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(71) Applicant: **Whirlpool Corporation**
Benton Harbour, MI 49022 (US)

(72) Inventors:
- **Afajalpurkar, Vinayak**
  21025 Comerio (IT)
- **Bronn, Tobias**
  21025 Comerio (IT)
- **Gandhi, Praful**
  21025 Comerio (IT)
- **Schuster, Rainer**
  21025 Comerio (IT)
- **Stegemeyer, Ulrich**
  21025 Comerio (IT)

(74) Representative: **Guerci, Alessandro**
Whirlpool Europe S.r.l.
Patent Department
Viale G. Borghi 27
21025 Comerio (VA) (IT)

(54) **Washing machine with a water storage tank**

(57) A washing machine comprises a washing unit and a water storage tank having a flow connection to the washing unit through a pump for filling said storage tank with water to be reused, and an overflow connection to a drain through a valve. Such valve comprises a first valve member driven by an actuator for diverting flow to the drain or to the storage tank and a second valve member automatically driven for closing/opening said overflow connection.

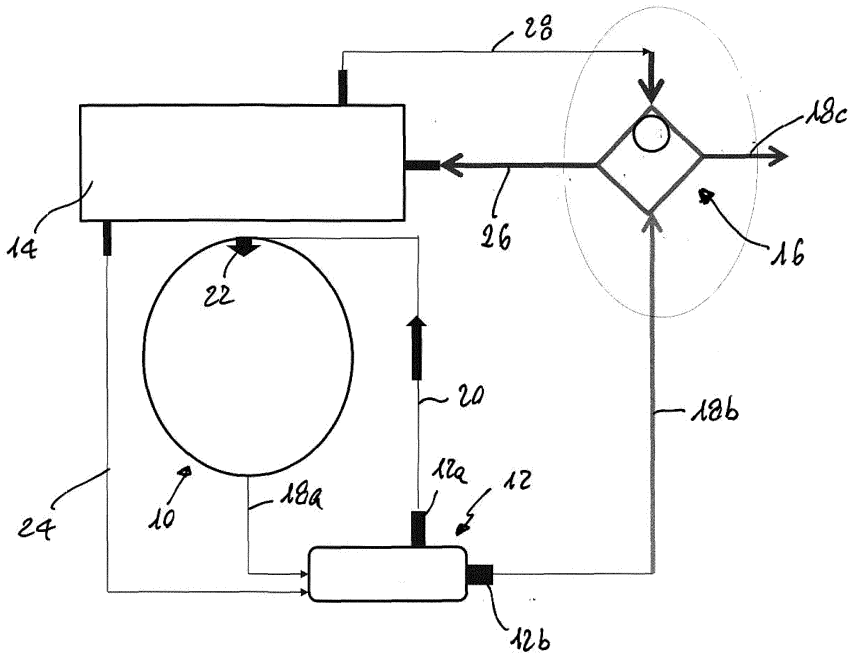


Fig. 1

EP 2 937 459 A1

Description

[0001] The present invention relates to a washing machine comprising a tub in which a drum is rotatably mounted, and a storage tank having a flow connection to the tub via a feeding line provided with a pump for filling the storage tank and an overflow connection to a drain through a valve device.

[0002] A washing machine of the above type is disclosed in European patent applications 13159882 and 13159873 filed by the same applicant.

[0003] Another solution is known from WO 2009/141218 which allows storage of rinsing water in a storage tank, but it requires the use of two three-port valves (known also as "diverter valves"), one upstream the storage tank for diverting liquid to the tank or to a discharge line, and a second one for diverting the liquid from the discharge line to the drain or back to the tub by means of a circulation line. The use of two diverter valves makes the control of the washing machine more complex and also such diverter valves have to react rapidly in order to avoid cross flows. This increases the overall cost of the washing machine. Another disadvantage of the above known solution is the need to place the storage tank in a position so that it can be emptied by gravity.

[0004] A similar solution is known from DE 4409303 where three three-port valves are used, with an addition of two check valves. It is evident that this known solution is quite expensive due to the high number of valves.

