filler valve assembly, in particular for machines for filling containers with liquids, of the present invention, that is characterised by the contents of the claims set out below and in particular in that it comprises pneumatic means connected to a conduit for gas or air and operatively active on means for bringing said conduit back to an operative closure configuration, to the reaching of a pre-set level of the liquid in the container.

[0018] The filler valve assembly of the invention is further characterised in that it comprises at least a deflecting valve so shaped as to inhibit the operation of the pneumatic valve when the pre-set level of liquid is reached, in order to prevent a reactivation of the filling.

[0019] These and other aims shall become more readily apparent from the following description of a preferred embodiment illustrated, purely by way of non limiting example, in the accompanying drawing tables, in which:

- Figure 1 shows a partially section front view of a first embodiment of a filler valve assembly according to the invention, in an operative configuration raised above a container;
- Figure 2 shows a partially sectioned front view of the assembly of Figure 1 in an operative configuration of insertion inside a container, during the filling phase;
- Figure 3 shows a partially sectioned front view of the assembly of Figure 1 in an operative configuration of insertion inside a container, but not during the filling phase;
- Figures 4 and 5 show enlarged and partially sectioned front views of a construction detail of the filler valve assembly shown in Figure 1;
- Figures 6 and 7 show enlarged and partially sectioned front views of two construction details of the filler valve assembly shown in Figure 1;
- Figure 8 shows a partially sectioned front view of a second embodiment of a filler valve assembly according to the invention;
- Figure 9 shows a partially sectioned front view of a constructive-functional detail of the second embodiment of the filler valve assembly shown in Figure 8.

[0020] With reference in particular to Figures 1, 2 and 3, the filler valve assembly is globally indicated with the number 1 and it comprises at least a first conduit 2 for the flow of filling liquid to a container 3 positioned underneath the conduit itself. The assembly 1 is provided with a second conduit 4, inserted in sliding fashion in the inflow conduit 2, and preferably coaxial thereto, to allow the escape of gas or air present inside the container 3, during the filling operation.

[0021] The second conduit 4 has a shutter portion 4a in correspondence with its own lower end and is movable between a first operative configuration in which said shutter portion 4a completely shuts a dispensing outlet 2a of the first conduit 2 (Figure 3) and a second operative configuration (Figure 2) in which said shutter portion 4a is disengaged from the dispensing outlet 2a and allows the flow of liquid to the container 3, and vice versa.

[0022] The assembly 1 further comprises means 5 for bringing the conduit 4 in the second operative flow configuration and with means 6 for bringing said conduit back to the first closed operative configuration. In particular, the second conduit 4 moves relative to the first by the combined action of the means 5 and of the displacement of the entire filler valve assembly which, as shown in the figures, is movable between a raised operative configuration (Figure 1) and an operative configuration of insertion inside a container 3 (Figure 2, 3).

[0023] The means 5 for bringing the second conduit 4 in the operative inflow configuration comprise at least an abutment element 11 integral with the first conduit 2 and so shaped as to bear onto an inlet 3a of the container 3, allowing the second conduit to slide relative to the first and the consequent disengagement of the shutter portion of the dispensing outlet 2a of the first conduit 2. In particular, to the means 5 is fastened a gasket 16 substantially of the lip type, whereon the inlet 3a of the container 3 bears.

[0024] In the first embodiment shown in Figures 1, 2 and 3, the first and the second conduit are mutually connected by means of an elastic element 12, typically a spring, and the whole filling assembly 1 is movable with vertical alternating motion under the action of a first cam (not shown herein) operatively active on a roller 13 integral with the second conduit 4. In this way it is possible to lift the assembly 1 to allow the positioning of a container to be filled underneath the assembly itself. On the contrary, during the insertion phase, the filler valve assembly moves downwards under the action of its own weight and of an additional elastic element, preferably another spring 14.

[0025] More specifically, the assembly 1, moving towards the container 3, forces the inflow conduit 2 to position the gasket 16 on the inlet 3a of the container 3. During the filling phase the assembly 1 further moves with vertical motion downwards under the action of a second cam (not shown herein) operatively active on the roller 13 integral with the second conduit 4 which, given the presence of the elastic element 12, slides relative to the first conduit 2 and partially projects with respect thereto, to allow the opening of the dispensing outlet 2a of the inflow conduit 2.

[0026] With reference in particular to Figures 4 and 5, the assembly 1 comprises pneumatic means 7 connected to the second conduit 4 and operatively active on the means 6 to bring the conduit itself back to the closed operative configuration, when the liquid reaches a pre-

set level in the container.

[0027] In the first embodiment shown in Figures 1, 2 and 3, said pneumatic means 7 comprise at least a source of pressure (not shown herein) and at least a chamber 8 communicating with the second conduit 4 and having at least an opening 8a operatively communicating with a conduit (not shown) associated to said pressure source. Also present is an elastic element 9, preferably a membrane, internally anchored to the chamber 8 to partition it in two distinct volumes. In particular, said elastic element 9 is flexibly movable by effect of the pressure exerted by the gas or air present in the second conduit 4, between a resting configuration and a configuration of obstruction of the opening 8a. As shown in Figures 4 and 5, the membrane 9 is in the resting position (Figure 5) if, through the second conduit 4, no air returns from the container 3, whilst said membrane shuts off the opening 8a (Figure 5) if air coming from the container flows in the second conduit.

[0028] With reference to Figure 6, said pneumatic means 7 comprise at least a control valve 17 operatively active on the conduit associated to the pressure source, in order to detect a pressure drop inside the second conduit 4. In particular, said valve is so shaped as to allow the source to send fluid under pressure to the means 6, if air does not return from the container and to shut off the flow of fluid if, on the contrary, there is a return of air, in order to bring the conduit 4 back to the closed operative configuration. Specifically, the control valve 17 has an inlet I for a fluid coming from the pressure source and destined, through an outlet U, to the means 6 for bringing the second conduit in said first closed operative configuration, as soon as the filling operation is complete. The control valve 17 provides and additional outlet P communicating with the chamber 8, where the membrane 9 is located, and necessary for driving the operation of the control valve itself, in order to activate or inhibit the sending of fluid under pressure to the means 6.

