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(54) **Device for washing laundry**

Vorrichtung zum Waschen von Wäsche

Dispositif pour laver le linge

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(56) References cited:
EP-A1- 0 607 628
EP-A1- 0 789 105
EP-A2- 0 771 898
WO-A1-2006/073373

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Description

[0001] The present invention refers to a device and a method for washing laundry, in particular a washing machine or household washer-dryer.

[0002] Household washing machines and washer-dryers comprise a support and housing structure, inside which a washing tank is housed provided with a front opening that can be closed through a door with a window that is hinged at the front to the housing. Inside the washing tank, a basket for receiving the laundry that is to be washed and (in the case of the washer-dryer machine) that is to be dried, is housed in a rotatable manner around a horizontal or inclined axis. Also the basket defines a front opening arranged at the opening of the washing tank, so as to be able to carry out the loading and the unloading of the laundry..

[0003] The washing tank is suitable for containing the washing liquid during the steps of washing the laundry and for forming (in washer-dryer machines) a portion of the drying circuit during the drying step of the laundry.

[0004] In order to allow the tank to be loaded with mains water and detergent substances and additives, a washing water loading system is foreseen that can be connected to the water mains. At the bottom of the washing tank, a discharge duct is foreseen with associated discharge pump that provides for removing the washing liquid from the tank and that, together with the loading system, controls the level of liquid inside the tank. In order to heat the washing liquid contained in the tank it is foreseen for there to be an electric resistance arranged inside the tank in the gap between the wall of the tank and the laundry-holder basket.

[0005] The drying circuit of washer-dryer machines of the prior art typically comprises an extraction unit, a heat exchanger and a heating unit with electrical resistances communicating with one another by means of a drying duct.

[0006] In such a closed circuit, the air flow caused by the extraction unit is heated by the electrical resistances and is conveyed into the basket, in which, passing through the wet laundry, causes the water contained in the fabrics to evaporate. In the heat exchanger, generally a container separate from the washing tank and equipped with a.spraying nozzle, the moist air is cooled down by a spray of cold water. Due to the cooling, the vapour condenses and is collected and discharged together with the cooling water. The dehumidified air is then sucked up again by the extraction unit and is made to recirculate.

[0007] Supplying the heat exchanger with cooling water usually occurs through a cooling duct with a dedicated solenoid valve that adjusts the loading of mains water into the heat exchanger (condenser). EP0771898A2 describes a washing machine in accordance with the preamble of claim 1.

[0008] Washing machines and washer-driers of the prior art and the washing and drying methods they implement, although satisfactory from many aspects, are bulky and have high water, electric energy and detergent consumption, both in the washing step and in the drying step.

[0009] The main purpose of the present invention is therefore that of providing a wishing machine or washer-dryer, as well as a washing method having characteristics such as to reduce the consumption of water, detergent, additives and electric energy, for the same amount of washing and for the same washing results and (in the case of the washer-dryer machine) drying results, as well as not substantially increasing the bulk of the household appliance.

This and other purposes are achieved, with a washing machine in accordance with claim 1.

[0010] Thanks to the formation of the recovery tank in the door it is possible to recover, hold and reuse a portion of the water already used previously inside a space which does not cause an increase in the overall bulk of the household appliance.

[0011] In accordance with the invention, the washing machine comprises a control unit with a program selector configured so as to automatically carry out a washing program comprising:

B) loading mains water into the washing tank and carrying out a first wash cycle, in which said first wash cycle comprises:

B1) a washing step that uses the water contained in the washing tank and activates the heating means so as to heat the water in the washing tank;
B2) a rinsing step that uses the water contained in the washing tank with the heating means deactivated,

as well as:

- recycling means configured, so as to introduce, during one of the steps of the wash cycle, the portion of recovered liquid from the recovery tank (15) into the washing tank, and
- recovery means configured so as to convey, after at least one step of the wash cycle, one portion of liquid used during the wash cycle from the washing tank to the recovery tank.

[0012] Thanks to the recovery and reuse of a portion of the water already used in the previous wash cycle, there is a saving both in terms of water and electric energy, due to the fact that it is possible to have a volume of recovered water at room temperature or at a temperature that is further increased due to the operation temperature of the washing machine

[0013] Further advantageous aspects of the invention shall emerge from the following description of some embodiments thereof, given as an example and not for limiting purposes, with reference to the attached figures, in which:

- figure 1 is a schematic representation of a washing method according to a first embodiment of the invention;
- figure 2 is a schematic representation of a washing method according to a second embodiment of the invention;
- figure 3 is a schematic representation of a washing method according to a third embodiment of the invention;
- figure 4 is a schematic representation of a washing method according to a fourth embodiment of the invention;
- figure 5 is a schematic representation of a washing method according to a fifth embodiment of the invention;
- figure 6 is a schematic view of a washing machine according to one embodiment of the invention;
- figure 7 is a schematic view of a washer-dryer machine according to one embodiment;
- figure 8 is a transparent side view of a washing machine according to one embodiment;
- figure 9 is a transparent front view of a washer-dryer machine according to one embodiment;
- figure 10 is a transparent front view of a washer-dryer machine according to a further embodiment;
- figure 11 is a transparent front view of a washing machine according to one preferred embodiment;
- figure 12 is a transparent side view of the washing machine of figure 11;
- figures 13 and 14 are partial section views of a door of the washing machine in its open and closed configuration;
- figure 15 is a partial view of a door with a window with an extractable siphon.

[0014] With reference to the figures, a washing machine 1 or washer-dryer, meant as a particular embodiment of the washing machine, comprises a support and housing structure 2, inside which a washing tank 3 is housed equipped with a front opening that can be closed by means of a door with a window 4 hinged at the front to the housing 2. Inside the washing tank 3 a basket 5 for receiving the laundry that is to be washed and/or dried is housed, in a rotatable manner around a horizontal or inclined axis. Also the basket 5 defines a front opening arranged at the opening of the washing tank 3, so as to be able to carry out the loading and the unloading of the laundry.

[0015] The washing tank 3 is suitable for containing the washing liquid during the steps of washing the laundry and (in the embodiment of the washer-dryer machine) to form a portion of the drying circuit during the laundry drying step.

[0016] In order to make it possible to load the tank with mains water and detergent substances and additives, a loading system of the washing water is foreseen that can be connected to the water mains. Such a loading system of the washing water comprises a plurality of wash flow paths that extend, for example, from two supply solenoid valves 6 through corresponding compartments of a detergent holder tray 7, to inside the washing tank 3.

[0017] At the bottom 8 of the washing tank 3 a discharge duct 9 is connected with an associated discharge pump 10 that provides for removing the washing liquid from the tank 3 and that controls, together with the supply solenoid valves 6, the level of liquid inside the tank 3.

[0018] In order to heat the washing liquid contained in the tank 3, a coiled electrical resistance 11 is foreseen, arranged inside the tank 3, in particular at the bottom 8 of the latter, in the gap between the wall of the tank 3. and the laundry-holder basket 5.

[0019] The washer-dryer machine 1 can also comprise a closed drying circuit 12 with an extraction unit, for example a fan rotor actuated by an electric motor, a heat exchanger, as well as a heating unit with electrical resistances communicating with one another by means of a drying duct.

[0020] In such a closed circuit, the air flow 13 caused by the extraction unit is heated by the electrical resistance and is conveyed into the basket 5, in which, passing through the wet laundry, causes the water contained in the fabrics to evaporate. The heat exchanger is arranged downstream of the laundry-holder basket 5 (with reference to the direction of the drying air flow 13) and cools down the moist air coming from the basket 5.

[0021] Due to the cooling, the vapour condenses and is collected and can be discharged, for example, together with a volume of cooling water. The dehumidified air is then sucked up again by the extraction unit and is made to recirculate.

[0022] The washing machine 1 also comprises a control unit 14 with a program selector that can make it possible to automatically select and carry out a washing program that comprises the steps of loading the mains water into the washing tank and carrying out a wash cycle that comprises:

- one or more washing steps that use the water contained in the washing tank 3 and in which the control unit activates the electrical resistance 11 to heat the water in the washing tank 3;
- one or more rinsing steps that use the water contained in the washing tank 3 with electrical resistance 3 deactivated,
- possibly but not necessarily a step of centrifuging the laundry by means of rotation of the washing basket 5.

[0023] The washing machine 1 also comprises a recovery tank 15 formed in the door 4 and separate from the washing tank 3, in which the recovery tank 15 is suitable for containing a portion of recovered liquid. Recycling means are also foreseen in connection with a recirculation duct 17 that connects (when the door 4 is closed) the recovery tank 15 with the washing tank 3. The recirculation means are controlled by the control unit 14 so

as to introduce, during one of the steps of the wash cycle, the portion of recovered liquid from the recovery tank 15 into the washing tank 3.

[0024] Advantageously, the recovery tank 15 comprises an inner wall 21 facing inside the washing tank 3 and an outer wall 20 opposite to the inner wall 21 and facing outwards from the washing machine 1, in which such inner and outer walls 21, 20, also form the corresponding inner and outer walls of the door 4.

[0025] In accordance with one embodiment, the outer wall 20 of the recovery tank 15 is rounded outwards so as to increase the volume of the tank 15 itself. The volume that can be loaded into the recovery tank can be of about 9 - 10 litres and can correspond to a rinsing volume for a partial load of laundry or at least a part of the rinsing volume for a full load of laundry.

[0026] he washing machine 1 also comprises recovery means, in particular a recovery duct 18 having an outlet opening connected (when the door 4 is closed) to the recovery tank 15 and an inlet opening connected for example by means of a selector valve 19 to the discharge duct 9 downstream of the discharge pump 10 (Figures 6, 7, 8, 9).