[0005] Another quite complex solution is disclosed by US 2012/0137447 where three pumps are used, one for recirculation of the washing liquor into the tub, one for draining the tub and a third for feeding the water from the reuse tank to the tub. Moreover the reuse system needs a three-port valve downstream the drain pump and a four-port valve downstream the reuse pump associated with the reuse tank.

[0006] The solutions disclosed in European patent applications 13159882 and 13159873, even if much simpler than solutions disclosed in the above documents, have three major components, i.e. the water storage tank, a diverter three-port valve configured to supply the water from the tub to the water storage tank or to the drain and an automatic valve, known also as "drain tank", connected to the drain downstream the three-port valve and including a connection from an overflow of the storage tank. Even if this system has many advantages over previous solutions, it is quite bulky and requires several hose connections and related leakage points, a quite long assembly time and related assembling cost.

[0007] It is an object of the present invention to provide a solution which does not present the above drawbacks and which is simple and cheap to be implemented.

[0008] The above object is reached thanks to the features listed in the attached claims.

[0009] One of the main relevant features of the present invention is to integrate the diverter valve and the automatic valve upstream the drain as a combined single valve mechanism which comprises four ports and includes a first valve member driven by an actuator and a second valve member automatically driven, such second valve member being preferably a floating ball or the like.

[0010] With the solution according to the invention it is possible to reduce the space occupied by the system and to simplify the adaptation of traditional washing machines to the use of storage tanks for water which can be reused. Moreover the system according to a first embodiment of the invention does not need the traditional "eco ball" system to prevent back flow of water to water tank, since an eco ball is incorporated in the single valve mechanism to avoid back flow.

[0011] Further features and advantages of a washing machine according to the present invention will become clear from the following detailed description, provided as a non limiting example, with reference to the attached drawings in which:

- Figure 1 is a schematic hydraulic diagram of a washing machine according to the invention;
- Figure 2 is a perspective view of a component of the washing machine of figure 1;
- Figure 3 is a top view of the component of figure 2 with a part removed;
- Figure 4 is a perspective view of the same component of figure 3;
- Figure 5 is a perspective view of the part removed from the component of figure 3; and
- Figures 6 to 8 are schematic view of the component of figures 2 and 3 in three different configuration of the washing machine.

[0012] With reference to the drawings, a washing machine comprises a washing unit 10 (including a tub and a rotating drum), a pump unit 12, a storage water tank 14 and a valve device 16. Such components are hydraulically connected together by means of a first portion 18a of a draining conduit downstream the washing unit 10 and upstream the pump unit 12, a second portion 18b of such draining conduit downstream the pump unit 12 and upstream the valve device 16 and a third portion 18c of the draining conduit downstream the valve device 16. The hydraulic circuit further comprises a recirculation conduit 20 between the pump unit 12 and a nozzle 22 spraying water in the washing unit, a storage tank discharge conduit 24 between the storage water tank 14 and the pump unit 12, a filling conduit 26 between the valve device 16 and the storage water tank 14 and an overflow conduit 28 between the water storage tank 14 and the valve device 16.

[0013] The washing machine can be either a horizontal axis clothes washing machine or a vertical axis washing machine. It can be also a combination washing machine and clothes dryer.

[0014] The pump unit 12 is preferably a single component with a single pump body having a recirculation port 12a and a drain port 12b. The pump body contains two

impellers which can be driven by different motors or by a single motor.

[0015] The valve device 16 (figures 2 and 3) comprises a box-shaped body 30, preferably made of polymeric material, including a cup-shaped double-walled first portion 30a having four ports on its side wall and a second cover portion 30b having a fifth port and a seat for an actuator 32, for instance a solenoid. The first portion 30a of the valve body 30 presents an upper edge with shaped gaskets 31 a and 31 b which cooperates with the flat cover portion 30b and with a double wall 33 of the first portion 30a in order to avoid water leakage from the valve device 16. The assembly of the first portion 30a of the valve body 30 and of the cover portion 30b is advantageously made by known snap engaging fastening means. Three of the four ports on the side wall of the body 20 are connected to internal chambers through the double wall. These three ports are a first inlet 34 connected to the second portion 18b of the drain conduit, a second inlet 36 connected to the overflow conduit 28and a first outlet 38 connected to the third portion 18c of the draining conduit. The fourth port is a valve leakage port 40 which communicates only with an annular intermediate space 41 (shown clearly in figure 4) defined by the double wall of the first portion 30a and is connected to a bottom surface of the washing machine (like in the safety device "aqua stop" system) or drains water directly on ground surface in order to alert the user that there is a leakage in the system. On the cover portion 30b of the valve body 30 it is placed a second outlet 42 connected to the filling conduit 26.