[0029] The subject control valve 17 can be constructed according to different types, but it is preferable for it to serve the functions of signal amplifying valve, 3/2 valve (3 inlets/2 slides) and "not" valve (signal inversion).

[0030] In the illustrated embodiment (please see figures 1, 2, 3), the means 6 comprise a cylinder 10, coaxial to the conduit 4 and co-operating with a portion 4b thereof defining an active surface 4c for the fluid under pressure sent by the source, for the purpose of causing the sliding of the second conduit relative to the first. In short, the coupling between cylinder 10 and portion 4b of the second conduit 4 is of the cylinder-piston type.

[0031] In the illustrated embodiments, the shutter portion 4a defines, during the dispensing phase, a deflector for the flow of liquid entering the container 3. The assembly 1 comprises at least a deflecting valve 15 (Figure 7) so shaped as to inhibit the operation of the pneumatic means 7 when the pre-set liquid level is reached, in order to prevent a re-activation of the filling. Said deflecting valve is particularly useful during the filling of deformable containers.

[0032] In particular, the deflecting valve 15 is so shaped as to inhibit the sending of fluid under pressure to the chamber 8 to maintain the elastic element 9 in resting configuration at the end of the filling, when the filling assembly moves up again.

[0033] The operation of the deflecting valve 15 is as follows.

[0034] The deflecting valve 15 removes pressure from the pneumatic means 7, and in particular from the opening 8a, deflecting the pilot flow, normally directed from a connection 21 to a connection 21a and thence to the opening 8a, directly from the connection 21 to the external environment.

[0035] Once the filling level is reached in the container, the assembly 1 rises and a linear cam 22, comprised in the means 6, interacts with a ball 18 that causes the translation of a pivot pin 19 and the escape of the pilot flow from the connection 21 to the environment. This makes the elastic element 9 inactive, since the piloting pressure is not pressure in the chamber 8.

[0036] In accordance with a second embodiment shown in Figures 8 and 9, it is possible to obtain a fixed filling valve assembly, comprising means (not shown herein) for bringing the container to be filled in correspondence with the conduit for the inflow of the liquid.

[0037] The operation of such a filling assembly is wholly similar to that of the filling assembly obtained in accordance with the first embodiment illustrated and described above.

[0038] The conduit 4 moves downwards with alternating motion, coaxially to the inflow conduit 2, operating the disengagement of the shutter portion 4a and the start of the filling operation. The descent of the conduit 4 can take place through the mechanical forcing of an elastic element 23, or acting with a pressure signal on the control valve 17 in the piloting outlet P. In this latter case the cylinder-piston coupling of the means 6 causes, in fact, the descent of the conduit 4, whereto a portion 4b of the conduit 4 is rigidly connected, as a result of the switching of the valve 17.

[0039] When the filling level is reached in the container, the elastic membrane 9 disengages from the opening 8a, the valve 17 switches and the elastic element 23 causes the closure of the conduit 2 through the shutter portion 4a.

[0040] With reference to Figure 9, the control valve 17 serves the functions of signal amplifying valve, 3/2 valve (3 inlets/2 slides), and deflecting valve.

[0041] Such a filling assembly, being fixed, achieves the important advantage of requiring a very limited number of flexible conduits for the sending of air and filling liquid to the assembly itself.

[0042] The operation of the invention is as follows.

[0043] With reference to the first embodiment described and shown in Figures 1, 2 and 3, the assembly

1 is kept raised by a cam that acts on the roller 13, to allow the positioning of the container 3 underneath the assembly itself. In this configuration, the inflow conduit 2 is closed by the shutter portion 4a of the second conduit 4. Therefore, it is a filling valve assembly of the normally closed type.

[0044] Subsequently, the first cam releases the roller 13 and the assembly 1 moves towards the container 3 under the action of its own weight and of the spring 14.

[0045] More specifically, the assembly 1, moving towards the container 3, allows the inflow conduit 2 to stop as a result of the air cushion present between the portion 4b of the conduit 4 and the cylinder 10 of the means 6, positioning the gasket 16 on the inlet 3a of the container 3.

[0046] During the filling phase, the assembly 1 further moves with vertical motion downwards under the action of a second cam (not shown) operatively active on the roller 13 integral with the second conduit 4. The latter, given the presence of the elastic element 12, slides relative to the first conduit 2 and partially projects relative thereto, to allow the opening of the dispensing outlet 2a of the inflow conduit 2.

[0047] The filling assembly, during its descent towards the container 3, activates the deflecting valve 15.

[0048] During the filling, the air contained inside the container 3 projects from the conduit 4 and causes the flexure of the membrane 9, which shuts off the opening 8a, offsetting the pressure imposed by the source inside the conduit associated to the pressure source itself.

[0049] As soon as the free surface of the filling fluid comes in contact with the end of the conduit 4 for the escape of air and/or gas, the pressure exerted on the membrane 9 is cancelled out by effect of the different density between air and liquid. Consequently, the membrane 9 returns to the initial position and frees the opening 8a, determining a pressure drop in the conduit associated to the pressure source.

[0050] At the end of the filling operation, the assembly 1 does not immediately rise, but is maintained in contact with the inlet 3a of the container 3 to avoid any liquid from escaping (splash out) by effect of the pinching of the container (for plastic and deformable containers) due to the drop in the pressure of the air present on the free surface of the liquid inside the container.

[0051] At the end of the filling operation, the head pressure (in the order of 1.1 bar) present on the free surface takes about a second to vent and return to the value of atmospheric pressure.

[0052] Maintaining the filling assembly in contact with the inlet of the container, if on one hand prevents splash out, on the other hand could reactivate the filling due to a pressure wave that is generated by effect of the presence of the head pressure, which is not able rapidly to vent, to allow the establishment of atmospheric pressure on the free surface of the liquid inside the container.

[0053] For the reasons described above, the presence of the deflecting valve 15 is essential; said deflecting valve 15 is able to inhibit the operation of the membrane 9, keeping it in resting configuration, in order to prevent the reactivation of the filling operation.