[0027] In accordance with an alternative embodiment, the washing machine 1 configured as a washer-dryer comprises a double discharge pump having:

- a first pump 10.1 connected between the tank bottom and a duct 22 for supplying the heat exchanger and that is controlled to draw liquid from the tank bottom and to convey it into the supply duct 22 and,
- a second pump 10.2 that is connected between the tank bottom and the discharge duct 9 and is configured and controlled by the control unit 14 to discharge the liquid from the tank bottom and to convey it into the discharge duct 9.

[0028] In this embodiment, the inlet opening of the recovery duct 18 could be connected by means of the selector valve 19 to the supply duct 22 of the heat exchanger (Figure 10) or to the discharge duct 9 (not illustrated).

[0029] Moreover, both the pumps 10.1 and 10.2 can advantageously be integrated in the same pump housing.

[0030] The recovering means, in particular, the selector valve 19 and the discharge pump 10, are configured and controlled by the control unit 14 so as to convey, after at least one wash cycle step, a portion of liquid used during the wash cycle from the washing tank 3 into the recovery tank 15.

[0031] Advantageously, for the reintroduction of the recovered liquid, the washing machine 1 comprises an inverted siphon 23, that is to say a duct extending from an inlet opening 24 positioned at draining level near to the bottom 25 of the recovery tank 15 upwards up to an upper vertex 26 positioned at a priming level in the upper part of the recovery tank 15 and from the upper vertex 26 downwards to an outlet opening 27 arranged below the inlet opening 24 and that enters (when the door 4 is closed) into the washing tank 3.

[0032] The siphon 23, and therefore the emptying out of the recovery tank 15 into the washing tank 3 is primed by means of an integration of the volume of liquid into the recovery tank 15 to the priming level. Such a filling can be carried out by conveying a small portion of liquid through the recovery duct 18 by means of an actuation of the discharge pump 10 and of the selector valve 19. Alternatively, the integration of recovered liquid to the priming level can be carried out by conveying a small portion of mains water through a direct supply duct 28 that connects a solenoid loading valve 29 to the recovery tank (Figure 12) and that advantageously passes through a corresponding compartment of the detergent holder 7. In accordance with one embodiment, the loading valve and the direct supply duct 28 are configured to also carry out the function of loading detergent into the washing tank 3 during a washing step.

[0033] In accordance with a further embodiment, the loading valve 29 and the direct supply duct 28 are independent from the loading system of the washing tank and isolated from the detergent holder 7 and, therefore, can be actuated autonomously during any step of the washing program.

[0034] The outer wall 20 of the door 4 can be cloudy-transparent so as to be able to see the filling level of the recovery tank 15 from outside, but without seeing the possible turbidity of the recovered liquid.

[0035] In accordance with a further embodiment, the siphon 23 is equipped with a shut-off valve 30 configured so as to automatically close the outlet opening 27 when the door with a window 4 is opened and to open the outlet opening 27 when such a door is closed. This prevents the recovered liquid from coming out when the door is open and ensures, when the door is closed, a fluid connection between the outlet opening 27 and the washing tank. Advantageously, the shut-off valve 30 comprises a shutter 31 housed in a valve seat and pushed towards a closed position, for example elastically or by means of the hydrostatic pressure of the recovered liquid, as well as an actuation portion 32 in connection with the shutter 31 and positioned so as to be engaged, when the door 4 is closed, by a thrust surface 33 formed in the support structure 2. The thrust surface 33 defines for example a protuberance, formed in a bellows gasket 34 of the tank opening. When the door 4 is closed, the thrust surface 33 presses against the actuation portion 32 so that it moves the shutter 31 from the closed position into an open position of the shut-off valve 30. When the door 4 is opened, the actuation portion 32 disengages the thrust surface 33 and the shutter 31 moves in the closed position and locks the valve 30.

[0036] In accordance with one embodiment, the siphon 23 is removably housed in the recovery tank 15, from which the siphon 23 can be preferably slipped off upwards. In particular, the door 4 comprises an upper opening 35 and an opposite lower opening 36 and the siphon 23 comprises an upper cover 37 and a lower cap 38 suit-

able for tight sealing the corresponding upper and lower openings 35, 36. Advantageously, the upper cover 37 forms a recovery passage 39 which aligns, when the door 4 is closed, with a mouth 40 of the recovery duct 18 so as to create a fluid communication between the recovery duct 18 and the inside of the recovery tank 15. The upper cover 37 can also comprise a gripping portion 41 for the manual extraction and insertion of the siphon 23 into the door 4. Moreover, the portion of tube that forms the outlet opening 27 of the siphon 23 extends through the lower cap 38. In this way it is possible to make doors with integrated recovery tanks with standardized upper and lower openings and mount siphons having different shapes and priming levels that have an upper cover and a lower cap with a standardized shape that matches the openings of the door.

[0037] With the washing machine 1 described thus far it is possible to carry out a washing method that comprises the steps of:

- loading mains water into the washing tank 3 and carrying out a first wash cycle of a first load of laundry, in which the first wash cycle comprises:
- a washing step of the first load of laundry by using the water contained in the washing tank 3 and activating the heating means 11 so as to heat the water in the washing tank 3;
- a rinsing step of the first load of laundry with the heating means 11 deactivated and using the water contained in the washing tank 3;
- after the end of the first wash cycle, loading mains water into the washing tank 3 and carrying out a subsequent second wash cycle of a second load of laundry, in which also the second wash cycle comprises:
- a washing step of the second load of laundry by using the water contained in the washing tank 3 and activating the heating means 11 so as to heat the water in the washing tank 3;
- a rinsing step of the second load of laundry with heating means 11 deactivated and using the water contained in the washing tank 3,

and in which

- a portion of the water used during at least one step of the first wash cycle is conveyed from the washing tank 3 to the recovery tank 15; and
- during the second wash cycle, the portion of water recovered is introduced from the recovery tank 15 into the washing tank 3.

[0038] Thanks to the recovery and the reuse of a portion of the water already used in the previous wash cycle, there is a saving of water and of electric energy, since it is possible to have a volume of recovered water at room temperature or at a temperature that is further increased due to the operating temperature of the washing machine.

[0039] In accordance with one embodiment, the recovery means are configured and controlled by the control unit 14 so as to draw one portion of liquid used during the rinsing step and convey it from the washing tank 3 to the recovery tank 15.

[0040] In accordance with one alternative embodiment, the wash cycle comprises a plurality of rinsing steps broken up by steps of discharging the liquid from the washing tank 3 and loading of mains water into the washing tank 3 and the recovery means are configured and controlled by the control unit 14 so as to draw one portion of liquid used during a last rinsing step of the plurality of rinsing steps, and convey it from the washing tank 3 to the recovery tank 15. In such a way the recovered liquid is substantially clean water with a very low content of residual detergent.

[0041] Alternatively, the recovery means are configured and controlled by the control unit 14 so as to draw one portion of liquid used during a rinsing step before the last rinsing step, and convey it from the washing tank 3 to the recovery tank 15. In such a way the recovered liquid has a content of detergent or additives that can be reused together with the liquid itself in the subsequent wash cycle.

[0042] In accordance with one embodiment, the wash cycle comprises a step of centrifuging the laundry subsequent to a last rinsing step and the recovery means are configured and controlled by the control unit 14 so as to draw one portion of liquid used during the last rinsing step and convey it from the washing tank 3 to the recovery tank 15.

[0043] In accordance with a further embodiment, the wash cycle comprises a laundry drying step subsequent to a last rinsing step and the recovery means are configured and controlled by the control unit 14 so as to draw one portion of liquid used during the last rinsing step and condensed during the drying step and convey it from the washing tank 3 (in the case in which the heat exchanger discharges the condensate into the tank 3) or from the heat exchanger into the recovery tank 15. In this case, the recovered liquid is at least partially decalcified and, in the subsequent wash cycle, requires less detergent or additives to reduce the hardness of the water.

[0044] The washing machine 1 can also be configured to recover, in the drying step, in addition to the condensate, also a part of the cooling water used in the heat exchanger, in particular in the case in which the cooling water is discharged from the heat exchanger into the washing tank 3.

[0045] In accordance with one embodiment, the recycling means, in particular the discharge pump 10 and the selector valve 19 or the loading valve 29, are actuated by the control unit 14 so as to integrate the volume of recovered liquid to the priming of the siphon 23 so as to introduce the portion of recovered liquid from the recovery tank 15 into the washing tank 3 during the rinsing step.

[0046] In this way the recovered and reused liquid is preheated due to the heat of the previous washing steps

and of the motor which moves the washing basket 5.

[0047] Alternatively (and as a function of the selected washing program by means of the program selector), the recycling means 10, 19, 23 are driven by the control unit 14 so as to introduce the portion of recovered liquid from the recovery tank 15 into the washing tank 3 during the washing step.

[0048] In accordance with a further embodiment, the control unit 14 with the program selector make it possible to select a washing program that comprises a plurality of washing steps broken up by steps of discharging the liquid from the tank 3 and loading liquid into the tank 3, in which the recycling means 10, 19, 23 are configured and controlled by the control unit 14 so as to introduce the portion of recovered liquid from the recovery tank 15 into the washing tank 3 during a washing step after a first washing step, for example during a last washing step, of the plurality of washing steps.

[0049] Even in this case, the recovered and reused liquid is preheated due to the heat of the previous washing steps and to the motor that moves the washing basket 5.

[0050] In general it should be noted that the washing machine 1 is configured so that the portion of liquid recovered in the recovery tank 15 can be isolated from the volume of liquid in the washing tank 3 and from its movements that can be activated independently from the recovered liquid.

