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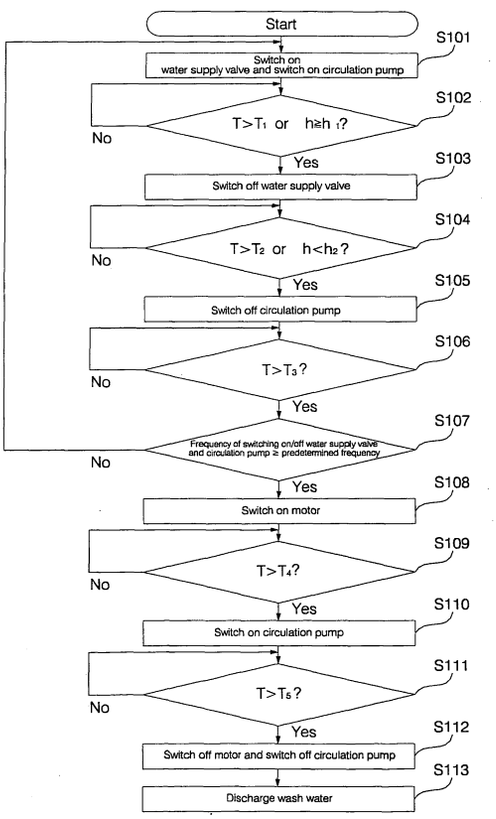
(54) Method for controlling a drum-type washing machine

(57) Disclosed is a method for controlling a drum-type washing machine including the steps of switching on a water supply valve to supply wash water into a tub, switching on a circulation pump to circulate the wash water in the tub into a drum, switching off the water supply valve when a first predetermined time(T_1) from the switching-on of the water supply valve elapses, and switching off the circulation pump when a second predetermined time (T_2) from the switching-off of the water supply valve elapses. The method allows laundry to be effectively cleaned using a small quantity of the wash water(W) and minimizes a power consumption rate required to operate the washing machine through several repetitions of the above steps.

FIG. 5



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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a drum-type washing machine, and more particularly to a method for controlling a drum-type washing machine, in which a small quantity of wash water is supplied and heated, thereby reducing the supply rate of the wash water and the electric consumption rate required to heat the wash water.

Description of the Related Art

[0002] Generally, drum-type washing machines'are apparatuses for removing contaminants from laundry and bedding contained in a drum using the action of detergent and wash water contained in a tub through a series of washing, rinsing, and dehydrating modes.

[0003] Fig. 1 is a sectional view of a conventional drum-type washing machine.

[0004] As shown in Fig. 1, the conventional drum-type washing machine comprises a base 1, a casing 2 positioned on the base for forming an external appearance of the washing machine and provided with an opening 2a for allowing laundry (m) to be put into and taken out of the washing machine, a door 4 rotatably installed at a front surface of the casing 2 for opening and closing the opening 2a, a tub 6 supported in the casing 102, a water supply unit 10 for supplying water containing detergent dissolved therein or clean water (hereinafter, referred to as "wash water (w)") into the tub 6, a drain unit 12 for discharging the wash water (w) in the tub 6 to the outside of the casing 2, a drum 20 rotatably positioned in the tub 6 for containing the laundry (m), and a motor 30 for rotating the drum 20.

[0005] An opening 7 is formed through the tub 6 in the rear of the opening 2a of the casing 2 for allowing the laundry (m) to be put into and taken out of the drum 20.

[0006] The drum 20 is provided with a lower part submerged in the wash water (w) in the tub 6, and includes an opening 21 formed therethrough in the rear of the opening 2a of the casing 2 for allowing the laundry (m) to be put into and taken out of the drum 20, and a plurality of water holes 22 formed through the circumference or the rear surface thereof so that the wash water (w) in the tub 6 is put into the drum 20 through the water holes 22.

[0007] A plurality of lifters 26 for lifting up the laundry (m) contained in the drum 20 and allowing the laundry (m) to drop due to the force of gravity are installed on the inner circumference of the drum 20.

[0008] The motor 30 is installed at the rear surface of the tub 6, and is approximately horizontally disposed such that a rotary shaft 32 of the motor 30 traverses the central portion of the rear surface of the tub 6 and is then connected to the central portion of the rear surface of the drum 20.

[0009] The drum-type washing machine further comprises a heater 8 installed on the lower surface of the tub 6 for heating the wash water (w) in the tub 6, thereby increasing force for washing the laundry (m).

[0010] Non-described reference numeral 48 represents a gasket installed at the tub 6 for preventing water leakage between the door 4 and the opening 7 of the tub 6 when the door 4 is closed.

[0011] Hereinafter, operation of the above-described conventional drum-type washing machine will be described in detail.

[0012] First, the laundry (m) is put into the drum 20, and the door 4 is closed. Thereafter, when the washing machine is operated, the water supply unit 10 supplies the wash water (w) into the tub 6 from the lower surface of the tub 6.

[0013] The water supply unit 10 supplies the wash water (w) to a level (h) higher than the lower end of the drum 20, thus allowing the lower part of the drum 20 to be sufficiently submerged in the wash water (w). The wash water (w) is introduced into the drum 20 through the water holes 22 or the opening 21 of the drum 20, thereby soaking the laundry (m) (S1).

[0014] Thereafter, the motor 30 is operated to rotate the drum 20. Then, the laundry (m) is lifted up and dropped by the lifters 26, thereby being cleaned by the action of the wash water (w) and a detergent (S2).

[0015] In a water supply or wash mode, the heater 8 heats the wash water (w) by means of power supplied thereto, and the wash water heated by the heater 8 has an increased solubility of the detergent, thus promoting the reaction between the detergent and dirt attached to the laundry (m) and rapidly and sanitarily eliminating the dirt from the laundry (m).

[0016] After the completion of the wash mode, the contaminated wash water (w) in the tub 6 is discharged to the outside of the drum-type washing machine through the drain unit 12 (S3).

[0017] Then, the drum-type washing machine is operated in a rinse mode for rinsing detergent foam remaining in the laundry (m). In the rinse mode, in the same manner as the washing mode, the water supply unit 10 supplies the wash water (w) to the level (h) higher than the lower end of the drum 20, the wash water (w) is introduced into the drum 20 through the water holes 22 or the opening 21 of the drum 20, the motor 30 rotates the drum 20, and the laundry (m) in the drum 20 is lifted up and dropped by the lifters 26 so that the detergent foam remaining in the laundry (m) is rinsed (S4 and S5).

