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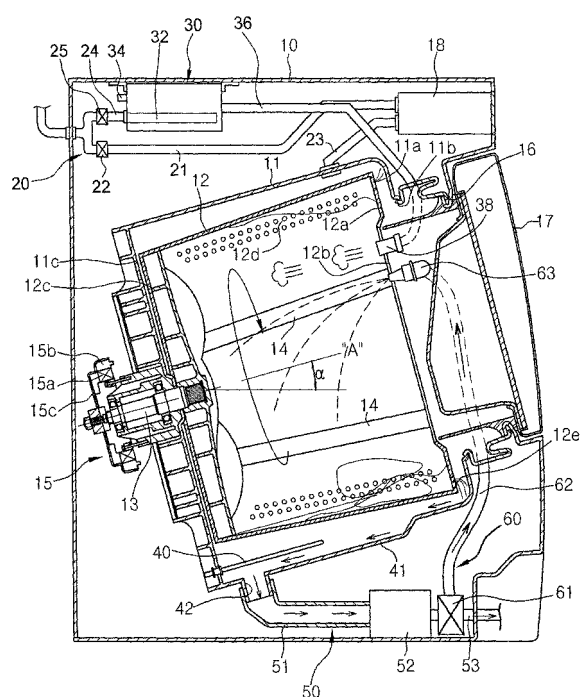
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(54) **Washing machine**

(57) A method of controlling a washing machine including a steam generating device (30) having a temperature sensor (34) and a control unit (130) for supplying water to the steam generating device to generate steam. The method includes the step of sensing the temperature of the steam generating device and supplying water to the steam generating device when a predetermined temperature has been reached.

FIG.1



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Description

[0001] The present invention relates to a method of controlling a washing machine including a steam generating device having a temperature sensor and, a control unit for supplying water to the steam generating device to generate steam.

[0002] A drum washing machine washes laundry by elevating and then dropping the laundry in a cylindrical drum when the drum is rotated. Compared to a conventional pulsator washing machine, a drum washing machine has a long washing time, but minimises laundry damage and consumes a small amount of wash water. Therefore, drum type washing machines have become more popular.

[0003] Japanese Patent Laid-open Publication No. 2001-149685 discloses a drum washing machine with a device for heating water with which to wash the laundry.

[0004] The above mentioned washing machine comprises a tub to contain water, a drum rotatably installed in the tub and rotated by a driving motor, and a heater installed below the tub to heat the water contained in the tub.

[0005] To perform a washing operation with this type of washing machine the laundry together with water are contained in the tub, wherein the laundry is elevated along the inner circumferential surface of the drum due to the rotation of the drum in the tub and then dropped, thereby washing the laundry. Additionally, the heater heating the water increases the washing efficiency of the washing machine.

[0006] A disadvantage of the above conventional washing machine is that it takes a long time to heat the water to a desired temperature in which to wash the laundry as the heater is required to heat a large amount of water contained in the tub, thereby requiring an increased overall washing time.

[0007] The present invention seeks to provide a method of controlling a washing machine which overcomes or substantially alleviates the problems discussed above.

[0008] A method of controlling a washing machine according to the present invention is characterised in that the method includes the step of sensing the temperature of the steam generating device and supplying water to the steam generating device when a predetermined temperature has been reached.

[0009] Preferably, the method the method includes the step of terminating the supply of water to the steam generating device when a predetermined period of time has elapsed.

[0010] In a preferred embodiment, the first predetermined time is the time taken for the steam generating device to generate steam from the water supplied thereto.

[0011] The method may further include the step of reinitiating the supply of water to the steam generating device when a second predetermined period of time has elapsed.

[0012] Advantageously, the second predetermined period of time is the time taken for the steam generating device to reach said predetermined temperature.

[0013] Embodiments of the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a longitudinal sectional view of a washing machine according to the present invention;

Figure 2 is a block diagram of a washing machine in according to the present invention;

Figure 3 is a flow chart illustrating a method for controlling the washing machine according to the present invention; and

Figure 4 is a flow chart illustrating a detailed process for heating wash water and laundry using steam in the method of Figure 3.

[0014] Referring now to the drawings, there is shown in Figure 1 a washing machine comprising a drum-type tub 11 installed in a main body 10 to hold water, and a drum 12 rotatably installed in the tub 11.

[0015] The tub 11 is aligned in the washing machine at a designated angle (α) to the base of the washing machine such that a front surface 11a of the tub 11, through which an inlet 11b is formed, is higher than that of a rear surface 11c of the tub 11, and the drum 12 installed in the tub 11 is inclined in the same manner as the tub 11 such that a front surface 12a of the drum 12, through which an inlet 12b is formed, is higher than that of a rear surface 12c of the drum 12.