[0016] With reference to figure 3, which show the first portion 30a of the valve body 30 without the cover portion 30b, the valve device 16 comprises internally two walls 44 and 46 defining with a side wall adjacent the first inlet 34 a first chamber 48 which is in open communication with the drain conduit 18b through such first inlet 34. Each wall 44 and 46 comprises an opening 44a and 46a respectively, defining seats for a valve member 50 hinged with a shaft 50a to a zone 52 where the two walls 44 and 46 are joined together. The shaft 50a of the valve member 50 is driven by the actuator 32 through a lever 54. A third shaped wall 54 defines with wall 44 a second chamber 56 which communicates directly with the second outlet 42 provided on the cover 30b. The above third wall 54 and the wall 46 define a third internal chamber 58 which communicates directly with the first outlet 38, with the interposition of a floating valve member 60, with the second inlet 36. The floating valve member 60, shaped as a ball, is guided by a first shaped wall 61 integral with the cover 30b (figure 5) and it is supported by a second shaped wall 62 in its idle configuration, i.e. when it does not close communication with the second inlet 36 due to buoyancy. By driving the actuator 32, which as the pump unit 12 is connected to a central control unit of the washing machine (not shown), the valve member 50 can close the seat 44a, in its upper configuration (with reference to figure 3), so allowing a fluid communication between the first chamber 48 and the third chamber 58. When the valve member 50 is driven in its lower configuration, it closes the seat 46a and allows fluid communication between the first chamber 48 and the second chamber 56. Of course the actuator 32, which can be of different type of the one shown in the drawings, can be also provided with micro switches or sensors (not shown) in order to detect the actual position of the valve member 50. Moreover the solenoid actuator may drive the rotation of the valve member 50 in one direction only, the rotation in the other direction being assured by a spring or the like.

[0017] The working of the washing machine according to the invention, and particularly of its valve device 16, will be explained mainly with reference to figures 4, 5 and 6 where the second outlet 42 is shown on the side wall of the valve body 30 and not on its cover 30b.

[0018] Figure 4 shows a configuration in which water is drained directly from the washing unit 10 to the drain 18c. In this configuration the second chamber 56 is closed by valve member 50 and the third chamber 58is in communication with the first chamber 48 so that water is drained directly. This will be the default condition of the device valve 16, and the valve member 50 is maintained in the upper position preferably under the action of a spring or the like. In this configuration the floating ball 60 closes by buoyancy the connection to the overflow from the water storage tank 14 avoiding that dirty water plus detergent from the washing unit 10 can pollute such tank.

[0019] In figure 5 it is shown the configuration where the solenoid actuator 32 drives the valve member 50 in its lower position in order to allow a communication between the first chamber 48 and the second chamber 56, during a phase in which rinsing water is delivered from the washing unit 10 to the water storage tank 14 in order to fill it. In this first phase of filling overflow of water does not happen.

[0020] Figure 6 is similar to figure 5 and shows the configuration in which the water storage tank 14 is completely filled and there is an overflow through conduit 28. In this case the automatic valve member 60 is not driven by buoyancy in a closed position, and therefore water can enter again the valve device 16 through its second inlet 36, pushing ball 60 against the shaped wall 62. Form the third chamber 58 water is drained through its first outlet 38.

[0021] From the above description of how the washing machine works it is clear how with a single simple component many functions can be carried out in a reliable way, reducing the number of connections compared to prior art.