[0018] During the above water supply or rinse mode, the heater 8 receives power supplied thereto and heats the wash water (w), and the detergent foam remaining in the laundry (m) is rapidly rinsed by the wash water (w) heated by the heater 8.

[0019] Then, the contaminated wash water containing the detergent foam is discharged to the outside through

the drain unit 12 (S6).

[0020] After several repetitions of the water supply, rinse and drain modes, the motor 30 rotates the drum 20 at a high speed and the laundry (m) in the drum 20 is dehydrated by centrifugal separation (S7, S8, S9 and S10).

[0021] Since the wash water having a quantity larger than the substantial quantity required to wash the laundry is supplied to the predetermined level (h), the above-described method for controlling the conventional drum-type washing machine is disadvantageous in that excessive wash water is consumed.

[0022] Further, since the heater heats a large quantity of the wash water, the above-described method for controlling the conventional drum-type washing machine is disadvantageous in that it has an increased energy consumption rate.

SUMMARY OF THE INVENTION

[0023] Therefore, the present invention has been made in view of the above problems, and it is an object of the present invention to provide a method for controlling a drum-type washing machine, which reduces the amount of wash water supplied thereto.

[0024] It is another object of the present invention to provide a method for controlling a drum-type washing machine, which increases energy efficiency.

[0025] In accordance with one aspect of the present invention, the above and other objects can be accomplished by the provision of a method for controlling a drum-type washing machine comprising the steps of: (a) switching on a water supply valve to supply wash water into a tub, and switching on a circulation pump to circulate the wash water in the tub into a drum; (b) switching off the water supply valve when a first predetermined time from the switching-on of the water supply valve elapses or the level of the supplied wash water is not less than a first predetermined level; and (c) switching off the circulation pump when a second predetermined time from the switching-off of the water supply valve elapses or the level of the supplied wash water is less than a second predetermined level, wherein the steps (a) to (c) are sequentially repeated several times.

[0026] In accordance with another aspect of the present invention, there is provided a method for controlling a drum-type washing machine comprising the steps of: (a) switching on a water supply valve to supply wash water into a tub, switching on a circulation pump to circulate the wash water in the tub into a drum, and switching on a heater to heat the wash water in the tub; (b) switching off the water supply valve when a first predetermined time from the switching-on of the water supply valve elapses or the level of the supplied wash water is not less than a first predetermined level; and (c) switching off the circulation pump and the heater when a second predetermined time from the switching-off of the water supply valve elapses or the level of the supplied wash water is less than a second predetermined level, wherein the steps (a) to (c) are sequentially repeated several times.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027] The above and other objects, features and other advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a sectional view of a conventional drum-type washing machine;

Fig. 2 is a flow chart illustrating a method for controlling the conventional drum-type washing machine;

Fig. 3 is a perspective view of a drum-type washing machine of the present invention;

Fig. 4 is a sectional view of the drum-type washing machine of the present invention;

Fig. 5 is a flow chart illustrating a method for controlling a drum-type washing machine in accordance with a first embodiment of the present invention; and

Fig. 6 is a flow chart illustrating a method for controlling a drum-type washing machine in accordance with a second embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0028] Now, preferred embodiments of the present invention will be described in detail with reference to the annexed drawings.

[0029] Fig. 3 is a perspective view of a drum-type washing machine of the present invention. Fig. 4 is a sectional view of the drum-type washing machine of the present invention.

[0030] As shown in Figs. 3 and 4, the drum-type washing machine of the present invention comprises a base 103, a cabinet 104 positioned on the base 103, a cabinet cover 105 installed on a front surface of the cabinet 104 and provided with an opening 105a for allowing laundry (m) to be put into and taken out of the cabinet 104, a door 109 rotatably installed at a front surface of the cabinet cover 105 for opening and closing the opening 105a, a top plate 106 installed on an upper surface of the cabinet 104, and an operating panel 107 installed on the upper surface of the top plate 106 or the cabinet cover 105 and manipulated by a user for selecting one mode out of wash, rinse and dehydration modes.

[0031] A tub 110 is positioned above the base 103 and is supported by a spring 103a and a damper 104a.

[0032] The tub 110 having a cylindrical structure is transversely laid down in the cabinet 104. An opening 112 is formed through the tub 110 in the rear of the open-

ing 105a of the cabinet 105, and a gasket 114 provided with a sealing portion adhered to the door 109 is installed around the edge of the opening 112.

[0033] A drum 120 for containing laundry (m) to be cleaned is positioned in the tub 110 such that the drum 120 is spaced from the inner surface of the tub 110.

[0034] The drum 120 having a cylindrical structure is transversely laid down in the tub 110. An opening 121 for allowing the laundry (m) to be put into and taken out of the drum 120 is formed through a front surface of the drum 120, a plurality of water holes 122 are formed through a circumference or a rear surface of the drum 120 so that wash water (w) in the tub 110 is put into the drum 120 through the water holes 122, and lifters 123 for lifting up the laundry (m) contained in the drum 20 and allowing the laundry (m) to drop are installed on the inner circumference of the drum 20.

[0035] A motor 130 for supporting and rotating the drum 120 is installed at the tub 110. A rotary shaft 132 of the motor 130 traverses the central portion of the rear surface of the tub 110 and is supported by the tub 110, and a front end of the rotary shaft 132 is connected to the rear surface of the drum 120.

[0036] A water supply unit for supplying the wash water into the tub 110 is provided on the tub 110.

[0037] The water supply unit includes a water supply valve 142 connected to an external hose 141 for intermitting clean water supply from the external hose 141, a water supply hose 142' for guiding the water passing through the water supply valve 142, a detergent chamber 143, having a detergent storage space, a water supply passage and an outlet, for mixing the water supplied through the water supply hose 142 with a detergent stored in advance and then discharging the mixture, and a water supply bellows tube 144 provided with one end connected to the outlet of the detergent chamber 143 and the other end connected to a water supply inlet formed on the upper surface of the tub 110 for guiding the mixture discharged from the detergent chamber 143 into the tub 110.