[0016] A rotational central line A of the drum 12 is therefore at the designated angle (α) to the base of the washing machine. A rotary shaft 13 is connected to the centre of the rear surface 12c of the drum 12 and is rotatably supported by the centre of the rear surface 11c of the tub 11, thereby allowing the drum 12 to be rotated in the tub 11.

[0017] A plurality of through holes 12d are formed through the circumferential surface of the drum 12 and a plurality of drain holes 12e are formed through the outer portion of the front surface 12a of the drum 12 to discharge water in the drum 12 when the drum 12 is rotated at a high speed. Further, a plurality of lifters 14 are installed along the inner surface of the drum 12 to elevate and drop laundry when the drum 12 is rotated,

[0018] A motor 15, is installed on an outer portion of the rear surface 11c of the tub 11 and serves as a driving device to rotate the rotary shaft 13 connected to the drum 12. The motor 15 includes a stator 15a fixed to the rear surface 11c of the tub 11, a rotor 15b rotatably disposed outside the stator 15a, and a driving plate 15c which connects the rotor 15b and the rotary shaft 13.

[0019] An inlet 16 to allow laundry to be inserted or removed from the drum 12 is formed through the front surface of the main body 10 and corresponds to the positions of the inlet 12b of the drum 12 and the inlet 11b of the tub 11 and a door 17 is installed at the inlet 16.

[0020] A detergent supply device 18 to supply a detergent to the inside of the tub 11, a steam generating device 30 to supply steam to the inside of the tub 11, and a water supply device 20 to supply water to the tub 11 and the steam generating device 30 are installed above the tub 11.

[0021] The detergent supply device 18 includes a space to contain the detergent therein, and is installed to be accessible from the front surface of the main body 10 so that a user can easily place detergent into the detergent supply device 18.

[0022] The water supply device 20 includes a first water supply pipe 21 to supply water to the inside of the tub 11, and a first water supply valve 22 installed in the water supply pipe 21 to control the supply of water to the first water supply pipe 21. The first water supply pipe 21 is connected to the detergent supply device 18 so that water is supplied to the detergent supply device 18 and a connection pipe 23 is installed between the detergent supply device 18 and the tub 11 such that water passing through the detergent supply device 18 dissolves detergent in the detergent supply device 18 therein and is then supplied to the tub 11.

[0023] The water supply device 20 further includes a second water supply pipe 24 to supply water to the steam generating device 30 and a second water supply valve 25 installed in the second water supply pipe 24 controls the supply of water to the steam generating device 30.

[0024] Although the water supply device 20 includes the water supply valves 22 and 25 which are separately installed as described above, the present invention is not limited thereto. For instance, the water supply device 20 may include integrating the water supply valves 22 and 25 using a conventional electric three-way or four-way valve.

[0025] The steam generating device 30 includes a U-shaped steam heater 32 installed therein to rapidly heat water passing therethrough to generate steam at a high temperature of at least 100°C, a temperature sensor 34 installed at one side of the steam generating device 30 to sense the temperature of the steam generating device 30, a steam supply pipe 36 which extends from the steam generating device 30 to the tub 11, and a discharge nozzle 38 installed at an outlet of the steam supply pipe 36.

[0026] Although the steam heater 32 is installed in the steam generating device 30, as described above, the present invention is not limited thereto. For example, the steam heater 32 may be an external heater having a structure contacting the external surface of an upper or lower portion of the steam generating device 30 or surrounding the external circumferential surface of the steam generating device 30.

[0027] A heater 40 to heat the water supplied to the inside of the tub 11 is installed in the lower portion of the tub 11. A heater receiving portion 41 to receive the heater 40 and collect a designated quantity of the water is formed in the lower surface of the tub 11 such that the heater receiving portion 41 has a downwardly protruded

structure. This structure of the heater receiving portion 41 allows the heater 40 to be submerged in the water collected in the heater receiving portion 41.

[0028] The washing machine of the present invention further comprises a drain device 50 to discharge the water from the tub 11, and a water circulating device 60 to supply water heated by the heater 40 in the tub 11 to the inside of the drum 12.

[0029] The drain device 50 includes a first drain pipe 51 connected to a drain hole 42 formed through the heater receiving portion 41 on the lower surface of the tub 11 to guide water out of the tub 11, a drain pump 52 installed in the first drain pipe 51, and a second drain pipe 53 connected to an outlet of the drain pump 52.