[0022] Even if in the above description the automatic valve member 60 has been shown as a floating ball, other automatic valve members can be used as well, for instance a flap valve member of elastic material such as rubber or the like. It is also possible to use a valve member 60 which is not automatically driven, rather it is an active device. Moreover, the actuator 32 does not need neces-

sarily to be placed outside the valve body 30, but it can be put inside such body. In case it is put outside (as shown in figure 2), the driving of the valve member 50 can be realized through a magnetic connection, i.e. without the need of having an aperture for the driving shaft 50a.

[0023] Also the shape of the valve body 30, as the position of the ports thereof is not at all critical and can be different from that shown in the drawings.

Claims

1. Washing machine comprising a washing unit (10) and a storage tank (14) having a flow connection (18a, 18b, 26) to the washing unit (10) through a pump (12) for filling said storage tank (14) with water to be reused, and an overflow connection (28) to a drain (18c) through a valve device (16), **characterized in that** said valve device (16) comprises a first valve member (50) driven by an actuator (32) for diverting flow to the drain or to the storage tank (14) and a second valve member (60) automatically driven for closing/opening said overflow connection.

2. Washing machine according to claim 1, wherein the valve device (16) comprises four ports (34, 36, 38, 42), such ports defining a first inlet (34) connected to a feeding line (18a, 18b, 26) downstream said pump (12), a second inlet (36) connected to an on overflow line (28) from the storage tank (14), a first outlet (38) connected to the drain (18c) and a second outlet (42) connected to the storage tank (14), the first valve member (50) being configured to assume a first position in which the first inlet (34) is in communication with the first outlet (38) and a second position in which the first inlet (34) is in communication with the second outlet (42), the second inlet (36) being controlled by the second valve member (60).

3. Washing machine according to claim 1 or 2, wherein the actuator of the first valve member (50) is selected in the group consisting of wax motors, solenoids (32), electric motors or combination thereof, and the second valve member is a floating device like a ball (60) or a flap valve member.

4. Washing machine according to claim 2 or 3, wherein the valve device (16) comprises a box-shaped valve body (30) having two opposite surfaces and a side wall, on such wall being positioned the two inlets (34, 36) and the first outlet (38), the second outlet (42) being placed on one (30b) of said parallel surfaces.

5. Washing machine according to claim 4, wherein said valve body (30) presents a first internal chamber (48) in direct communication with the first inlet (34) and having two seats (44a, 46a) for the first valve member (50).

6. Washing machine according to claim 5, wherein said valve body (30) presents a second and a third internal chamber (56, 58), the second internal chamber (56) being in communication with the second outlet (42) and configured to be put in communication with the first inlet (34) when the first valve member (50) is in its second position, the third chamber (58) being in communication with the first outlet (38) and being configured to be put into communication with the second inlet (36) when the second valve member (60) is idle and into communication with the first chamber (48) when the first valve member (50) is in its first position.

7. Washing machine according to any of claims 4 to 6, wherein the first valve member (50) is a flat element hinged to the body (30, 30a) of the valve device (16) and cooperating with two seats (44a, 46a) in two flat internal walls (44, 46) of the valve body (30).

8. Washing machine according to any of claims 4 to 7, wherein the box-shaped valve body (30) presents a double side wall (33) defining a hollow space (41) which is in communication with a fifth port (40) connected to a water leakage safety system.

9. Washing machine according to any claims 4 to 8, wherein the box-shaped valve body (30) presents a cup-shaped portion (30a) and a flat cover portion (30b).

10. Washing machine according to claim 9, wherein between the cup-shaped portion (30a) and the flat cover portion (30b) at least a gasket (31 a, 31 b) is interposed.

