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(71) Applicant: **Samsung Electronics Co., Ltd.**
Suwon-si, Gyeonggi-Do (KR)

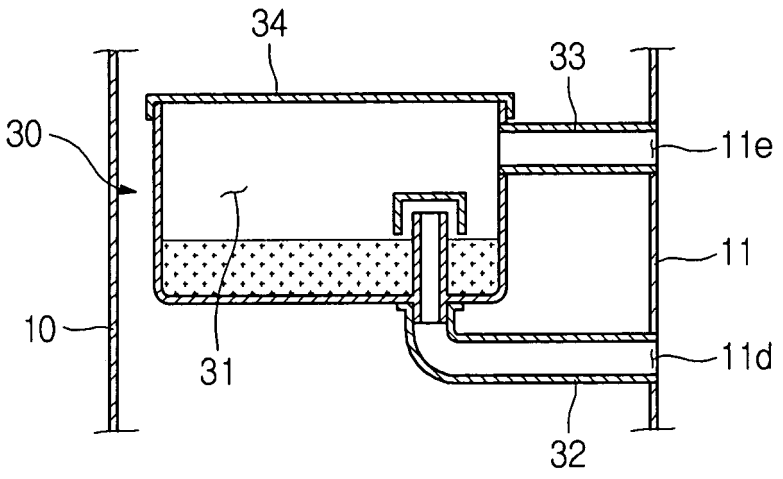
(72) Inventors:
- **Choi, Won Seok**
  Suwon-Si, Gyeonggi-Do (KR)
- **Hur, Woon Gu**
  Suwon-Si, Gyeonggi-Do (KR)
- **Choi, Dong Hyun**
  Gunpo-Si, Gyeonggi-Do (KR)

(74) Representative: **Sherrard-Smith, Hugh et al**
Appleyard Lees,
15 Clare Road
Halifax, HX1 2HY,
West Yorkshire (GB)

(54) Washing machine having rinse agent dispenser and control method thereof

(57) A washing machine having a rinse agent dispenser (30) and control method thereof. The rinse agent dispenser (30) is directly connected with a water tub (11) to automatically dispense a rinse agent into the water tub (11) via an adjustment of a level of wash water contained in the water tub (11) without requiring a separate water supply device. The washing machine includes the water tub (11), the rinse agent dispenser (30) connected with the water tub (11) to dispense the rinse agent into the water tub (11) via an adjustment of the level of the wash water contained in the water tub (11), water supply means to supply the wash water into the water tub (11), drainage means to drain the wash water from the water tub (11), and a controller to control the supply and drainage of the wash water by the water supply means and drainage means, thereby adjusting the level of the wash water in the water tub (11).

FIG. 6A



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Description

[0001] The present invention relates to a drum-type washing machine having a dispenser for a rinse agent, such as fabric softener.

[0002] In general, a washing machine, specifically, a drum-type washing machine, washes laundry contained in a cylindrical rotating drum by raising and dropping the laundry through rotation of the drum. The drum-type washing machine reduces clothes damage and water consumption as compared to a conventional pulsator-type washing machine, although it has a long wash time. Thus, the demand for drum-type washing machines is increasing.

[0003] The washing machine includes a detergent container, which is internally sectionalized into a plurality of chambers to receive a detergent, a rinse agent, etc., respectively. As water is supplied into the detergent container according to an operation of a water supply valve upon a final rinsing cycle, the rinse agent is dispensed into a water tub along with the water based on a siphon phenomenon that is caused in a gap between the detergent container and a container cap.

[0004] However, the washing machine requires a separate water supply device, which includes the water supply valve to dispense the rinse agent into the water tub and a water supply hose to supply water into the detergent container. Also, the detergent container has a limitation of an installation position thereof because it must be mounted close to a water supply pipe connected to an external water source, and is complex in structure.

[0005] In addition, dispensing the rinse agent requires a large number of parts, resulting in long production time and increasing a probability of malfunction, such as leakage.

[0006] In one aspect of the present invention there is provide a washing machine having a rinse agent dispenser, which is directly connected with a water tub to dispense a rinse agent into the water tub via an adjustment of a level of water contained in the water tub without requiring a separate water supply device, and a control method of the washing machine.

[0007] Another aspect of the present invention provides a washing machine having a rinse agent dispenser, which can automatically dispense a rinse agent into a water tub via an adjustment of a level of water contained in the water tub, thereby achieving a simplified structure and high productivity, and a control method of the washing machine.

[0008] Additional aspects and/or advantages of the invention will be set forth in part in the description which follows and, in part, will be apparent from the description, or may be learned by practice of the invention.

[0009] The foregoing and/or other aspects may be achieved by a washing machine including a water tub to contain wash water therein, and a rinse agent dispenser connected with the water tub to dispense a rinse agent into the water tub via an adjustment of a level of the water contained in the water tub.

[0010] The rinse agent dispenser may be connected with the water tub by means of connection tubes thereof.

[0011] The rinse agent dispenser may be mounted outside of the water tub at a position higher than a middle position of the water tub by a predetermined height. The predetermined height may be at least 3 cm.

[0012] The washing machine further may include water supply means to supply the wash water into the water tub, drainage means to drain the wash water from the water tub, and a controller to control water supply and drainage operations of the water supply means and drainage means, thereby adjusting the level of the wash water contained in the water tub.

[0013] The controller may determine whether a remaining cycle is a rinsing cycle, whereby, when the remaining cycle is the rinsing cycle, the controller controls the supply of the wash water so that the wash water reaches a predetermined rinse agent dispensing level.

