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

Waschmaschine mit Wasserspeichertank

Machine à laver avec réservoir de stockage d'eau

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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] Further the European patent applications EP2312045 A1 and EP2312042 A1 disclose washing machines having valves needing several actuators in order to operate.

[0008] 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.

[0009] The above object is reached thanks to the fea-

tures listed in the attached claims.

[0010] 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 a floating ball or the like.

[0011] 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.

[0012] 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.

[0013] 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.

[0014] 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.

[0015] 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.

[0016] 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 28 and 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.

[0017] 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.

[0018] 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.

[0019] Figure 6 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 58 is 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.

[0020] In figure 7 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.

[0021] Figure 8 is similar to figure 7 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. From the third chamber 58 water is drained through its first outlet 38.

[0022] 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.

[0023] 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 in-

stance 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 necessarily 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.

[0024] 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), said valve device (16) comprising 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) for closing/opening said overflow connection, 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), **characterized in that** said second valve member (60) is a floating ball or the like, that is automatically driven in a closed position by buoyancy.
2. Washing machine according to claim 1, 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.
3. Washing machine according to claim 1 or 2, 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.

4. Washing machine according to claim 3, 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).
5. Washing machine according to claim 4, 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.
6. Washing machine according to any of claims 3 to 5, 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).
7. Washing machine according to any of claims 3 to 6, 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.
8. Washing machine according to any claims 3 to 7, wherein the box-shaped valve body (30) presents a cup-shaped portion (30a) and a flat cover portion (30b).
9. Washing machine according to claim 8, wherein between the cup-shaped portion (30a) and the flat cover portion (30b) at least a gasket (31 a, 31 b) is interposed.

Patentansprüche

1. Waschmaschine, umfassend eine Wascheinheit (10) und einen Speichertank (14) mit einer Fließverbindung (18a, 18b, 26) zur Wascheinheit (10) durch eine Pumpe (12) zum Füllen des Speichertanks (14) mit Wasser, das wiederbenutzt werden soll, und einer Überlaufverbindung (28) zu einem Ablauf (18c) durch eine Ventilverrichtung (16), wobei die Ventilverrichtung (16) ein erstes Ventiltglied (50), das durch ein Stellglied (32) angetrieben ist, zum Ableiten von Fluss zum Ablauf oder zum Speichertank (14) und ein zweites Ventiltglied (60) zum Schließen/Öffnen der Überlaufverbindung umfasst, wobei die Ventilverrichtung (16) vier Durchlassöffnungen (34, 36,

