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(11) **EP 1 085 119 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
21.03.2001 Bulletin 2001/12

(51) Int. Cl.⁷: **D06F 39/08**

(21) Application number: **00120078.1**

(22) Date of filing: **15.09.2000**

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE**
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **15.09.1999 IT TO990787**

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(54) **Sensor for hydraulic devices of electric household appliances, in particular washing machines, and hydraulic device integrating said sensor**

(57) A sensor is described for a hydraulic device of a household appliances, in particular a washing machine, which hydraulic device (1') comprises at least a body (2), wherein a space (3) is defined to flow and/or contain a liquid, and at least a housing (6) in said body (2), for securing to the latter at least a control element (4) for the flow and/or containment of said liquid, said housing (6) defining a seat (6B) for positioning and/or fastening at least a part (4B) of said control element (4) to said body (2); according to the invention, said sensor (20) comprises at least a component defining coupling means capable of cooperating with said seat (6B), for allowing to position and/or fasten said sensor (20) on said housing (6), alternatively to said part (4B) of said control element (4).

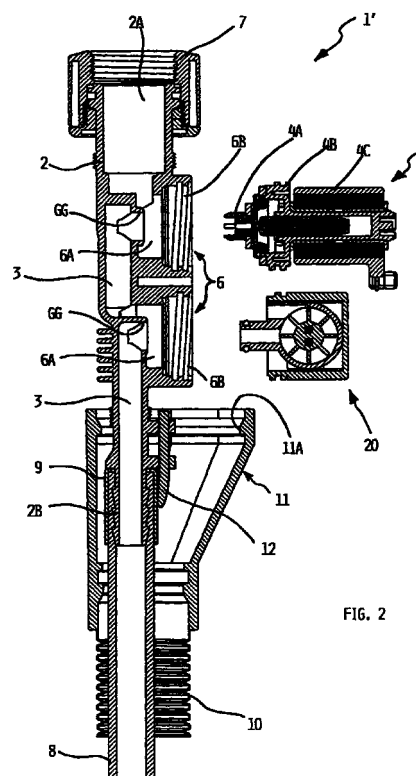


FIG. 2

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Description

[0001] The present invention relates to a sensor for hydraulic devices of household appliances, in particular washing machines.

[0002] It is known for some household appliances, such as washing machines, to be connected to a water supply source, consisting in general of a household water main; to this purpose appropriate hydraulic supply devices are used, which are connected and/or interposed between a tap of said water main and a wash tub of the household appliance.

[0003] These hydraulic devices may consist of simple ducts in rubber or similar material, with appropriate fastening connectors on both ends; in other instances, one or more valves may be provided along said ducts, which valves are used for enabling and stopping water intake at appropriate times to the household appliance for metering purposes and/or obtain a safety function against possible liquid leaks.

[0004] In fact, as known, a flooding risk of the apartment ensues in general following a sudden leakage of the liquid supply system of a washing machine; such sudden leakages may be due for example to a failure of the devices inside the machine (jammed supply solenoid valves or pressure switch) or to a breakage of the water supply duct.

[0005] Therefore, antiflooding safety devices are known, which ensure a nearly continuous control of possible leakages

[0006] Hydraulic devices of this type provide one or more valves, either electrically and/or pneumatically and/or mechanically operated, which are located upstream and/or downstream a water supply hose, and an appropriate sensor, such as a float or anhydrous sponge sensor, located in a water collecting tray underneath the wash tub of the machine; should a failure occur to the devices inside the machine, water would reach the water collecting tray and the sensor operate the closure of the above water supply valve or valves.

[0007] Hydraulic devices as described above are also known, which provide an outer tube enclosing a water supply hose; should the latter fail, then the outer tube would cause the water leakage from the supply hose (otherwise causing a flood) to flow into the above collecting tray, causing the sensor to operate a consequent closure of the safety valve or valves.

[0008] It is also known that the use of different types of sensor is of increasing interest in the field of household appliances, such as for sensing the temperature or conductivity or pH degree of a liquid used by the appliance, or for measuring the flow or flow-rate of a liquid supplied to the appliance.

[0009] For instance, EP-A-0 517 293 discloses an hydraulic device for the supply and volumetric control of a liquid in a washing machine; such an hydraulic device is practically obtained according to the technique described above with reference to antiflooding safety

devices, but instead of a sponge or float liquid leakage sensor, it uses a flow-meter, controlling the operation of a solenoid valve for the supply of a predetermined quantity of water in the wash tub.

[0010] According to the solution described in EP-A-0 517 293, the flow-meter comprises an impeller, whose rotation is caused by the water flowing inside the hose; the number of revolutions of the impeller, being representative of the volume of liquid supplied in, is counted by means of an appropriate detector, this information is used for controlling the operation of the solenoid valve of the hydraulic device, for the liquid metering and/or safety purposes against possible floods.

[0011] However, the solution described in EP-A-0 517 293 presumes a specific manufacture of the valve body of the hydraulic device, i.e. the component to which the impeller, the detector and the solenoid valve are associated; let consider, for example, that an appropriate housing has to be defined on the valve body of the device for fastening the detector.

[0012] Such a housing is obviously not required on those valve bodies to be employed for realizing antiflooding safety devices which do not use a water flow or flow-rate sensor.

[0013] Therefore, in this frame, the approach adopted by the known state of the art appears to contrast the usual requirements of manufacturing standardization, i.e. reducing the number of differing pieces and semi-finished parts for manufacturing different types of product; from a manufacturing standpoint it is obvious, in fact, that the manufacturers of the above hydraulic devices are actually forced to provide a wide range of components, particularly various types of valve bodies for the production of liquid supply devices having different features.

[0014] Similar problems as above can also be found in other hydraulic devices for household appliances, such as in liquid drain ducts, liquid metering vessels for washing machines, water softening devices, and so on; in this respect it should be considered, in fact, that such devices are also normally equipped with valves similar to the ones used in the water supply ducts for household appliances or in antiflooding safety devices.

[0015] The present invention has the aim of solving the above drawbacks related to known hydraulic devices and provide, in particular, a technical solution allowing to improve the manufacturing standardization of such hydraulic devices for use in household appliances, such as the devices for the supply and/or metering and/or drain and/or containment or treatment, in general, of liquid, either using sensing means or not.

[0016] Such aims are attained according to the present invention by a sensor for hydraulic devices of household appliances, in particular washing machines, incorporating the features of the annexed claims, which form an integral part of the present description.

[0017] Further aims, features and advantages of the present invention will become apparent from the fol-

lowing detailed description and the annexed drawings, which are supplied by way of non limiting example, wherein:

- Fig. 1 shows a schematic partial and exploded section view of a portion of a first generic hydraulic device for a household appliance;
- Fig. 2 shows a schematic partial and exploded section view of the device represented in Fig. 1, equipped with a sensor manufactured according to the teachings of the present invention;
- Fig. 3 shows an enlarged detail of the hydraulic device represented in Fig. 2;
- Fig. 4 shows the hydraulic device having by an orthogonal section with respect to the view of Fig. 3;
- Fig. 5 shows a schematic partial section of the hydraulic device of Fig. 2 being assembled;
- Fig. 6 shows a schematic partial section of a portion of a second generic hydraulic device for a household appliance, equipped with a sensor according to a possible variant embodiment of the present invention;
- Fig. 7 shows an enlarged detail of the hydraulic device represented in Fig. 6;
- Fig. 8 shows a schematic partial section of a third generic hydraulic device for a household appliance;
- Fig. 9 shows a schematic partial section of the hydraulic device represented in Fig. 8, equipped with a sensor according to the present invention.

[0018] Fig. 1 represents an exploded and partial section of a control device for liquid supply in a household appliance, in particular a washing machine, of the type commonly known and indicated as a whole with 1.

[0019] The device 1 comprises a valve body 2, for example being manufactured from thermoplastic material, delimiting inside a through-flow duct 3 for the water supplied to a washing machine; along the duct 3 two solenoid valves indicated with 4 and 5 are destined to be located in series.

[0020] The solenoid valves, even if located in a different way, are similar to each other and are of known type and operation; for a detailed description of such a type of solenoid valves, reference can be made for example to the Italian patent No. IT-B-1.281.406.

[0021] As for the housing and fastening purposes of the solenoid valves 4 and 5, two appropriate seats 6 are defined in the valve body 2. In particular, each seat 6 has:

- a first portion 6A, more internal with respect to the body 2, in direct communication with the through-flow duct 3, which is apt to house respective movable plugging elements 4A and 5A of the solenoid valves 4 and 5;
- a second portion 6B, having means for the mechanical coupling, in particular a threading, with respec-

tive fastening components 4B and 5B of the solenoid valves 4 and 5.