[0014] The rinsing cycle may be a final rinsing cycle, and the predetermined rinse agent dispensing level is higher than a predetermined rinsing level.

[0015] After completion of the supply of the wash water, the controller may control the drainage of the wash water so that the wash water reaches the predetermined rinsing level.

[0016] The foregoing and/or other aspects may be achieved by a method of controlling a washing machine having a water tub and a rinse agent dispenser connected with the water tub to receive a rinse agent, the method including controlling the supply of wash water when a remaining cycle is a rinsing cycle, thereby introducing the wash water into the rinse agent dispenser, and controlling a drainage of the wash water after the wash water is introduced into the rinse agent dispenser, thereby allowing the rinse agent to be dispensed into the water tub.

[0017] The controlling of the supply of the wash water may be performed to supply the wash water into the water tub to reach a predetermined rinse agent dispensing level.

[0018] The controlling of the drainage of the wash water may be performed to drain the wash water from the water tub to reach the predetermined rinsing level.

[0019] These and/or other aspects and advantages of the invention will become apparent and more readily appreciated from the following description of the embodiments, taken in conjunction with the accompanying drawings, of which:

Figure 1 is a sectional view illustrating a washing machine having a rinse agent dispenser according to an embodiment of the present invention;

Figure 2 is a perspective view schematically illustrating the rinse agent dispenser of Figure 1, which is mounted to the washing machine;

Figure 3 is a sectional view taken along the line A-

A' of Figure 2;

Figure 4 is a control block diagram of the washing machine having the rinse agent dispenser according to the embodiment of the present invention;

Figure 5 is a flow chart illustrating an operational sequence of a rinse agent dispensing process of the washing machine according to the embodiment of the present invention; and

Figures 6A to 6C are sectional views illustrating a sequential rinse agent dispensing operation of the washing machine according to the embodiment of the present invention.

[0020] Reference will now be made in detail to the embodiment of the present invention, an example of which is illustrated in the accompanying drawings, wherein like reference numerals refer to like elements throughout. The embodiment is described below to explain the present invention by referring to the figures.

[0021] Figure 1 is a sectional view illustrating a washing machine having a rinse agent dispenser according to an embodiment of the present invention.

[0022] As shown in Figure 1, the washing machine having a rinse agent dispenser according to the embodiment of the present invention comprises a drum-shaped water tub 11 mounted in a body 10 to contain wash water therein, and a rotating drum 12 rotatably mounted in the water tub 11.

[0023] The water tub 11 is generally tilted relative to a washing machine mounting plane by a predetermined inclination α so that a front surface 11a thereof formed with an opening 11b, is positioned higher than a rear surface 11c thereof. In the same manner as the water tub 11, the rotating drum 12, mounted in the water tub 11, is tilted so that a front surface 12a thereof formed with an opening 12b, is positioned higher than a rear surface 12c thereof.

[0024] That is, the rotating drum 12 is mounted so that a rotating center axis A thereof is tilted relative to the washing machine mounting plane by the predetermined inclination α to thereby allow the front surface 12a thereof formed with the opening 12b to face up and to the front. The rotating drum 12 comprises a rotating shaft 13, which is coupled with the center of the rear surface 12c of the rotating drum 12 to be rotatably supported at the center of the rear surface of the water tub 11. Through rotation of the rotating shaft 13, the rotating drum 12 is rotatable inside the water tub 11.

[0025] A plurality of through-holes 12d is formed at a circumferential wall of the rotating drum 12. Also, a plurality of lifters 14 is mounted at an inner surface of the rotating drum 12 to raise and drop laundry upon rotation of the rotating drum 12.

[0026] A motor 15 is mounted at an outside of the rear surface 11c of the water tub 11 and serves as a drive unit to rotate the rotating shaft 13 connected to the rotating drum 12. The motor 15 comprises a stator 15a affixed to the rear surface 11c of the water tub 11, a rotor 15b rotatably disposed around the stator 15a, and a rotating plate 15c to connect the stator 15a with the rotating shaft 13.

[0027] The body 10 is formed at a front surface thereof with an opening 16 at a position corresponding to the openings 12b and 11b of the rotating drum 12 and the water tub 11 to put laundry into the rotating tub 12 or to take the laundry out of the rotating tub 12. A door 17 is mounted at the opening 16 to open and close the opening 16.

[0028] A detergent supply device 18 and a water supply device 20 are provided above the water tub 11, and a drainage device 19 is mounted underneath the water tub 11 to drain water contained in the water tub 11. The drainage device 19 comprises a drainage pipe 19a, a drainage valve 19b, and a drainage motor 19c.

[0029] The detergent supply device 18 internally defines a detergent receiving chamber. The detergent supply device 18 is mounted at the front surface of the body 10 to facilitate the input of a detergent therein.

[0030] The water supply device 20 comprises cool and hot water supply pipes 21 and 22, respectively, to supply cool water and hot water, and water supply valves 23 and 24 mounted to the respective cool and hot water supply pipes 21 and 22 to control the supply of water via the pipes 21 and 22.

[0031] The cool and hot water supply pipes 21 and 22 are connected with the detergent supply device 18 to supply water from an external source (not shown) into the detergent supply device 18. A separate water supply pipe 25 is mounted between the detergent supply device 18 and the water tub 11 to supply the water, having passed through the detergent supply device 18, into the water tub 11. A water supply nozzle 26 is mounted at an outlet of the water supply pipe 25. Supplying the water into the water tub 11 by way of the detergent supply device 18 allows the detergent inside the detergent supply device 18 to be supplied into the water tub 11.