[0038] A drain outlet 115 for discharging the wash water is formed through the lower surface of the tub 110, and a drain bellows tube 148 for guiding the discharged wash water is connected to the drain outlet 115.

[0039] A pump unit 150 for pumping out the wash water discharged from the tub 110 through the drain outlet 115 and the drain bellows tube 148 or re-circulating the discharged wash water into the drum is connected to the drain bellows tube 148.

[0040] The pump unit 150 includes a filter case 152, a drain pump 154, and a circulation pump 156.

[0041] A connector connected to the drain bellows tube 148 is installed at the filter case 152, a passage for the wash water connected to the drain pump 154 and the circulation pump 156 is installed in the filter case 152, and a filter (not shown) for filtering out foreign substances such as pieces of thread contained in the wash water is installed in the filter case 152.

[0042] A drain hose 155 extended from the casing 102 is connected to the drain pump 154, thereby allowing the drain pump 154 to discharge the water introduced into the filter case 152 to the outside therethrough.

[0043] A circulation hose 160 extended toward the upper part of the gasket 114 is connected to the circulation pump 156, thereby allowing the circulation pump 156 to pump the water introduced into the filter case 142 to the circulation hose 160.

[0044] One end of the circulation hose 160 is close to the upper part of the gasket 114.

[0045] A spray hole 162 provided with a nozzle opened into the drum 120 and connected to the upper part of the gasket 114 for spraying the guided wash water into the drum 120 is connected to the circulation hose 160.

[0046] Further, an electric heater 170 for heating the wash water is installed in the lower part of the tub 110.

[0047] The drum-type washing machine further comprises a water level sensing apparatus for sensing the level of the supplied wash water.

[0048] The above water level sensing apparatus includes a water level sensing bellows tube 180 connected to one end of the drain bellows tube 148, an air chamber 182 communicating with a lower end of the water level sensing bellow tube 180 and filled with air, to which a pressure is applied, according to the level of water of the water level sensing bellows tube 180, a water level sensing tube 184 connected to a lower end connected to one end of the air chamber 182, and a water level sensor 186 connected to an upper end of the water level sensing tube 184 for sensing the level of the supplied wash water by sensing an air pressure in the water level sensing tube 184.

[0049] Non-described reference numeral 190 represents a control unit for controlling the motor 130, the water supply valve 142, the drain pump 154, the circulation pump 156 and the heater 170 based on the manipulation of the operating panel 107 and the level of the wash water sensed by the water level sensor 186.

[0050] Hereinafter, operation of the above-described drum-type washing machine will be described in detail.

[0051] Fig. 5 is a flow chart illustrating a method for controlling a drum-type washing machine in accordance with a first embodiment of the present invention.

[0052] First, after laundry is introduced into the drum 120, and a desired course and mode are selected, the drum-type washing machine is operated. Then, the control unit 190 determines whether or not a wash mode is selected, and in case that it is determined that the wash mode is selected, the control unit 190 switches on the water supply valve 142 and switches on the circulation pump 156 (S101).

[0053] Wash water (w) supplied from the external hose 141 is introduced into the detergent chamber 143 through the water supply valve 142 and the water supply hose 142', when the water supply valve 142 is switched on, passes through the detergent chamber 143, and is

then supplied into the tub 110.

[0054] The wash water (w) supplied into the tub 110 is discharged to the filter case 152 and the drain bellows tube 148 through the drain outlet 115 of the tub 110, and fills the filter case 152 and the drain bellows tube 148.

[0055] The wash water (w) is pumped by the circulation pump 156, and is sprayed into the drum 120 through the circulation hose 160 and the spray hole 162, thereby rapidly soaking the laundry (m).

[0056] The control unit 190 controls the water supply valve 142 such that only a small quantity of the wash water is supplied. That is, the control unit 190 switches off the water supply valve 142 when a first predetermined time (T_1) from the switching-on of the water supply valve 142 elapses or the level (h) of the supplied wash water is not less than a first predetermined level (h_1) (S102 and S103).

[0057] Here, the first predetermined time (T_1) and the first predetermined level (h_1) are set such that the supplied wash water has a quantity pumped by the circulation pump 156, and preferably, the level of the supplied wash water is lower than the lower end of the drum 120.

[0058] When the water supply valve 142 is switched off, new wash water is no longer supplied into the tub 110, the filter case 152 and the drain bellows tube 148 and the wash water (w) remaining in the filter case 152 and the drain bellows tube 148 is pumped by the circulation pump 156 and is sprayed into the drum 120 so as to soak the laundry (m).

[0059] That is, when the water supply valve 142 is switched off and the circulation pump 156 continuously sprays the wash water into the drum 120, the quantity of the wash water (w) absorbed by the laundry (m) is gradually increased and the quantity of the wash water (w) circulated by the circulation pump 156 is gradually decreased.

[0060] The control unit 190 switches off the circulation pump 156 when a second predetermined time (T_2) from the switching-off of the water supply valve 142 elapses or the level (h) of the supplied wash water is less than a second predetermined level (h_2) (S104 and S105).

[0061] The second predetermined level (h_2) is set to be lower than the first predetermined level (h_1).

[0062] After the switching-off of the circulation pump 156, a part of the wash water absorbed by the laundry (m) is eliminated from the laundry (m), fills the lower part of the tub 110 through the water holes 122 of the drum 120, and is collected in the filter case 152 or the drain bellows tube 148.

[0063] Thereafter, the control unit 190 re-supplies a quantity of the wash water required to operate the circulation pump 156. When a third predetermined time (T_3) from the switching-off of the circulation pump 156 elapses, the control unit 190 determines whether or not the wash water is re-supplied or not based on the frequency of the switching-on/off of the water supply valve 142 and the circulation pump 156 and the level (h) of the supplied wash water, thereby determining whether or not the switching-on of the water supply valve 142 and the circulation pump 156, the switching-off of the water supply valve 142, and the switching-off of the circulation pump 156 are repeated (S106 and S107).

[0064] That is, the control unit 190 repeats the switching-on of the water supply valve 142 and the circulation pump 156, the switching-off of the water supply valve 142, and the switching-off of the circulation pump 156 are repeated, until the frequency of the switching-on/off of the water supply valve 142 and the circulation pump 156 is more than a predetermined number (for example, four times) or the level (h) of the supplied wash water is not less than a third predetermined level (h_3).

