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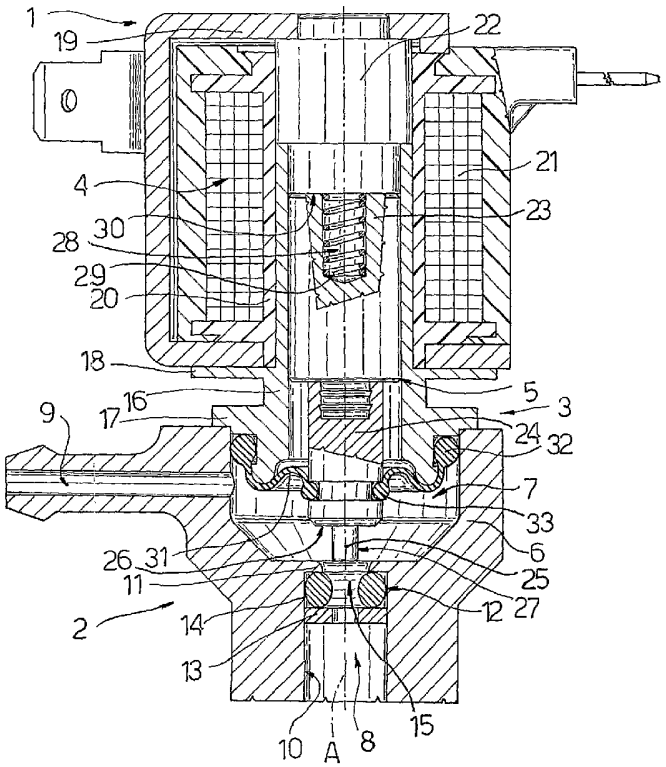
(54) Title: FLOW CUT-OFF SOLENOID VALVE IN A FEEDING CIRCUIT OF A FLUID CONTAINING WATER VAPOUR



(57) Abstract: A flow cut-off solenoid valve (1) in a fluid feeding circuit containing water vapour presents a guiding cylinder (16); a slider (5) , which comprises a shutter (25) and a piston (23) which is slidingly coupled to the guiding cylinder (16) along a determined axis (A) ; a solenoid (4) actuating said slider (4) ; and a valve body (2) in which a passage section (15) of the fluid is made, which is defined by an annular wall (14) and is adapted to be selectively closed by the shutter (25) which is insertable with interference in the passage section (15) in contact with the annular wall (14) .

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FLOW CUT-OFF SOLENOID VALVE IN A FEEDING CIRCUIT OF A FLUID CONTAINING WATER VAPOUR

TECHNICAL FIELD

The present invention relates to a flow cut-off solenoid valve in a feeding circuit of a fluid containing water vapour.

In particular, the present invention relates to a flow cut-off solenoid valve in a feeding circuit of a fluid containing water vapour in a household appliance.

BACKGROUND ART

The use of water vapour has multiple applications in the household appliance sector. It will suffice to mention surface washing machines equipped with steam jet and espresso coffee machines with respective auxiliary systems.

Each of these household appliances comprises a boiler or other vapour generating and water heating devices, a distribution circuit of the fluid containing water vapour and a flow cut-off solenoid valve controlled by the operator.

Generally, a flow cut-off solenoid valve in a feeding circuit of a fluid containing water vapour comprises a guiding cylinder; a slider, which comprises a shutter and a piston slidingly coupled to the guiding cylinder along a determined axis; an operating solenoid of said slider; and a valve body in which a passage section of the fluid is made and adapted to be selectively closed by said shutter.

The type of solenoid valve mentioned above is effective and widely experimented. However, household appliances employing water vapour often present problems of operation linked to the rapid deterioration of the solenoid valve. Among the causes of rapid deterioration of the solenoid valve there is certainly the formation and deposit of lime on the structural elements of the solenoid valve.

Concerning this, it must be remembered that lime is released in the vapour generation step and then deposited on the solid parts of the solenoid valve, such as the shutter and valve body. Since household appliances are subjected to discontinuous operation with long pauses, lime solidifies creating scaling also on the elements which should ensure a fluid-tightness, such as the shutter and the valve body.