[0032] A rinse agent dispenser 30 is mounted at the outside of the water tub 11 to dispense a rinse agent into the water tub 11. The rinse agent dispenser 30 is coupled with the water tub 11 to directly dispense a rinse agent into the water tub 11. To facilitate easy input of the rinse agent, the rinse agent dispenser 30 is positioned on a side of the door 17.

[0033] Figure 2 is a perspective view schematically showing the rinse agent dispenser of Figure 1, which is mounted to the washing machine. Figure 3 is a sectional view taken along the line A-A' of Figure 2.

[0034] The rinse agent dispenser 30 is positioned at a height higher than a middle position of the water tub 11 by approximately 3cm. The height of the rinse agent dispenser 30 is slightly higher than a level of water during a rinsing cycle (i.e., a rinsing level). The rinsing level is half-full level of the water tub 11. Positioning the rinse

agent dispenser 30 at the above height allows the rinse agent to be automatically dispensed into the water tub 11 using a siphon phenomenon caused by adjustment of the level of water contained in the water tub 11 without assistance of the water supply device 20.

[0035] As shown in Figure 3, the rinse agent dispenser 30 internally defines a rinse agent receiving chamber 31. To allow the water contained in the water tub 11 to be introduced into the rinse agent dispenser 30 and the water introduced into the rinse agent dispenser 30 to be returned to the water tub 11, the rinse agent dispenser 30 comprises first and second connection tubes 32 and 33. Also, a cover 34 is provided at an upper side of the receiving chamber 31.

[0036] The first and second connection tubes 32 and 33 are fitted in holes 11d and 11e formed at the water tub 11 to guide the flow of water between the water tub 11 and the rinse agent dispenser 30. As the water contained in the water tub 11 is introduced into the rinse agent dispenser 30, the rinse agent contained in the rinse agent dispenser 30 can be introduced into the water tub 11.

[0037] Figure 4 is a control block diagram of the washing machine having the rinse agent dispenser according to the embodiment of the present invention. As shown in Figure 4, a control system comprises a signal input unit 100, a water level sensor 110, a temperature sensor 120, a controller 130, and a drive unit 140.

[0038] The signal input unit 100 serves to input various operational information, such as a desired wash course, a temperature of wash water, revolutions per minute for spin-drying, and addition of a rinsing operation, to the controller 130. The water level sensor 110 senses a level of wash water supplied to the water tub 11. The temperature sensor 120 senses a temperature of wash water supplied to the water tub 11.

[0039] The controller 130 is a micro-computer to control the washing machine based on the operational information inputted by the signal input unit 100. The controller 130 controls operation of the water supply valves 23 and 24, drainage valve 19b, and drainage pump 19c depending on the water level sensed by the water level sensor 110 during a final rinsing cycle, in order to adjust the level of water inside the water tub 11. Adjustment of the water level inside the water tub 11 enables the rinse agent filled in the rinse agent dispenser 30 to be automatically dispensed into the water tub 11.

[0040] The drive unit 140 is adapted to drive the motor 15, drainage valve 19b, drainage pump 19c, and water supply valves 23 and 24 according to drive control signals of the controller 130.

[0041] Now, the washing machine having the rinse agent dispenser configured as stated above and the operational sequence and effects of the control method of the washing machine will be explained.

[0042] Figure 5 is a flow chart illustrating an operation of a rinse agent dispensing process of the washing machine according to the embodiment of the present invention.

[0043] In operation 100, laundry is put into the rotating drum 12, and various operational information, such as a desired wash course, a temperature of wash water, revolutions per minute for spin-drying, and addition of a rinsing operation, is selected. Then, the selected operational information is inputted to the controller 130 via the signal input unit 100.

[0044] According to the inputted operational information from the signal input unit 100, the controller 130 progresses a washing cycle and a rinsing cycle in this sequence. The washing and rinsing cycles are identical to those of a general washing machine, and thus, a description thereof will be omitted hereinafter. The following description is based on only a rinse agent dispensing process using the rinse agent dispenser 30.

[0045] As an initial condition of operation according to the present invention, it is assumed that the rinse agent dispenser 30 is filled with the rinse agent (See Figure 6A).

[0046] After completion of the washing and rinsing cycles except for a final rinsing cycle in operation 100, the process moves to operation 110 where the controller 130 determines whether a remaining cycle is the final rinsing cycle.

[0047] When the remaining cycle is the final rinsing cycle in operation 110, the process moves to operation 120 where the controller 130 switches on the water supply valves 23 and 24 to supply wash water into the detergent supply device 18 via the water supply pipes 21 and 22. The wash water, specifically, rinsing water, supplied to the detergent supply device 18, is further supplied to the water tub 11 via the water supply pipe 25.

[0048] As the wash water is supplied to the water tub 11, a level of the water inside the water tub 11 gradually rises to a rinsing level that is equal to the half-full level of the water tub 11. In the present invention, the water is continuously supplied beyond the rinsing level to reach a predetermined level. Here, the predetermined level is a level to allow the wash water, contained in the water tub 11, to be introduced into the rinse agent dispenser 30 to thereby dissolve the rinse agent present therein. The predetermined level varies depending on an installed position of the rinse agent dispenser 30.