[0051] In accordance with one embodiment, the recirculation duct 17 can be in fluid communication with a detergent compartment of the detergent holder 7, so that, during the introduction of the portion of recovered liquid into the washing tank 3, such recovered liquid can mix with a detergent or washing additive contained in the detergent compartment when the recovered liquid is passing.

[0052] As can be seen from the figures, the door 4 with the recovery tank 15 and the relative recovery and recirculation means can be added to washing machines and washer-dryers known today without requiring any redesign of their base structure and partially keeping the current industrial manufacture.

[0053] In accordance with a further embodiment, the recovery means are configured and controlled by the control unit 14 so as to draw from the washing tank 3 one portion of liquid enriched with detergent or sanitizing substances in general (for example during or after a washing step with detergent) and convey it to the recovery tank 15, avoiding the proliferation of micro-organisms while waiting for the subsequent wash cycle and reuse of the recovered liquid.

[0054] In accordance with a further embodiment, the recovery tank 15 is in communication with the surrounding environment (for example by means of an upper vent opening, and operates at atmospheric pressure in a simple and safe manner without requiring hydraulic circuits with a pressure seal.

[0055] In accordance with a further embodiment, the washing machine 1 can comprise a sensor 42 for detecting the presence of detergent substances in the portion of recovered liquid in the recovery tank 15, for example a turbidity sensor, and the control unit 14 is configured to control the loading into the tank 3:

- of the liquid recovered from the recovery tank 15,
- of mains water through the detergent holder 7,
- of mains water, bypassing the detergent holder 7,

as a function of a value detected by the turbidity sensor 42 so as to obtain a mixture of water and detergent substances foreseen by the washing program in the washing tank 3.

[0056] This allows substantial savings in detergent for washing loads of slightly dirty laundry.

[0057] The procedure steps described with reference to the operation of specific components of the washing machine/washer-dryer 1 should be intended also as embodiments of the washing method that can be carried out with means and components that are different from the embodiments of the washing machine 1 described.

[0058] The washing method and the machine for treating laundry according to the invention, in particular in the embodiment of a washer-dryer machine have numerous advantages.

[0059] It makes it possible to save water, electric energy and detergent substances necessary for the treatment of the laundry.

[0060] Of course, a man skilled in the art, with the purpose of satisfying contingent and specific requirements, can carry out further modifications and variants to the machine for treating laundry, in particular the washer-dryer.

Claims

1. Washing machine (1) comprising:

- a washing basket (5) supported inside a washing tank (3) suitable for containing the washing liquid and that can be closed by means of a door (4),
- heating means (11) arranged inside the washing tank (3),
- a loading system (6, 7) suitable for supplying mains water into the washing tank,
- a discharge system (9, 10) suitable for discharging the liquid contained in the washing tank (3),
- a recovery tank (15) separated from the washing tank (3), said recovery tank (15) being suitable for containing a portion of recovered liquid
- a control unit (14) with a program selector configured so as to automatically carry out a washing program comprising:

B) loading mains water into the washing tank (3) and currying out a first wash cycle, in which said first wash cycle comprises:

B1) a washing step that uses the water contained in the washing tank (3) and activates the heating means (11) so as to heat the water in the washing tank (3);
B2) a rinsing step that uses the water contained in the washing tank (3) with the heating means (11) deactivated,

- recycling means (10, 17, 23) configured so as to introduce, during one of the wash cycle steps, the portion of recovered liquid from the recovery tank (15) into the washing tank (3), and
- recovery means (18, 19) configured so as to convey, after at least one step of the wash cycle, one portion of liquid used during the wash cycle from the washing tank (3) into the recovery tank (15),

characterized in that the recovery tank (15) is formed in the door (4) and
comprises an inner wall (21) facing inside the washing tank (3) and an outer wall (20) opposite to the inner wall (21) and facing outwards from the washing machine (1), wherein said inner and outer walls (21, 20), also form corresponding inner and outer walls of the door (4).

2. Washing machine (1) according to claim 1, wherein an outer wall (20) of the recovery tank (15) is rounded outwards.

3. Washing machine (1) according to 1 or 2, wherein the recovery means comprise a recovery duct (18) having an outlet opening connected, when the door (4) is closed, to the recovery tank (15) and an inlet opening connected by means of a selector valve (19) to the discharge duct (9) downstream of a discharge pump (10), wherein the selector valve (19) and the discharge pump (10) are controlled by the control unit (14).

4. Washing machine (1) according to 1 or 2, wherein said recycling means comprise an inverted siphon (23).

5. Washing machine (1) according to claim 4, wherein said siphon (23) comprises an inverted U-shaped duct with an inlet opening (24) positioned at draining level near to the bottom (25) of the recovery tank (15), an upper vertex (26) positioned at a priming level in the upper part of the recovery tank (15) and an outlet opening (27) arranged below the inlet opening (24) and entering, when the door (4) is closed, into the washing tank (3).

6. Washing machine (1) according to claim 4 or 5, wherein said siphon (23) is configured to be primed by means of an integration of the volume of liquid into the recovery tank (15) to the priming level.

7. Washing machine (1) according to one of claims 4 to 6, wherein a control unit (14) of the washing machine (1) is suitable for priming the syphon (23) through the actuation of the discharge pump (10) and of the selector valve (19).

8. Washing machine (1) according to one of claims 4 to 6, comprising a direct supply duct (28) that connects a solenoid valve (29) for loading mains water into the recovery tank (15), wherein a control unit (14) of the washing machine (1) is suitable for priming the siphon (23) through the actuation of the solenoid loading valve (29).

9. Washing machine (1) according to claim 8, wherein said loading valve (29) and the direct supply duct (28) are configured to also carry out a function of loading detergent into the washing tank (3) during a washing step.

10. Washing machine (1) according to claim 8, wherein said loading valve (29) and the direct supply duct (28) are independent from the loading system of the washing tank and are isolated from the detergent holder (7).

11. Washing machine (1) according to any one of the previous claims, wherein an outer wall (20) of the door (4) can be cloudy-transparent or coloured so as to make the filling level of the recovery tank (15) visible from outside without highlighting turbidity of the recovered liquid.

12. Washing machine (1) according to any one of the previous claims, wherein said siphon (23) is equipped with a shut-off valve (30) configured so as to automatically close the outlet opening (27) when the door (4) is opened and to open the outlet opening (27) when such a door is closed.

13. Washing machine (1) according to any one of the previous claims, wherein said siphon (23) is removably received in the recovery tank (15) and can be slipped off upwards.

14. Washing machine (1) according to any one of the previous claims, wherein said door (4) comprises an upper opening (35) and an opposite lower opening (36) and the syphon (23) comprises an upper cover (37) and a lower cap (38) suitable for tight sealing the corresponding upper and lower openings (35,

36).

15. Washing machine (1) according to the previous claim, whereon:

- the upper cover (37) forms a recovery passage (39) which is aligned, when the door (4) is closed, with a mouth (40) of the recovery duct (18) so as to create fluid communication between the recovery duct (18) and the inside of the recovery tank (15),
- a portion of tube that forms the outlet opening (27) of the siphon (23) extends through the lower cap (38).

16. Washing machine (1) according to one of the previous claims, said machine (1) being configured as a washer-dryer machine and comprising a drying circuit (12) with an extraction unit, a heat exchanger and heating element communicating with one another by means of a drying duct, wherein the wash cycle controlled by the control unit (14) comprises a laundry drying step subsequent to a last rinsing step and the recovery means are configured and controlled by the control unit (14), as a function of the selected washing program, so as to draw a portion of liquid used during the rinsing step and condensed during the drying step and to convey said portion of condensed, liquid into the recovery tank (15) in the door (4).

Patentansprüche

1. Waschmaschine (1), umfassend:

- einen Waschkorb (5), welcher innerhalb eines Waschbehälters (3) gehaltert ist, welcher zum Enthalten der Waschflüssigkeit geeignet ist und mittels einer Tür (4) geschlossen werden kann,
- Erwärmungsmittel (11), welche innerhalb des Waschbehälters (3) angeordnet sind,
- ein Einfüllsystem (6, 7), welches zum Zuführen von Leitungswasser in den Waschbehälter geeignet ist,
- ein Ablasssystem (9, 10), welches zum Ablassen der in dem Waschbehälter (3) enthaltenen Flüssigkeit geeignet ist,
- einen Rückgewinnungsbehälter (15), welcher von dem Waschbehälter (3) getrennt ist, wobei der Rückgewinnungsbehälter (15) zum Enthalten eines Teils von zurückgewonnener Flüssigkeit geeignet ist,
- eine Steuerungs-/Regelungseinheit (14) mit einem Programmwähler, welche eingerichtet ist, um ein Waschprogramm automatisch auszuführen, welches umfasst:

B) ein Einfüllen von Leitungswasser in den Waschbehälter (3) und ein Ausführen eines ersten Waschzyklus, in welchem der erste Waschzyklus umfasst:

B1) einen Waschschritt, welcher das in dem Waschbehälter (3) enthaltene Wasser verwendet und die Erwärmungsmittel (11) aktiviert, um das Wasser in dem Waschbehälter (3) zu erwärmen;
B2) einen Spülschritt, welcher das in dem Waschbehälter (3) enthaltene Wasser verwendet, wobei die Erwärmungsmittel (11) deaktiviert sind,

- Rückführmittel (10, 17, 23), welche zum Einführen des Teils zurückgewonnener Flüssigkeit aus dem Rückgewinnungsbehälter (15) in den Waschbehälter (3) während eines der Waschzyklusschritte eingerichtet sind, und
- Rückgewinnungsmittel (18, 19), welche zum Befördern eines Teils während des Waschzyklus verwendeter Flüssigkeit aus dem Waschbehälter (3) in den Rückgewinnungsbehälter (15) nach zumindest einem Schritt des Waschzyklus eingerichtet sind,

dadurch gekennzeichnet, dass der Rückgewinnungsbehälter (15) in der Tür (4) ausgebildet ist und eine innere Wand (21), welche in den Waschbehälter (3) weist, und eine äußere Wand (20) umfasst, welche der inneren Wand (21) entgegengesetzt ist und von der Waschmaschine (1) nach außen weist, wobei die innere und die äußere Wand (21, 20) auch eine entsprechende innere und eine entsprechende äußere Wand der Tür (4) ausbilden.