[0030] The water circulation device 60 includes a channel change valve 61 installed in the second drain pipe 53, a water circulating pipe 62 extended from the channel change valve 61 to the inlet 12b of the drum 12, and a spray nozzle 63 installed at the outlet of the water circulating pipe 62. The channel change valve 61 changes the flow path of the water at the outlet of the drain pump 52 such that it is discharged to the outside or flows to the water circulating pipe 62, and is in this embodiment an electric three-way valve.

[0031] Hereinafter, the operation of the above-described washing machine will be described.

[0032] To operate the washing machine, laundry is placed in the drum 12 and detergent is placed in the detergent supply device 18, wherein the first water supply valve 22 of the water supply device 20 is opened so that water is supplied to the detergent supply device 18.

[0033] The detergent in the detergent supply device 18 is dissolved in the water and thereafter supplied to the tub 11. As the washing machine comprises the water circulating device 60, it does not need to supply water to a level inside the drum 12 to soak the laundry, thereby reducing the quantity of water required compared to the conventional washing machine.

[0034] After the supply of the water to the inside of the drum 12 is completed, the heater 40 is operated to heat the water in the tub 11. Since the washing machine requires a small quantity of water compared to a conventional washing machine, the temperature of the water heated by the heater 40 is rapidly increased, thereby shortening overall washing time and reducing the quantity of energy consumed to heat the water.

[0035] After the water is heated by the heater 40 to a desired temperature required to wash the laundry, the channel change valve 61 of the water circulating device 60 is operated. Then, the channel is formed such that the outlet of the drain pump 52 communicates with the water circulating pipe 62, and the water at the lower portion of the tub 11 is supplied to the inside of the drum 12 through the first drain pipe 51 and the water circulating pipe 62 by the operation of the drain pump 52.

[0036] Since the water supplied to the inside of the drum 12 is sprayed onto the laundry through the spray nozzle 63, the water uniformly soaks the laundry. A wash-

ing operation is performed wherein the drum 12 is rotated by the motor 15 at a low speed.

[0037] During the washing operation, when the level of the water in the drum 12 is above the height of the drain holes 12e, the water flows into the tub 11 through the drain holes 12e. The water is circulated from the tub 11 to the inside of the drum 12 through the first drain pipe 51 and the water circulating pipe 62 by the operation of the drain pump 52.

[0038] When a user selects a steam cycle, the second water supply valve 25 is opened so that water is supplied to the steam generating device 30 through the second water supply pipe 24, wherein the water supplied is rapidly heated by the heater 32 to generate a high temperature steam of at least 100°C.

[0039] The high temperature steam is supplied to the inside of the tub 11 through the steam supply pipe 36 and the discharge nozzle 38, and serves to additionally heat the water and the laundry in the tub 11, which were previously heated by the heater 40.

[0040] When the water and laundry temperatures are increased to a predetermined temperature by the circulation of the water and the supply of steam, the supply of the steam is stopped and the drum 12 is rotated by the motor 15 at low speed thereby achieving a washing operation.

[0041] After the washing operation is completed, a rinsing operation, in which dehydration and the repeated supply of water occurs, is performed. During the rinsing operation, the first water supply valve 22 is opened so that water is supplied to the inside of the tub 11 through the first water supply pipe 21. The channel change valve 61 is opened so that the outlet of the drain pump 52 is opened toward the external drain pipe 53, and the drain pump 52 is operated, thereby discharging the water in the tub 11. When a final dehydrating operation is performed after the rinsing operation, the drain pump 52 is operated under the condition that the outlet of the drain pump 52 is opened toward the external drain pipe 53, and the drum 12 is rotated at a high speed for a designated time, thereby dehydrating the laundry in the tub 11.

[0042] Referring to Figure 2, the washing machine comprises a signal input unit 100, a water level sensing unit 110, a temperature sensing unit 120, a control unit 130, and an operating unit 140.

[0043] The signal input unit 100 allows a user to input selected operating data, such as a washing cycle, a washing temperature, a dehydrating rotation speed, and an additional rinsing operation. The water level sensing unit 110 senses the level of the water supplied to the inside of the tub 11. The temperature sensing unit 120 includes a temperature sensor 34 to sense the temperature of the water supplied to the tub 11 and the temperature of the steam generating device 30.