- 38, 42) umfasst, wobei solche Durchlassöffnungen einen ersten Einlass (34), der mit einer Zufuhrleitung (18a, 18b, 26) stromabwärts von der Pumpe (12) verbunden ist, einen zweiten Einlass (36), der mit einer Überlaufleitung (28) vom Speichertank (14) verbunden ist, einen ersten Auslass (38), der mit dem Ablauf (18c) verbunden ist, und einen zweiten Auslass (42) definieren, der mit dem Speichertank (14) verbunden ist, wobei das erste Ventilglied (50) dazu konfiguriert ist, eine erste Position, in der der erste Einlass (34) in Verbindung mit dem ersten Auslass (38) ist, und eine zweite Position einzunehmen, in der der erste Einlass (34) in Verbindung mit dem zweiten Auslass (42) ist, wobei der zweite Einlass (36) durch das zweite Ventilglied (60) gesteuert ist, **dadurch gekennzeichnet, dass** das zweite Ventilglied (60) eine Schwimmkugel oder dergleichen ist, die durch Auftrieb automatisch in eine geschlossene Position getrieben wird.
2. Waschmaschine nach Anspruch 1, wobei das Stellglied des ersten Ventilglieds (50) aus der Gruppe ausgewählt ist, die aus Wachsmotoren, Solenoiden (32), Elektromotoren oder einer Kombination davon besteht, und das zweite Ventilglied eine schwimmende Vorrichtung wie etwa eine Kugel (60) oder ein Rückschlagventilglied ist.
 3. Waschmaschine nach einem der Ansprüche 1 oder 2, wobei die Ventilvorrichtung (16) einen kastenförmigen Ventilkörper (30) mit zwei gegenüberliegenden Oberflächen und einer Seitenwand umfasst, wobei an einer solchen Wand die zwei Einlässe (34, 36) und der erste Auslass (38) angeordnet sind, wobei der zweite Auslass (42) an einer (30b) der parallelen Oberflächen angeordnet ist.
 4. Waschmaschine nach Anspruch 3, wobei der Ventilkörper (30) eine erste Innenkammer (48) in direkter Verbindung mit dem ersten Einlass (34) aufweist und zwei Sitze (44a, 46a) für das erste Ventilglied (50) aufweist.
 5. Waschmaschine nach Anspruch 4, wobei der Ventilkörper (30) eine zweite und eine dritte Innenkammer (56, 58) aufweist, wobei die zweite Innenkammer (56) in Verbindung mit dem zweiten Auslass (42) ist und dazu konfiguriert ist, in Verbindung mit dem ersten Einlass (34) gebracht zu werden, wenn das erste Ventilglied (50) in seiner zweiten Position ist, wobei die dritte Kammer (58) in Verbindung mit dem ersten Auslass (38) ist und dazu konfiguriert ist, in Verbindung mit dem zweiten Einlass (36) gebracht zu werden, wenn das zweite Ventilglied (60) untätig ist, und in Verbindung mit der ersten Kammer (48), wenn das erste Ventilglied (50) in seiner ersten Position ist.
 6. Waschmaschine nach einem der Ansprüche 3 bis 5, wobei das erste Ventilglied (50) ein flaches Element ist, das an den Körper (30, 30a) der Ventilvorrichtung (16) angelenkt ist und mit zwei Sitzen (44a, 46a) in zwei flachen Innenwänden (44, 46) des Ventilkörpers (30) zusammenwirkt.
 7. Waschmaschine nach einem der Ansprüche 3 bis 6, wobei der kastenförmige Ventilkörper (30) eine doppelte Seitenwand (33) aufweist, die einen hohlen Raum (41) definiert, welcher in Verbindung mit einer fünften Durchlassöffnung (40) ist, die mit einem Wasserlecksicherheitssystem verbunden ist.
 8. Waschmaschine nach einem der Ansprüche 3 bis 7, wobei der kastenförmige Körper (30) einen becherförmigen Abschnitt (30a) und einen flachen Abdeckabschnitt (30b) aufweist.
 9. Waschmaschine nach Anspruch 8, wobei zwischen dem becherförmigen Abschnitt (30a) und dem flachen Abdeckabschnitt (30b) zumindest eine Dichtung (31a, 31b) eingelegt ist.