DISCLOSURE OF INVENTION

It is the object of the present invention to make a flow cut-off solenoid valve in a vapour feeding conduit which is free from the drawbacks of the solenoid valves of the known type and which at the same time is particularly cost-effective and compact in size, as required for use in the household appliance sector.

According to the present invention a solenoid valve of the type described is made, characterised in that the passage section is defined by an annular wall and in that the shutter is insertable with interference in said passage section in contact with the annular wall.

Coupling by interference between the shutter and the annular wall which defines the passage section determines a rubbing which eliminates the deposits of lime at least between the members responsible for ensuring fluid-tightness.

According to a preferred embodiment of the present invention, said valve body comprises a cup-shaped body, which is coupled to said guiding cylinder and forms a compartment; and a membrane arranged in said compartment so as to fluid-tightly separate the piston from the fluid.

According to this preferred embodiment of the invention, the membrane prevents the deposit of lime on the piston and ensures, in time, an optimal coupling between the piston and the guiding cylinder.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the invention, it will now be described an embodiment only by way of non-limitative example, and with reference to the accompanying drawings, in which:

- figure 1 is a longitudinal section view, with parts removed for clarity, of a solenoid valve made according to the present invention in a first operative position;

- figure 2 is a longitudinal section view, with parts removed for clarity, of the solenoid valve in figure 1 in a second operative position;

- figure 3 is a sectional, magnified view of a detail in figure 2; and

- figure 4 is a sectional, magnified view of a detail in figure 1.

BEST MODE FOR CARRYING OUT THE INVENTION

With reference to figure 1 or 2, it is indicated as a whole by 1 a flow cut-off solenoid valve arranged along a feeding circuit (not shown) of a fluid containing water vapour in a household appliance (not shown). The solenoid valve 1 prevalently extends along an axis A and comprises a valve body 2 assembled to a structure 3, which supports a solenoid 4 and a mobile slider 5 between a first operative position (open solenoid valve, as shown in figure 1) and a second operative position (closed solenoid valve, as shown in figure 2).

The valve body 2 comprising a cup-shaped body 6 which defines a compartment 7 is arranged to be coupled with structure 3 and is in communication with a feeding conduit 8 and a delivery conduit 9.

As better shown in figure 3, the conduit 8 is defined by a hole 10 with axis A, along which, at the confluence of conduit 8 with compartment 7 of the cup-shaped body 6, a thrust ring 11 is arranged which is integrally made in the

valve body 2 and whose diameter is smaller than the diameter of hole 10. The valve body 2 comprises an annular o-ring type seal 12, which is abuttingly arranged against ring 11 and is maintained in such position by a stop ring 13, which is driven by interference in hole 8. Seal 12 presents an oval section annular wall 14, which defines a passage section 15 of the fluid along the feeding conduit 8.

From a constructive point of view, seal 12 may be fixed in conduit 8 with any tool suitable to prevent sliding of the same along axis A. For example, according to a variant not shown, thrust ring 11 may be driven in hole 10, while stop ring 13 may be integrally made in the valve body 2. According to a further variant (not shown), seal 12 is inserted in an annular groove made in the feeding conduit 8.

With reference to figures 1 and 2, structure 3 comprises a cylinder 16 coaxial to axis A and two annular flanges 17 and 18 which protrude from cylinder 16. Flange 17 is adapted to couple with the valve body 2, while flange 18 supports the solenoid valve 4. Structure 3 comprises a skirt 19 closed about a solenoid valve 4, which presents annular shape, comprises a core 20 and an electrical winding 21 and extends about a guiding cylinder 16; and a cylindrical body 22 of magnetic flow conducting material, with a first portion inserted inside the cylinder 16, and a second portion whose diameter is larger than the first portion and is in direct contact with the core 20. The skirt 19 encloses at least in part also the cylindrical body 22 and the electrical connections.

Slider 5 comprises a piston 23, which is made of magnetic flow conducting material and slides inside a cylinder 16; an elongated body 24, which is firmly anchored to the piston 23; and a shutter 25, which has the shape of

an elongated body 24 and is adapted to be selectively inserted in the passage section 15 defined by the annular wall 14. The elongated body 24 has a flat face 26, which is adapted to be abuttingly arranged against the cup-shaped body 6, specifically against the thrust ring 11, which defines the end-of-stroke position of the second operative position (figures 2 and 3).