[0044] The control unit 130 is a microcomputer to control the washing machine according to the operating data inputted from the signal input unit 100. The control unit 130 controls operations of the steam valve 25 and the

steam heater 32 dependent on the temperature sensed by the temperature sensing unit 120, thereby causing the steam generating device 30 to generate a large quantity of steam at a high temperature of at least 100°C.

[0045] The operating unit 140 operates the motor 15, the water supply valves 22, 25, the steam heater 32, the heater 40, the drain pump 52, and the channel change valve 61 based on an operation control signal of the control unit 130.

[0046] Hereinafter, the operation and effects of the above-described washing machine and a method for controlling the same will be described in detail.

[0047] Figure 3 is a flow chart illustrating the method for controlling the washing machine of the present invention. In Figure 3, "S" denotes an operation.

[0048] The method of controlling the washing machine according to the present invention comprises the operation (S100-S200) of supplying water to the tub 11 dependent on the steam washing cycle selected by a user; operations (S300-S400) wherein the water supplied to the inside of the tub 11 is heated using the heater 40; operations (S500-S600) wherein the water and laundry in the tub 11 is further heated by spraying steam of a high temperature of at least 100°C thereonto; an operation (S700) wherein a washing operation is performed dependent on a washing cycle selected by the user after the water and the laundry is heated by the heater 40 and the heater; and an operation (S800) wherein rinsing, dehydrating and drying operations are performed after the washing operation is completed.

[0049] Hereinafter, the method of controlling the washing machine according to the present invention will be described in detail.

[0050] When the user selects operating data, such as a washing cycle (for example, a steam washing course), a washing temperature, a dehydrating rotation speed, and an additional rinsing operation, the operating data selected by the user is inputted to the control unit 130 through the signal input unit 100 (S100).

[0051] The control unit 130 then opens the first water supply valve 22 so that wash water is supplied to the detergent supply device 18, wherein detergent is dissolved in the water and is then supplied to the tub 11 (S200).

[0052] The method of controlling the washing machine comprising the water circulating device 60, does not require water to be supplied to a level in the drum 12 to soak the laundry and so the quantity of wash water required is reduced as compared to conventional washing machines.

[0053] After a predetermined quantity of the water is supplied to the inside of the tub 11, the control unit 130 turns the first water supply valve 22 off so that the supply of water to the first water supply pipe 21 is stopped.

[0054] After the supply of the water is completed, the heater 40 is operated by the control unit 130, thereby heating the wash water in the tub 11 (S300). As a small quantity of water is required compared to a conventional

method, the temperature of the water heated by the heater 40 is rapidly increased, thereby shortening the overall washing time and reducing the quantity of energy consumed to heat the water.

[0055] Once a designated time for operating the heater 40 is determined (T1; the time taken to heat the wash water to the temperature required to perform a washing operation using the heater 40) has elapsed (S400), the operation of the heater 40 is stopped.

[0056] Thereafter, the control unit 130 controls the second water valve 25 such that water is supplied to the steam generating device 30 through the second water supply pipe 24, and this water is rapidly heated by the steam heater 32 to generate high temperature steam of at least 100°C.

[0057] The at high temperature steam is supplied to the inside of the tub 11 through the steam supply pipe 36 and the discharge nozzle 38, and serves to additionally heat the water and the laundry in the tub 11, which were previously heated by the heater 40 (S500).

[0058] As a small quantity of water is required due to the use of the water circulating device 60 and a large quantity of high temperature steam is supplied of at least 100°C to the inside of the tub 11 through the steam generating device 30, the temperature of the water is rapidly increased compared to the conventional method, in which the water is heated only by the heater 40 installed in the lower portion of the tub 11, thereby remarkably shortening the overall washing time and reducing the quantity of energy consumed to heat the water.

[0059] Further, since high temperature steam is sprayed onto the laundry, which is sufficiently soaked by the wash water, the temperature of the laundry is rapidly increased, thereby shortening the washing time and improving the detergency to increase the washing effects of the washing machine.

[0060] Once it is determined that a designated time (T2; overall operating time of the steam generating device 30 from a point of the time when the steam heater 32 is preheated, approximately 6~10 minutes) has elapsed (S600), the operation of the steam heater 32 is stopped, and the drum 12 is rotated at a low speed by the operation of the motor 15 so that the washing operation is performed according to the selected washing cycle (S700).

[0061] When the washing operation is completed, at least one or all of rinsing, dehydrating, and drying operations is performed according to the selected operating data, and the steam washing cycle is terminated (S800).

[0062] Hereinafter, with reference to Figure 4, a process to heat the water and the laundry using steam in the method for controlling the washing machine as shown in Figure 3 will be described in more detail.