[0065] The third predetermined level (h_3) is set to be higher than the first predetermined level (h_1).

[0066] Since the wash water is supplied into the drum-type washing machine, is circulated, and is then re-supplied to the drum-type washing machine, the wash water rapidly and sufficiently soaks the laundry (m) and the laundry (m) is effectively washed by only a small quantity of the wash water (w).

[0067] When the frequency of the switching-on/off of the water supply valve 142 and the circulation pump 156 is more than the predetermined number (for example, four times) or the level (h) of the supplied wash water is not less than the third predetermined level (h_3), the control unit 190 stops the re-supply of the wash water, and switches on the motor 130 to rotate the drum 120 (S108).

[0068] When the motor 130 is switched on, the drum 120 is rotated, and the laundry (m) is lifted up by the lifters 126 and is then dropped, thereby being cleaned by the action of the wash water (w).

[0069] During the rotation of the drum 120, the wash water (w) soaking the laundry (m) fills the tub 110 through the water holes 122 of the drum 120, and is collected in the filter case 152 or the drain bellows tube 148.

[0070] When a fourth predetermined time (T_4) from the switching-on of the motor 130 elapses, the control unit 190 switches on the circulation pump 156 again (S109 and S110).

[0071] When the circulation pump 156 is switched on, the wash water (w) collected in the filter case 152 or the drain bellows tube 148 is pumped by the circulation pump 156 and is sprayed into the drum 120 so as to soak the laundry (m). The wash water soaking the laundry (m) increases the weight of the laundry (m), thus increasing the dropping force of the laundry (m) having the increased weight and improving launderability.

[0072] When a fifth predetermined time (T_5) from the switching-on of the circulation pump 156 elapses, the control unit 190 switches off the motor 130 and the circulation pump 156, thereby terminating the wash mode (S111 and S112).

[0073] Thereafter, the control unit 190 switches on the drain pump 154 for a designated time so that the contaminated wash water is discharged to the outside through the drain hose 155, and switches off the drain

pump 154 (S113).

[0074] The control unit 190 determines whether or not a rinse mode is selected after the water supply, the water re-supply, the wash and the drain steps are performed, and in case that it is determined that the rinse mode is selected, the control unit 190 repeats at least one cycle of the water supply, the water re-supply, the rinse and the drain steps the same as the above wash mode.

[0075] In the rinse mode, since the wash water (w) rapidly and sufficiently soaks the laundry (m), the total quantity of the supplied wash water (w) is decreased.

[0076] Thereafter, the control unit 190 determines whether or not a dehydration mode is selected, and in case that it is determined that the dehydration mode is selected, the control unit 190 switches on the motor 130 at a high speed for a designated time, thereby dehydrating moisture remaining in the laundry (m) by centrifugal separation.

[0077] Fig. 6 is a flow chart illustrating a method for controlling a drum-type washing machine in accordance with a second embodiment of the present invention.

[0078] First, after laundry is introduced into the drum 120, and a desired course and mode are selected, the drum-type washing machine is operated. Then, the control unit 190 determines whether or not a wash mode is selected, and in case that it is determined that the wash mode is selected, the control unit 190 switches on the water supply valve 142 and switches on the heater 170 and the circulation pump 156 (S201).

[0079] In the same manner as the first embodiment, wash water (w) supplied from the external hose 141 is introduced into the tub 110, and the wash water (w) supplied into the tub 110 is heated by the heater 170 positioned at the lower part of the tub 110 and fills the filter case 152 and the drain bellows tube 148 through the drain outlet 115 of the tub 110.

[0080] The wash water (w) filling the filter case 152 and the drain bellows tube 148 is pumped by the circulation pump 156, and is sprayed into the drum 120 through the circulation hose 160 and the spray hole 162, thereby rapidly soaking the laundry (m).

[0081] In the same manner as the first embodiment, the control unit 190 controls the water supply valve 142 such that only a small quantity of the wash water is supplied. Hereinafter, the control of the water supply valve in the second embodiment is substantially the same as that of the first embodiment, and a detailed description thereof will thus be omitted because it is considered to be unnecessary (S202 and S203).

[0082] When the water supply valve 142 is switched off, new wash water is no longer supplied into the tub 110, the filter case 152 and the drain bellows tube 148, and the wash water (w) remaining in the filter case 152 and the drain bellows tube 148 is pumped by the circulation pump 156 and is sprayed into the drum 120 so as to soak the laundry (m).

[0083] That is, when the water supply valve 142 is switched off and the circulation pump 156 continuously sprays the wash water into the drum 120, the quantity of the wash water (w) absorbed by the laundry (m) is gradually increased and the quantity of the wash water (w) circulated by the circulation pump 156 is gradually decreased.

[0084] Since the heater 170 heats only the small quantity of the wash water (w) dropped down to the bottom of the tub 110, it is possible to rapidly heat the wash water (w), thereby increasing heating efficiency of the heater 170 and reducing a power consumption rate required to operate the heater 170.

[0085] The control unit 190 switches off the circulation pump 156 and the heater 170 when a second predetermined time (T_2) from the switching-off of the water supply valve 142 elapses or the level (h) of the supplied wash water is less than a second predetermined level (h_2) (S204 and S205) .

[0086] Hereinafter, the switching-off of the circulation pump 156 of the second embodiment is substantially the same as that of the first embodiment, and a detailed description thereof will thus be omitted because it is considered to be unnecessary.

[0087] Thereafter, the control unit 190 re-supplies a quantity of the wash water required to operate the circulation pump 156. When a third predetermined time (T_3) from the switching-off of the circulation pump 56 elapses, the control unit 190 determines whether or not the wash water is re-supplied or not based on the frequency of the switching-on/off of the water supply valve 142, the circulation pump 156 and the heater 170, and the level (h) of the supplied wash water, thereby determining whether or not the switching-on of the water supply valve 142, the circulation pump 156 and the heater 170, the switching-off of the water supply valve 142, and the switching-off of the circulation pump 156 and the heater 170 are repeated (S206 and S207).