[0054] The pressure drop in the conduit associated to the pressure source is detected by the control valve 17, which activates the means 6 to bring the conduit 4 back to the closed operative configuration. In particular, the valve routes fluid under pressure coming from the pressure source directly into the cylinder 10; said fluid, expanding in the cylinder 10, exerts a force on the portion 4b of the second conduit 4, causing it to rise and thereby allowing the closure of the dispensing outlet 2a of the inflow conduit 2.

[0055] Subsequently, the first cam, acting on the roller 13, brings the assembly 1 back to the raised position and the cylinder 10 discharges the fluid under pressure remained therein and readies itself for a new filling cycle.

[0056] In particular, it is stressed that, in the raised position, the assembly 1 is in normally shut position due to the presence of the connecting spring 12 between the inflow conduit 2 and the conduit 4.

[0057] The invention achieves important advantages.

[0058] First of all, the assembly 1, given the presence of the shutter portion 4a operatively active directly on the dispensing outlet 2a of the inflow conduit 2, allows to shut off the dispensing, without interposing any membrane, or other mechanical components, between the two conduits.

[0059] Secondly, an assembly according to the invention allows to measure the filling level, preventing suction and the consequent escape of liquid from the container.

[0060] Advantageously, the assembly 1, in resting configuration, is normally closed and therefore, in case of failure in the filling line, no type of manual intervention is required to prevent the accidental escape of liquid.

[0061] An additional advantage is represented by the fact that a filling valve assembly according to the invention allows rapidly to fill a container, precisely measuring the level reached by the liquid.

[0062] Another advantage is given by the fact that such a filling assembly, being able to be kept in contact with the inlet 3a of the container 3, allows to prevent splash outs caused by the pinching of the container due to the drop in the pressure of the air present on the free surface of the liquid inside the container.

[0063] Advantageously, the present of the lip gasket 16 allows the inflow conduit 2 completely to adhere to the inlet 3a of the container 3, guaranteeing the seal of the container during the filling operation.

Claims

1. Filler valve assembly (1), in particular for machines for filling containers with liquids, of the type comprising:

at least a first conduit (2) for the flow of filling liquid to a container (3) positioned underneath the conduit (2) itself;
at least a second conduit (4) for gas or air inserted in sliding fashion in the first conduit (2) and having a shutter portion (4a) in correspondence with its own lower end, said second conduit (4) being movable between a first operative configuration in which the shutter portion (4a) completely closes a dispensing outlet (2a) of the first conduit (2) and a second operative configuration in which said portion (4a) is disengaged from the dispensing outlet (2a) and allows the flow of liquid to the container (3), and vice versa; means (5;6) for bringing the second conduit (4) in said second inflow operative configuration; and
means (6) for bringing the second conduit (4) back to said first closed operative configuration;

characterised in that it comprises pneumatic means (7) connected to the second conduit (4) and operatively active on said means (6) for bringing the second conduit (4) back to said first closed operative configuration, when the liquid reaches a pre-set level in the container.

2. Filler valve assembly as claimed in claim 1, **characterised in that** it comprises at least a deflecting valve (15) so shaped as to inhibit the operation of the pneumatic means (7) when the pre-set level of liquid is reached, in order to prevent a reactivation of the filling.

3. Filler valve assembly as claimed in claim 1, **characterised in that** said pneumatic means (7) comprise:

at least a pressure source;
at least a chamber (8) communicating with the second conduit (4) and having at least an opening (8a) operatively communicating with a conduit associated to said pressure source;
at least an elastic element (9) anchored internally to said chamber (8) to partition it in two distinct volumes, said elastic element (9) being flexibly movable, by effect of the pressure exerted by the gas or air present in the second conduit (4), between a resting configuration and a configuration of obstruction of said opening (8a); and
at least a control valve (17) operatively active on said conduit associated to the pressure source to detect a pressure drop inside the second conduit (4), said valve being shaped in such a way as to allow the source to send fluid under pressure to the means (6) to bring the second conduit (4) back to the first closed operative configuration.

4. Filler valve assembly as claimed in claim 3, **characterised in that** the deflecting valve (15) is so shaped as to send fluid under pressure to the chamber (8) to maintain the elastic element (9) in resting configuration at the end of the filling operation.

5. Filler valve assembly as claimed in claim 3, **characterised in that** said elastic element (9) is substantially a membrane.

6. Filler valve assembly as claimed in claim 3, **characterised in that** said means (6) for bring the second conduit (4) back to said first closed operative configuration comprise a cylinder (10) coaxial to the second conduit (4) and co-operating with a portion (4b) thereof defining an active surface (4c) for a fluid under pressure sent by said pressure source, to cause the sliding of the second conduit (4) relative to the first (2).

7. Filler valve assembly as claimed in claim 1, **characterised in that** said means (5) for bringing the second conduit (4) to said second inflow operative configuration comprise at least an abutment element (11) integral with the first conduit (2) and so shaped as to bear on an inlet (3a) of the container (3), allowing the second conduit (4) to slide relative to the first (2) and the consequent disengagement of said shutter portion (4a) from the dispensing outlet (2a) of the first conduit (2).

8. Filler valve assembly as claimed in claim 1, **characterised in that** said first and said second conduit (2;4) are mutually connected by means of at least an elastic element(12).

9. Filler valve assembly as claimed in claim 1, **characterised in that** it comprises at least a roller (13) integral to the second conduit (4) and able to be associated to a pair of actuating cams, a first cam raising the filler valve assembly (1) to allow the positioning of a container (3) to be filled underneath the assembly (1) itself, and a second cam lowering the filler valve assembly (1) to activate the inflow of liquid to the container (3).

10. Filler valve assembly as claimed in claim 1, **characterised in that** said shutter portion (4a) of the second conduit (4) defines, during the dispensing phase, a deflector for the flow of liquid entering the container (3).

11. Filler valve assembly as claimed in claim 1, **characterised in that** it comprises means for bring the container (3) to be filled in correspondence with the

conduit (2) for the inflow of the liquid.