[0049] When the wash water is supplied beyond the rinsing level, the wash water inside the water tub 11 is introduced into the receiving chamber 31 of the rinse agent dispenser 30 by way of the first and second connection tubes 32 and 33 connected to the holes 11d and 11e of the water tub 11 (See Figure 6B).

[0050] During the supply of the wash water into the water tub 11 in operation 120, the process moves to operation 130 where the water level sensor 110 senses a level Ws of the wash water inside the water tub 11. From operation 130, the process moves to operation 140 where the controller 130 determines whether the sensed level Ws of the wash water exceeds a predetermined rinse agent dispensing level W1. Here, the predetermined rinse agent dispensing level W1 is set to be higher

than the rinsing level to allow the wash water contained in the water tub 11 to be introduced into the rinse agent dispenser 30.

[0051] When it is determined that the sensed level Ws of the wash water is lower than the predetermined rinse agent dispensing level W1 in operation 140, the process returns to operation 120 where the wash water is continuously supplied until it reaches the predetermined rinse agent dispensing level W1.

[0052] When the sensed level Ws of the wash water is higher than the predetermined rinse agent dispensing level W1 in operation 140, the process moves to operation 150, where the controller 130 switches off the water supply valves 23 and 24 to stop the supply of the wash water into the water supply pipes 21 and 22.

[0053] Next, prior to performing a rinsing cycle, the process moves to operation 160 where the controller 130 operates the drainage valve 19b and the drainage pump 19c to allow the wash water inside the water tub 11 to be drained via the drainage pipe 19a.

[0054] As the wash water is drained from the water tub 11, the level of the wash water gradually decreases. In the present invention, the drainage of the wash water is continued until the water reaches the rinsing level that is the half full level of the water tub 11. During the drainage of the wash water, the rinse agent present inside the rinse agent dispenser 30 is able to be dispensed into the water tub 11 along with the wash water.

[0055] That is, as the level of the wash water inside the water tub 11 is lowered by the drainage of the wash water, a siphon phenomenon is caused, thereby allowing the rinse agent present inside the rinse agent dispenser 30 to be introduced into the water tub 11 by way of the first and second connection tubes 32 and 33, connected to the holes lid and lie of the water tub 11, along with the wash water (See Figure 6C).

[0056] During the drainage of the wash water in operation 160, the process moves to operation 170 where the water level sensor 110 senses a level of the wash water Wd inside the water tub 11, and from operation 170, the process moves to operation 180 where the controller 130 determines whether the sensed water level Wd is lower than a predetermined rinsing level W2. Here, the predetermined rinsing level W2 is equal to the half-full level of the water tub 11.

[0057] When the sensed water level Wd is higher than the predetermined rinsing level W2 in operation 170, the process returns to operation 160 where the wash water is continuously drained until it reaches the predetermined rinsing level W2.

[0058] When the sensed water level Wd is lower than the predetermined rising level W2 in operation 180, the process moves to operation 190 where the controller 130 switches off the drainage valve 19b and the drainage pump 19c to stop the drainage of the wash water to the drainage pipe 19a .

[0059] After completion of the dispensing operation of the rinse agent, the process moves to operations 200 and 210 where the motor 15 is operated under a control of the controller 130 to rotate the rotating drum 12 to thereby perform a final rinsing cycle and spin-drying cycle, successively.

[0060] Although the embodiment of the present invention exemplifies the rinse agent, such as fabric softener, which is filled in the rinse agent dispenser 30 to be dispensed into the water tub 11 during the final rising cycle, it should be understood that the present invention is not limited thereto and a detergent may be filled in the rinse agent dispenser 30 to be automatically dispensed into the water tub 11.

[0061] As apparent from the above description, the present invention provides a washing machine having a rinse agent dispenser, which is directly connected to a water tub to automatically dispense a rinse agent into the water tub via adjustment of the level of water contained in the water tub without requiring a separate water supply device, and control method thereof. Using the rinse agent dispenser as stated above simplifies the overall structure of the washing machine, resulting in improved productivity.

[0062] Further, differently from conventional rinse agent dispensers, the rinse agent dispenser of the embodiment of the present invention eliminates the necessity of an expensive water supply valve, for example, a three-way valve, and reduces the number of parts, thereby achieving a reduction of manufacturing costs. Also, the rinse agent dispenser has a simplified structure and requires fewer connecting parts, resulting in a reduction of malfunction, such as leakage.

[0063] Although the embodiment of the present invention has been shown and described, it would be appreciated by those skilled in the art that changes may be made in this embodiment without departing from the principles and spirit of the invention, the scope of which is defined in the claims and their equivalents.

[0064] Although a few preferred embodiments have been shown and described, it will be appreciated by those skilled in the art that various changes and modifications might be made without departing from the scope of the invention, as defined in the appended claims.

[0065] Attention is directed to all papers and documents which are filed concurrently with or previous to this specification in connection with this application and which are open to public inspection with this specification, and the contents of all such papers and documents are incorporated herein by reference.

[0066] All of the features disclosed in this specification (including any accompanying claims, abstract and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any combination, except combinations where at least some of such features and/or steps are mutually exclusive.

[0067] Each feature disclosed in this specification (including any accompanying claims, abstract and drawings) may be replaced by alternative features serving the same, equivalent or similar purpose, unless expressly

stated otherwise. Thus, unless expressly stated otherwise, each feature disclosed is one example only of a generic series of equivalent or similar features.

[0068] The invention is not restricted to the details of the foregoing embodiment(s). The invention extends to any novel one, or any novel combination, of the features disclosed in this specification (including any accompanying claims, abstract and drawings), or to any novel one, or any novel combination, of the steps of any method or process so disclosed.