The shutter 25 is defined by an essential cylindrical appendix, whose cylindrical side face 27 has a larger diameter than the diameter of the passage section 15. In this way, the coupling between the shutter 25 and the wall 14 is a coupling with interference.

Slider 5, or better in the case in point piston 23, present a cylindrical cavity 28 which extends along axis A, is arranged on the opposite side with respect to the elongated body 24 and accommodates spring 29, which is abutting against a face 30 of the cylindrical body 22 so as to maintain slider 5 separated from cylindrical body 22. In other words, spring 29 holds slider 5 in the second operative position.

Solenoid valve 1 further comprises an annular membrane 31, which is arranged in compartment 7 and prevents the fluid from occupying the coupling zone between slider 5 and cylinder 16. Membrane 31 is externally delimited by a seal 32 secured between the valve body 2 and the structure 3, and inside by a seal 33, which is arranged about the elongated body 24. Specifically, seal 33 is accommodated in an annular groove 34 made in the elongated body 24 itself.

Cylinder 16 presents a segment 35 extending belong flange 17 and in compartment 7. Segment 35 presents a first cylindrical portion 36 and a second flared portion 37, which protrudes outwards. Portions 36 and 37 are delimited by a curved face without edges adapted to be arranged in contact with the membrane 31. Seal 32 is closed between

portions 26 and 36, cup 6 and flange 17. Furthermore, in the first operative position (figure 4) the membrane 31 is arranged in contact with the cylinder 16 without interfering with the edges so as to preserve their integrity.

In use, the solenoid valve 1 is normally closed, i.e. arranged in the second operative position shown in figures 2 and 3. Shutter 25 is maintained in passage section 15 within the annular wall 14 by spring 29 which acts directly on slider 5. Energising solenoid 4 determines a magnetic flow whose course is defined by core 20, cylindrical body 22 and piston 23. The magnetic flow overcomes the force exerted by spring 29 and determines the approach of piston 23 to cylindrical body 22 and the raising of shutter 25 (figure 1). The interruption of electrical current to solenoid 4 determines the lowering of shutter 25 again.

The particular efficiency of the solenoid valve 2 object of the present invention consists in that the shutter 25 rubs against the walls 14, thus scraping off the possible deposit of lime from the walls 14 and the shutter 25 itself.

Furthermore, the membrane 31 protects the coupling between cylinder 16 and piston 23 from the deposit of lime scaling. In actual fact, membrane 31 prevents the fluid from coming into contact with cylinder 16 and piston 23. The deformability of the annular rubber wall 14 presents the advantage of not requiring high insertion and extraction forces of the shutter 25 and, at the same time, facilitates the detachment of possible lime scaling.

C L A I M S

1. A flow cut-off solenoid valve in a fluid feeding circuit containing water vapour, the solenoid valve comprising a guiding cylinder (16); a slider (5), which comprises a shutter (25) and a piston (23) slidingly coupled to the guiding cylinder (16) along a determined axis (A); a solenoid (4) for actuating said slider (5); and a valve body (2) in which a passage section (15) of the fluid is made adapted to be selectively closed by said shutter (25); the solenoid valve being characterised in that the passage section (15) is defined by an annular wall (14) and the shutter (25) is insertable with interference in said passage section (15) in contact with the annular wall (14).

2. A solenoid valve according to claim 1, characterised in that said annular wall (14) is elastically yielding.

3. A solenoid valve according to claim 2, characterised in that said elastically yielding annular wall (14) is formed by a annular rubber seal (12).

4. A solenoid valve according to any of the claims from 1 to 3, characterised in that said shutter (25) presents a cylindrical side wall (27) having an external diameter larger than the diameter of the passage section (15).

5. A solenoid valve according to claim 5, characterised in that said slider (5) comprises an elongated body (24) having a flat face (26) from which said shutter (25) protrudes; said cylindrical body (24) being selectively arranged against said valve body (2) so as to make a stopper for said slider (5) and said shutter (25).

6. A solenoid valve according to any of the preceding claims, characterised in that said valve body (2) comprises

a cup-shaped body (6), which is coupled to said cylinder (16) and forms a compartment (7); and a membrane (31) arranged in said compartment (7) so as to fluid-tightly separate the piston (23) from the fluid.