[0022] In the above example, the above fastening components 4B and 5B consist of threaded flanges integral to the supporting body of a coil 4C and 5C; however, it is clear that fastening the components 4B and 5B to the seats 6 can be obtained in a different way, such as by means of bayonet joints or threaded seats and relevant screws; or by welding, bonding, etc.

[0023] An outer ring 7 is mounted in the upper portion of the valve body 2, for connecting the device 1 to a tap, with a relevant sealing gasket, not shown in the figure; at the inlet 2A of the duct 3, a filter and flow regulator not shown here can also be inserted upstream the solenoid valves 4 and 5, such as of the type indicated in IT-B-1.281.406 mentioned above.

[0024] In correspondence with the outlet length of the duct 3, a rubber tube 8 is provided, being engaged on the lower end 2B of the valve body 2, shaped accordingly; the tube 8 is fastened to the end 2B by means of a clipping or fastening metal ring 9.

[0025] With 10 an outer corrugated tube is indicated, which encloses the tube 8 and acts for collecting leakage water, should the latter have a failure; this outer tube 10 is connected on its upper end to a covering element 11, in a known manner; this covering element 11 has engaging teeth 11A, whose function will be clarified later.

[0026] Reference 12 indicates a visible length of a sheath, being provided for carrying electric conductors, whose terminals (not visible) are to be connected to the solenoid valves 4 and 5; the sheath 12 extends parallel to the tube 8 within the outer tube 10, up to inside the washing machine, where said electric conductors are connected in a known way to an appropriate system for controlling the operation of the solenoid valves 4 and 5.

[0027] The lower end of the device 1, i.e. the portion connected to the household apparatus, and its overall operation are per se known, and they are therefore not described nor represented herein; however, assuming that the device 1 also performs antiflooding safety functions, an appropriate sensor is provided inside the washing machine, which causes the valves 4 and 5 to close should a liquid leakage be detected.

[0028] From the above, it can be seen how the valve body 2 is used for obtaining a first type of hydraulic device, for controlling the liquid supply to a washing machine, comprising a pair of solenoid valves controlled by appropriate sensing means located within the relevant washing machine.

[0029] Fig. 2 represents a situation, on the contrary, where the same valve body 2 of Fig. 1 is used for realizing a second type of device, indicated as a whole with 1', which integrates a sensor according to the present invention, in particular a liquid flow or flow-rate sensor; it should be noticed how in this figure the same reference numbers of the previous figure are used for indi-

cating technically equivalent elements.

[0030] As it can be seen in Figure 2, the device 1' comprises the upper solenoid valve 4 only; instead of the second solenoid valve, the device 1' shows a flow sensor 20, manufactured according to the present invention, which is destined to be housed and fastened in correspondence with the lower seat 6, i.e. the seat which in the instance of Fig. 1 was used for fastening the solenoid valve 5.

[0031] Figs. 3 and 4 show the sensor 20 more in detail, following its coupling in the relevant seat of the valve body 2.

[0032] As it can be noticed, said sensor 20 has a main body 21, made by thermoplastic material, whose outer surface delimits a threading 22, apt to be coupled with the threading of the portion 6B of the seat 6 of the valve body 2 (Fig. 1), with an interposed sealing gasket G.

[0033] A chamber 23 housing an impeller 24 is defined within the body 21; this chamber 23 has a round inlet 23A, defined by an opening in the front portion of the body 21, and an outlet 23B, defined by a special round duct 23C, which departs from the chamber 23; as it can be seen in Figs. 3 and 4, the above duct 23C protrudes on the front from the body 21, concentrically with respect to the inlet 23A, thus being able to enter a throat GG delimited by the duct 3 within the valve body 2; to this purpose, the duct 23C has on its end side at least a ring 23D, such as an O-ring, which provides a seal between the duct 23C and the surfaces of the duct 3 (it should be noticed that the throat GG delimited in the duct 3 is provided, in case of application of Fig. 1, for locating a plugging element of the lower solenoid valve 5).

[0034] In order to allow the assembly of the impeller 24 inside the chamber 23, the latter may advantageously be provided with a movable wall or lid PM, visible in Fig. 4, which is water-tightly fastened to the body 21, e.g. by welding, bonding, and so on.

[0035] The impeller 24 has a set of vanes 24A departing from a central core 24B, wherein exciting or magnetic elements 24C are inserted; as it can be seen in Fig. 4, outward pins 24D depart from the outer surface of the core 24B; these pins are used to support and rotate the impeller itself and are apt to be inserted in appropriate housings provided by the chamber 23.

[0036] As it can be seen, the impeller 24 is located outside the body 2; in the instance represented here, is of the so-called tangential type, i.e. apt for being actuated by a liquid flow substantially perpendicular with respect to the rotary axis of the impeller itself; however, nothing binds to place an axial impeller within the body 21, i.e. of the type with a rotary axis substantially coinciding or parallel to the flow of the liquid to be metered, or to the axis of the relevant seat 6.

[0037] A rotation detector 25 of the impeller 24, not detailed in the figures as being of known conception, is inserted within a portion of the body 21, perfectly insu-

lated and sealed from an hydraulic standpoint with respect to the chamber 23 and the duct 3; it is enough to point out herein how in the above example such a detector 25 can be of the magnetic type (such as Hall-effect) and is substantially aligned with the elements 24C of the impeller 24, so as to detect the number of rotations of the latter.

[0038] As said, the outlet 23B of the chamber 23 extends in its central position with respect to the front part of the body 21, so as to be at least partially surrounded by the round inlet 23A and allow an exact easy coupling of the sensor 20 on the seat 6; moreover, according to such a specific arrangement, no particular constraint in the angular position of the sensor 20 will arise with respect to the seat 6; in other words, both the shape and arrangement of the inlet 23A and outlet 23B ensure perfect operation of the sensor 20 even if the rotary axis of the impeller 24 is not positioned with respect to the duct 3 as illustrated in Figs. 3 and 4, following complete tightening of the body 21 in the seat 6.

[0039] Therefore, as it can be seen in the example illustrated, the sensor 20 has detecting means 24 and 25, which after the fastening of the body 21 in the relevant seat 6, appear to be located outside the through-flow duct 3 and the valve body 2.

[0040] Similarly, as it can be noticed, a passage 23, 23A, 23B is defined inside the sensor body 21, in hydraulic communication with the duct 3, through which at least a portion of the liquid can flow outside the same duct 3 and/or valve body 2.

[0041] The assembled device 1' is illustrated in Fig. 5 and is obtained as follows.

[0042] The ring 7 is associated, in a known manner, to the body 2, while the pre-assembled solenoid valve 4 is fastened to the relevant seat 6 of the body 2; this is practically obtained by screwing the component 4B of the solenoid valve 4 on the threading of the portion 6B of said seat; after this fastening, the movable plugging element 4A of the valve 4 is located in the portion 6A of the seat itself (Fig. 1); subsequently, the coil 4C of the solenoid valve 4 is assembled on the component 4B.

[0043] Then, the pre-assembled sensor 20 is inserted and fastened in the relevant seat 6 of the body 2; this is practically obtained by screwing the threading 22 of the body 21 of the sensor 20 on the threading of the portion 6B of the above seat, with the interposed gasket G.

[0044] Following this fastening operation, the end of the outlet duct 23C is inserted in the cited throat GG along the duct 3 of the body 2; also the inlet 23A of the chamber 23 housing the impeller 24 is hydraulically connected to the duct 3, in the portion enclosing the throat GG itself (Fig. 4).

[0045] Now, first conductors contained in the sheath 12 are connected to the solenoid valve 4, whereas other conductors contained in the same sheath are connected to the detector 25 of the sensor 20; the other ends of such conductors, as said, are duly

connected to the control system of the machine to which the device 1' is associated with.

[0046] The above semi-finished component, or only a part of it, obtained as above, is overmoulded with a layer of insulating material, in particular a thermoplastic material, so obtaining a housing indicated with SS in Fig. 5; such an overmoulding technique is described in the above patent IT-B-1.281.406, whose teachings in this connection are herein incorporated by reference.

[0047] As it can be seen, the overmoulded insulating material forming the housing covers, besides an intermediate portion of the valve body 2, also the solenoid valve 4, the sensor 20 and a portion of the sheath 12; obviously, the material of the housing SS also covers the terminals of the solenoid valve and the sensor, to which the electric conductors contained in the sheath 12 are connected, which therefore results in being electrically and hygroscopically insulated.

[0048] Preferably, the material forming the sheath 12 is a flexible material; in this way, its slightly compressing which occurs during the overmoulding operation of the insulating material, allows for obtaining an excellent adhesion between the parts, avoiding any subsequent risk of humidity seepage.

[0049] From the above, it can be deduced how the insulating material defining the housing SS ensures a structural sturdiness, electric and hygroscopic insulation, as well as an outer coverage of the upper portion of the device 1', which also has aesthetic functions.