Revendications

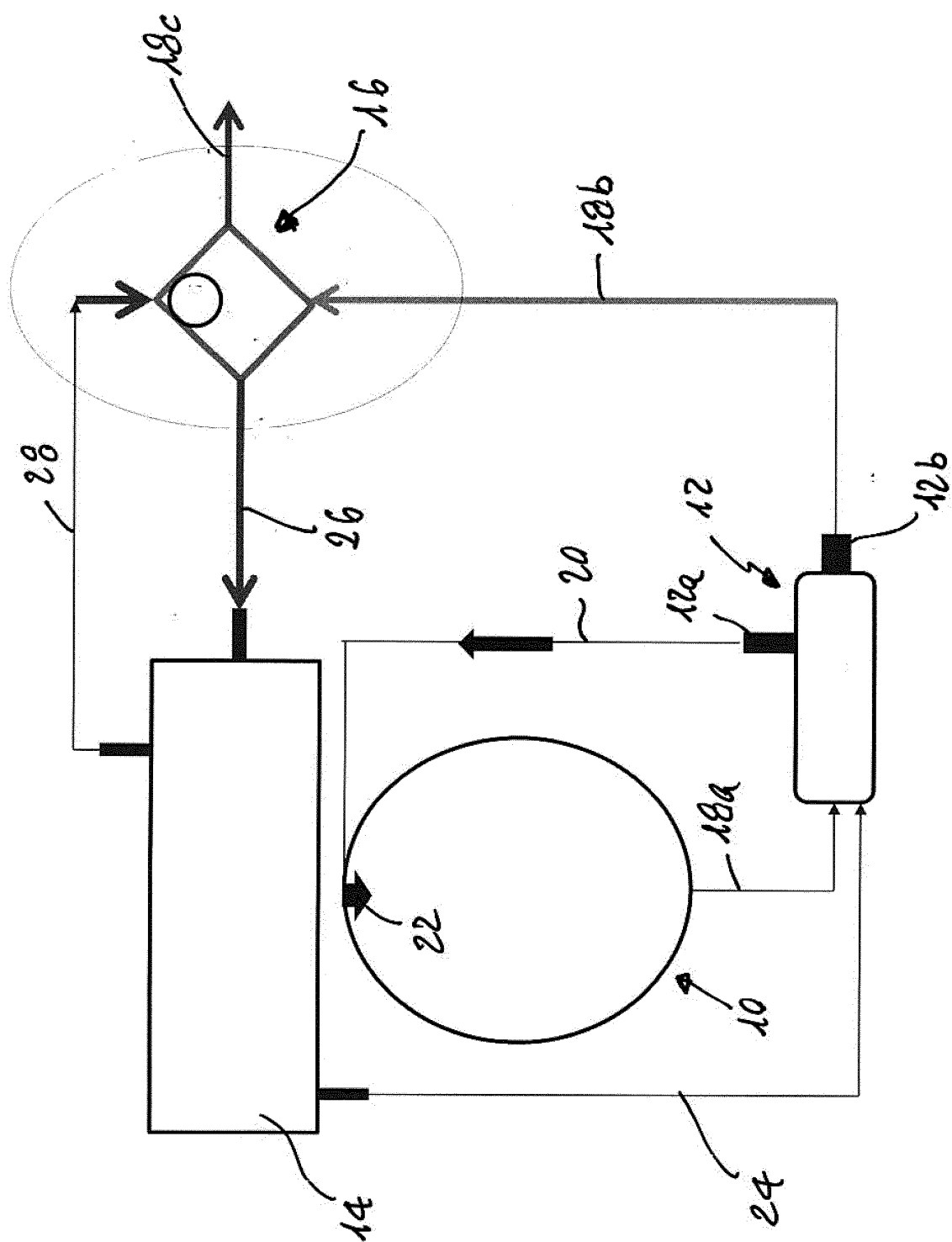
1. Machine à laver comprenant une unité de lavage (10) et un réservoir de stockage (14) ayant une communication fluide (18a, 18b, 26) avec l'unité de lavage (10) via une pompe (12) pour remplir ledit réservoir de stockage (14) par de l'eau à réutiliser, et un raccord de débordement (28) avec une évacuation (18c) via un dispositif à vanne (16), ledit dispositif à vanne (16) comprenant un premier élément de vanne (50) entraîné par un actionneur (32) pour dévier l'écoulement vers l'évacuation ou vers le réservoir de stockage (14) et un second élément de vanne (60) pour fermer/ouvrir ledit raccord de débordement, dans laquelle le dispositif à vanne (16) comprenant quatre orifices (34, 36, 38, 42), ces orifices définissant une première entrée (34) raccordée à une conduite d'alimentation (18a, 18b, 26) en aval de ladite pompe (12), une seconde entrée (36) raccordée à une conduite de débordement (28) du réservoir de stockage (14), une première sortie (38) raccordée à l'évacuation (18c) et une seconde sortie (42) raccordée au réservoir de stockage (14), le premier élément de vanne (50) étant configuré pour assumer une première position dans laquelle la première entrée (34) est en communication avec la première sortie (38) et une seconde position dans laquelle la première entrée (34) est en communication avec la seconde sortie (42), la seconde entrée (36) étant commandée par le second élément de vanne (60), **caractérisée en ce que** ledit second élément de vanne (60) est une bille flottante ou similaire, qui est entraînée automatiquement en position fermée