Claims

1. A washing machine comprising:

a water tub (11) to contain wash water therein: and
a rinse agent dispenser (30) connected with the water tub (11) to dispense a rinse agent into the water tub (11) via adjustment of a level of the water contained in the water tub (11).

2. The washing machine according to claim 1, wherein the rinse agent dispenser (30) is connected with the water tub (11) via connection tubes (32, 33) thereof.

3. The washing machine according to claim 1 or 2, wherein the rinse agent dispenser (30) is mounted outside of the water tub (11) at a position higher than a middle position of the water tub (11) by a predetermined height.

4. The washing machine according to claim 3, wherein the predetermined height is at least 3 cm.

5. The washing machine according to any preceding claim, further comprising:

water supply means (20, 21, 22) to supply the wash water into the water tub (11);
drainage means (19, 19a, 19b, 19c) to drain the wash water from the water tub (11); and
a controller (130) to control water supply (23, 24) and drainage operations (19b, 19c) of the water supply means and drainage means, thereby adjusting the level of the wash water contained in the water tub (11).

6. The washing machine according to claim 5, wherein the controller (130) determines whether a remaining cycle is a rinsing cycle (S110),
wherein when the remaining cycle is the rinsing cycle, the controller controls the supply of the wash water so that the wash water (S120, S130, S140) reaches a predetermined rinse agent dispensing level.

7. The washing machine according to claim 6, wherein the rinsing cycle is a final rinsing cycle.

8. The washing machine according to claim 6 or 7, wherein the predetermined rinse agent dispensing level is higher than a predetermined rinsing level (S140).

9. The washing machine according to any of claims 6 to 8, wherein after completion of the supply of the wash water (S150), the controller controls the drainage (S160) of the wash water so that the wash water reaches the predetermined rinsing level (S180).

10. A method of controlling a washing machine having a water tub (11) and a rinse agent dispenser (30) connected with the water tub (11) to receive a rinse agent, the method comprising:

controlling the supply of wash water (S120) when a remaining cycle is a rinsing cycle, thereby introducing the wash water into the rinse agent dispenser (30); and
controlling the drainage of the wash water (S160) after the wash water is introduced into the rinse agent dispenser (30), thereby allowing the rinse agent to be dispensed into the water tub (11).

11. The method according to claim 10, wherein the rinsing cycle is a final rinsing cycle.

12. The method according to claim 10 or 11, wherein the controlling of the supply of the wash water (S130, S140) is performed to supply the wash water into the water tub (11) to reach a predetermined rinse agent dispensing level.

13. The method according to claim 12, wherein the predetermined rinse agent dispensing level is higher than a predetermined rinsing level.

14. The method according to any of claims 10 to 13, wherein the controlling of the drainage of the wash water (S160, S170, S180) is performed to drain the wash water from the water tub (11) to reach the predetermined rinsing level.

15. A method of controlling a washing machine having a water tub (11) and a rinse agent dispenser (30) directly connected with the water tub (11) to receive a rinse agent, the method comprising:

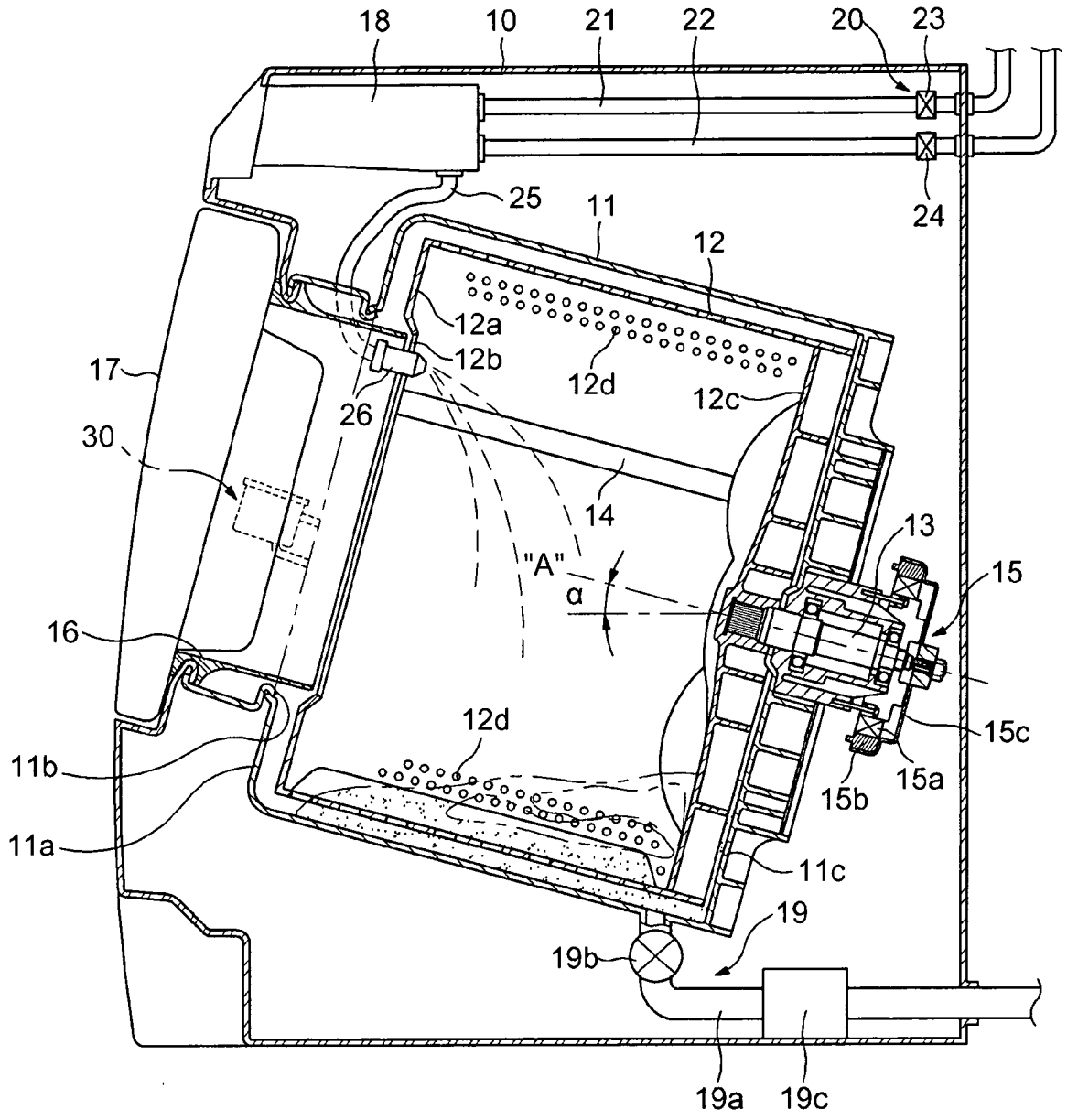
determining whether the washing machine is at a final rinsing cycle (S110);
supplying a predetermined amount of wash water (S120, S130, S140) into the water tub (11) above a half level of the water tub (11) and al-