[0050] Once the housing SS is obtained as described above, the lower portion of the body 2 not covered by insulating material is connected to the tube 8, through the clipping or fastening ring 9; the tube 8 and sheath 11 are then inserted in the outer tube already equipped with the covering 11; the latter is then water-tightly engaged, by means of its own teeth 11A, with specific seats that were defined in the housing SS, during the moulding operation.

[0051] The non visible end of the device 1' can be obtained through a known technique, fitting it with means for the mechanical connection to the structure of the relevant washing machine, means for the hydraulic connection to its water circuit and means for its electric connection to the associated control system.

[0052] The operation of the device 1', vice-versa, is as follows.

[0053] It is assumed that the device 1' has both functions of controlling the metering of the liquid to be supplied to the household appliance, and anti-flooding safety functions, and that the device is connected through the conductors contained in the sheath 12 to the control system of the household appliance itself, duly programmed for the intended purpose.

[0054] As to the liquid supply, the control system of the machine enables the opening of the solenoid valve 4, which is a normally closed valve.

[0055] The liquid coming from the water main flows along the duct 3 to the inlet 23A of the sensor 20, and is

conveyed in the chamber 23, onto the vanes 24A of the impeller 24; the latter's angular movement is started by the flow of the liquid, which can exit the chamber 23 through the outlet 23B, and go back to the duct 3. The liquid then reaches the washing machine through the tube 8.

[0056] The magnetic detector 25 detects the rotation of the impeller 24, i.e. the movement of the magnetic elements 24C; the relevant pulses generated by the sensor 25 are transmitted by the respective conductors contained in the sheath 12 to the machine control system, which elaborates them for calculating the amount of liquid flown through and emit an electric control signal of the solenoid valve 4.

[0057] Practically, when the metered quantity of liquid flown through the device 1' equals the predetermined amount stored in the memory of the control system, the latter deactivates the solenoid valve 4 through the conductors in the sheath 12, thus closing the duct 3. This means that a predetermined quantity of liquid has been supplied to the machine.

[0058] It should be noticed, anyway, that nothing hinders to use a supply solenoid valve located inside the washing machine, for the liquid metering control, in which case the solenoid valve 4 will only have antiflooding safety functions; of course, in such an application and under normal operating conditions of the machine, opening and closure of the supply solenoid valve and the solenoid valve 4 will occur simultaneously.

[0059] Similarly, the quantity of supplied liquid may be controlled by means of a conventional pressure switch system, placed inside the washing machine, in which case the sensor 20 and eventually the solenoid valve 4 will only have antiflooding safety functions.

[0060] Operation of the device 1' as a safety element may be of different types.

[0061] Let us assume, for example, the situation where the machine control system has instructed the valve 4 (and a likely internal supply solenoid valve) to open, but the detector 25 does not detect any rotation of the impeller 24; such a circumstance is obviously strange and indicative of a malfunction, which may for instance be due to a failure of the solenoid valve 4 (or likely internal supply solenoid valve) remaining closed, or to an occlusion of the duct 3 and/or tube 8, which does not allow the outflow of the liquid to the washing machine.

[0062] Another possible situation may occur when the control system does not instruct the solenoid valve 4 to open, but the detector 25 detects a rotation of the impeller 24; also such a situation is obviously indicative of a malfunction, which may be due for example to a poor sealing of the plug of the solenoid valve 4, or to a leakage from the tube 8.

[0063] Another situation arises when the control system has instructed the solenoid valve 4 to close, but the sensor 25 goes on sensing a rotation of the impeller 24; also this occurrence may be indicative of a breakage

or jammed opening of the solenoid valve 4 or of a leakage from the tube 8.

[0064] Obviously, in order to perform the above safety functions of the device 1', the control system of the machine will be programmed accordingly, for the correct interpretation of the information deducible from the rotation or non rotation of the impeller 24, and cause the closure of further safety valves (not shown) and/or activation of acoustic or optical alarm means for the user, and/or modify appropriately the operating program of the control system, as the case may be.

[0065] According to a further possible application, the washing machine may have an internal supply solenoid valve of the normally closed type, and the device 1 has a normally open solenoid valve 4'.

[0066] In such an application, if the control system does not instruct the internal supply solenoid valve to open (or instructs the valve to close), but the detector 25 detects a rotation of the impeller 24, this is obviously indicative of a malfunction due to a leakage of the plug seal of the supply solenoid valve, or a breakage of the tube 8.

[0067] Also in this situation, of course, the machine control system will be duly programmed accordingly.

[0068] Fig. 6 illustrates a second possible embodiment of the present invention, for application to a pneumatically actuated antiflooding safety device; it should be noticed that in this figure the same reference numbers of the previous figures are used for indicating technically equal elements, with the addition of the index'.

[0069] In this case, the valve body 2' of the device indicated as a whole with 1'', has two seats 6' usually apt for housing respective pneumatic actuated valves; here, too, according to the basic idea of the present invention, a suitable sensor is provided, which is apt for its coupling in one of such seats 6', instead of one of the two pneumatic valves.

[0070] Fig. 6 illustrates the situation where the upper seat 6' houses a pneumatic valve 4', whereas the lower seat 6' is housing a flow or flow-rate sensor 20'.

[0071] Said valve 4' and sensor 20' are represented more in detail in Fig. 7.

[0072] The valve 4' consists essentially of two portions 4A' and 4B', joined together with interposition of an elastic membrane 4D; reference 4E indicates a permanent magnet integral to and supported by the elastic membrane 4D.

[0073] The portion 4A' has an external threading 4F, apt for its screwing in a nut screw or thread 6B' defined by the relevant seat 6', with an interposed seal gasket 4G.

[0074] The same portion 4A' defines a central seat 4A1', open on its front end, for a shutter element or core 4H made from metal or ferromagnetic material; one end of such a shutter 4H protrudes from the main seat 4A1' and has a sealing element 4I apt to cooperate with a specific housing 2C delimited over an inner surface of the duct 3'. A spiral spring 4L is provided between the

second end of the shutter 4H and the closed bottom of said central seat of the portion 4A'.

[0075] Under normal conditions, as illustrated in Fig. 7, the attraction force generated by the magnet 4E, contrasting the action of the spring 4L, maintains the shutter 4H in a retracted position within the relevant seat 4A1'; therefore, as it can be noticed, the duct 3' is open and the liquid entering the device 1'' can outflow to the relevant washing machine; as it can be noticed, the valve 4' is a normally open valve.

[0076] Should operation of the valve 4' be required (such as for a liquid leakage detected in a known way), the control system of the machine activates a compressed air generator, either of the electric or the mechanical type, located within the machine itself; the compressed air generated is conveyed to a tube T communicating with the chamber delimited by the portion 4A' and the membrane 4D; the air entering such a chamber causes a pressure on the membrane 4D and a consequent shifting of the latter and of the magnet 4E to the rear bottom of the portion 4B', which has a vent SF for that purpose.

[0077] Thus, the shutter 4H, no longer retained by the magnet 4E, is pushed by the elastic reaction of the spring 4L to close the duct 3, in particular through the element 4I, which ensures sealing on the proper housing 2C. Therefore, in such a situation, any further entry of liquid from the duct 3 is hindered.

[0078] The type of realization of the valve 4' here given is merely schematic and by way of example; in fact, it is clear that pneumatic valves of different known type can be used for the same purpose.

[0079] Fig. 7 is also illustrates how the sensor 20' is realized.

[0080] In this case, the sensor comprises an impeller 24' with vanes 24A' and magnetic inserts 24C' directly inserted in the duct 3'; to this purpose, two pins 24D' depart from the central core of the impeller 24' in two opposite directions; one of these pins 24D' is inserted in the seat 2C associated to the lower seat 6' of the body 2', whereas the other pin 24D' is inserted in a housing AL defined on the external surface of a body 21', e.g. made from thermoplastic material, for housing a magnetic detector 25'.

[0081] This body 21' has a threading 22' on its external surface apt to be screwed in the nut screw 6B' provided by the lower seat 6', with a suitable sealing gasket G' being interposed. The body 21', wherein the sensor 25' is housed, is of course sealed with respect to the duct 3'.

[0082] The device 1'' is assembled in a similar as that previously described with reference to the embodiment of Figs. 2 and 5.

[0083] The ring 7' is associated to the valve body 2' and the pre-assembled valve 4' is fastened to the relevant seat 6' of the body 2'; this is practically obtained screwing the threading 4F of the body 4A'- 4B' of the valve 4' on the nut screw 6B' of the relevant seat 6', with

the interposed gasket 4G.

[0084] The impeller 24' is then inserted within the duct 3', with the left pin 24D' (with reference to Fig. 7) inserted in the housing 2C in correspondence with the lower seat 6'; now, the threading 22' of the body 21' of the sensor 20' is screwed on the nut screw 6B' of the seat 6' itself, so that the right pin 24D' (with reference to Fig. 7) of the impeller 24' will be inserted in the housing AL of the body 21' itself.