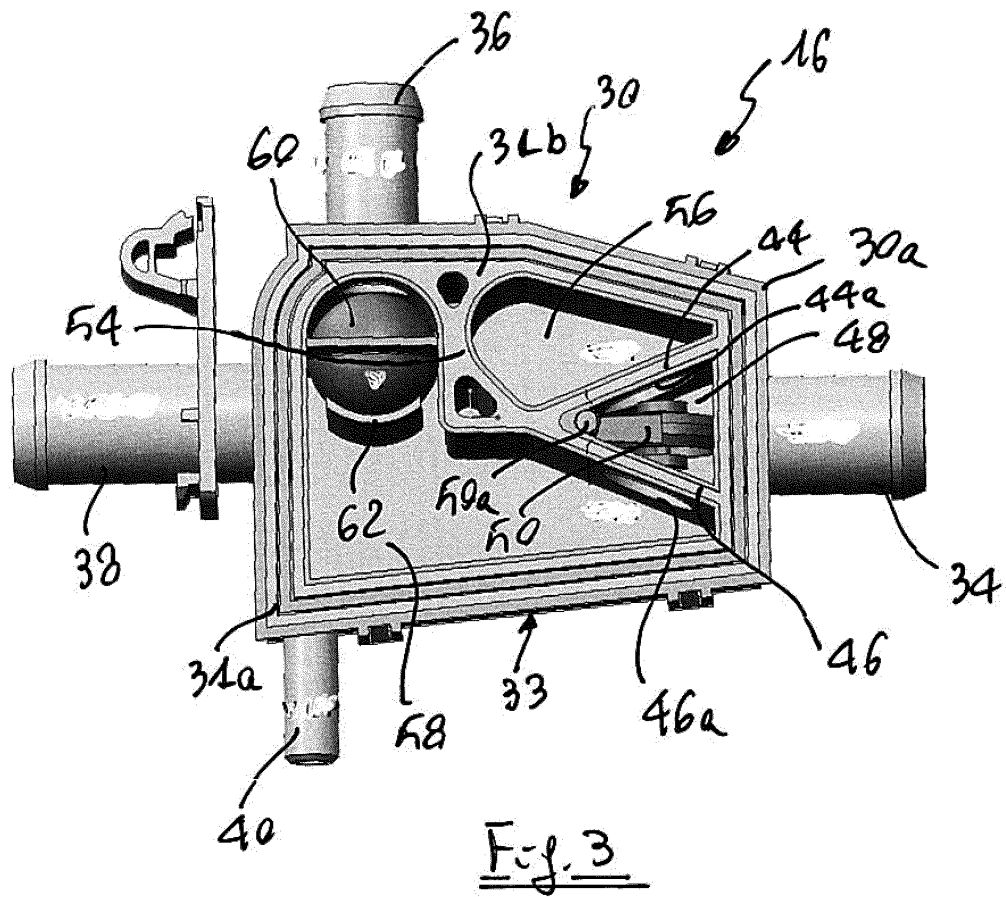
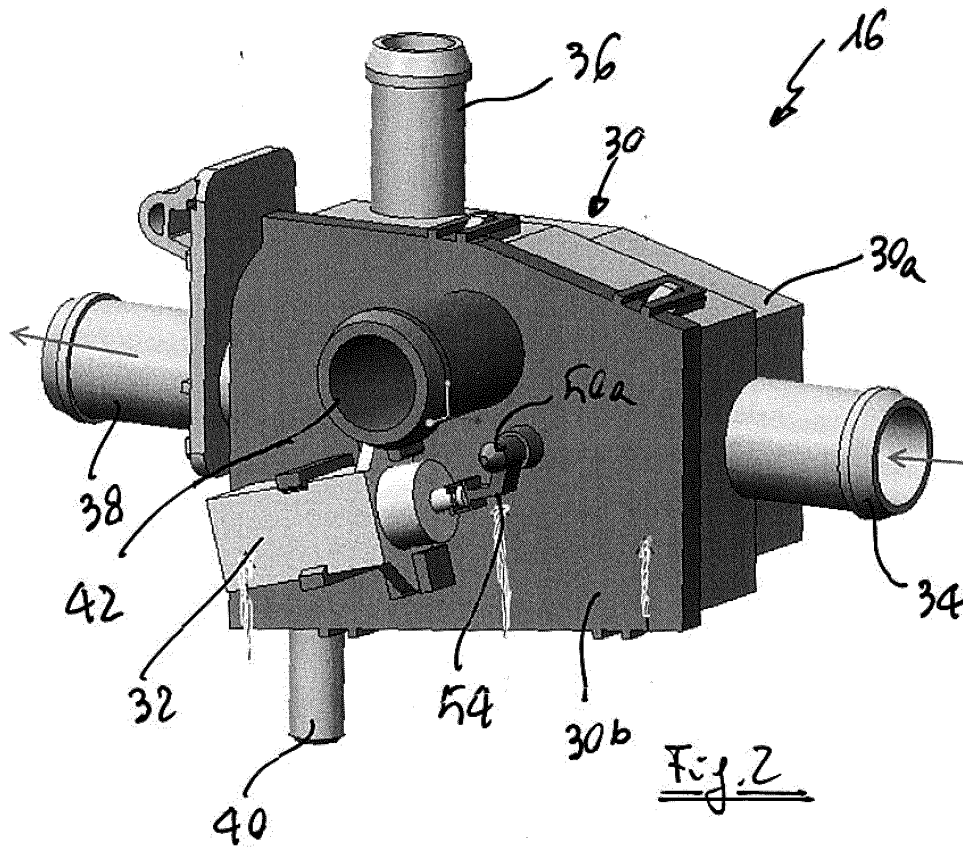
par sa flottabilité.