[0063] In order to supply a large quantity of high temperature steam to the inside of the tub 11, the control unit 130 preheats the steam heater 32 installed in the steam generating device 30 (S510).

[0064] The steam heater 32 is preheated so that the

steam generating device 30, at an initial operating state, supplies pure steam, which is not mixed with water at room temperature (23~24°C), to the inside of the tub 11.

[0065] The temperature sensing unit 120 senses a temperature (S_T) of the steam generating device 30 due to the preheating of the steam heater 32, and outputs the sensed temperature (S_T) to the control unit 130 (S520). When the control unit 130 determines that the temperature (S_T) of the steam generating device 30 inputted from the temperature sensing unit 120 has exceeded a predetermined reference temperature (S_{TS} ; the lowermost temperature for heating the steam heater 32 to generate steam, approximately 100°C) (S530). The control unit 130 turns the second water supply valve 25 on (S540).

[0066] When the second water valve 25 is turned on, the water is supplied to the steam generating device 30 through the second water supply pipe 24, and the water supplied to the steam generating device 30 is rapidly heated by the steam heater 32 to generate steam at a high temperature steam of at least 100°C.

[0067] The high temperature steam is supplied to the inside of the tub 11 through the steam supply pipe 36 and the discharge nozzle 38, and additionally heats the water and the laundry in the tub 11, which were previously heated by the heater 40.

[0068] Thereafter, when a designated time (T3; a time taken to generate steam at a high temperature of at least 100°C, approximately 2 seconds) has elapsed (S550), the control unit 130 turns the steam valve 25 off (S560).

[0069] A time during the turning off of the second steam valve 25 is checked, and when a designated time (T4; a time taken to increase the temperature of the steam generating device 30 to a high temperature of at least 100°C, approximately 10 seconds) has elapsed (S570), the control unit 130 turns the second steam valve 25 on again until the designated time (T2) elapses, thereby repeating the above process.

[0070] Although embodiments of the present invention have been shown and described, it will be appreciated by those skilled in the art that changes may be made to the embodiments without departing from the principles of the invention, the scope of which is defined in the claims and their equivalents and the foregoing description should be regarded as a description of preferred embodiments only.

Claims

1. A method of controlling a washing machine including a steam generating device having a temperature sensor and, a control unit for supplying water to the steam generating device to generate steam, **characterised in that** the method includes the step of sensing the temperature of the steam generating device and supplying water to the steam generating device when a predetermined temperature has been reached.

2. A method according to claim 1, wherein the method includes the step of terminating the supply of water to the steam generating device when a predetermined period of time has elapsed.
3. A method according to claim 2, wherein the first predetermined time is the time taken for the steam generating device to generate steam from the water supplied thereto.
4. A method according to claim 2 or claim 3, wherein the method includes the step of reinitiating the supply of water to the steam generating device when a second predetermined period of time has elapsed.
5. A method according to claim 4, wherein the second predetermined period of time is the time taken for the steam generating device to reach said predetermined temperature.
6. A washing machine including a steam generating device, a temperature sensor for sensing the temperature of the steam generating device and, a control unit for supplying water to the steam generating device to generate steam, **characterised in that** the control unit is configured to supply water to the steam generating device when the steam generating device has reached a predetermined temperature as sensed by the temperature sensor.
7. A washing machine according to claim 6, wherein the control means is configured to terminate the supply of water to the steam generating device when a predetermined time period has elapsed.
8. A washing machine according to claim 7, wherein the control means is configured to reinitiate the supply of water to the steam generating device when a second predetermined period of time has elapsed.
9. A method for controlling a washing machine, which heats supplied water using a steam generating device to generate steam, comprising sensing a temperature of the steam generating device, controlling water supply means for supplying water to the steam generating device according to the sensed temperature of the steam generating device, and performing a steam operation for controlling the steam generated from the steam generating device according to a time taken to control the water supply means.
10. The method as set forth in claim 9 wherein the water supply means is controlled such that the wash water is supplied to the steam generating device when the temperature of the steam generating device is more than a predetermined reference temperature.
11. The method as set forth in claim 9 wherein the water supply means is controlled such that the wash water supplied to the steam generating device is cut off when the temperature of the steam generating device is not more than a predetermined reference temperature.
12. The method as set forth in claim 9 wherein the wash water supplied to the steam generating device is cut off to stop generation of the steam, when a time during which the water supply means is turned on to supply water exceeds a predetermined water supply time.
13. The method as set forth in claim 9 wherein the wash water is supplied to the steam generating device to generate the steam, when a time during which the water supply means is turned off to stop supplying water exceeds a predetermined water supply stop time.
14. A method for controlling a washing machine, which heats supplied wash water using a steam generating device to generate steam, comprising preheating the steam generating device before wash water is supplied to the steam generating device sensing a temperature of the preheated steam generating device, controlling water supply means for supplying the wash water to the steam generating device by comparing the sensed temperature of the steam generating device to a predetermined reference temperature and controlling the generation of the steam by comparing a time, taken to control the water supply means to a predetermined water supply time and a predetermined water supply stop time.
15. The method as set forth in claim 14 wherein the wash water supplied to the steam generating device is cut off to stop the generation of the steam, when a time during which the water supply means is turned on to supply water exceeds the predetermined water supply time.
16. The method as set forth in claim 14 wherein the wash water is supplied to the steam generating device to generate the steam, when a time during which the water supply means is turned off to stop supplying water exceeds the predetermined water supply stop time.
17. A washing machine having a steam generating device for heating supplied wash water to generate steam comprising a temperature sensing unit for sensing a temperature of the steam generating device, water supply means for supplying wash water to the steam generating device, and a control unit for controlling the water supply means such that the steam generated from the steam generating device is controlled according to the temperature of the