2. Waschmaschine (1) nach Anspruch 1, wobei eine äußere Wand (20) des Rückgewinnungsbehälters (15) nach außen abgerundet ist.

3. Waschmaschine (1) nach Anspruch 1 oder 2, wobei die Rückgewinnungsmittel einen Rückgewinnungskanal (18) mit einer Auslassöffnung, welche, wenn die Tür (4) geschlossen ist, mit dem Rückgewinnungsbehälter (15) verbunden ist, und eine Einlassöffnung umfassen, welche mittels eines Schaltventils (19) mit dem stromabwärts einer Ablasspumpe (10) gelegenen Ablasskanal (9) verbunden ist, wobei das Schaltventil (19) und die Ablasspumpe (10) durch die Steuerungs-/Regelungseinheit (14) gesteuert/geregelt sind.

4. Waschmaschine (1) nach Anspruch 1 oder 2, wobei die Rückführmittel einen invertierten Siphon (23) umfassen.

5. Waschmaschine (1) nach Anspruch 4, wobei der Siphon (23) einen invertierten, U-förmigen Kanal mit einer Einlassöffnung (24), welche an einem Ablaufpegel nahe des Bodens (25) des Rückgewinnungsbehälters (15) positioniert ist, einen oberen Scheitelbereich (26), welcher an einem Vorfüllpegel in dem oberen Teil des Rückgewinnungsbehälters (15) positioniert ist, und eine Auslassöffnung (27) umfasst, welche unterhalb der Einlassöffnung (24) angeordnet ist und in den Waschbehälter (3) eindringt, wenn die Tür (4) geschlossen ist.

6. Waschmaschine (1) nach Anspruch 4 oder 5, wobei der Siphon (23) eingerichtet ist, um mittels einer Einbringung des Flüssigkeitsvolumens in den Rückgewinnungsbehälter (15) bis zu dem Vorfüllpegel gefüllt zu werden.

7. Waschmaschine (1) nach einem der Ansprüche 4 bis 6, wobei eine Steuerungs-/Regelungseinheit (14) der Waschmaschine (1) zum Vorfüllen des Siphons (23) durch die Betätigung der Ablasspumpe (10) und des Schaltventils (19) geeignet ist.

8. Waschmaschine (1) nach einem der Ansprüche 4 bis 6, umfassend einen direkten Zufuhrkanal (28), welcher ein Magnetventil (29) zum Einfüllen von Leitungswasser in den Rückgewinnungsbehälter (15) verbindet, wobei eine Steuerungs-/Regelungseinheit (14) der Waschmaschine (1) zum Vorfüllen des Siphons (23) durch die Betätigung des Magneteinfüllventils (29) geeignet ist.

9. Waschmaschine (1) nach Anspruch 8, wobei das Einfüllventil (29) und der direkte Zufuhrkanal (28) auch zum Ausführen einer Einfüllfunktion von Detergenzien in den Waschbehälter (3) während eines Waschschritts eingerichtet sind.

10. Waschmaschine (1) nach Anspruch 8, wobei das Einfüllventil (29) und der direkte Zufuhrkanal (28) von dem Einfüllsystem des Waschbehälters unabhängig und von der Detergenzienhaltevorrichtung (7) isoliert sind.

11. Waschmaschine (1) nach einem der vorhergehenden Ansprüche, wobei eine äußere Wand (20) der Tür (4) trüb-transparent oder eingefärbt sein kann, um den Füllpegel des Rückgewinnungsbehälters (15) von außerhalb sichtbar zu machen, ohne die Trübung der rückgewonnenen Flüssigkeit hervorzuheben.

12. Waschmaschine (1) nach einem der vorhergehenden Ansprüche, wobei der Siphon (23) mit einem Sperrventil (30) ausgestattet ist, welches zum automatischen Schließen der Auslassöffnung (27), wenn die Tür (4) geöffnet ist, und zum Öffnen der Auslassöffnung (27), wenn eine solche Tür geschlossen ist, eingerichtet ist.

13. Waschmaschine (1) nach einem der vorhergehenden Ansprüche, wobei der Siphon (23) in dem Rückgewinnungsbehälter (15) abnehmbar aufgenommen ist und nach oben geschoben werden kann.

14. Waschmaschine (1) nach einem der vorhergehenden Ansprüche, wobei die Tür (4) eine obere Öffnung (35) und eine entgegengesetzte untere Öffnung (36) umfasst, und wobei der Siphon (23) eine obere Abdeckung (37) und eine untere Kappe (38) umfasst, welche zum dichten Abdichten der entsprechenden oberen und der entsprechenden unteren Öffnung (35, 36) geeignet sind.

15. Waschmaschine (1) nach dem vorhergehenden Anspruch, wobei

- die obere Abdeckung (37) einen Rückgewinnungsdurchlass (39) ausbildet, welcher mit einer Mündung (40) des Rückgewinnungskanals (18) ausgerichtet ist, um eine Fluidkommunikation zwischen dem Rückgewinnungskanal (18) und dem Inneren des Rückgewinnungsbehälters (15) zu erzeugen, wenn die Tür geschlossen ist,
- ein Teil einer Röhre, welcher die Auslassöffnung (27) des Siphons (23) ausbildet, sich durch die untere Kappe (38) erstreckt.

16. Waschmaschine (1) nach einem der vorhergehenden Ansprüche, wobei die Maschine (1) als eine Wasch-Trocken-Maschine eingerichtet ist und einen Trocknungskreislauf (12) mit einer Extraktionseinheit, einem Wärmetauscher und einem Wärmeelement umfasst, welche mittels eines Trocknungskanals miteinander kommunizieren, wobei der durch die Steuerungs-/Regelungseinheit (14) gesteuerte/geregelte Waschzyklus einen sich zumindest dem Spülschritt anschließenden Wäschetrocknungsschritt umfasst und die Rückgewinnungsmittel abhängig von dem ausgewählten Waschprogramm eingerichtet und durch die Steuerungs-/Regelungseinheit (14) gesteuert/geregelt sind, um einen Flüssigkeitsteils, welcher während des Spülschritts verwendet wurde und während des Trocknungsschritts kondensierte, abzuziehen und den Teil kondensierter Flüssigkeit in den Rückgewinnungsbehälter (15) in der Tür (4) zu befördern.

Revendications

1. Machine à laver (1) comprenant :

- un tambour de lavage (5) monté à l'intérieur

d'une cuve de lavage (3) adaptée pour contenir le liquide de lavage et qui peut être fermée au moyen d'une porte (4),
- un moyen de chauffage (11) placé à l'intérieur de la cuve de lavage (3),
- un système de chargement (6, 7) adapté pour alimenter la cuve de lavage en eau courante,
- un système d'évacuation (9, 10) adapté pour décharger le liquide contenu dans la cuve de lavage (3),
- une cuve de récupération (15) séparée de la cuve de lavage (3), ladite cuve de récupération (15) étant adaptée pour contenir une partie de liquide récupéré,
- une unité de commande (14) dotée d'un sélecteur de programme configurée de façon à exécuter automatiquement un programme de lavage comprenant :

B) le chargement d'eau courante dans la cuve de lavage (3) et l'exécution d'un premier cycle de lavage, dans lequel ledit premier cycle de lavage comprend :

B1) une étape de lavage qui utilise l'eau contenue dans la cuve de lavage (3) et active le moyen de chauffage (11) de manière à chauffer l'eau dans la cuve de lavage (3) ;
B2) une étape de rinçage qui utilise l'eau contenue dans la cuve de lavage (3) avec le moyen de chauffage (11) désactivé,

- un moyen de recyclage (10, 17, 23) configuré de sorte à introduire, pendant l'une des étapes du cycle de lavage, la partie de liquide récupéré depuis la cuve de récupération (15) dans la cuve de lavage (3), et
- un moyen de récupération (18, 19) configuré de façon à transporter, après au moins une étape du cycle de lavage, une partie du liquide utilisé pendant le cycle de lavage depuis la cuve de lavage (3) dans la cuve de récupération (15),

caractérisé en ce que la cuve de récupération (15) est formée dans la porte (4) et comprend une paroi interne (21) faisant face à l'intérieur de la cuve de lavage (3) et une paroi externe (20), opposée à la paroi interne (21) et orientée vers l'extérieur de la machine à laver (1), dans laquelle lesdites parois interne et externe (21, 20) forment également des parois interne et externe correspondantes de la porte (4).

2. Machine à laver (1) selon la revendication 1, dans laquelle une paroi externe (20) de la cuve de récupération (15) est arrondie vers l'extérieur.

3. Machine à laver (1) selon la revendication 1 ou 2, dans laquelle le moyen de récupération comprend un conduit de récupération (18) ayant une ouverture de sortie raccordée, lorsque la porte (4) est fermée, à la cuve de récupération (15) et une ouverture d'entrée raccordée au moyen d'une soupape de sélection (19) au conduit d'évacuation (9) en aval d'une pompe d'évacuation (10), dans laquelle la soupape de sélection (19) et la pompe d'évacuation (10) sont commandées par l'unité de commande (14).

4. Machine à laver (1) selon la revendication 1 ou 2, dans laquelle ledit moyen de recyclage comprend un siphon inversé (23).