2. Machine à laver selon la revendication 1, dans laquelle l'actionneur du premier élément de vanne (50) est choisi dans le groupe constitué de moteurs à cire, de solénoïdes (32), de moteurs électriques ou d'une combinaison de ceux-ci et le second élément de vanne est un dispositif flottant telle qu'une bille (60) ou un élément de vanne à clapet. 5
3. Machine à laver selon la revendication 1 ou 2, dans laquelle le dispositif à vanne (16) comprend un corps de vanne en forme de caisse (30) ayant deux surfaces opposées et une paroi latérale, en positionnant sur cette paroi les deux entrées (34, 36) et la première sortie (38), la seconde sortie (42) étant placée sur l'une (30b) desdites surfaces parallèles. 10
4. Machine à laver selon la revendication 3, dans laquelle ledit corps de vanne (30) présente une première chambre interne (48) en communication directe avec la première entrée (34) et ayant deux sièges (44a, 46a) pour le premier élément de vanne (50). 15
5. Machine à laver selon la revendication 4, dans laquelle ledit corps de vanne (30) présente une deuxième et une troisième chambre interne (56, 58), la deuxième chambre interne (56) étant en communication avec la seconde sortie (42) et étant configurée pour être mise en communication avec la première entrée (34) lorsque le premier élément de vanne (50) se trouve dans sa seconde position, la troisième chambre (58) étant en communication avec la première sortie (38) et étant configurée pour être mise en communication avec la seconde entrée (36) lorsque le second élément de vanne (60) est au repos et en communication avec la première chambre (48) lorsque le premier élément de vanne (50) est dans sa première position. 20
6. Machine à laver selon l'une quelconque des revendications 3 à 5, dans laquelle le premier élément de vanne (50) est un élément plat articulé sur le corps (30, 30a) du dispositif à vanne (16) et coopérant avec deux sièges (44a, 46a) dans deux parois internes plates (44, 46) du corps de vanne (30). 25
7. Machine à laver selon l'une quelconque des revendications 3 à 6, dans laquelle le corps de vanne en forme de caisse (30) présente une double paroi latérale (33) définissant un espace creux (41) qui est en communication avec un cinquième orifice (40) raccordé à un système de sécurité à l'égard des fuites d'eau. 30
8. Machine à laver selon l'une quelconque des revendications 3 à 7, dans laquelle le corps de vanne en forme de caisse (30) présente une partie en forme 35

de coupe (30a) et une partie couvrante plate (30b).