12. Filler valve assembly as claimed in claim 1, **characterised in that** it comprises a gasket (16) substantially of the lip type fastened to the means (5) for bringing the second conduit to said second inflow configuration, on said gasket (16) bearing an inlet (3a) of the container (3).

13. Filling plant, **characterised in that** it comprises a filler valve assembly (1) as claimed in any of the previous claims.

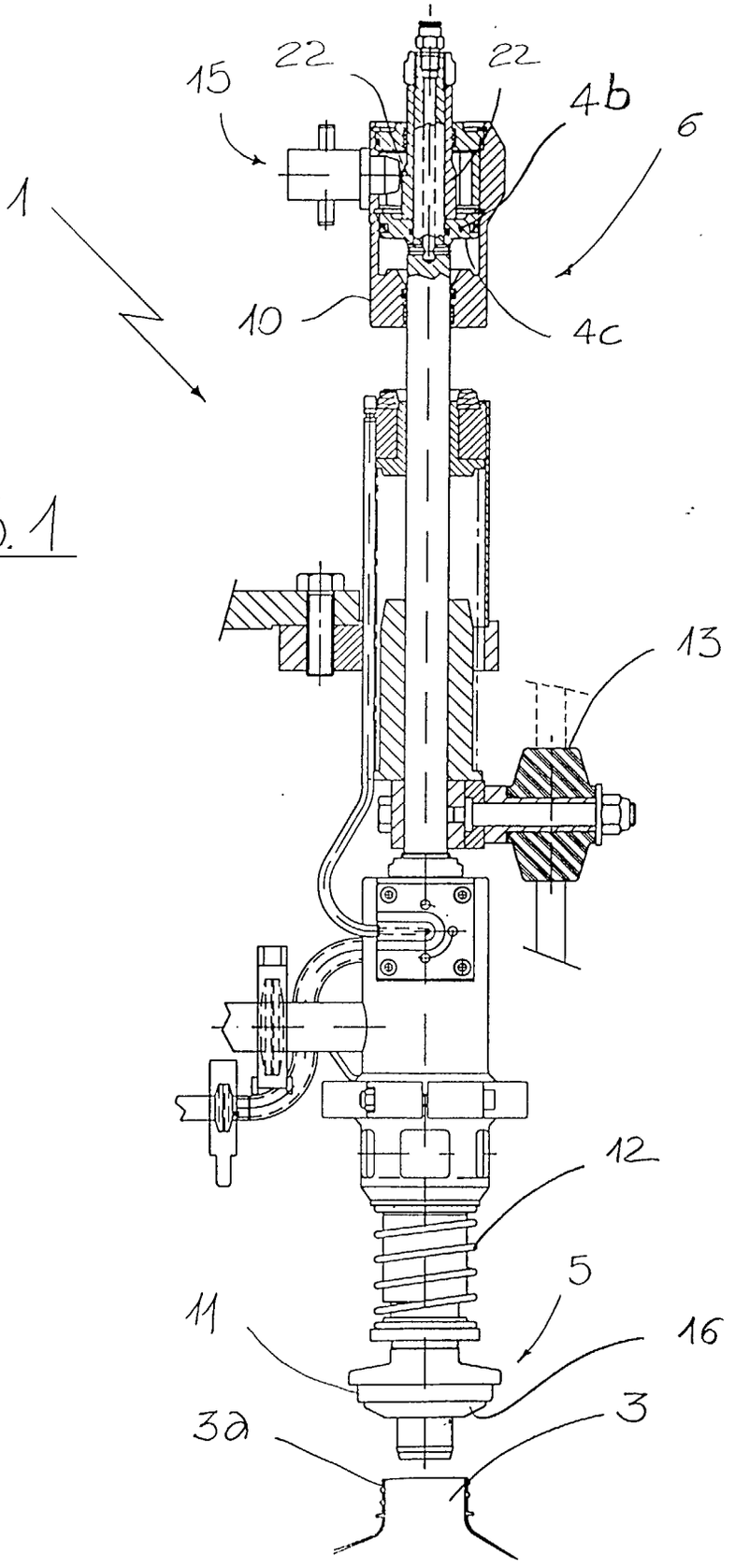


FIG. 1

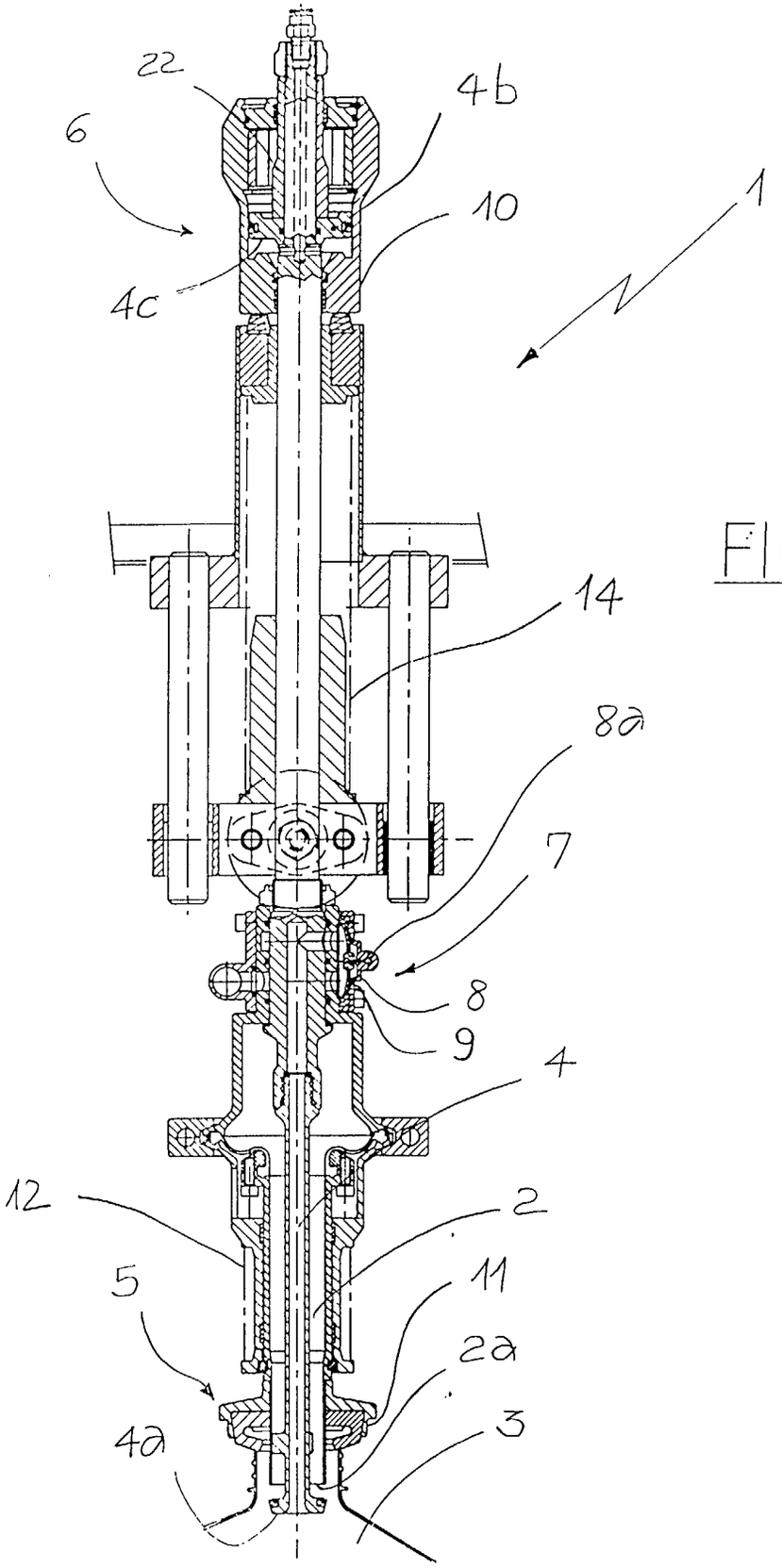


FIG.2

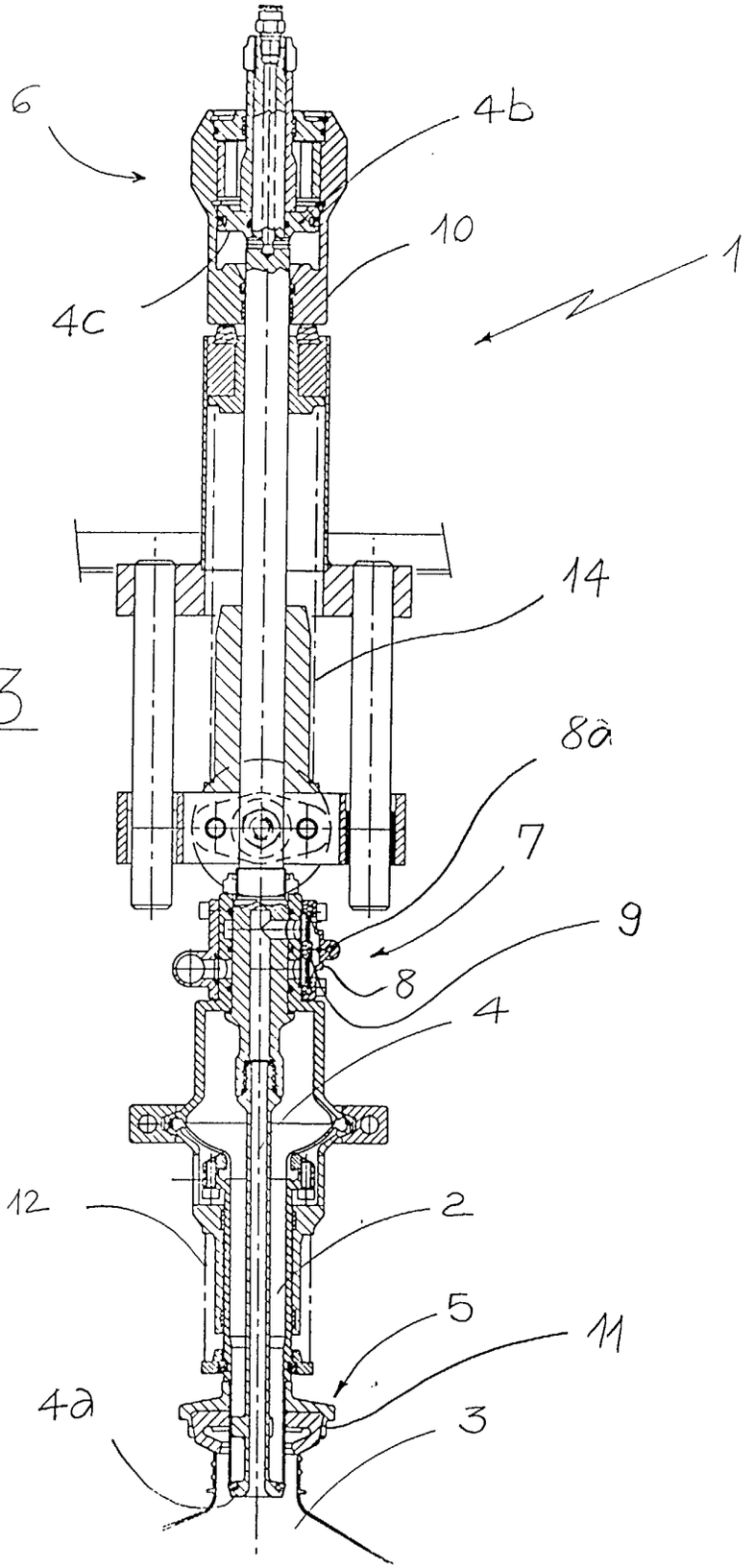


FIG.3