[0085] It should be noticed, also in this instance, that perfect operation of the sensor 20' is always ensured, independently from the angular position the detector 25' may take following the tightening of the body 21' in the seat 6'.

[0086] Now, the tube T running through the sheath 12' is connected to the chamber delimited by the portion 4A' and the membrane 4D of the valve 4'; vice-versa, electric conductors, not shown here, though also contained in the sheath 12, are connected to the detector 25' of the sensor 21'.

[0087] The second end of the tube T, as said, is destined to be connected to a compressed air generator located inside the household apparatus, whereas the other end of the electric conductors related to the sensor 20' are connected to the control system of the washing machine associated to the device 1".

[0088] The semi-finished product obtained above may be covered with a housing, not represented, made from plastic material similar to the one previously mentioned, or obtained by two half shells coupled to each other and maintained in position by means of suitable mutual fastening elements.

[0089] Then the tube 8' is associated to the lower portion 2B' of the body 2', through the clipping ring 9'; the tube 8' and the sheath 12' are subsequently inserted in the outer tube 10', inclusive of the covering 11'; the latter is then engaged by its own teeth 11A' to specific seats delimited in the housing mentioned above.

[0090] Also in this situation, the non visible end of the device 1" is obtained in a known way, providing it with means for the mechanical connection to the structure of the washing machine, means for hydraulic connection to its water circuit, means for connecting the tube T to the cited compressed air generator and means for the electric connection of the conductors of the sensor 21' to the relevant control system.

[0091] Operation of the antiflooding safety device 1" is as follows.

[0092] As to liquid supply, the control system of the machine enables opening of a supply solenoid valve located inside the cabinet of the washing machine, which is a normally closed valve.

[0093] The liquid from the water main flows along the duct 3', causing an angular movement of the impeller 24'; such a rotation is detected by the magnetic detector 25', which transmits, through the relevant conductors contained in the sheath 12', the pulses to the control system of the washing machine, the latter elab-

orating them for calculating the quantity of water flown through, and issuing an electric control signal of the cited supply solenoid valve.

[0094] Practically, as soon as the quantity of liquid flown through the device 1" equals a predetermined quantity, the control system deactivates the supply solenoid valve; this means that a predetermined quantity of liquid has been supplied to the machine.

[0095] However, also in this situation, nothing hinders the use of a conventional pressure switch system placed inside the washing machine for metering the liquid and controlling the cited supply solenoid valve; in this case the sensor 20' will only be used for antiflooding safety purposes.

[0096] The operation of the device 1" as a safety element is similar to the one previously described, with reference to the embodiment according to the present invention shown in Figs. 2-5.

[0097] Also in this instance, the control system of the machine will of course be programmed accordingly, for correctly interpreting the information deducible from the rotation or non rotation of the impeller 24', and if required, operate the valve 4' for the closure of the duct 3'.

[0098] Figs. 8 and 9 illustrate a further possible embodiment of the present invention, with reference to antiflooding safety devices having a solenoid valve placed substantially downstream the liquid supply hose.

[0099] Fig. 8 shows a partial section of such an antiflooding safety device, indicated with 30 as a whole.

[0100] The device 30 comprises a connecting body 32 to an external water network, such as made from thermoplastic material, delimiting inside a throughflow duct 33 for the fluid to be supplied to a washing machine.

[0101] The upper portion of the connecting body 32 has an outer ring 37 mounted on it, for coupling the device 30 to a tap, with a relevant sealing gasket, not represented in the figure; a filter 34 and a flow regulator 35, commonly known, are inserted in the upper portion 32A of the duct 33.

[0102] In correspondence with the outlet length of the duct 33, a rubber tube 38 is provided, which is engaged on a duly shaped lower end 32B of the connecting body 32, by means of a clipping or fastening metal ring 39.

[0103] Reference 40 indicates an outer corrugated tube, enclosing the tube 38, to collect any leakage water should the latter fail; such an outer tube 40 is coupled in a known way to a covering housing 41.

[0104] The lower end of the device 30, which may also be housed within the washing machine, comprises a valve body 50, in which a duct 51 is defined; such a duct 51 is connected to the tube 38 through a duly shaped portion 50A of the body 50 and a relevant clipping ring 52.

[0105] Along the duct 51, the valve body also defines a seat 6, similar to one of the seats 6 mentioned

with reference to Figs. 1-5 above; such a seat 5 is destined to accommodate for example a solenoid valve 4, normally closed, or similar to solenoid valves 4 and 5 of Figs. 1 and 2, electrically connected to the control system of the machine.

[0106] Reference 53 indicates a fastening element for the water-tight sealing of the outer tube 40 to the valve body 50; reference 54 indicates a second duct obtained in the body 50, which is apt to put the air space between the tubes 38 and 40 in communication with the wash tub of the machine associated to the device 30 or through a special tube not represented here, with a drain duct for the purposes to be further explained.

[0107] Finally, reference 50B indicates the end of the valve body 50 for the connection to the water circuit of the washing machine.

[0108] Operation of the device 30 is quite simple.

[0109] When performing a water supply from the mains, the control system of the machine causes the solenoid valve 4 and a likely supply solenoid valve inside the machine, if provided, to open.

[0110] The liquid available in the duct 33, in the tube 38 and the duct 51, as well as the liquid supplied by the mains, is able to flow through 50B and reach the wash tub of the machine; upon reaching a desired filling level, detected for example by means of a common pressure switch, the control system causes the solenoid valve 4 and the likely supply solenoid valve to close.

[0111] Therefore, the presence of the solenoid valve 4 has the function of stopping the liquid entering the machine by the tube 38, should the internal supply solenoid valve, if provided, and/or a fluid metering pressure switch have a failure.

[0112] Should the tube 38 of the device 30 fail, the leakage liquid would be conveyed from the outer tube 40 to the valve body 50, where the duct 54 will address it, through a proper tube, to an outlet for direct drain, or to a tub fitted with control and drain means.

[0113] As said above, the duct 54 may be, for example, hydraulically connected to the wash tub of the machine, wherein a likely liquid leakage due to a failure of the tube 38 will also be conveyed.

[0114] In this situation, the control system of the machine will detect, through a proper sensor or safety pressure switch, an unusual liquid level increase inside the wash tub and activate the usual drain pump of the machine, for gradual discharge of the leakage liquid to the tub, and eventually actuate some acoustic or optical signalling means for the user (in this regard it should be noticed that washing machines usually have two different pressure switches, one for the normal liquid metering, and the other for detecting a potentially dangerous too high liquid level inside the wash tub).

[0115] Fig. 9 illustrates, vice-versa, the situation of the valve body 50 utilized for obtaining a second type of device, indicated with 30' as a whole, which integrates a sensor according to the present invention; in this figure the same reference numbers of Fig. 8 are used for indi-

cating technically equivalent elements.

[0116] As it can be seen in Fig. 9, the device 30' comprises a sensor similar to the one indicated with 20 in Figs. 2-5, which is housed and fastened in correspondence with the seat 6 used in Fig. 8 for fastening the solenoid valve 4.

[0117] The coupling of the pre-assembled sensor 20 with the seat 6 of the valve body 50 and its connection to the control system of the machine is performed according to procedures being similar to those previously described with reference to the fastening of the sensor 20 shown in Figs. 2-5.

[0118] Operation of the device 30' as antiflooding safety device may be as follows.

[0119] For example, if the control system of the machine has caused the supply solenoid valve within the machine to open, but the sensor 20 does not detect any liquid flow, this means a malfunction, which may for instance be due to a failure of the supply solenoid valve itself, remaining closed, or to an occlusion of the ducts 33 and/or 51 and/or of the tube 38, which does not allow the liquid to enter the washing machine.

[0120] Another possible situation arises when the control system does not cause the supply solenoid valve to open, but the sensor 20 is anyway detecting a liquid flow; also this situation is obviously indicative of a malfunction, for example due to a failure of the supply solenoid valve.

[0121] An analogous situation also arises when the control system has caused the supply solenoid valve to close, but the sensor 20 goes on detecting a liquid flow.

[0122] Obviously, in order to have the device 30' perform the above safety functions, the control system of the machine will be duly programmed for interpreting the information deducible from the sensor 20 and cause a closure of further safety valves (not represented) and/or the activation of acoustic and/or optical alarm means for the user, as the case may be.

[0123] It is also clear that, besides its safety functions, the sensor 20 can also perform metering functions of the wash liquid in replacement or additionally to a standard pressure switch; also in this case, of course, the control system of the machine will be programmed accordingly.

[0124] The basic concept of the present invention, as previously described with reference to the liquid supply devices and/or antiflooding safety devices can obviously be extended also to other hydraulic devices utilized in household appliances, such as liquid drain conduits from a washing machine, liquid metering vessels for use in a washing machine, water softening devices, and so on.