9. Machine à laver selon la revendication 8, dans laquelle au moins un joint étanche (31a, 31b) est intercalé entre la partie en forme de coupe (30a) et la partie couvrante plate (30b). 40





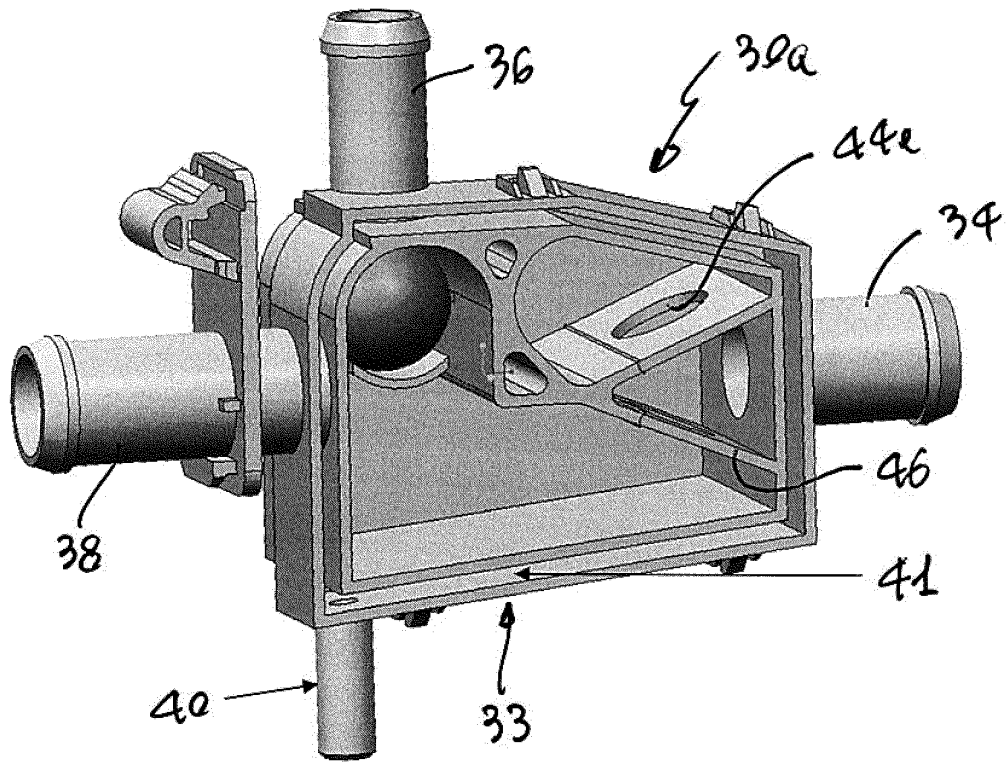


Fig. 4

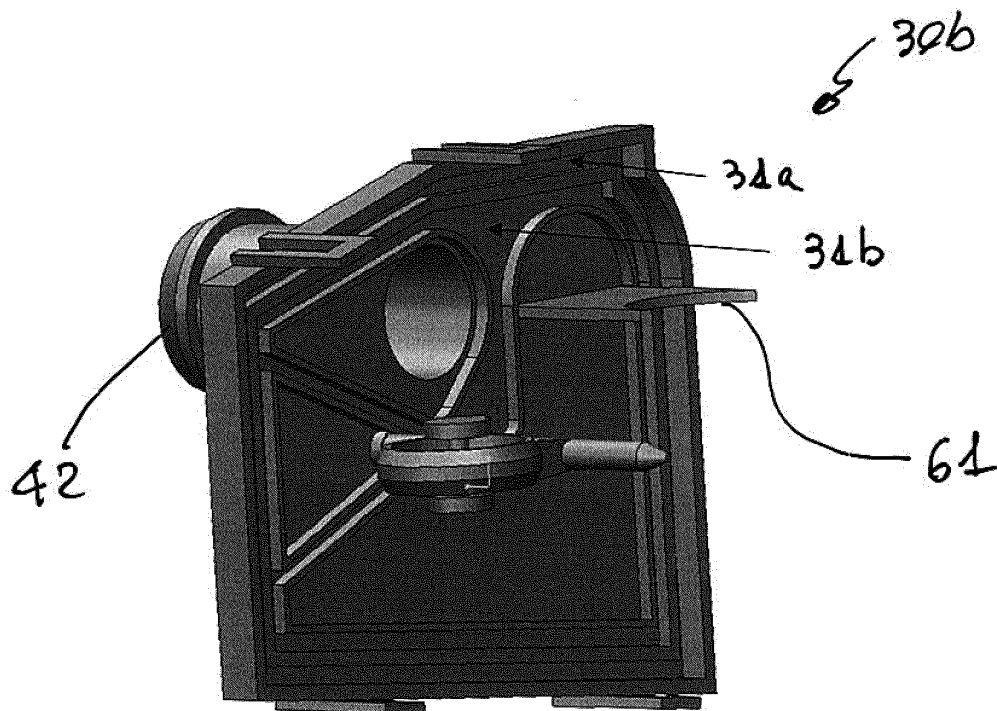