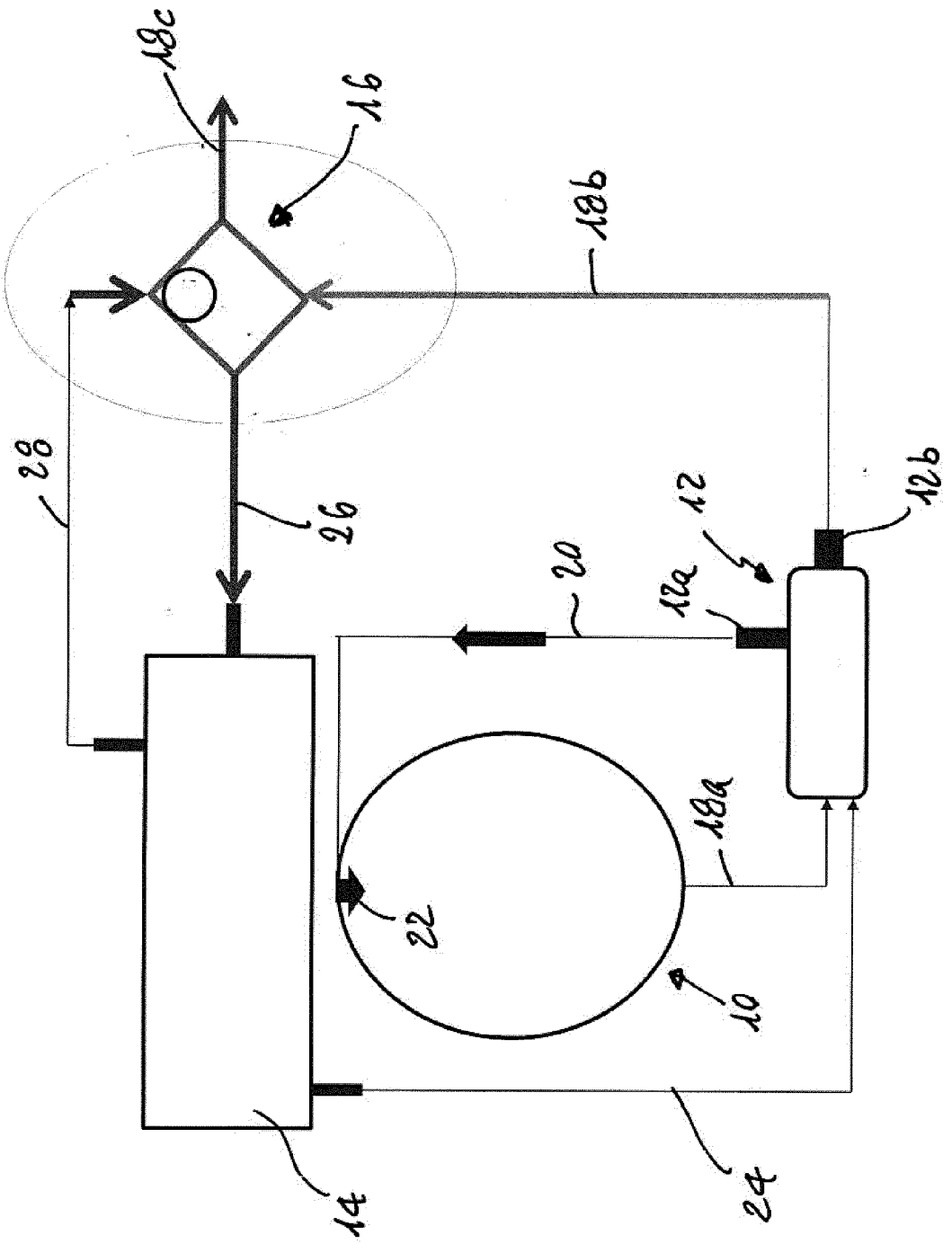


Fig. 1