[0125] As mentioned, in fact, softening devices may comprise valves or valve systems, such as for deviation of the liquid flows during the softening or regenerating operations, similar to the one previously mentioned; therefore, within this frame, the seat of one such valves, if not required for a specific application, can be utilized

for housing a sensor according to the present invention; the same applies for common tanks or metering "containers" for wash or regeneration water, usually fitted with valve seats or for liquid discharge systems in a household appliance, along which valve housing seats can be provided.

[0126] Similarly, the present invention previously described with reference to a flow sensor, can also be applied in the instance of other detecting means, such as temperature sensors, conductivity sensors, pH sensors, etc.

[0127] In order to further extend the advantages of the present invention in terms of manufacturing standardization, it is finally pointed out that special plugs can be provided, for occluding the seats 6 and/or 6' eventually not used for housing a valve or a sensor, thus obtaining further types of hydraulic devices.

[0128] The surface of the body of such plugs will obviously have suitable means for their coupling to the seats 6 and/or 6'; for example and always in view of obtaining a considerable productive standardization, such plugs may consist of the bodies 21 or 21' alone, i.e. without the relevant impeller 24 or 24' and detecting means 25 or 25'.

[0129] From the above description the features of the present invention as well as the relevant advantages are clear.

[0130] Specifically, a sensor for an hydraulic device of a household appliance, in particular a washing machine, has been described, where the hydraulic device comprises at least a body defining a space for the transit and/or the containment of a fluid, and at least a housing for securing to the body at least a liquid flow control element; said housing delimiting a seat for locating and/or fastening at least a portion of the control element to the body.

[0131] According to the present invention, the sensor comprises at least a component defining coupling means capable of cooperating with said seat, in order to locate and/or fasten the sensor on said housing alternatively to said portion of the control element.

[0132] An hydraulic device for a household apparatus, in particular a washing machine, has also been described, which is capable of utilization with said sensor.

[0133] Therefore, according to the present invention, a seat usually provided for example for housing a liquid control device can also be simply used for locating a sensor, such as a flow sensor.

[0134] The specific features of the present invention are detailed in the annexed claims, which form an integral part of the present description.

[0135] From the above description and the relevant claims also the advantages of the present description are clear, mainly reflecting a considerable standardization provided for the manufacturing of hydraulic devices for household appliances, such as liquid control and/or supply and/or metering and/or drain and/or treatment

devices in general.

[0136] It is obvious, in fact, how according to the present invention one same body may be used for the production, for example, of devices integrating simple valves and/or devices integrating a sensor of various nature (flow, flow-rate, temperature, pH, etc.) and/or devices with one or more housing seats occluded by a plug.

[0137] Therefore, from the above it is clear that a lower number of basic bodies of one same type can be kept in stock, for assembly in different configurations as required by the various applications.

[0138] It is obvious, too, that the use of a sensor according to the present invention facilitates the provision of an automated assembly line for various embodiments of one same hydraulic device; in fact, the suggested solution avoids expensive change operations to production lines (such as replacing usual handling or parts assembly templates), also reducing as a result changeover times; as a result, the present invention also allows to decrease the number of manufacturing and/or assembly lines, with clear advantages in view of available space in the manufacturing plants.

[0139] Moreover, according to the present invention, the sensing means can be located outside the associated household appliance, for facilitating their possible maintenance and/or repair operations.

[0140] It is obvious that many changes are possible for the man skilled in the art to the sensor and/or the hydraulic device described above by way of example, without departing from the novelty spirit of the innovative idea.

[0141] It is clear, for example, that the mutual coupling means between the body of the sensor 20 or 21' and the seat 6 or 6' may provide fastening means differing from the ones described above, such as bayonet joints or similar, or be conceived for other fastening techniques, such as ultrasound welding, hot blade welding, bonding, resin bonding, snap engagement, etc.

[0142] Additionally, hydraulic devices can also be obtained combining the devices represented in two or more of the annexed figures, i.e. comprising for example a valve upstream and a sensor downstream, or a valve and sensor upstream and a sensor or valve downstream, etc..

Claims

1. A sensor for a hydraulic device of a household appliance, in particular a washing machine, said hydraulic device (1';1",30') comprising at least a body (2,2',50) wherein a space (3;3';51) is defined for the transit and/or containment of a liquid, and at least a housing (6;6') in said body (2,2',50), for securing to the latter at least a control member (4,5;4') of the transit and/or containment of said liquid, said housing (6;6') defining a seat (6B;6B') for positioning and/or fastening at least a part (4B;4A')

of said control member (4;5;4') to said body (2;2';50), characterized in that said sensor (20;20') comprises at least a component (21;21') defining coupling means (22;22') capable of cooperating with said seat (6B;6B'), so as to allow to position and/or fasten said sensor (20;20') on said housing (6;6') alternatively to said part (4B;4A') of said control member (4;5;4').

2. A sensor, according to claim 1, characterized in that an inlet (2A;2A',50A) and an outlet (2B;2B',50B) for said liquid are defined in said body (2;2';50), and a zone defining a duct (3;3';51) connecting said inlet (2A;2A',50A) to said outlet (2B;2B',50B), where said housing (6;6') is located along said duct (3;3';51) and is provided for the alternative positioning, with respect to said body (2;2';50), of a plugging device (4;5;4') of said duct (3;3';51) or said sensor (20;20').
3. A sensor, according to claim 1 or 2, characterized in that said component and/or said coupling means (22;22') comprise a threading (22;22'), or at least a portion of a bayonet joint or of a snap engagement.
4. A sensor, according to claim 1 or 2, characterized in that it is provided for being fastened to said housing (6;6') by welding, in particular ultrasound or hot blade welding, or bonding or resin bonding.
5. A sensor, according to claim 1 or 2, characterized in that it comprises detecting means (24;25) being activated by said liquid, said detecting means (24;25) resulting in being located outside said space (3;51) and/or said body (2) following the fastening of said component (21) to said housing (6).
6. A sensor, according to claim 1 or 2, characterized in that it comprises a container (21) within which at least a passage (23;23A,23B) is defined, being in hydraulic communication with said space (3;51) through which, following the fastening of said component (21) in said housing (6), at least a portion of said liquid can flow outside said space (3;51) and/or said body (2).
7. A sensor, according to claim 1 or 2, characterized in that it is provided for the detection of the flow and/or flow-rate of the liquid passing through and/or conveyed to said space (3;3';51).
8. A sensor, according to the previous claim, characterized in that it comprises at least:
 - an impeller (24;24'), apt to start an angular movement by a liquid flow,
 - detecting means (25;25'), apt to detect the angular movement of said impeller (24;24').

9. A sensor, according to the previous claim, characterized in that, following the fastening of said component (21) in said housing (6), said impeller (24) results in being located outside said space (3;51) and/or said body (2).
10. A sensor, according to claim 1, characterized in that a chamber (23) is defined within said component (21;21') and/or said container (21;21'), for housing at least a detecting means (24) activated by said liquid, said chamber (23) comprising an inlet (23A) and an outlet (23B) for the hydraulic connection with said space or duct (3;51).
11. A sensor, according to the previous claim, characterized in that said inlet (23A) and said outlet (23B) are substantially concentric to each other.
12. A sensor, according to at least one of the previous claims, characterized in that the angular position of said component (21;21'), following its fastening on said housing (6;6'), has no effect for the purposes of detecting the liquid flow or flow-rate.
13. A sensor, according to one or more of the previous claims, characterized in that, independently from the angular fastening position of said component (21;21') on said housing (6;6'), said inlet (23A) and/or said outlet (23B) are always in hydraulic connection with said space or duct (3;51).
14. A sensor, according to one or more of the previous claims, characterized in that said component (21;21') or said container (21;21') has a portion housing said detecting means (25;25'), said portion being insulated and sealed with respect to said space or duct (3;3'51) and/or said chamber (23).
15. A sensor, according to claim 8, characterized in that, following the fastening of said component (21') in said seat (6'), said impeller (24') results in being located within said space or duct (3') and/or said body (2).
16. An hydraulic device for a household appliance, in particular a washing machine, comprising at least a body (2;2',50), wherein a space (3;3';51) is defined for the transit and/or containment of a liquid, and at least a housing (6;6') in said body (2;2',50), being provided for securing to the latter at least a control member (4;5;4') for of the transit and/or containment of the liquid, said housing (6;6') defining at least a seat (6B;6B') for positioning and/or fastening a part (4B;4A') of said control member (4;5;4') to said body (2;2';50), characterized in that said housing (6;6') is capable of being occupied at least partially by a sensor (20;20') comprising a component (21;21') defining coupling means (22;22') apt to co-

operate with said seat (6B;6B'), in order to allow the positioning and/or fastening of said sensor (20;20') on said housing (6;6'), alternatively to said part (4B;4A') of said control member (4,5;4').