5. Machine à laver (1) selon la revendication 4, dans laquelle ledit siphon (23) comprend un conduit inversé en forme de U avec une ouverture d'entrée (24) positionnée au niveau de vidange à proximité du fond (25) de la cuve de récupération (15), un vertex supérieur (26) positionné à un niveau d'amorçage dans la partie supérieure de la cuve de récupération (15) et une ouverture de sortie (27) disposée sous l'ouverture d'entrée (24) et pénétrant, lorsque la porte (4) est fermée, dans la cuve de lavage (3).

6. Machine à laver (1) selon la revendication 4 ou 5, dans laquelle ledit siphon (23) est configuré pour être amorcé au moyen d'une intégration du volume de liquide dans la cuve de récupération (15) au niveau d'amorçage.

7. Machine à laver (1) selon l'une des revendications 4 à 6, dans laquelle une unité de commande (14) de la machine à laver (1) est adaptée pour amorcer le siphon (23) par l'actionnement de la pompe d'évacuation (10) et de la soupape de sélection (19).

8. Machine à laver (1) selon l'une des revendications 4 à 6, comprenant un conduit d'alimentation directe (28) qui raccorde une électrovanne (29) pour charger de l'eau courante dans la cuve de récupération (15), dans laquelle une unité de commande (14) de la machine à laver (1) est adaptée pour amorcer le siphon (23) par l'actionnement de l'électrovanne de chargement (29).

9. Machine à laver (1) selon la revendication 8, dans laquelle la vanne de chargement (29) et le conduit d'alimentation directe (28) sont configurés pour exécuter également une fonction de chargement de détergent dans la cuve de lavage (3) pendant une étape de lavage.

10. Machine à laver (1) selon la revendication 8, dans laquelle ladite vanne de chargement (29) et le conduit d'alimentation directe (28) sont indépendants du système de chargement de la cuve de lavage et sont

isolés du support de détergent (7).

11. Machine à laver (1) selon l'une quelconque des revendications précédentes, dans laquelle une paroi externe (20) de la porte (4) peut être voilée-transparente ou colorée de manière à rendre le niveau de remplissage de la cuve de récupération (15) visible depuis l'extérieur sans faire ressortir la turbidité du liquide récupéré.

12. Machine à laver (1) selon l'une quelconque des revendications précédentes, dans laquelle ledit siphon (23) est équipé d'une soupape d'arrêt (30) configurée pour fermer automatiquement l'ouverture de sortie (27) lorsque la porte (4) est ouverte et pour ouvrir l'ouverture de sortie (27) lorsque ladite porte est fermée.

13. Machine à laver (1) selon l'une quelconque des revendications précédentes, dans laquelle ledit siphon (23) est reçu de façon amovible dans la cuve de récupération (15) et peut être détaché vers le haut.

14. Machine à laver (1) selon l'une quelconque des revendications précédentes, dans laquelle ladite porte (4) comprend une ouverture supérieure (35) et une ouverture inférieure opposée (36), et le siphon (23) comprend un couvercle supérieur (37) et un capuchon inférieur (38) adaptés pour assurer l'étanchéité des ouvertures supérieure et inférieure correspondantes (35, 36).

15. Machine à laver (1) selon la revendication précédente, dans laquelle :

- le couvercle supérieur (37) forme un passage de récupération (39) qui est aligné, lorsque la porte (4) est fermée, avec une embouchure (40) du conduit de récupération (18) de façon à créer une communication fluidique entre le conduit de récupération (18) et l'intérieur de la cuve de récupération (15),
- une partie du tube qui forme l'ouverture de sortie (27) du siphon (23) s'étend à travers le capuchon inférieur (38).

16. Machine à laver (1) selon l'une des revendications précédentes, ladite machine (1) étant configurée comme une machine à laver-sécher et comprenant un circuit de séchage (12) avec une unité d'extraction, un échangeur de chaleur et un élément chauffant communiquant l'un avec l'autre au moyen d'un conduit de séchage, dans laquelle le cycle de lavage commandé par l'unité de commande (14) comprend une étape de séchage du linge faisant suite à une dernière étape de rinçage, et le moyen de récupération est configuré et commandé par l'unité de commande (14), en fonction du programme de lavage sélectionné, de façon à aspirer une partie du liquide utilisé pendant l'étape de rinçage et condensé pendant l'étape de séchage et à transférer ladite partie de liquide condensé dans la cuve de récupération (15) dans la porte (4).