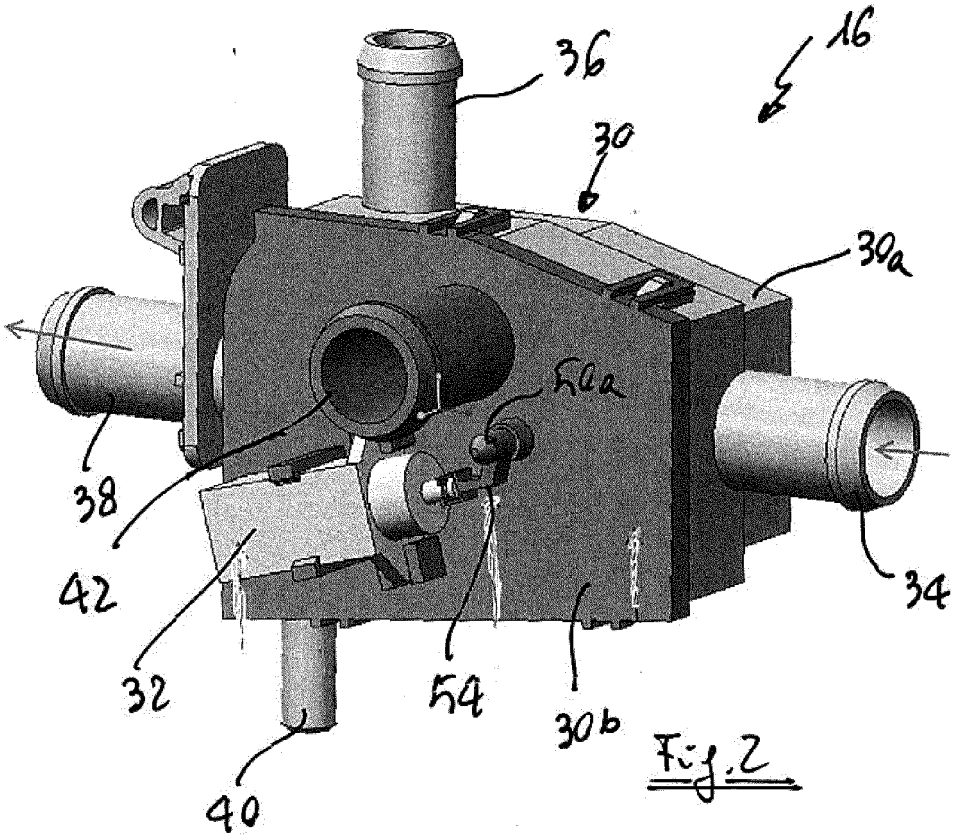
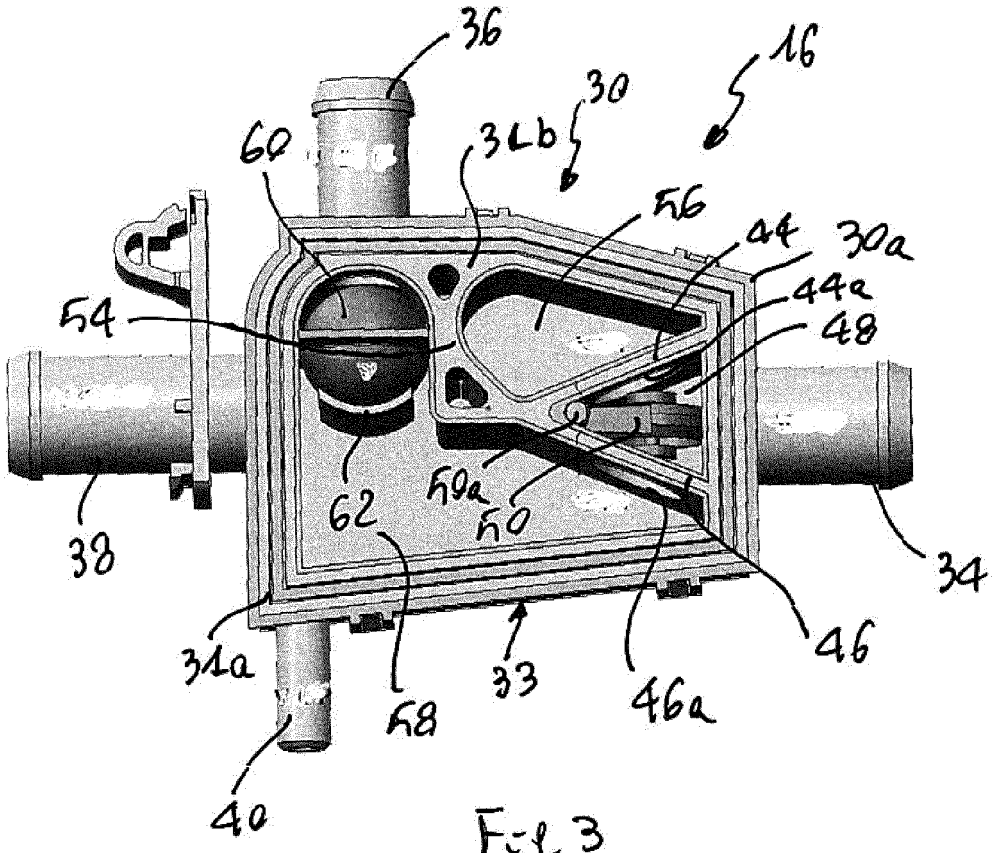