[0088] That is, the control unit 190 repeats the switching-on of the water supply valve 142, the circulation pump 156 and the heater 170, the switching-off of the water supply valve 142, and the switching-off of the circulation pump 156 and the heater 170 are repeated, until the frequency of the switching-on/off of the water supply valve 142, the circulation pump 156 and the heater 170 is more than a predetermined number (for example, four times) or the level (h) of the supplied wash water is not less than a third predetermined level (h_3).

[0089] The third predetermined level (h_3) is set to be higher than the first predetermined level (h_1).

[0090] Since the wash water is supplied into the drum-type washing machine, is circulated, and is then re-supplied to the drum-type washing machine, the wash water rapidly and sufficiently soaks the laundry (m) and the laundry (m) is effectively washed by only a small quantity of the wash water (w). Further, since the heater 170 heats only the small quantity of the supplied wash water (w), it is possible to rapidly heat the wash water (w), thereby increasing heating efficiency of the heater 170 and reducing a power consumption rate required to op-

erate the heater 170.

[0091] When the frequency of the switching-on/off of the water supply valve 142 and the circulation pump 156 is more than the predetermined number (for example, four times) or the level (h) of the supplied wash water is not less than the third predetermined level (h_3), the control unit 190 stops the re-supply and heating of the wash water, and switches on the motor 130 to rotate the drum 120 (S208).

[0092] When the motor 130 is switched on, the drum 120 is rotated, and the laundry (m) is lifted up by the lifters 126 and is then dropped, thereby being cleaned by the action of the wash water (w). The wash water (w) heated by the heater 170 has an increased solubility of the detergent, thus promoting the reaction between the detergent and dirt attached to the laundry (m) and rapidly and sanitarily eliminating the dirt from the laundry (m).

[0093] During the rotation of the drum 120, the wash water (w) soaking the laundry (m) fills the tub 110 through the water holes 122 of the drum 120, and is collected in the filter case 152 or the drain bellows tube 148.

[0094] When a fourth predetermined time (T_4) from the switching-on of the motor 130 elapses, the control unit 190 switches on the circulation pump 156 again (S209 and S210).

[0095] Hereinafter, the switching-on of the circulation pump 156 of the second embodiment is substantially the same as that of the first embodiment, and a detailed description thereof will thus be omitted because it is considered to be unnecessary.

[0096] When a fifth predetermined time (T_5) from the switching-on of the circulation pump 156 elapses, the control unit 190 switches off the motor 130 and the circulation pump 156, thereby terminating the wash mode (S211 and S212).

[0097] Thereafter, the control unit 190 switches on the drain pump 154 for a designated time so that the contaminated wash water is discharged to the outside through the drain hose 155, and switches off the drain pump 154 (S213).

[0098] The control unit 190 determines whether or not a rinse mode is selected after the water supply, the water re-supply, the wash and the drain steps are performed, and in case that it is determined that the rinse mode is selected, the control unit 190 repeats at least one cycle of the water supply, the water re-supply, the rinse and the drain steps the same as the above wash mode. Hereinafter, the rinse and dehydration modes of the second embodiment are substantially the same as those of the first embodiment, and detailed descriptions thereof will thus be omitted because they is considered to be unnecessary.

[0099] The present invention is not limited to the above-described embodiments. That is, whether or not the water supply valve 142 is switched off may be determined using only one of the first predetermined time (T_1) and the first predetermined level (h_1), and whether or not the circulation pump 156 and the heater 170 are switched off using only one of the second predetermined time (T_2) and the second predetermined level (h_2). Further, whether or not the wash water is re-supplied may be determined using only one of the predetermined frequency and the third predetermined level (h_3).

[0100] As apparent from the above description, the present invention provides a method for controlling a drum-type washing machine comprising the steps of: (a) switching on a water supply valve and switching on a circulation pump; (b) switching off the water supply valve after the switching-on of the water supply valve; and (c) switching off the circulation pump after the switching-off of the water supply valve, wherein the steps (a) to (c) are sequentially repeated several times, thus allowing a small quantity of the wash water to rapidly and sufficiently soak laundry (m) and the laundry (m) to be effectively washed using a small quantity of the wash water.

[0101] Further, the present invention provides a method for controlling a drum-type washing machine comprising the steps of: (a) switching on a water supply valve and switching on a circulation pump and a heater; (b) switching off the water supply valve after the switching-on of the water supply valve; and (c) switching off the circulation pump and the heater after the switching-off of the water supply valve, wherein the steps (a) to (c) are sequentially repeated several times, thus allowing the laundry (m) to be effectively washed using a small quantity of the wash water and minimizing a power consumption rate required to operate the heater.

[0102] Although the preferred embodiments of the present invention have been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

Claims

1. A method for controlling a drum-type washing machine comprising the steps of:

   (a) switching on a water supply valve(142) to supply wash water into a tub(110), and switching on a circulation pump(156) to circulate the wash water(W) in the tub(110) into a drum (120);

   (b) switching off the water supply valve(142) when a first predetermined time(Ti) from the switching-on of the water supply valve(142) elapses or the level of the supplied wash water is not less than a first predetermined level(hi); and

   (c) switching off the circulation pump(156) when a second predetermined time(T2) from the switching-off of the water supply valve(142) elapses or the level of the supplied wash water

is less than a second predetermined level(h2),

wherein the steps (a) to (c) are sequentially repeated several times.

2. The method as set forth in claim 1,
wherein the step (a) is performed when a third predetermined time(T3) from the switching-off of the circulation pump(156) in the step (c) elapses.

3. The method as set forth in claim 1, further comprising the step of (d) switching on a motor (130) to rotate the drum(120) after at least two sequential repetitions of the steps (a) to (c).

4. The method as set forth in claim 3, further comprising the step of (e) switching on the circulation pump (156) when a third predetermined time (T3) from the switching-on of the motor (130) elapses.

5. The method as set forth in claim 4, further comprising the step of (f) switching off the motor (130) and the circulation pump(156) when a fourth predetermined time (T4) from the step (e) elapses.