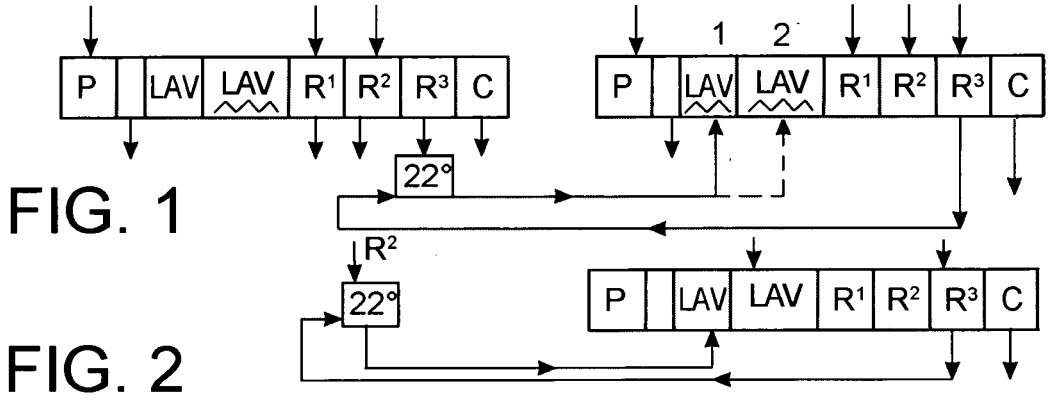


FIG. 1

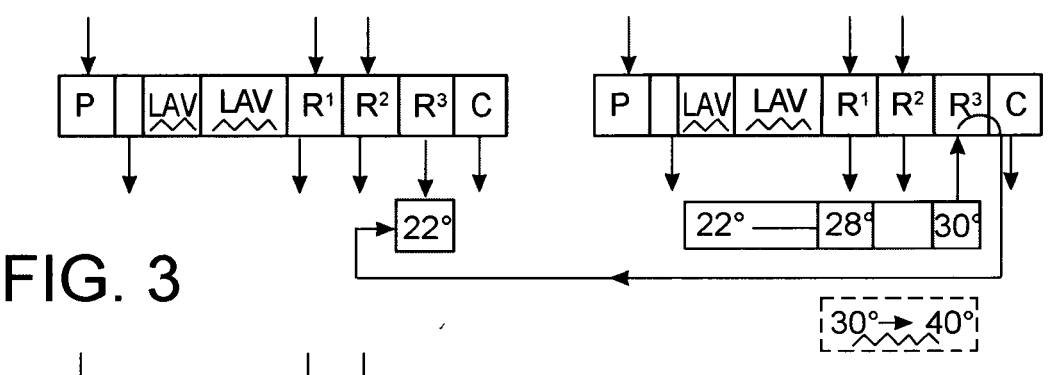


FIG. 2

FIG. 3

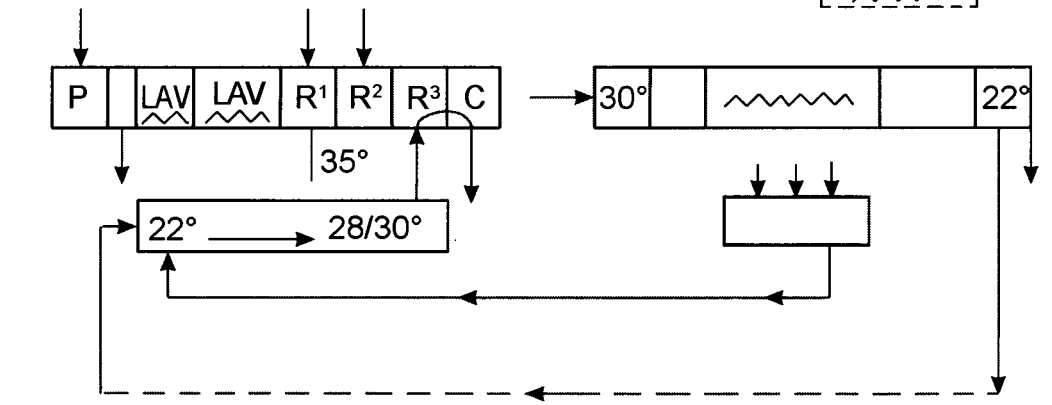


FIG. 4

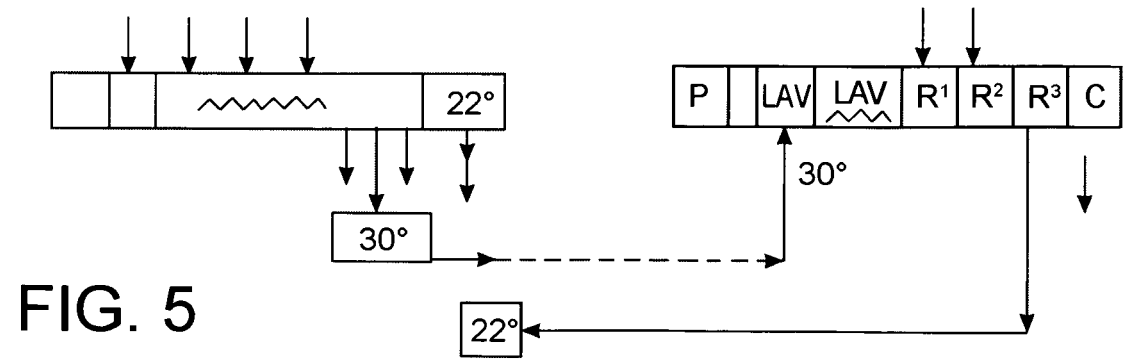


FIG. 5

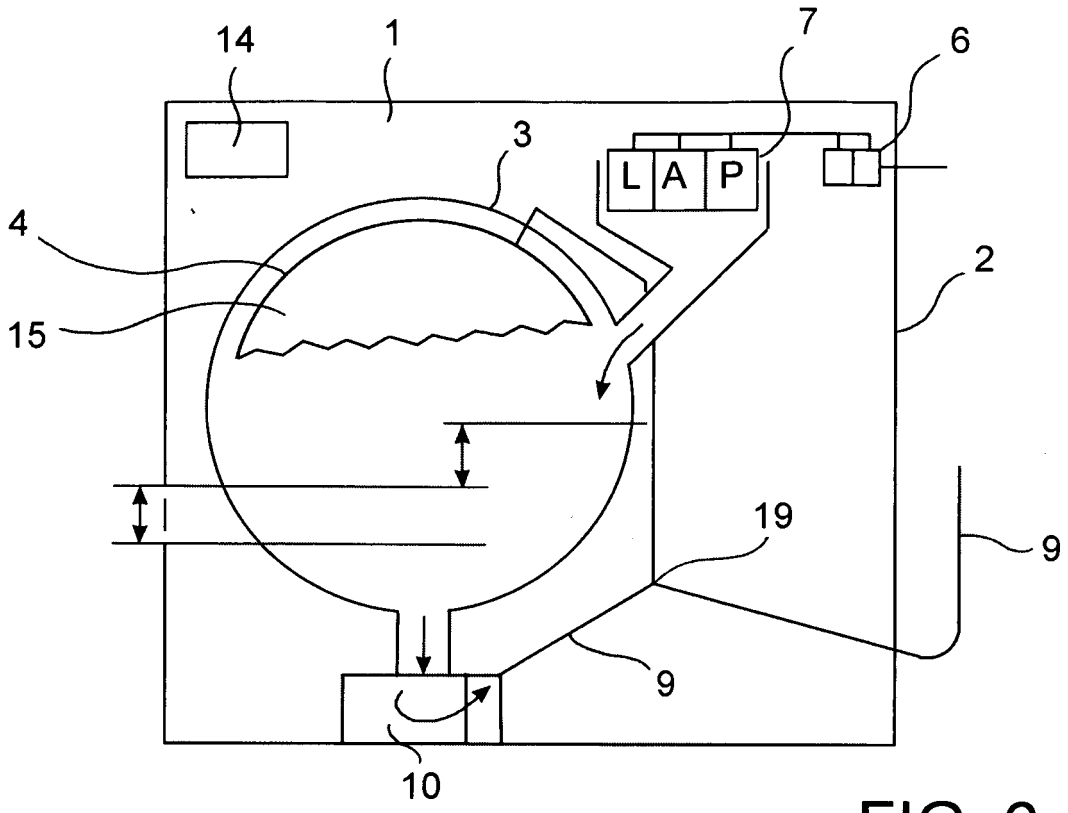