Fig. 5

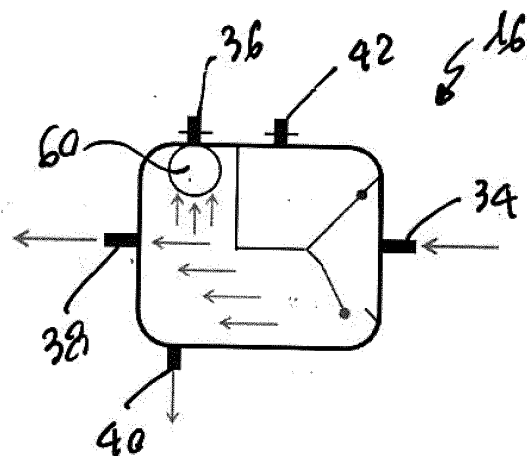


Fig. 6

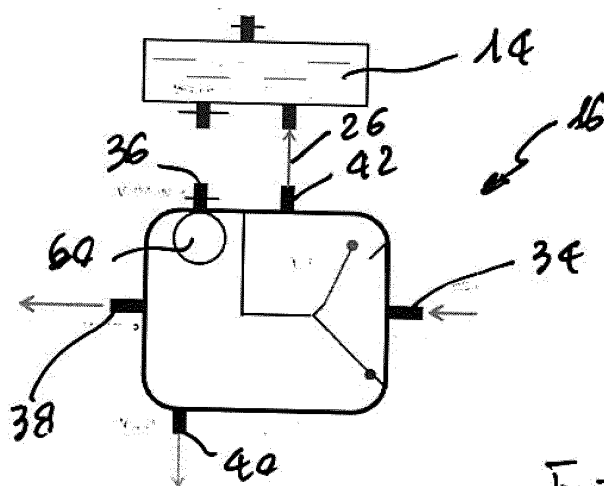


Fig. 7

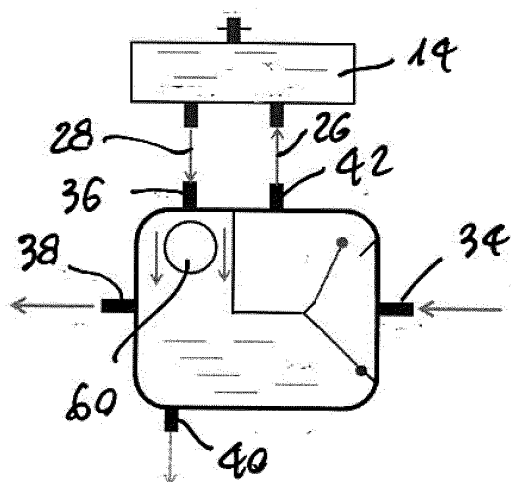


Fig. 8

REFERENCES CITED IN THE DESCRIPTION

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