FIG. 4

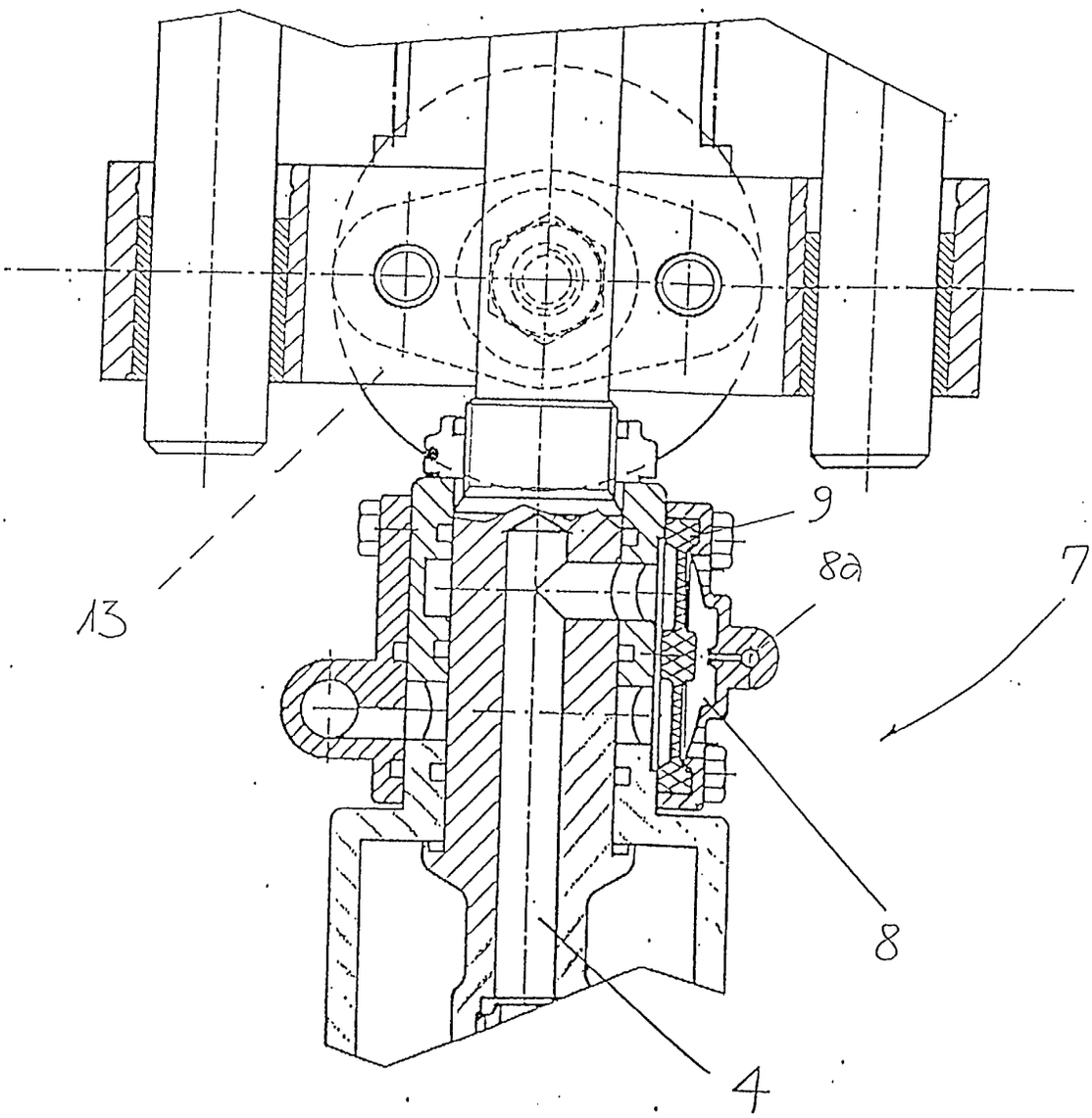


FIG. 5

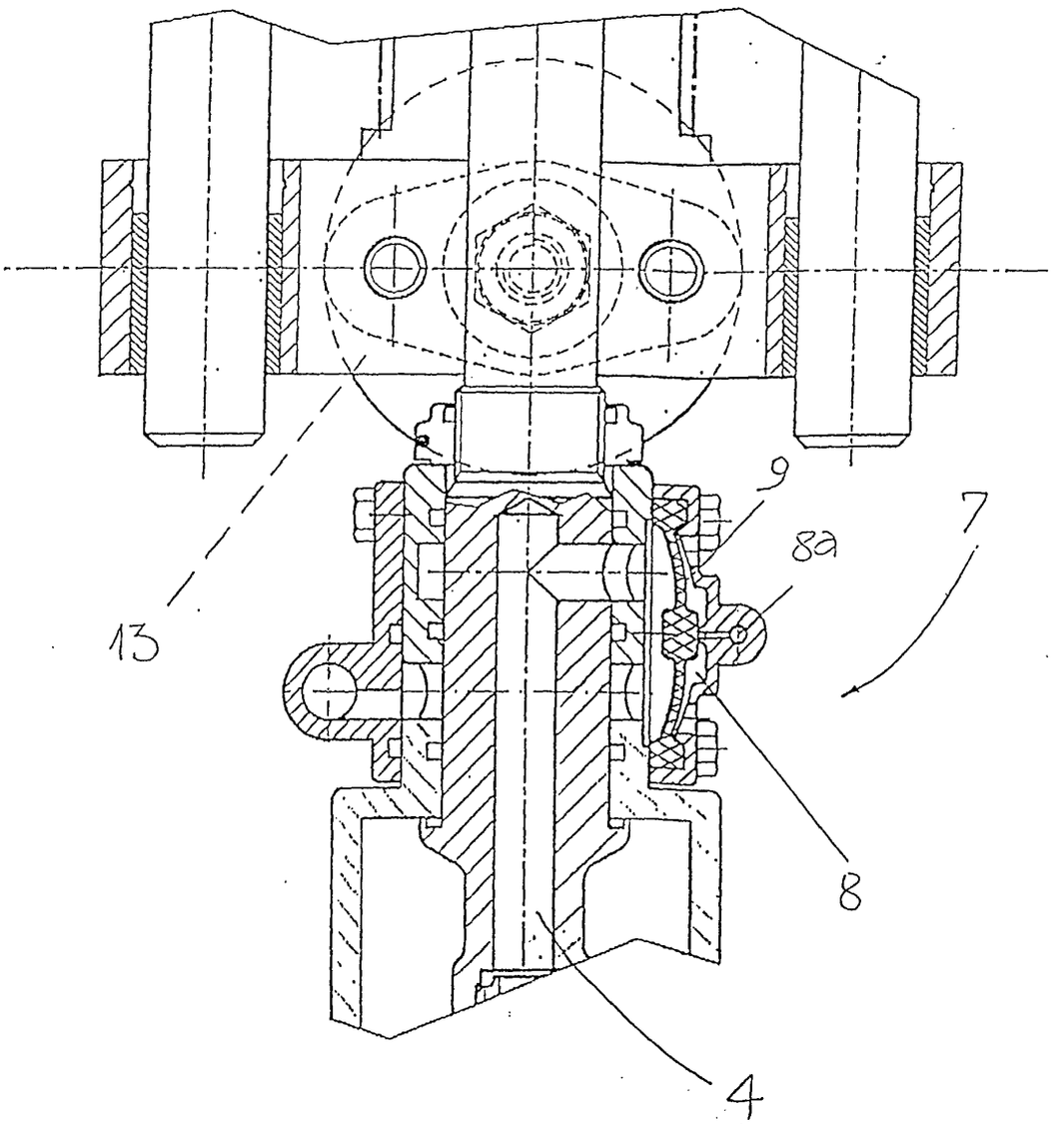


FIG.6

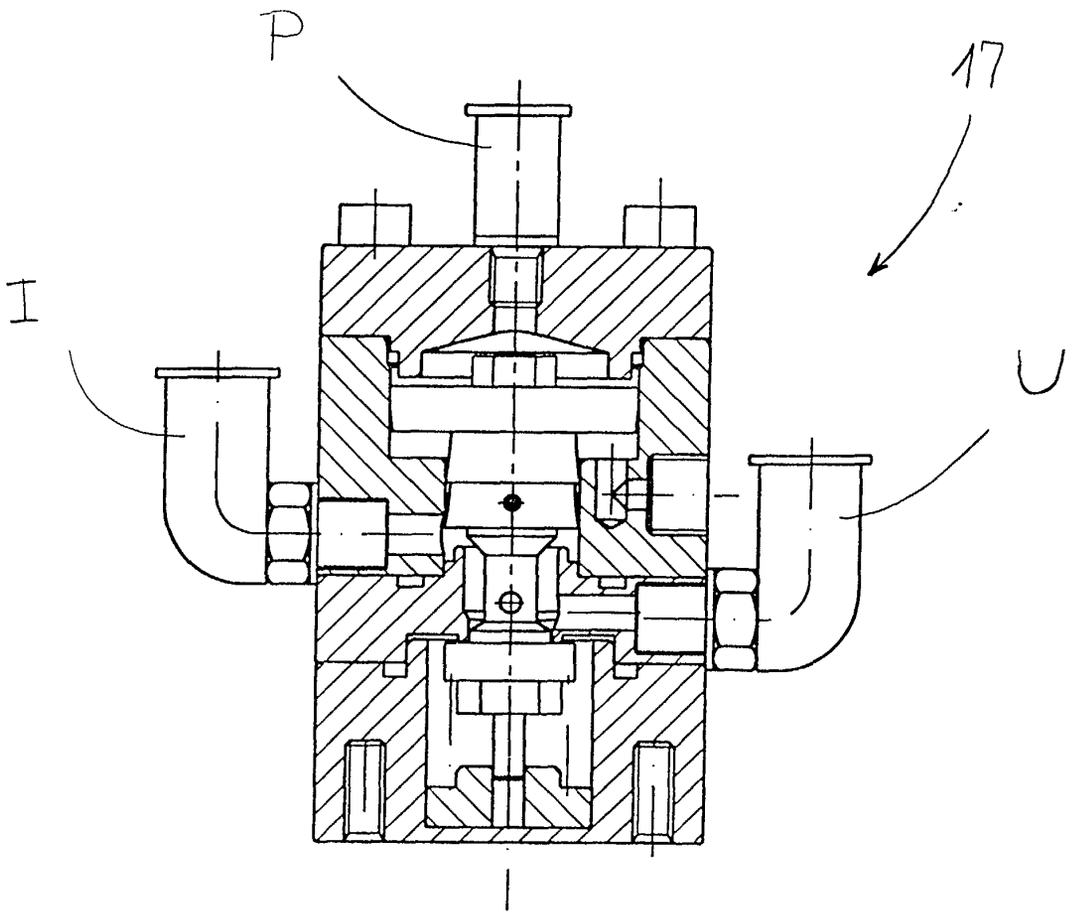
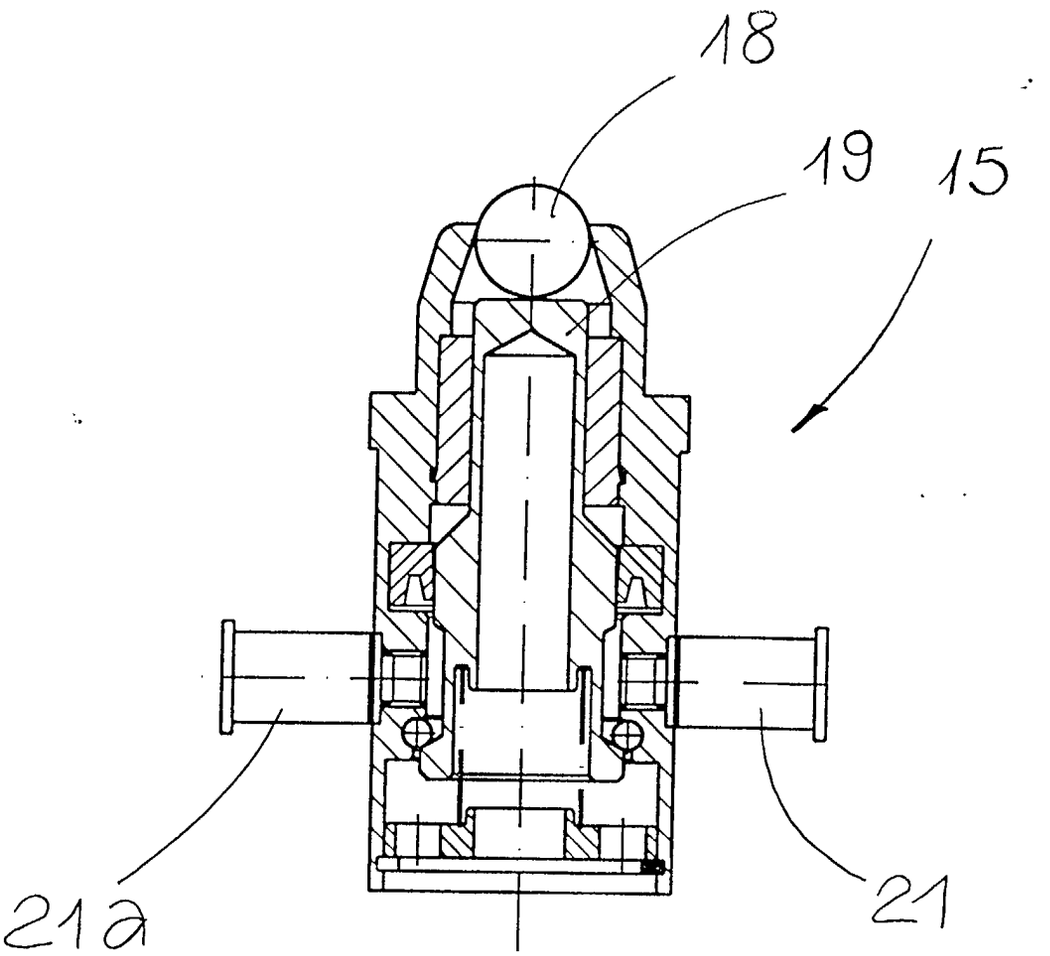