steam generating device.

- 18.** The washing machine as set forth in claim 17 wherein the control unit controls the steam generating device such that the steam generating device is preheated before the wash water is supplied to the steam generating device. 5
- 19.** The washing machine as set forth in claim 17 wherein the control unit compares a time, taken to control the water supply means to a predetermined water supply time and a predetermined water supply stop time, and controls the generation of the steam according to the result of the comparison. 10
- 20.** The washing machine as set forth in claim 17 wherein the water supply means is a steam valve capable of being turned on and off so as to control the wash water supplied to the steam generating device according to control of the control unit. 15 20

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FIG.1

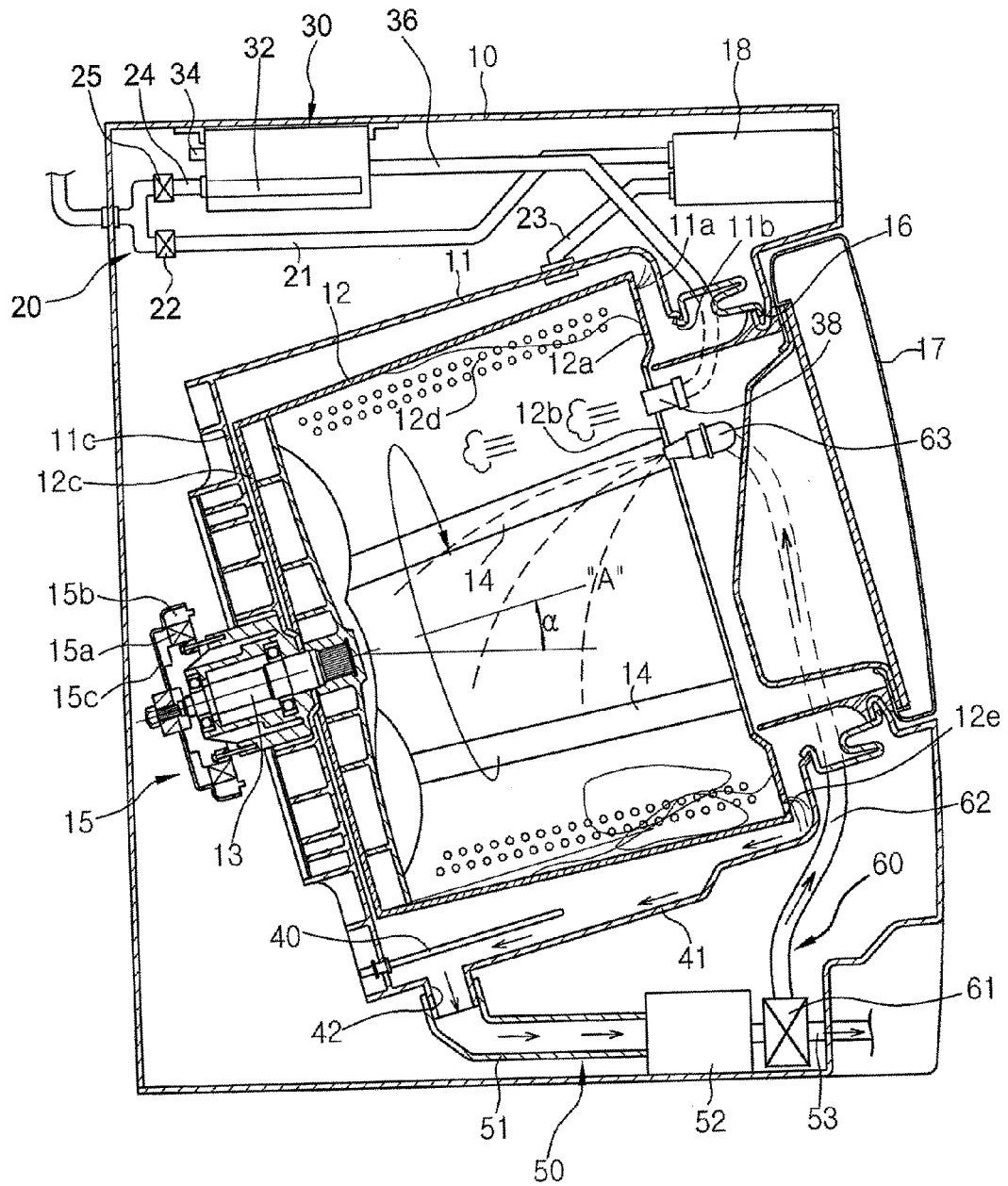


FIG.2

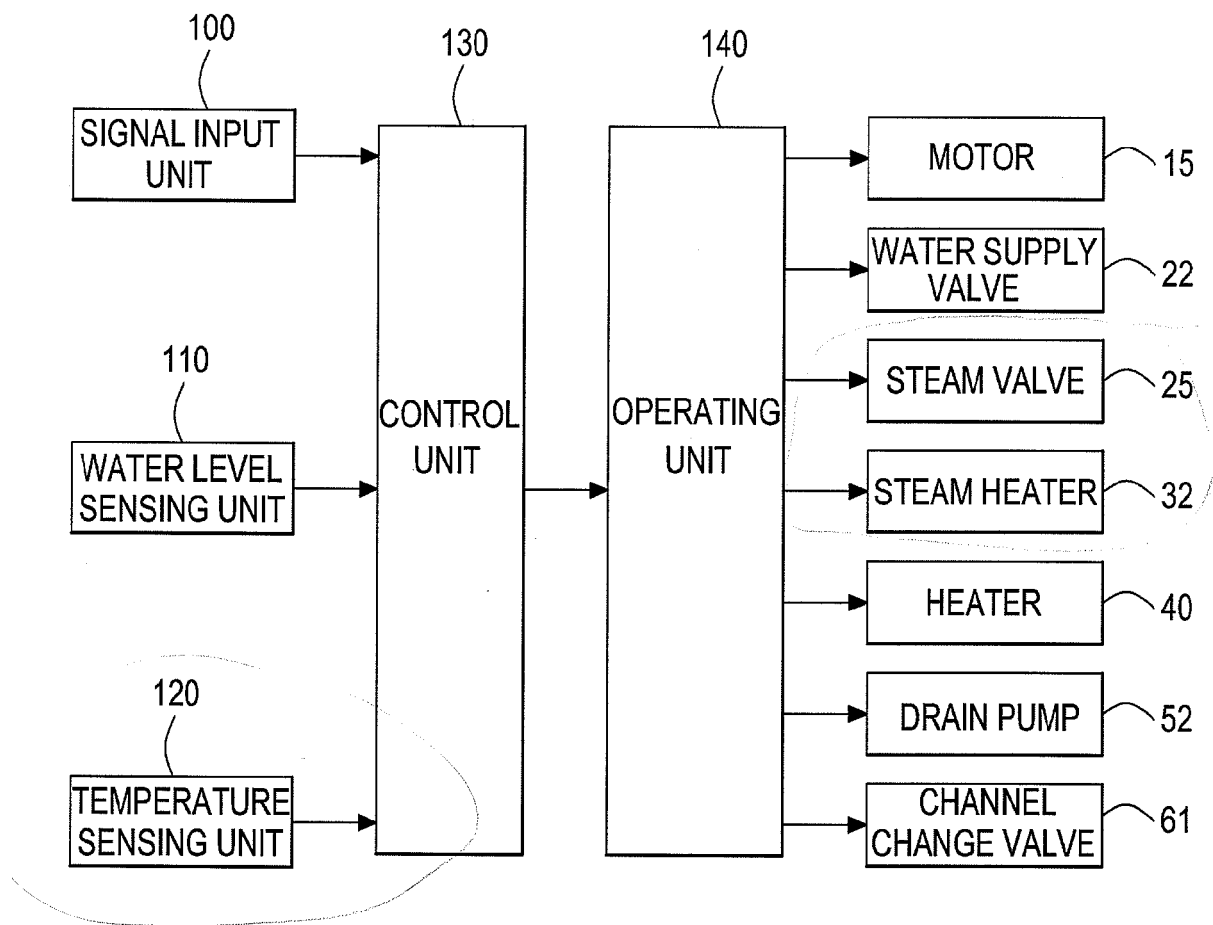


FIG.3

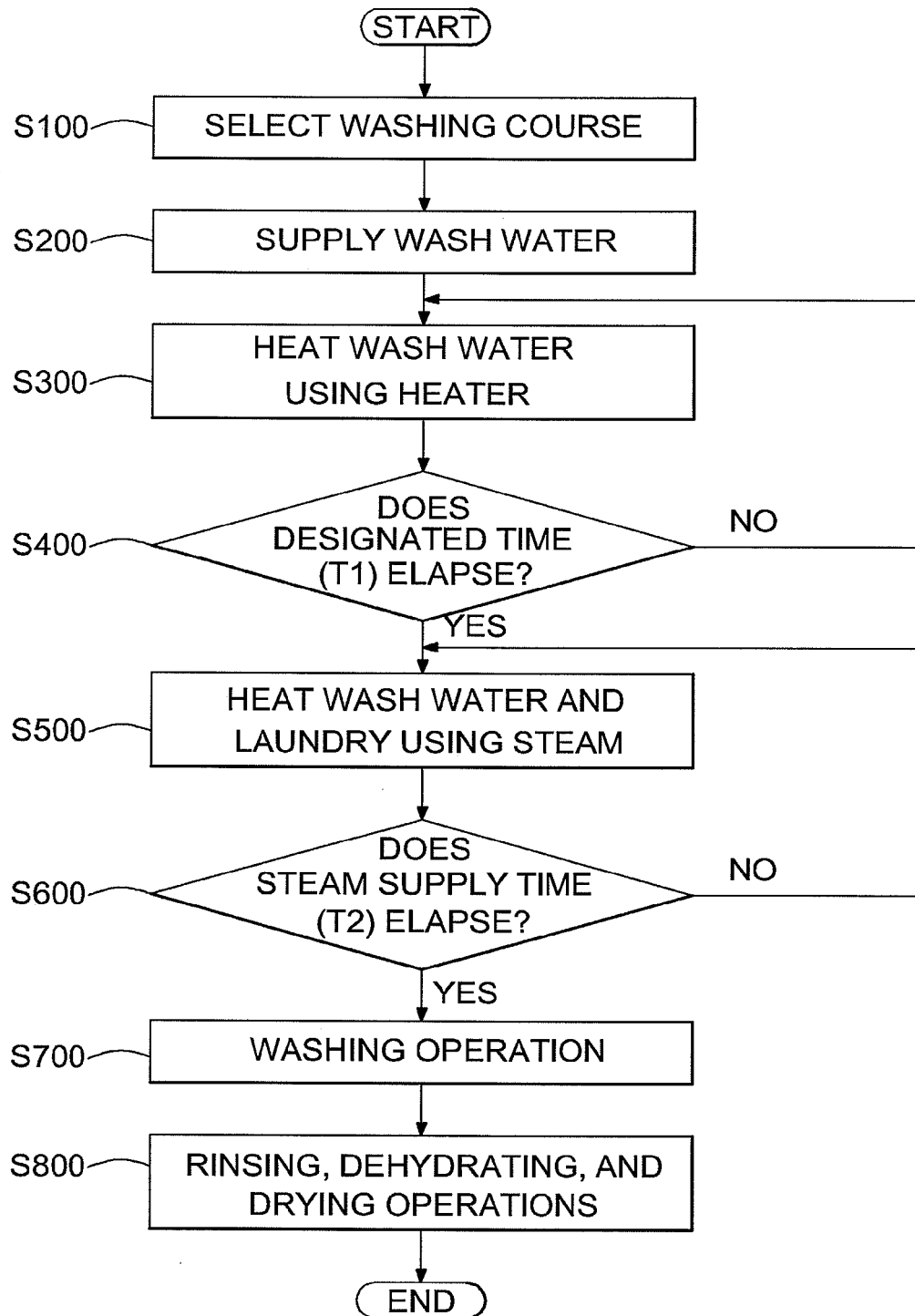


FIG.4