7. A solenoid valve according to claim 6, characterised in that said membrane (31) presents an annular shape and is coupled to said slider (5) and to said valve body (2).

8. A solenoid valve according to claim 7, characterised in that said membrane (31) presents an internal seal (33) coupled to said slider (6).

9. A solenoid valve according to claim 8, characterised in that said slider (5) presents a groove (34) in which said internal seal (33) is accommodated.

10. A solenoid valve according to any of the claims from 7 to 9, characterised in that said membrane comprises an external seal (32) fixed to said valve body (2).

11. A solenoid valve according to claim 10, characterised in that said external seal (32) is secured between said valve body (2), said guiding cylinder (16) and a flange (17) integral with said guiding cylinder (16).

12. A solenoid valve according to claim 11, characterised in that said guiding cylinder (16) presents an undulated face (32) without edges and adapted to be arranged in contact with said membrane (31).

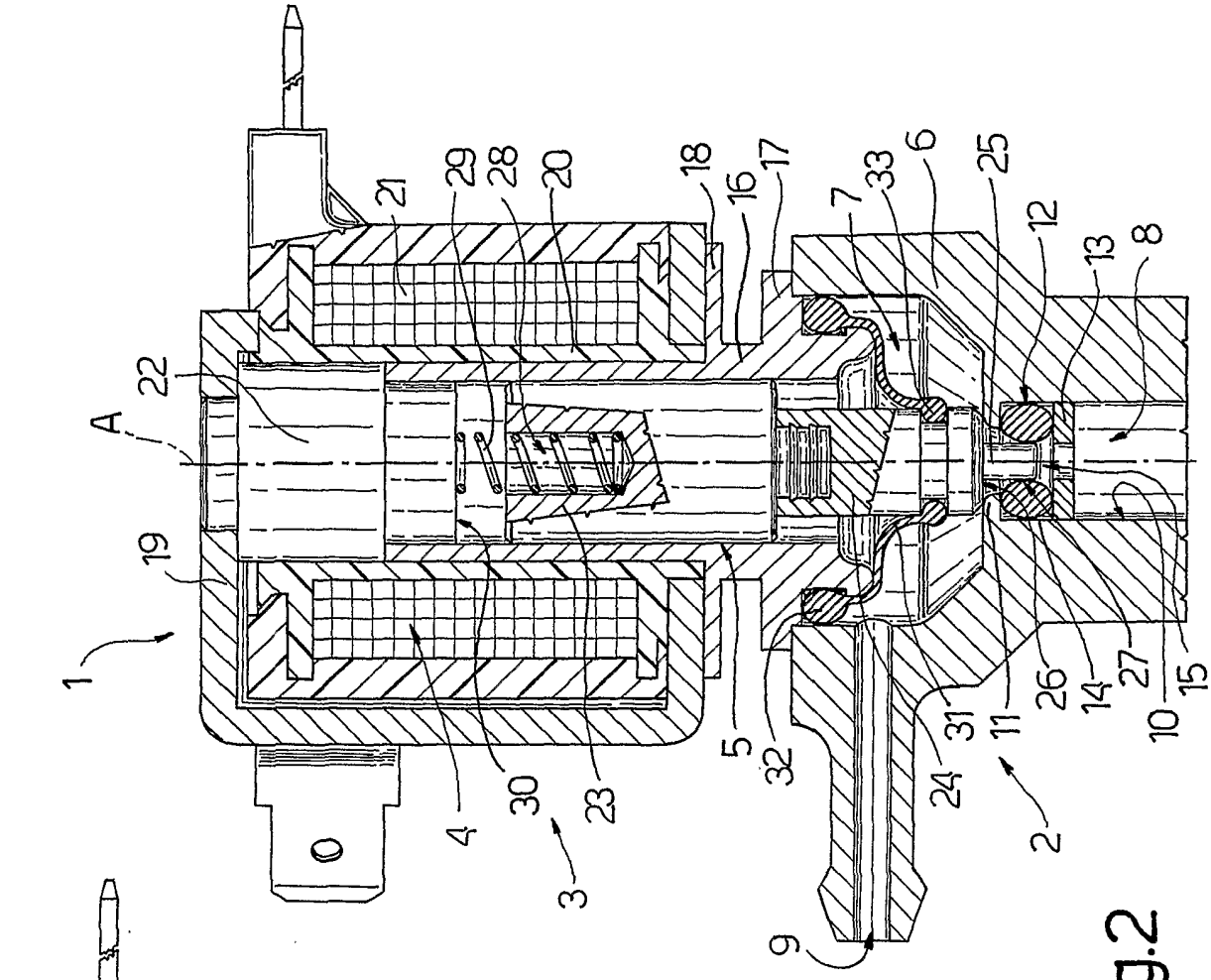
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Fig.2