FIG. 7



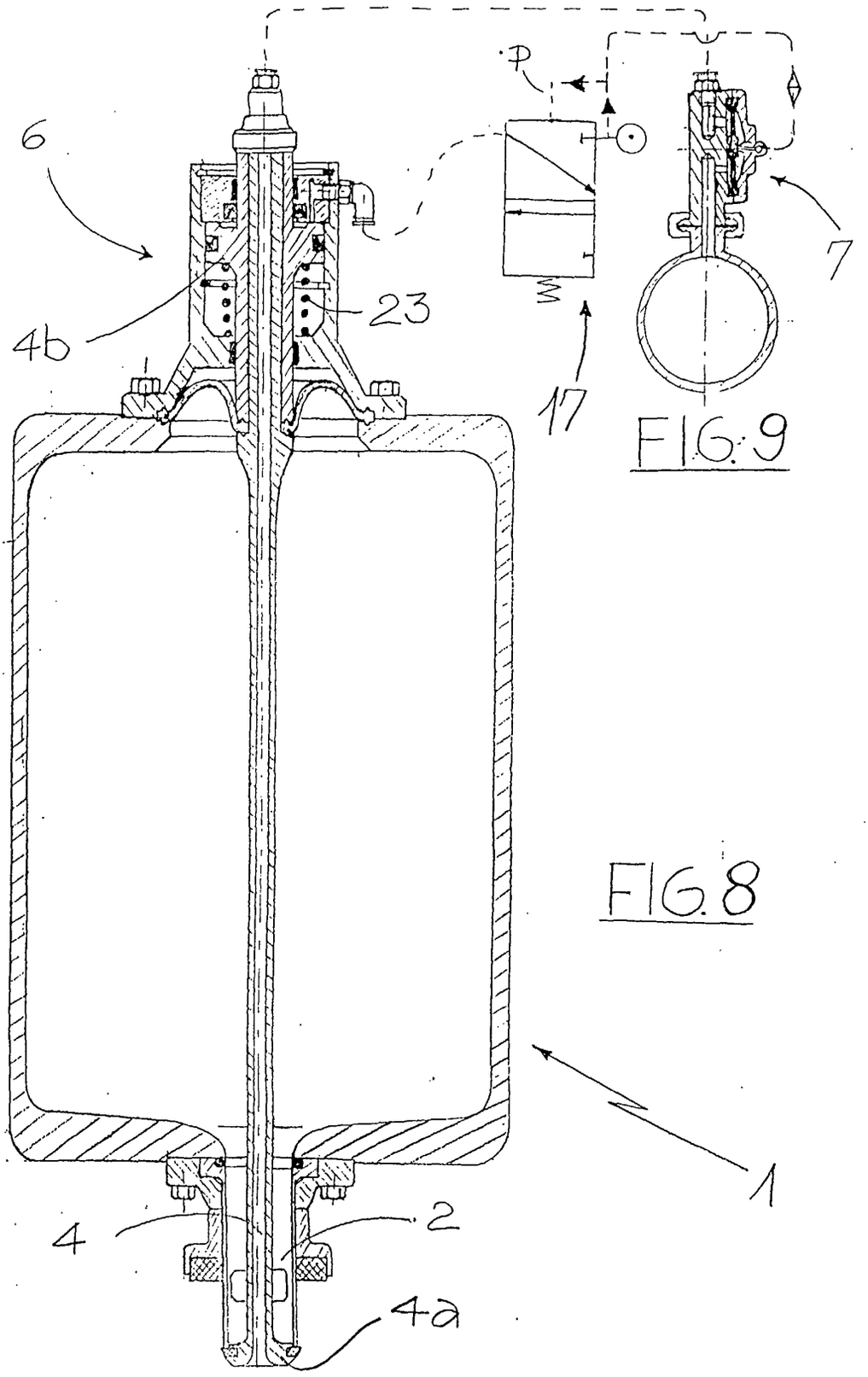


FIG. 9

FIG. 8