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17. A device, according to the previous claims, characterized in that said body (2;2') is connected to an end of a tube or duct (8;8') for supplying liquid to a said household appliance, where in particular said supply tube or duct (8;8';38) is at least partially enclosed by an outer tube (10;40). 10
18. A device, according to at least one of the previous claims, characterized in that said body (2;2') comprises at least two of said housings (6;6'), a plugging device (4;4') being located in the first of said housings and said sensor (20;20') being located in the second of said housings. 15
19. A device, according to at least one of the previous claims, characterized in that said control member or plugging device (4,5;4') is an electrically actuated valve (4,5) or a pneumatically actuated valve (4') or a mechanically actuated valve. 20
20. A device, according to claim 16, characterized in that a housing (SS) is associated to said body (2;2') for said control member or plugging device (4;4') and/or said component (21;21') of said sensor (20;20'), said housing (SS) being in particular obtained by overmoulding on said body (2) a layer of thermoplastic material. 25 30

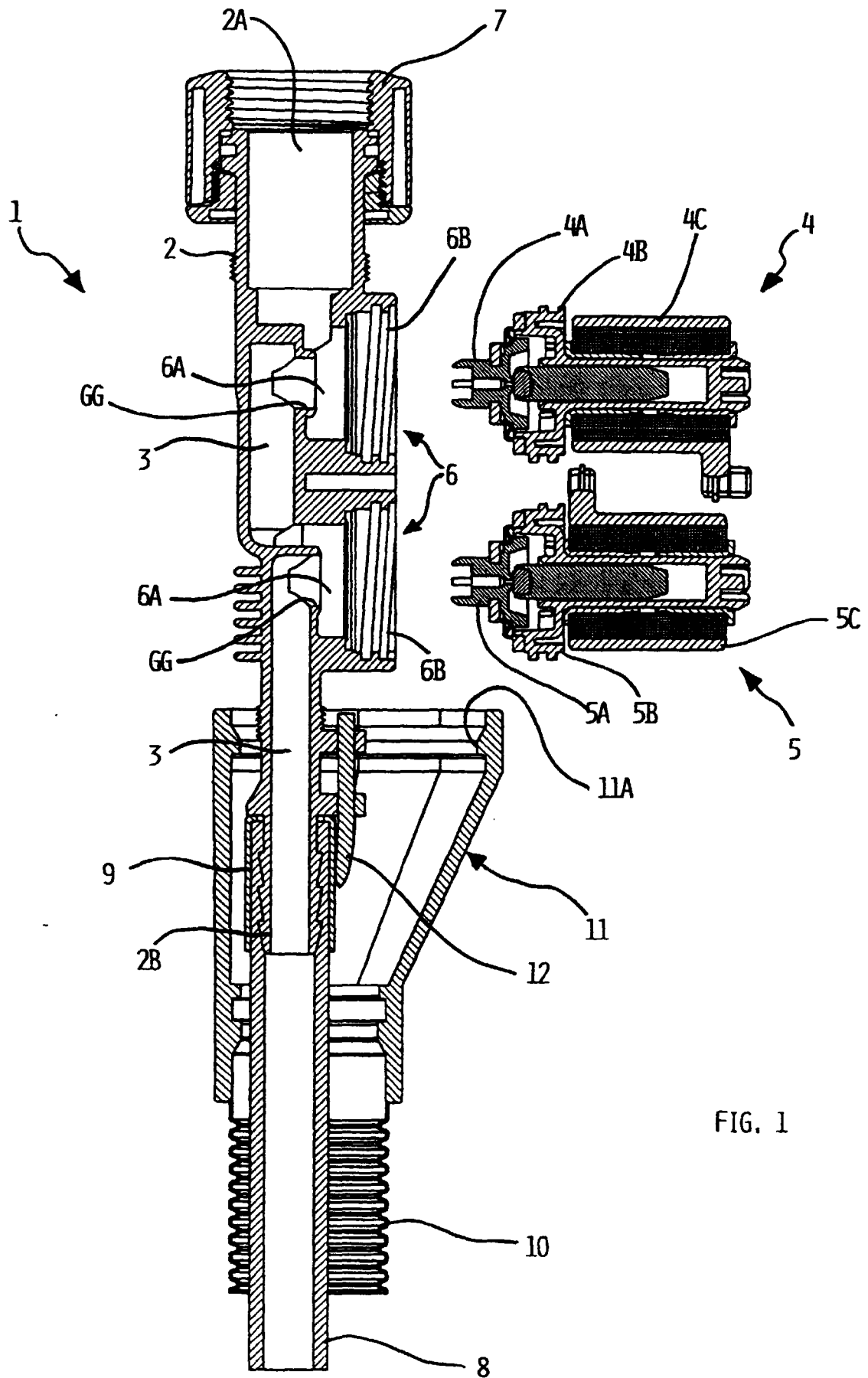
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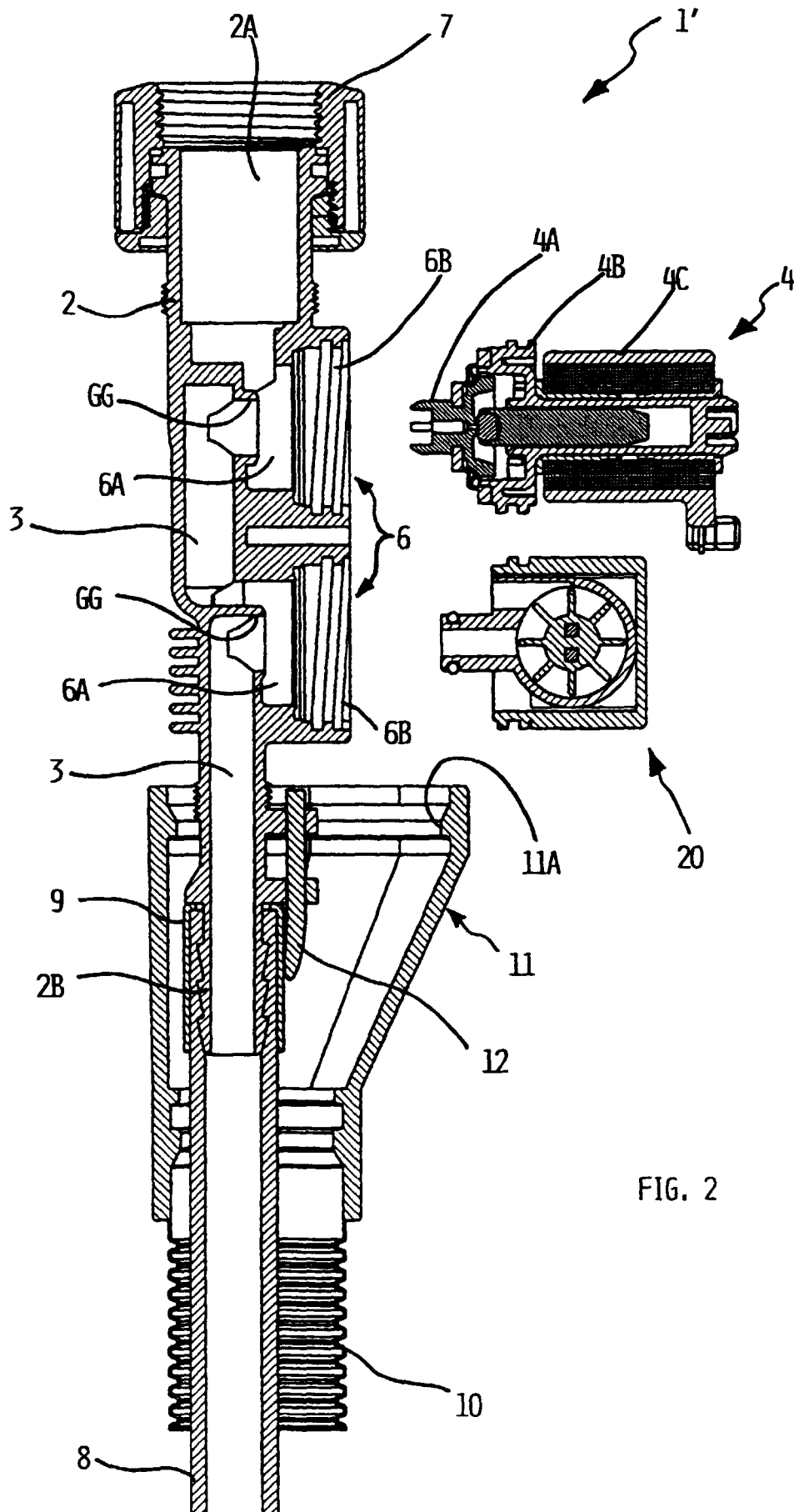
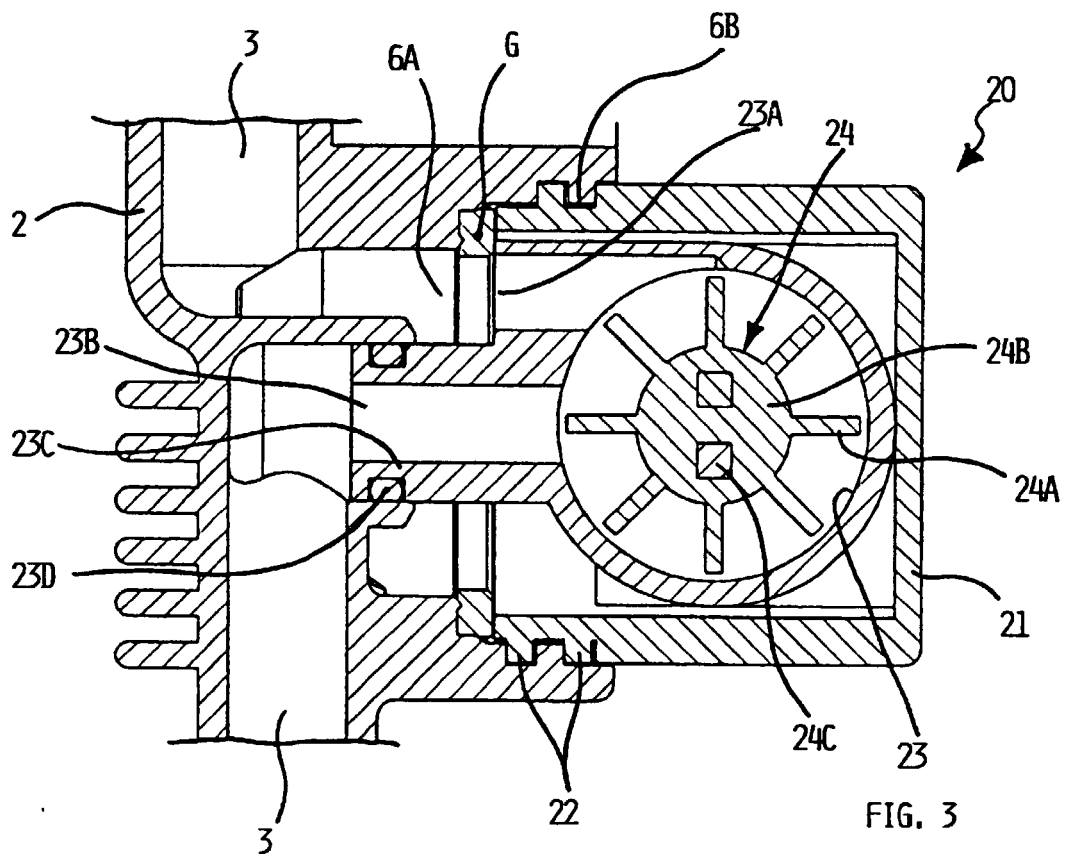
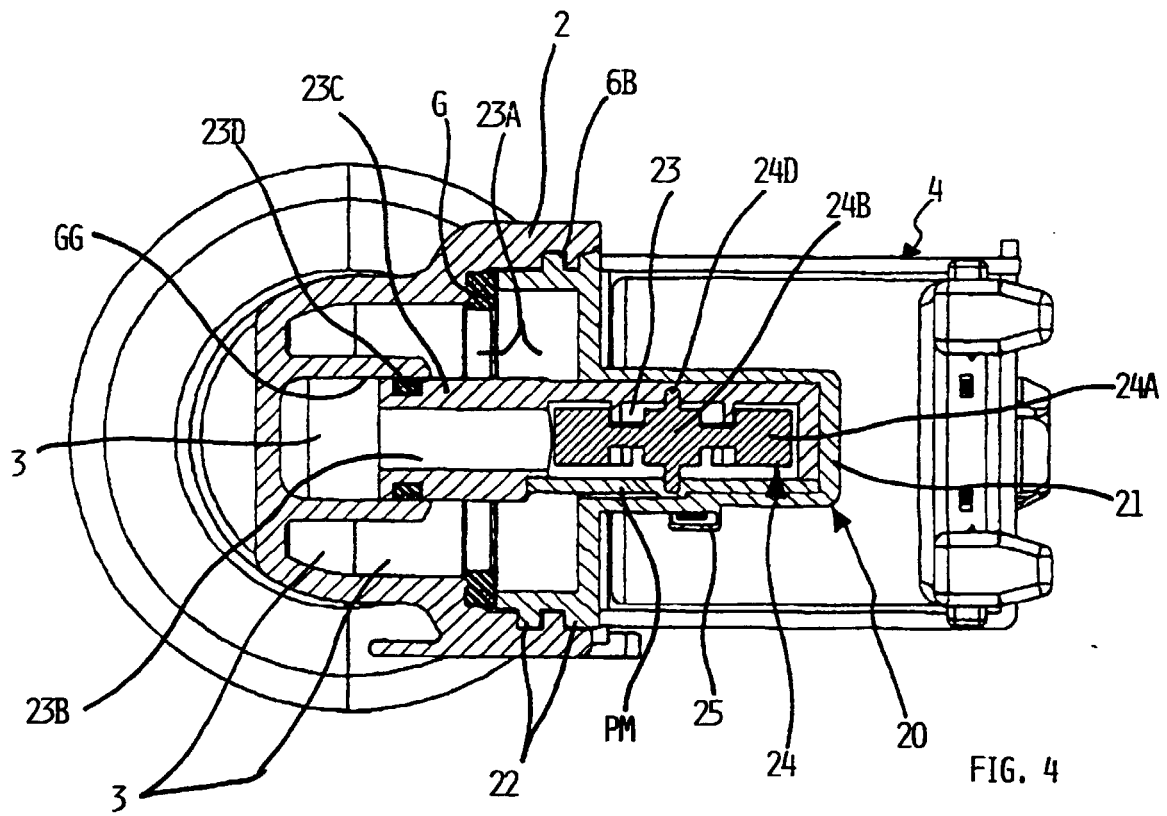