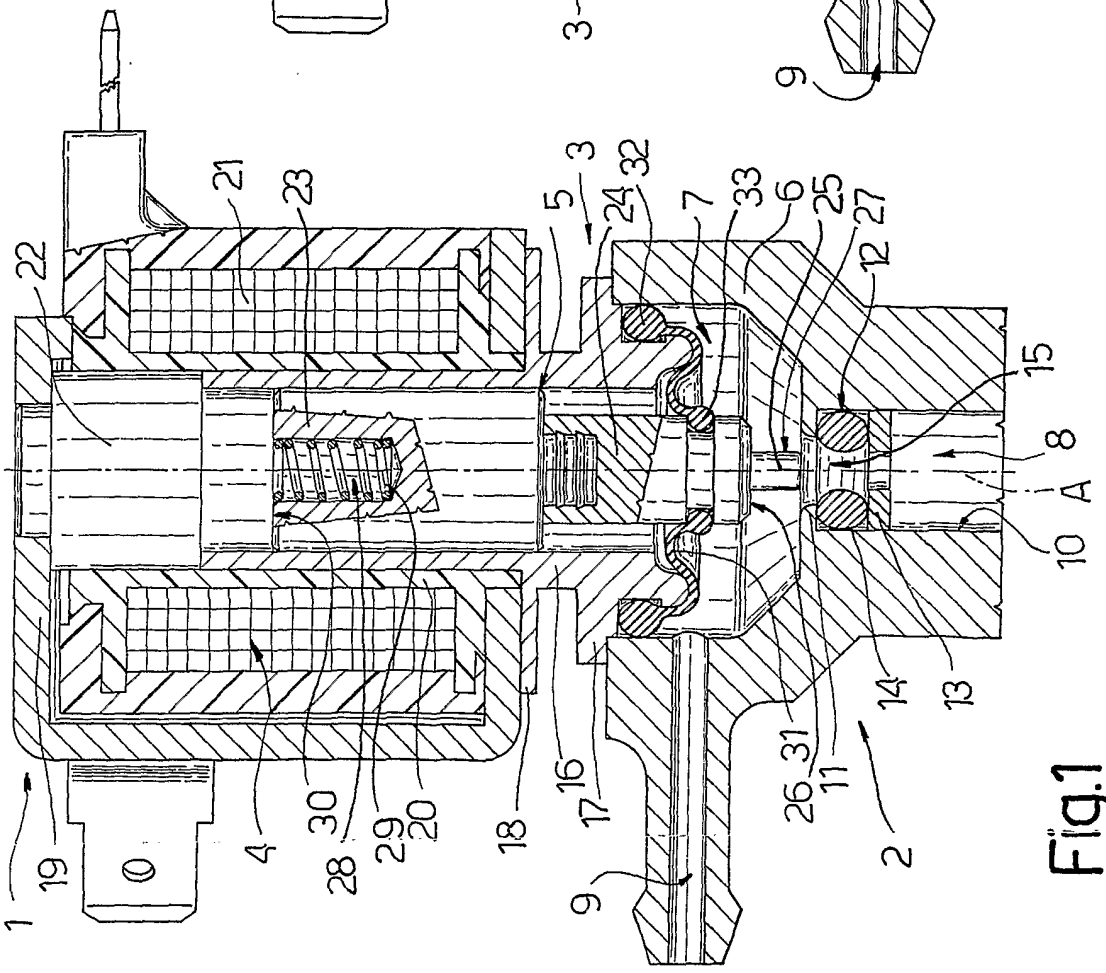
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Fig.1