lowing the wash water to be introduced into the rinse agent dispenser (30) and mixed with the rinse agent;

stopping (S150) and draining (S160, S170, S180) the predetermined amount of wash water to the half level of the water tub (11) while dispensing the rinse agent into the water tub (11); and

performing a final rinsing cycle (S200).

FIG. 1


18
10
21
22
20
23
24
25
11
12
12a
12b
12d
12c
17
26
30
14
13
"A"
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15c
11b
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15a
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19b
19a
19c

FIG. 2

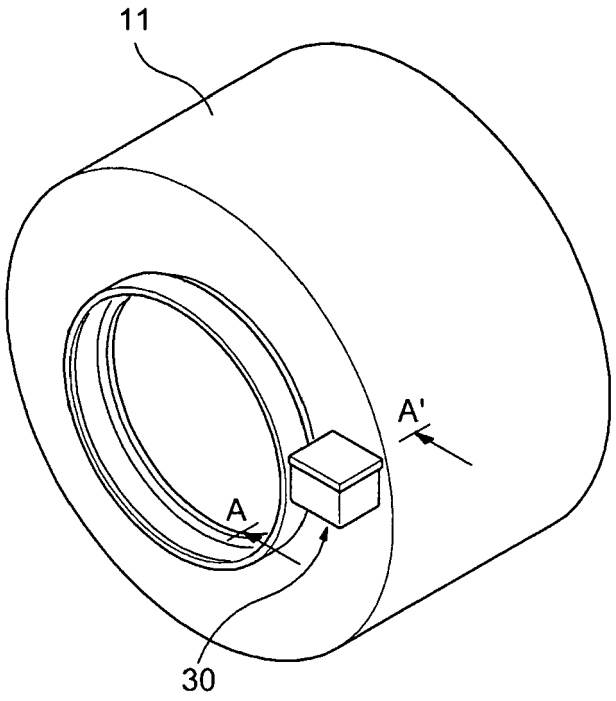


FIG. 3

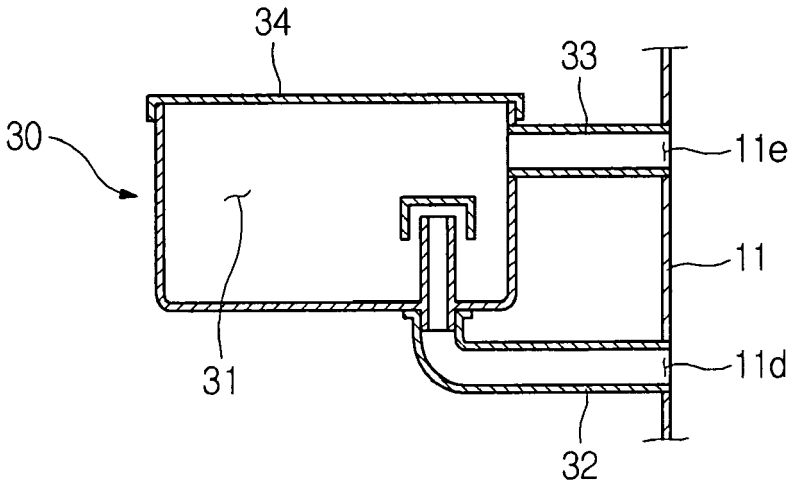


FIG. 4

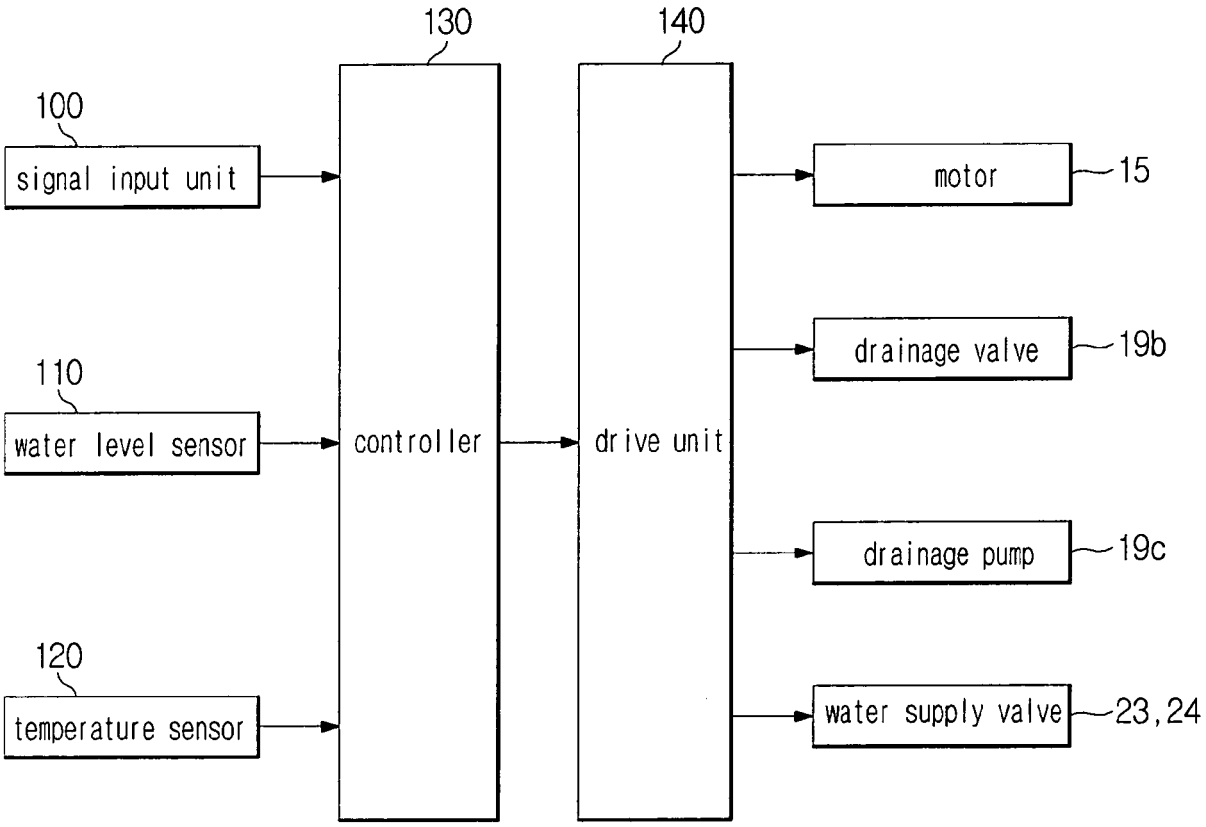

130
140
100
signal input unit
110
water level sensor
120
temperature sensor
controller
drive unit
motor
15
drainage valve
19b
drainage pump
19c
water supply valve
23,24