6. The method as set forth in claim 5,
wherein the steps (a) to (f) are performed in a wash or rinse mode.

7. A method for controlling a drum-type washing machine comprising the steps of:

(a) switching on a water supply valve(142) to supply wash water(W) into a tub (110), switching on a circulation pump(156) to circulate the wash water(W) in the tub (110) into a drum, and switching on a heater(170) to heat the wash water(W) in the tub(110);
(b) switching off the water supply valve(142) when a first predetermined time(Ti) from the switching-on of the water supply valve(142) elapses or the level of the supplied wash water is not less than a first predetermined level(hi); and
(c) switching off the circulation pump(156) and the heater(170) when a second predetermined time(T2) from the switching-off of the water supply valve(142) elapses or the level of the supplied wash water is less than a second predetermined level (h2),

wherein the steps (a) to (c) are sequentially repeated several times.

8. The method as set forth in claim 7,
wherein the step (a) is performed when a third predetermined time (T3) from the switching-off of the circulation pump(156) in the step (c) elapses.

9. The method as set forth in claim 7, further comprising the step of (d) switching on a motor (130) to rotate the drum(120) after at least two sequential repetitions of the steps (a) to (c).

10. The method as set forth in claim 9, further comprising the step of (e) switching on the circulation pump (156) when a third predetermined time(T3) from the switching-on of the motor(130) elapses.

11. The method as set forth in claim 10, further comprising the step of (f) switching off the motor (130) and the circulation pump(156) when a fourth predetermined time (T4) from the step (e) elapses.

12. The method as set forth in claim 11, ,
wherein the steps (a) to (f) are performed in a wash or rinse mode.

FIG. 1 (Prior Art)

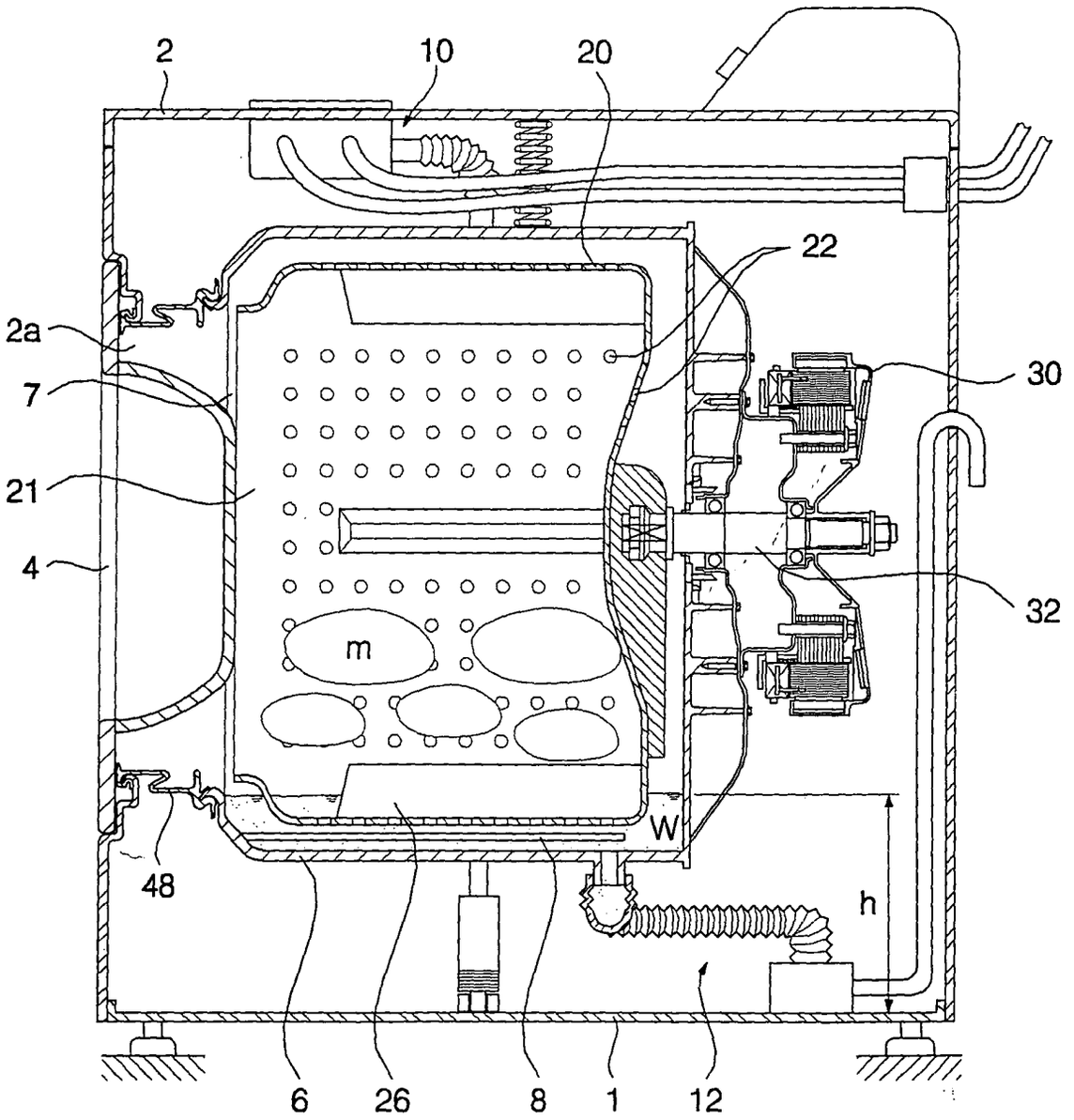


FIG. 2 (Prior Art)