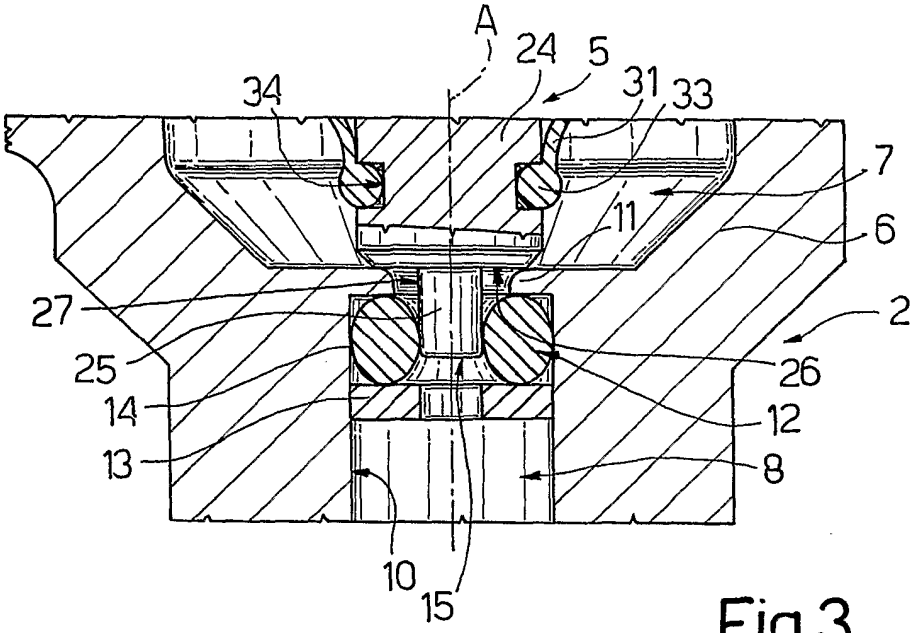
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Fig.3

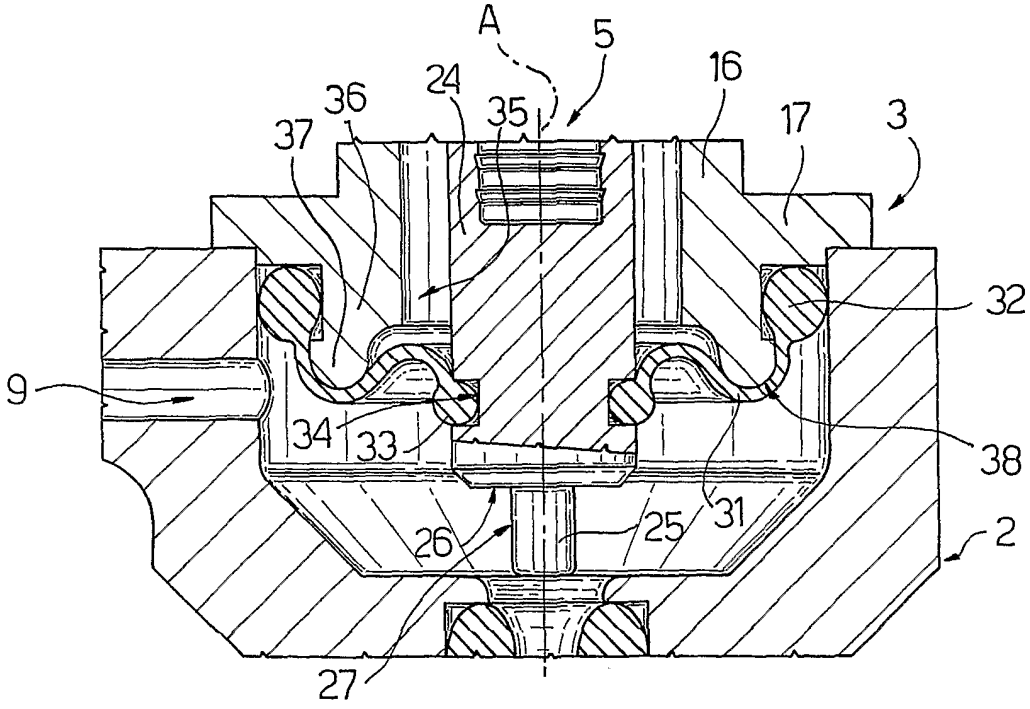
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Fig.4