FIG. 5

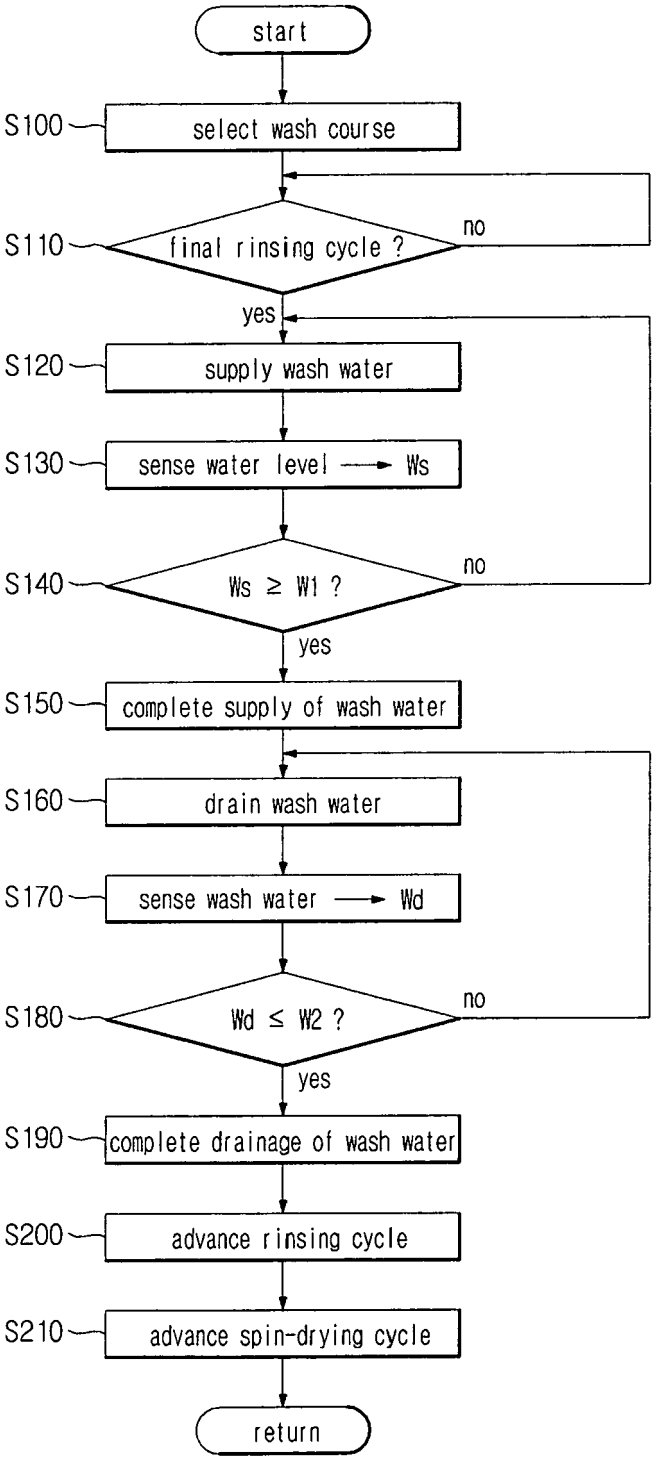

start
S100
select wash course
S110
final rinsing cycle ?
no
yes
S120
supply wash water
S130
sense water level → Ws
S140
Ws ≥ W1 ?
no
yes
S150
complete supply of wash water
S160
drain wash water
S170
sense wash water → Wd
S180
Wd ≤ W2 ?
no
yes
S190
complete drainage of wash water
S200