FIG. 6

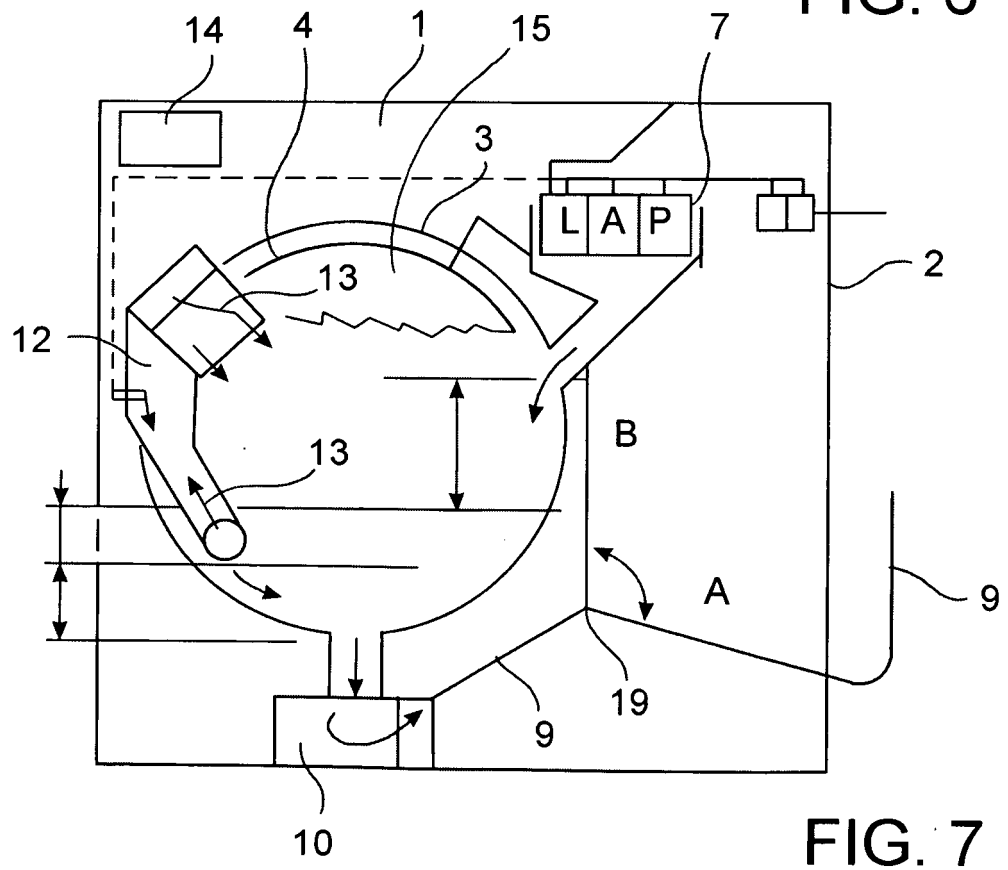


FIG. 7

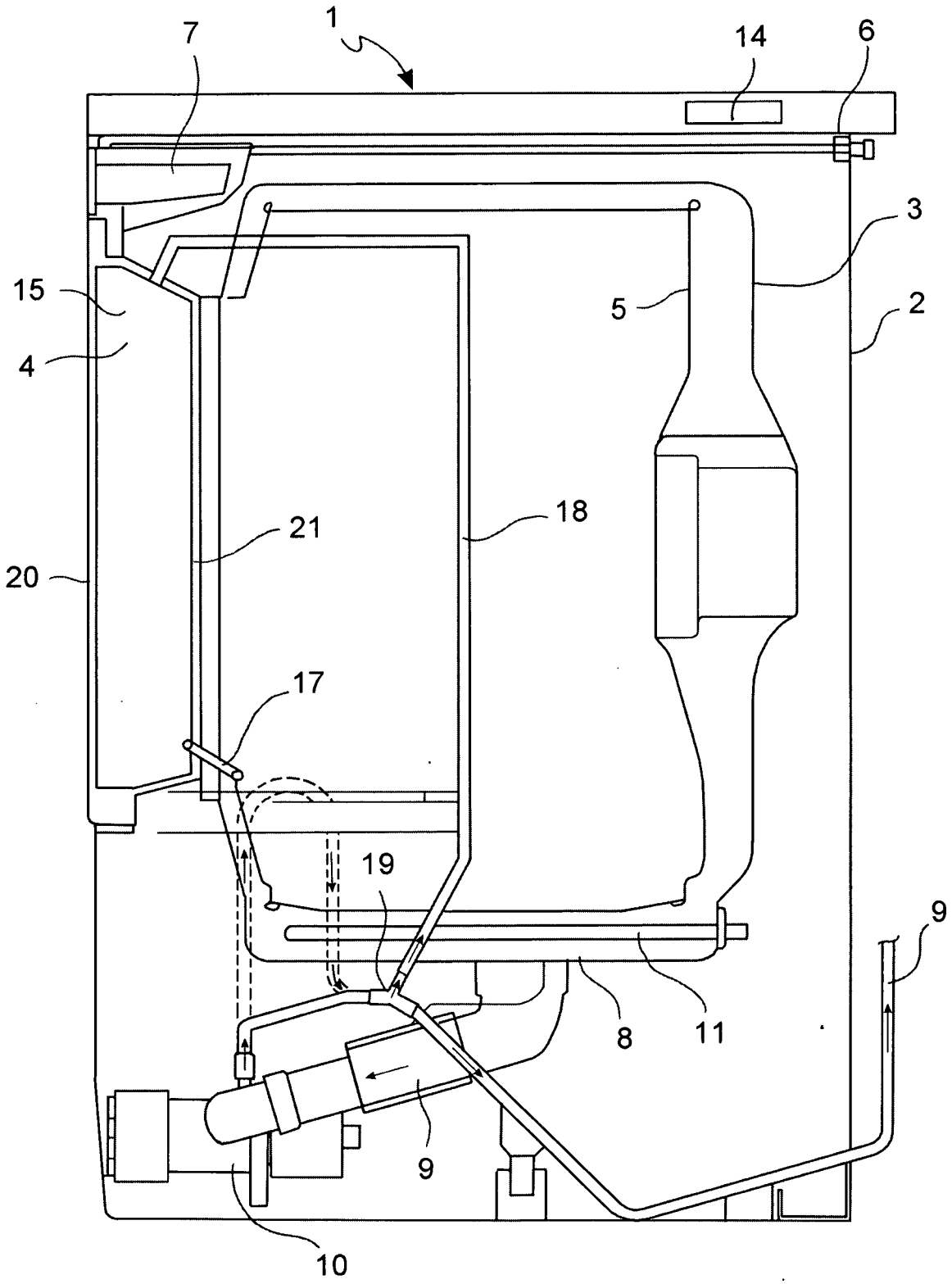


FIG. 8

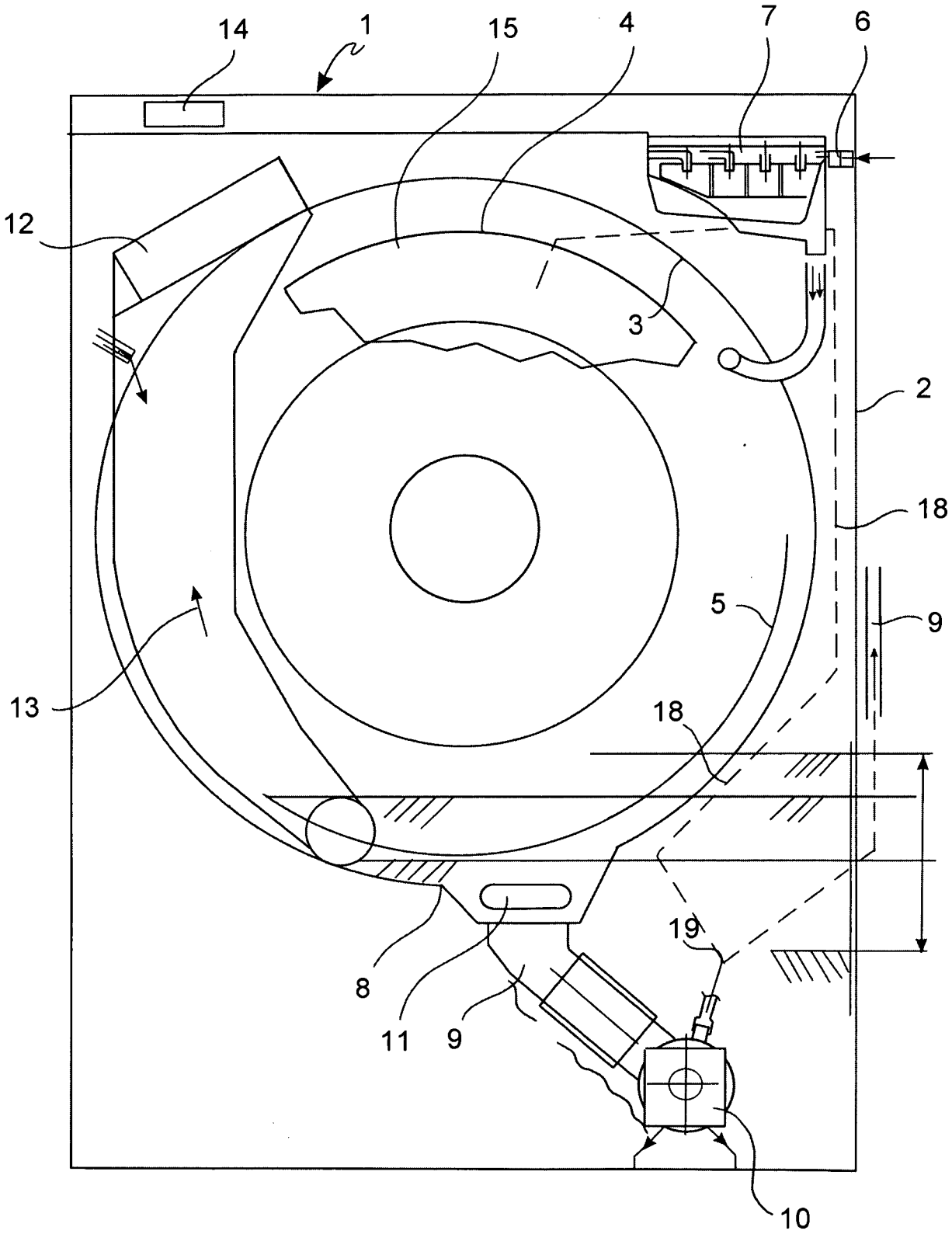


FIG. 9

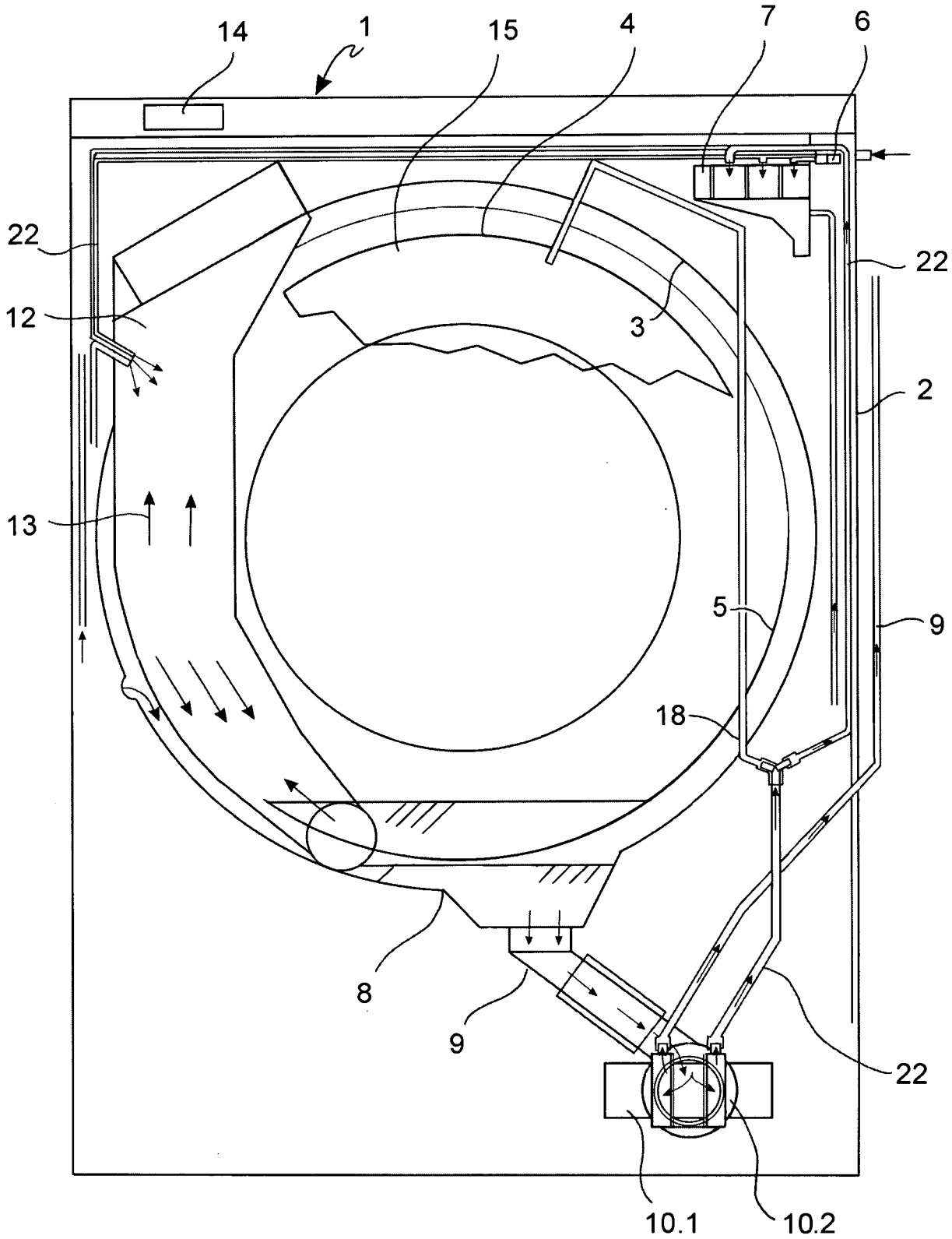


FIG.10