16
36
30
30a
50a
38
42
32
54
30b
34
40

Fig. 2


36
16
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31b
56
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50a
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62
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46a
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Fig. 3

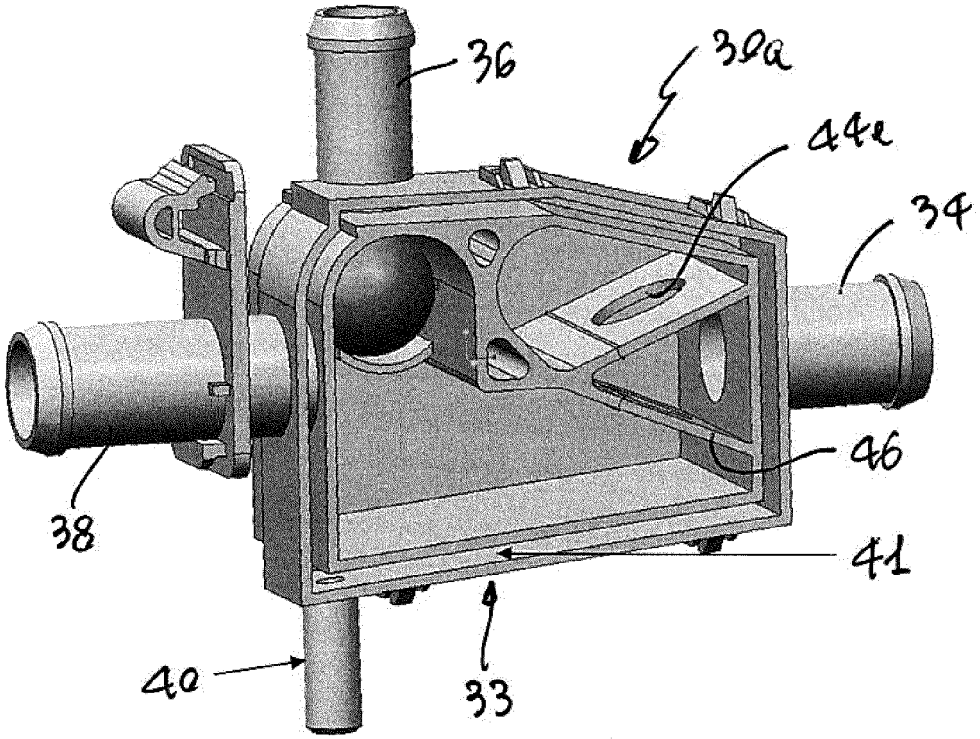

Fig. 4

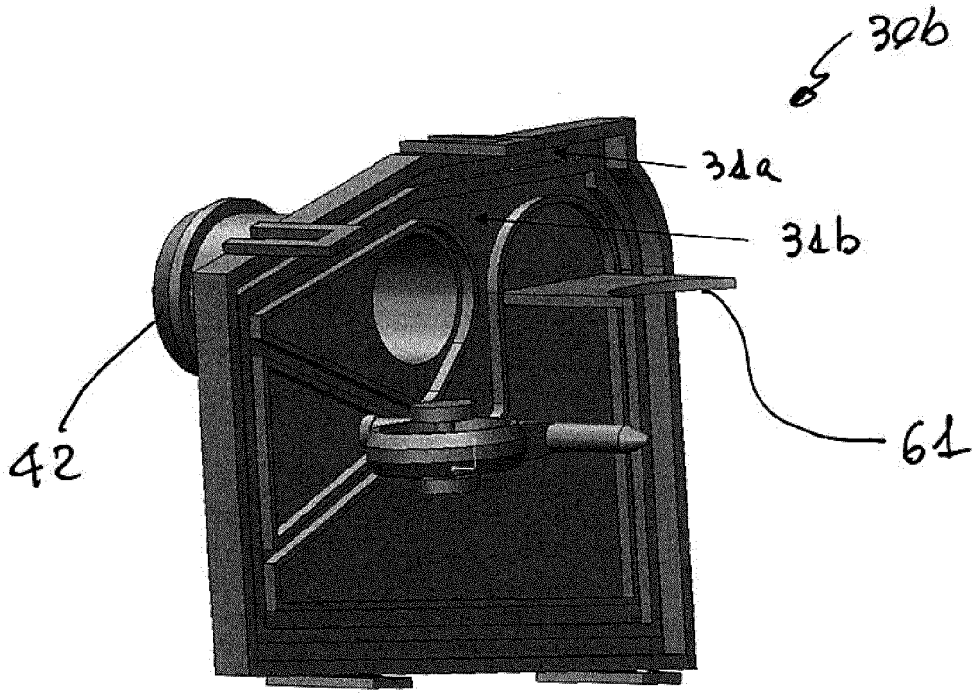