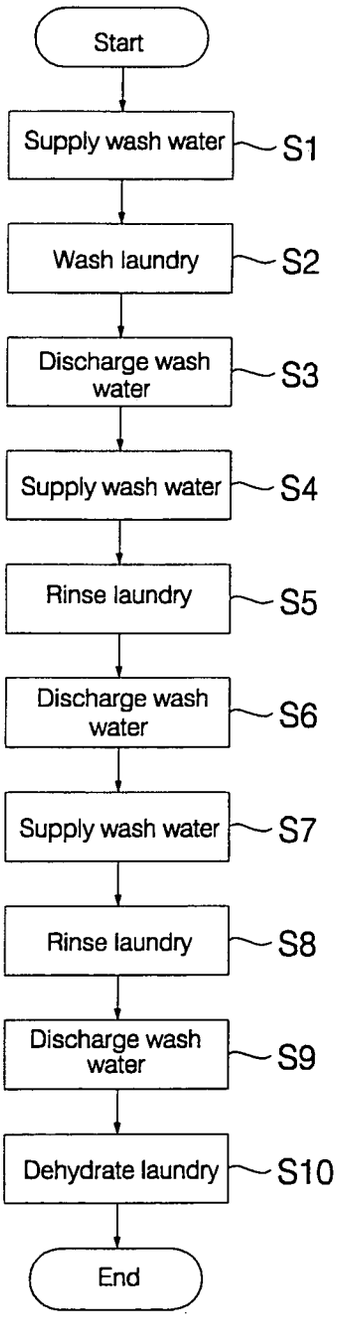


FIG. 3

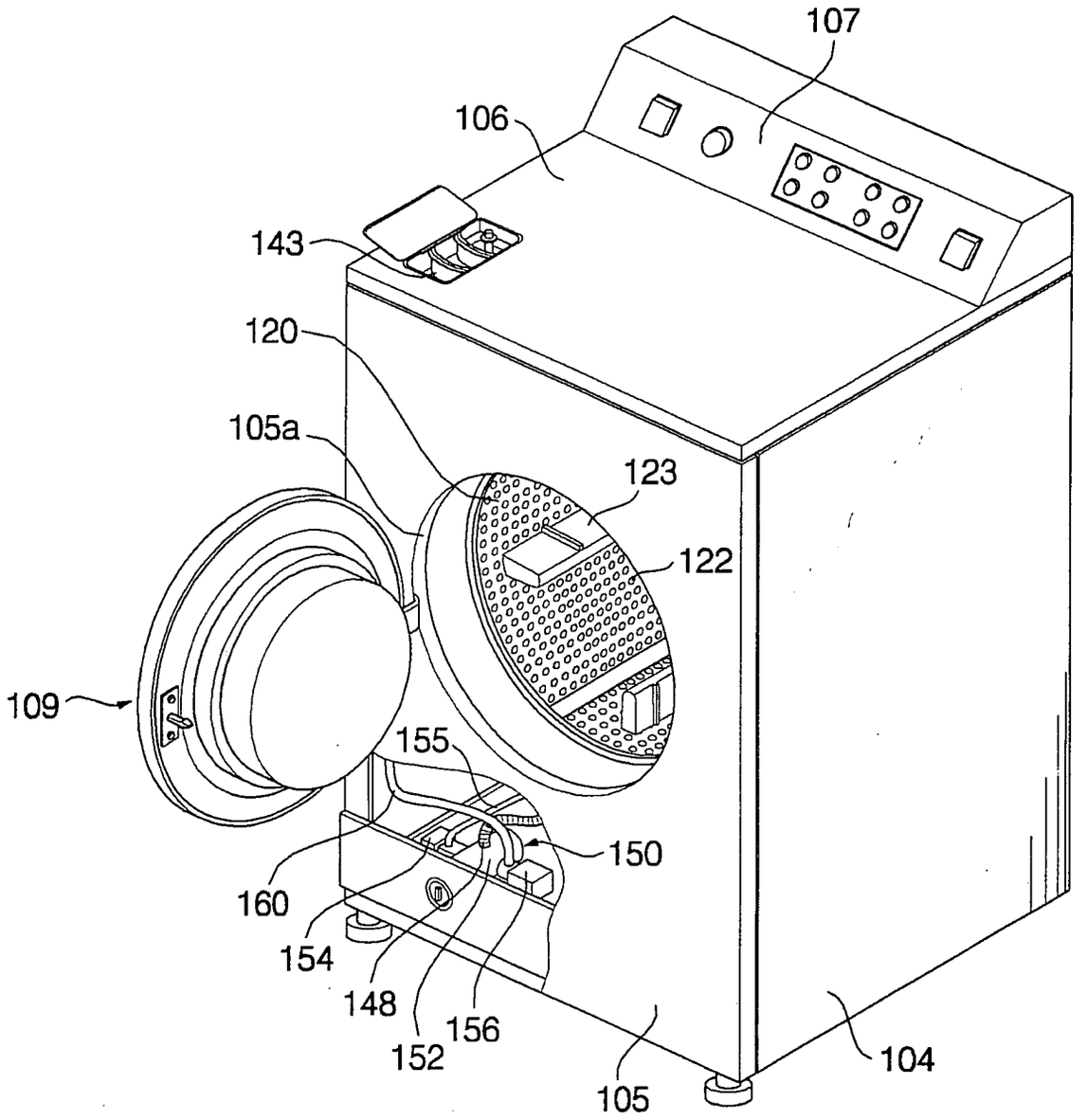

107
106
143
120
105a
123
122
109
155
150
160
154
148
156
152
105
104

FIG. 4

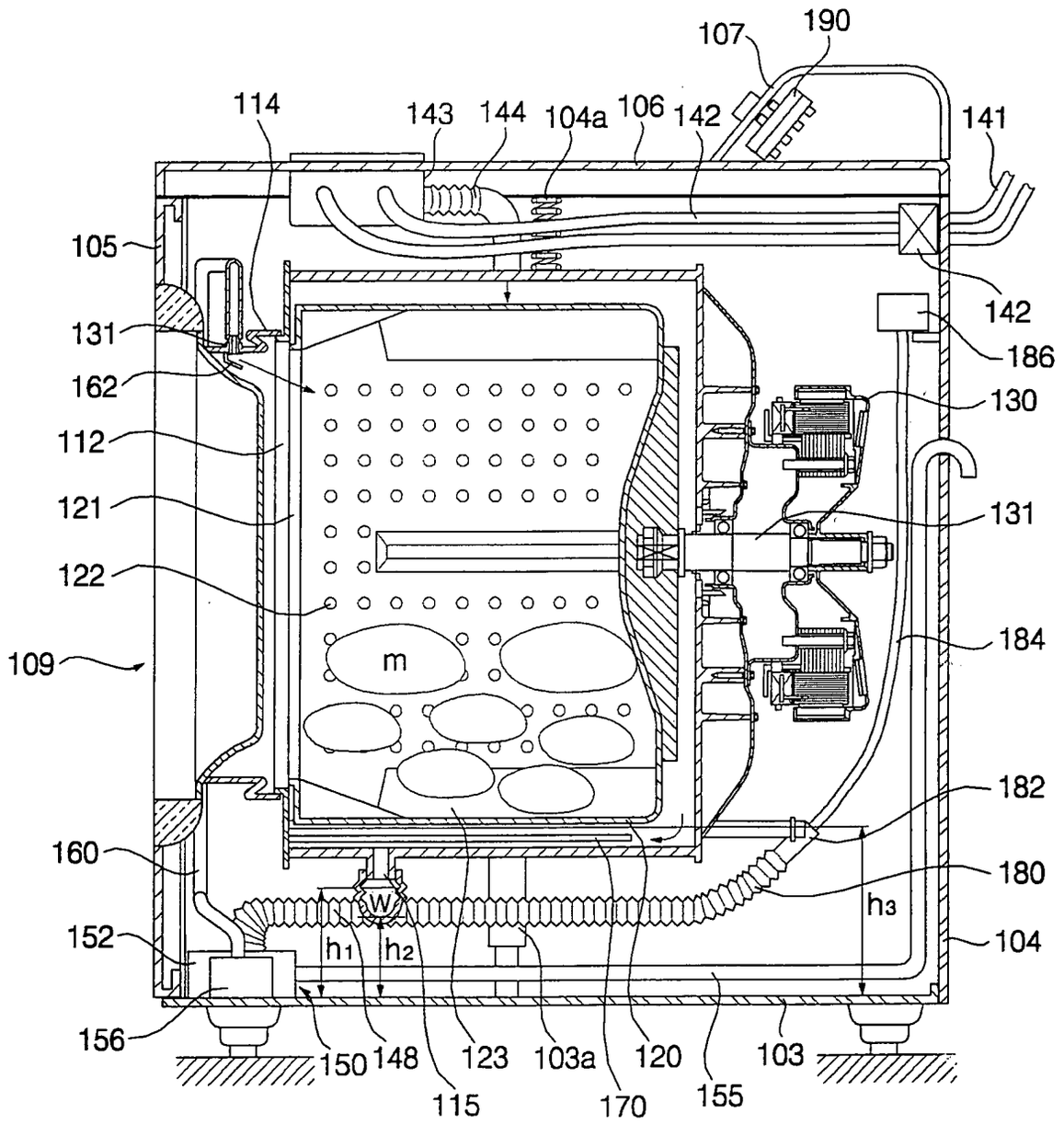