FIG. 2



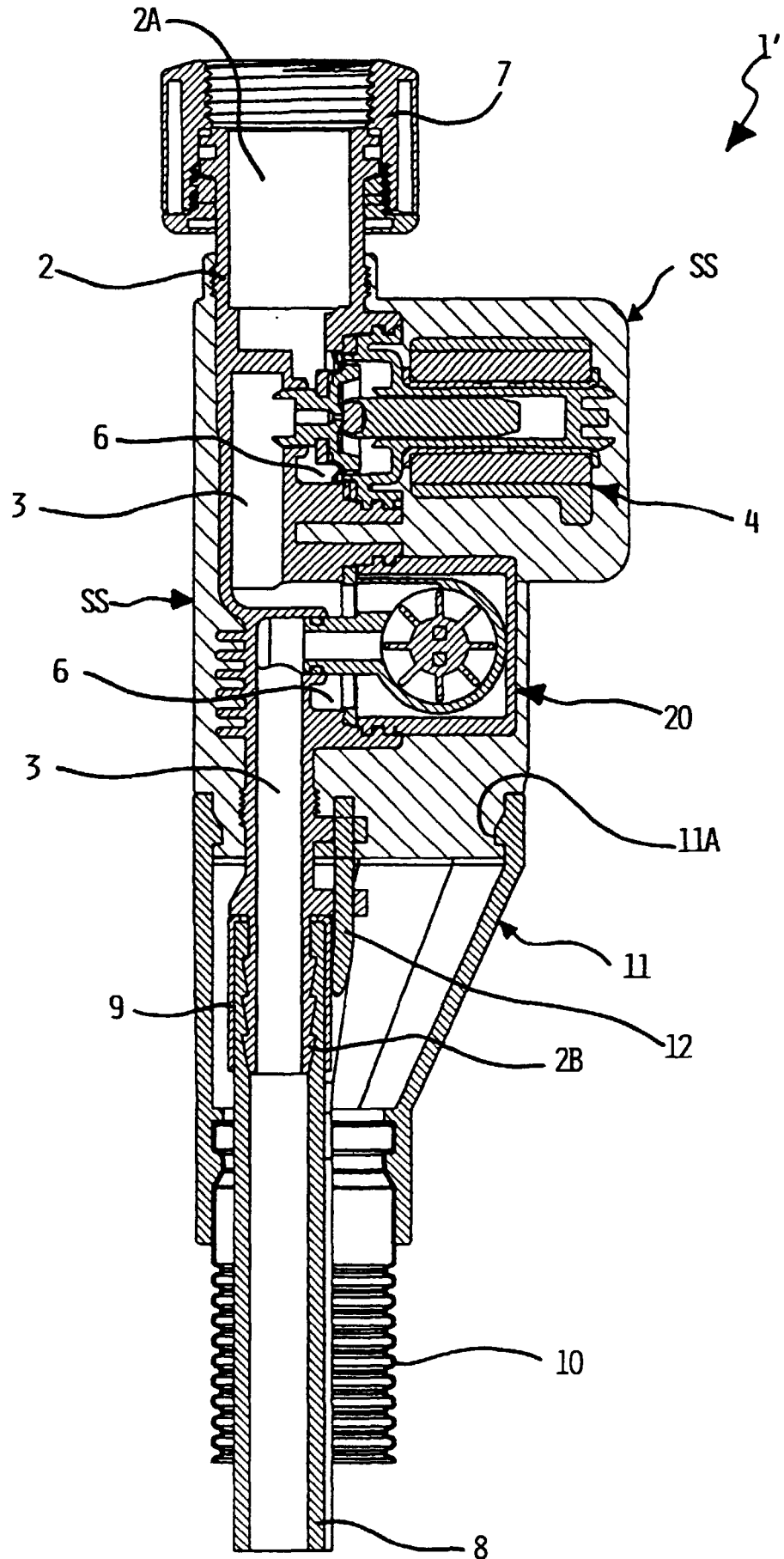
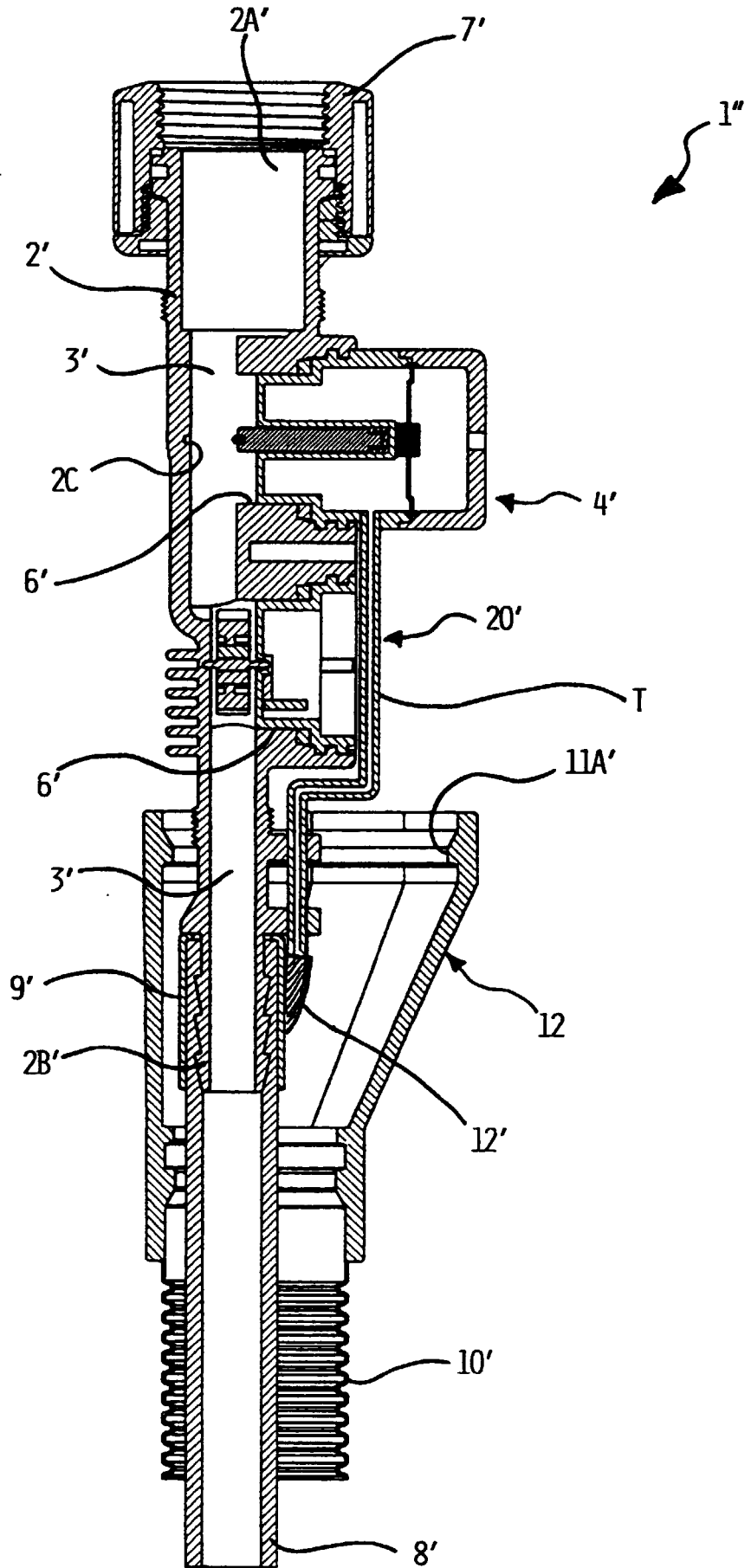


FIG. 5

FIG. 6



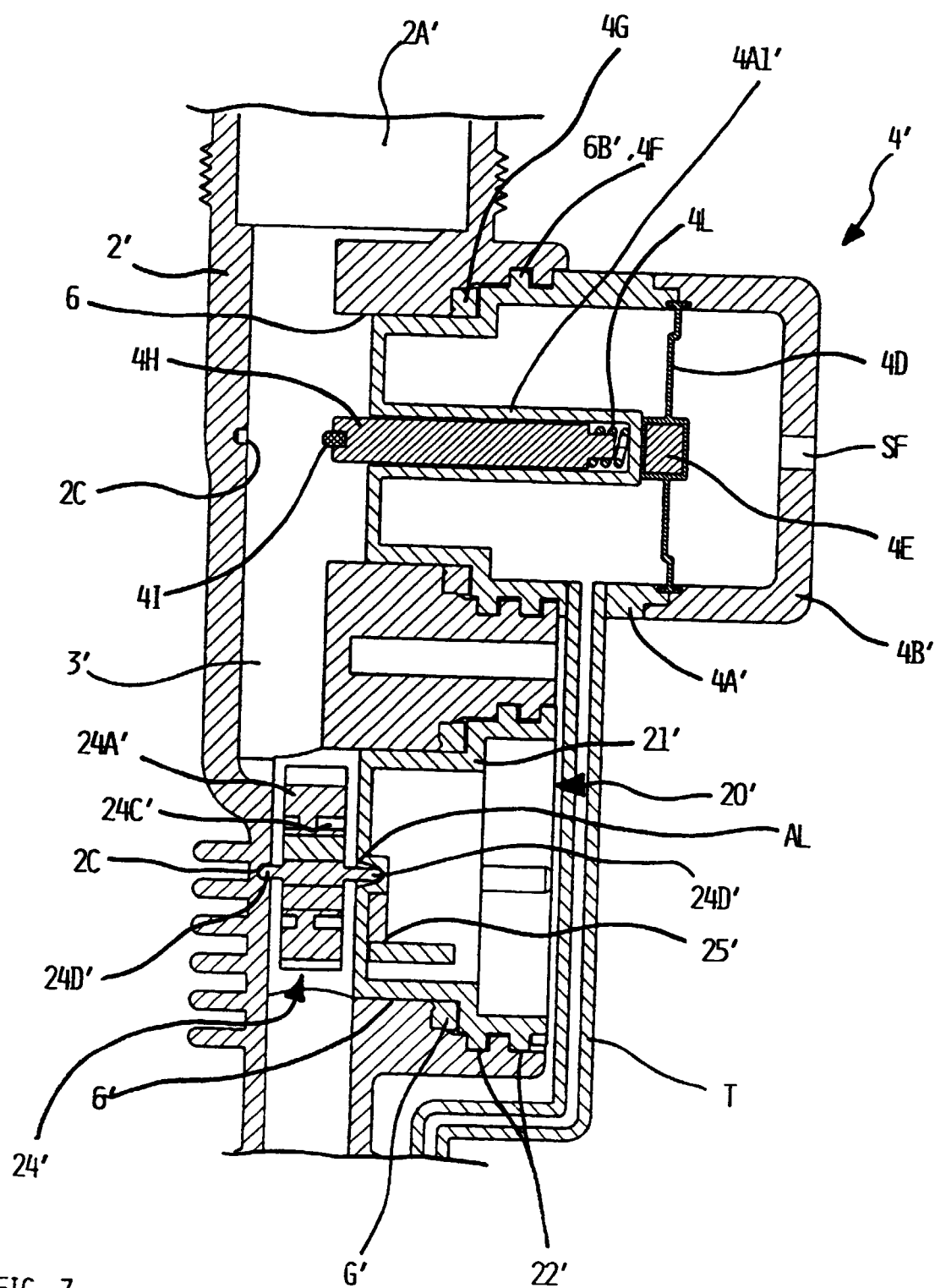


FIG. 7