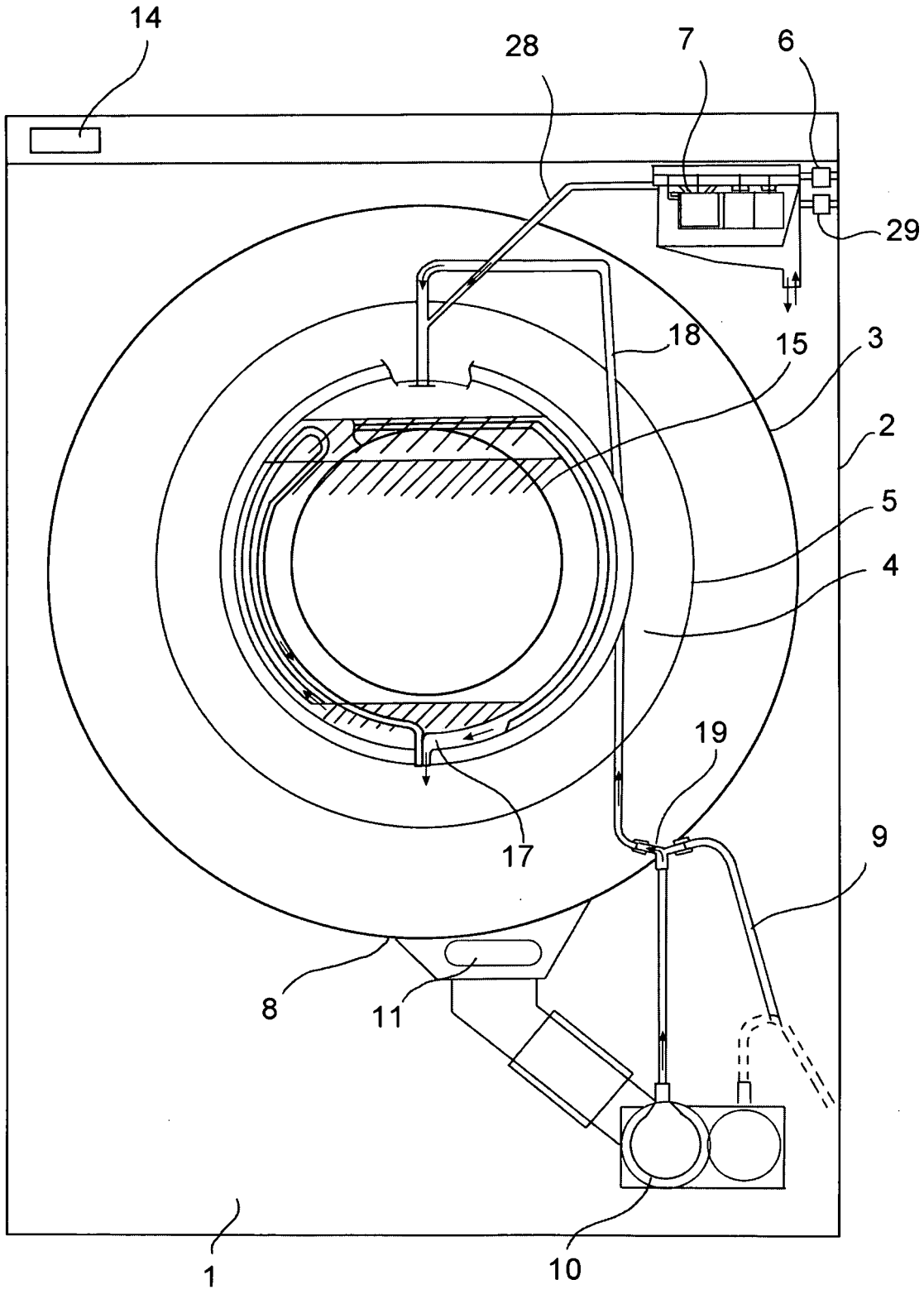


FIG. 11

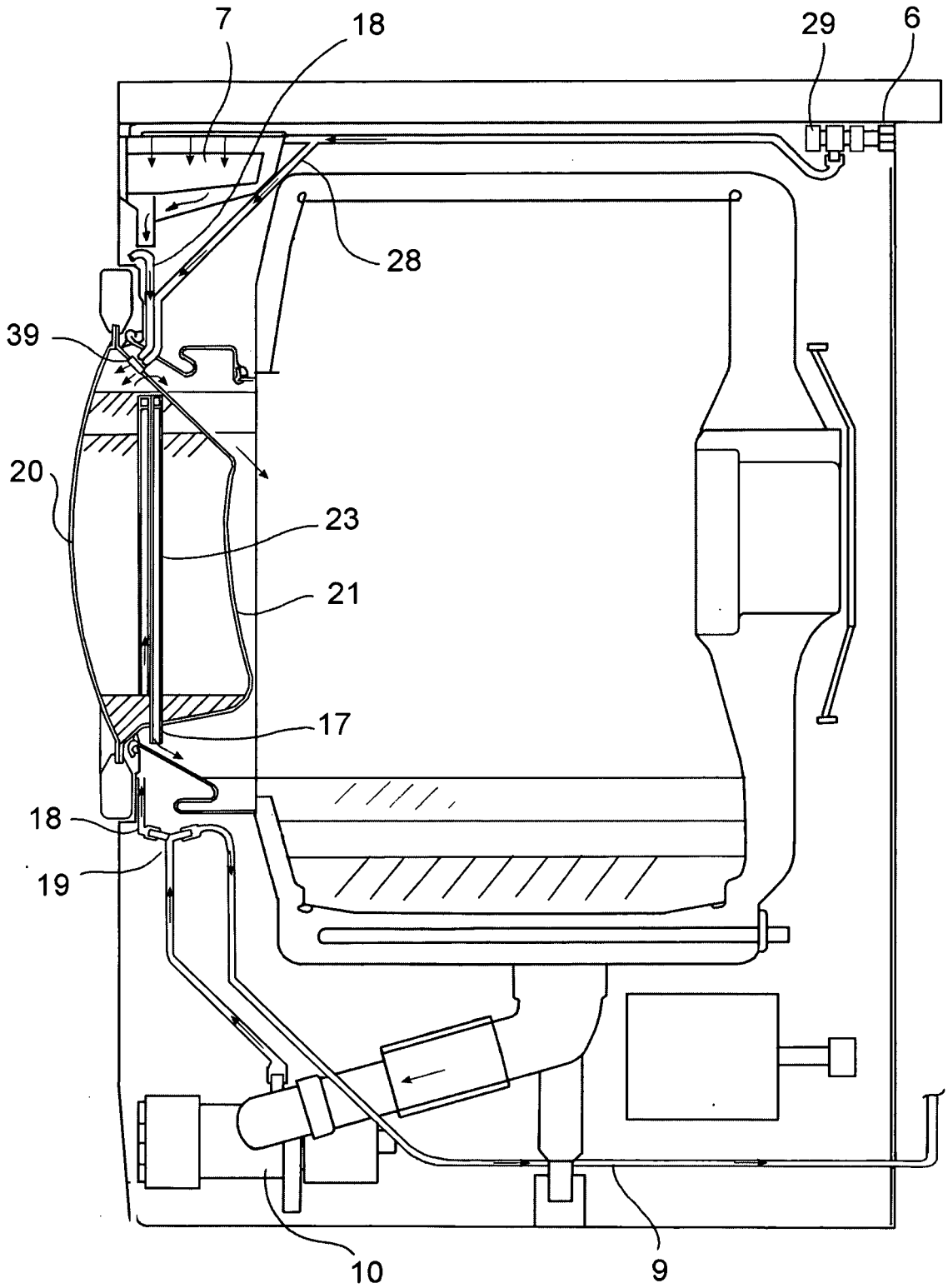


FIG.12

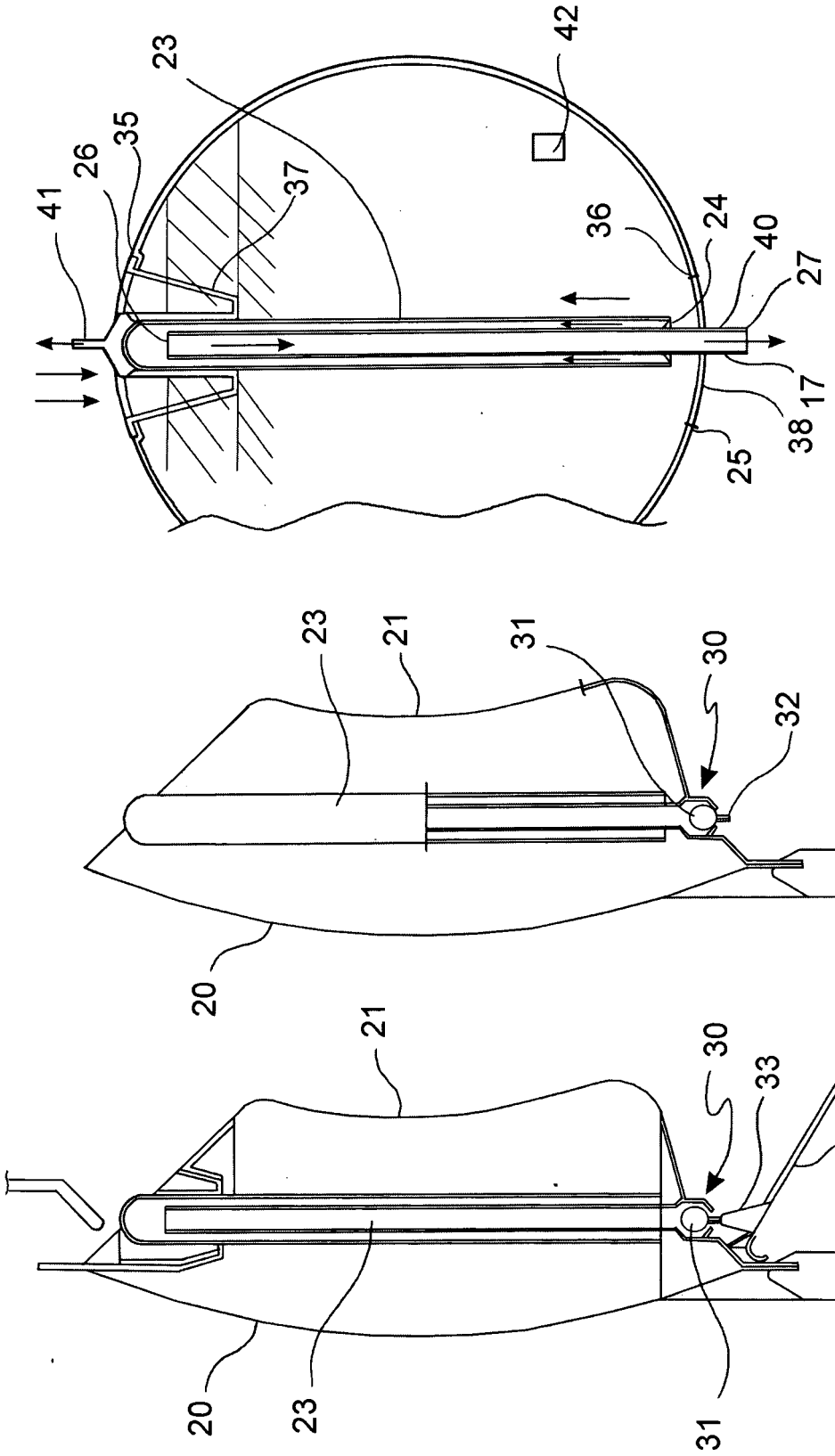


FIG. 15

FIG. 14

FIG. 13

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 0771898 A2 **[0007]**