Fig. 5

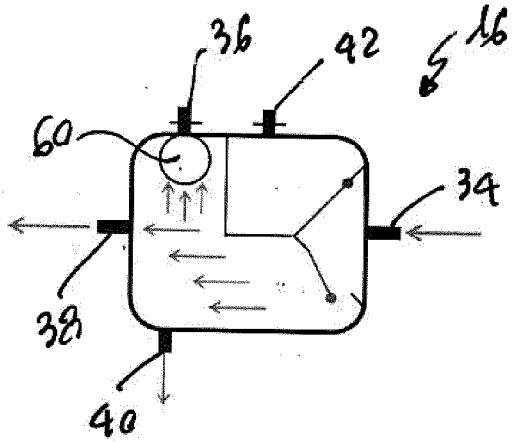

Fig. 6

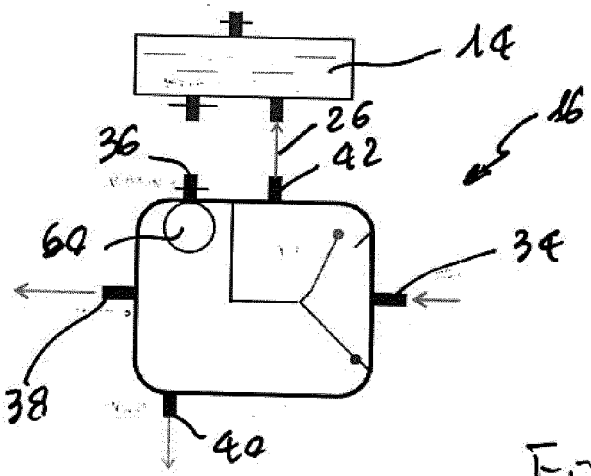

Fig. 7

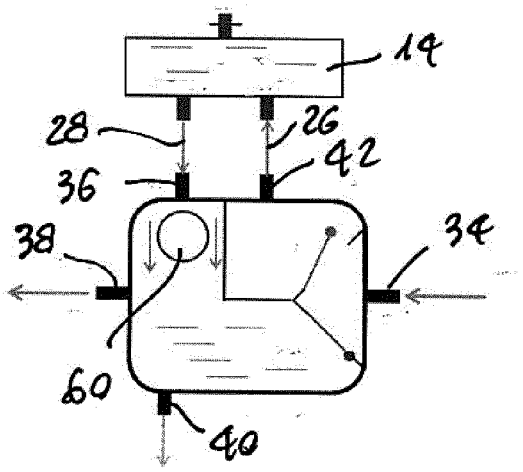

Fig. 8

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EUROPEAN SEARCH REPORT

Application Number
EP 14 16 6118

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	19 August 2014	Bermejo Pasetti, M

CATEGORY OF CITED DOCUMENTS

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