advance rinsing cycle
S210
advance spin-drying cycle
return

FIG. 6A

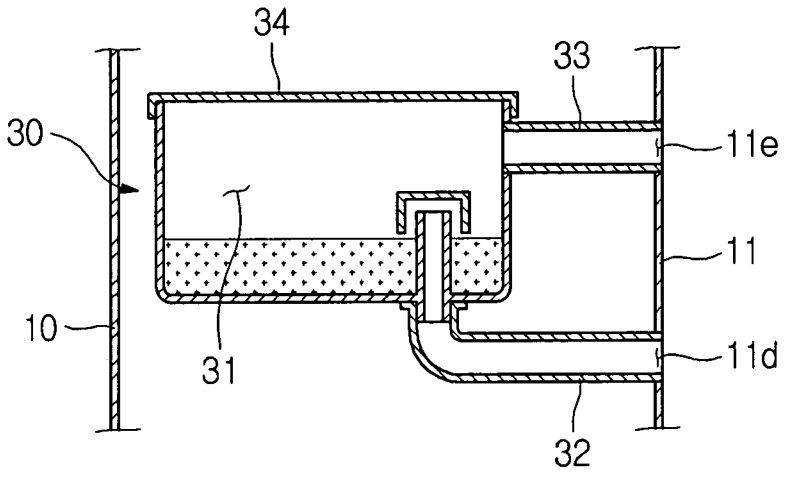


FIG. 6B

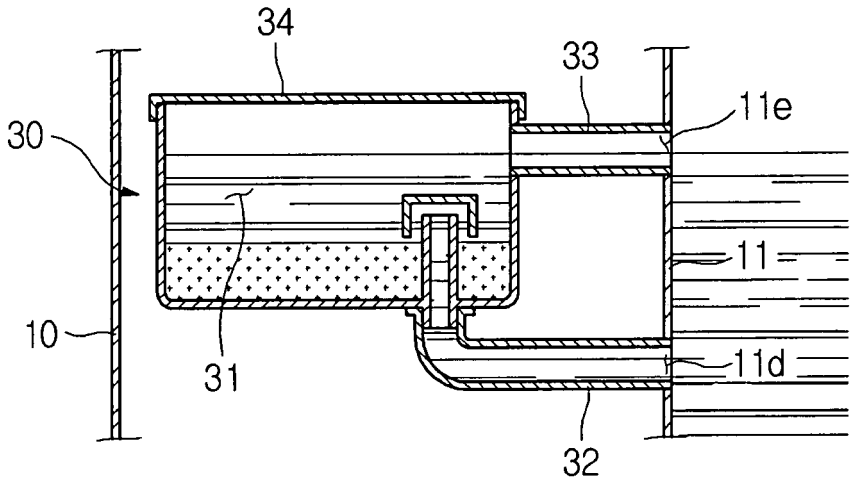
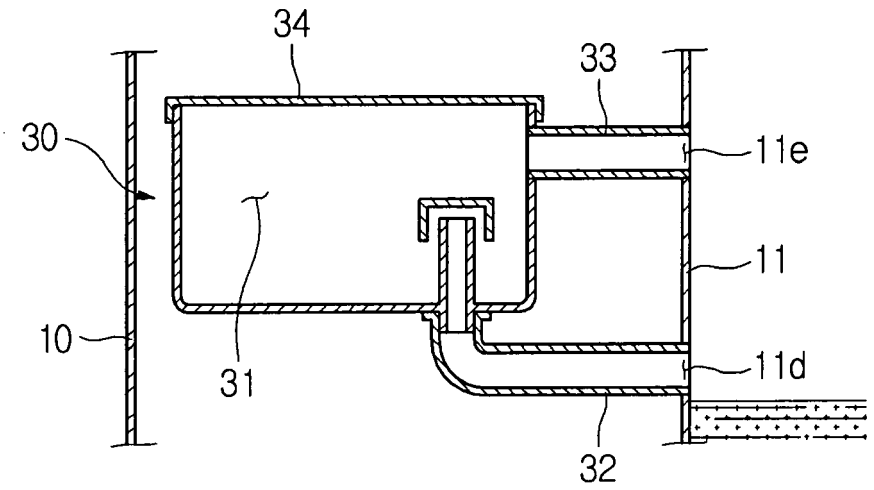


FIG. 6C



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Application Number
EP 06 25 0035

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