107
190
114
143
144
104a
106
142
141
105
131
162
112
121
122
109
m
160
152
156
150
148
123
115
103a
170
120
155
103
142
186
130
131
184
182
180
h3
104
W
h1
h2

FIG. 5

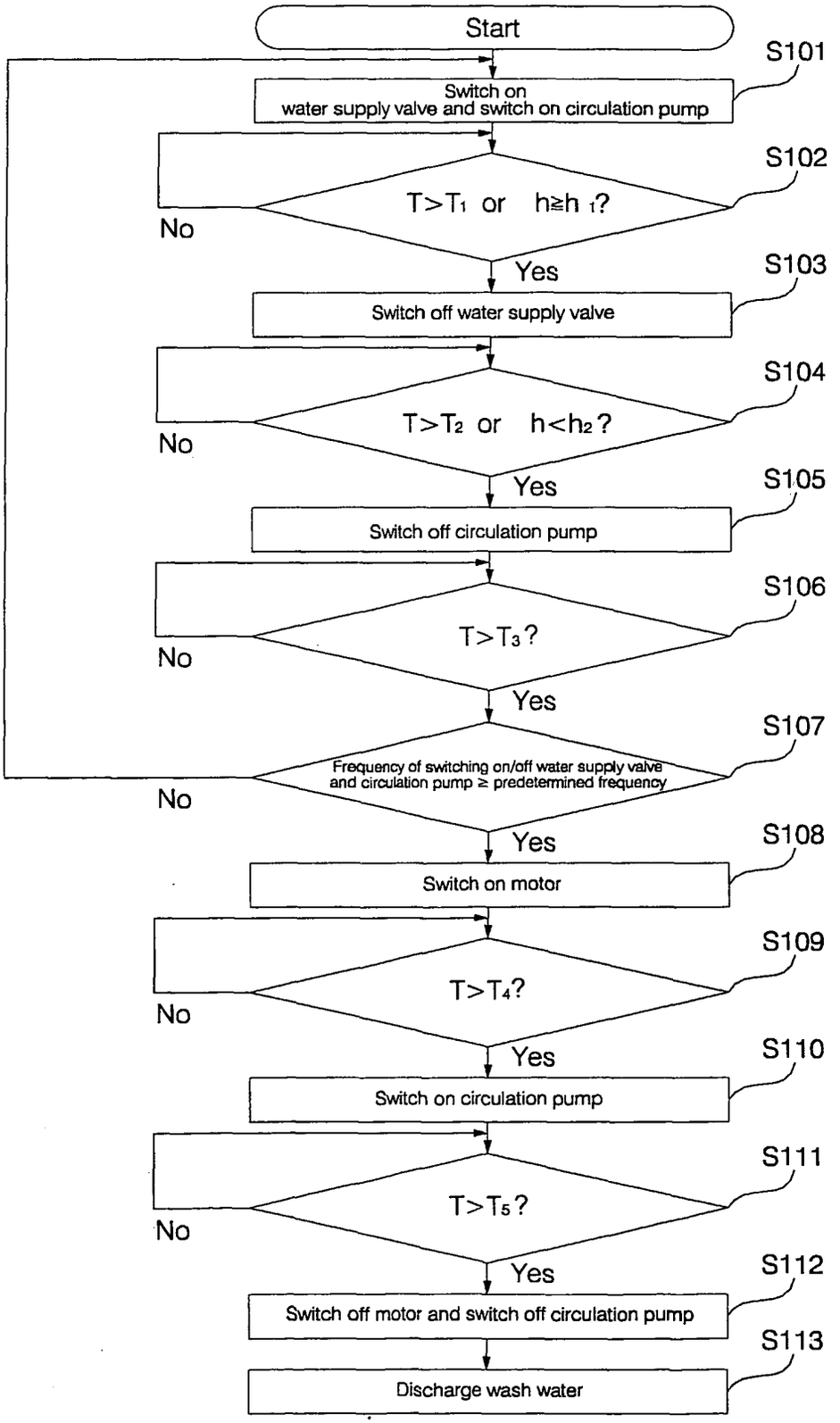
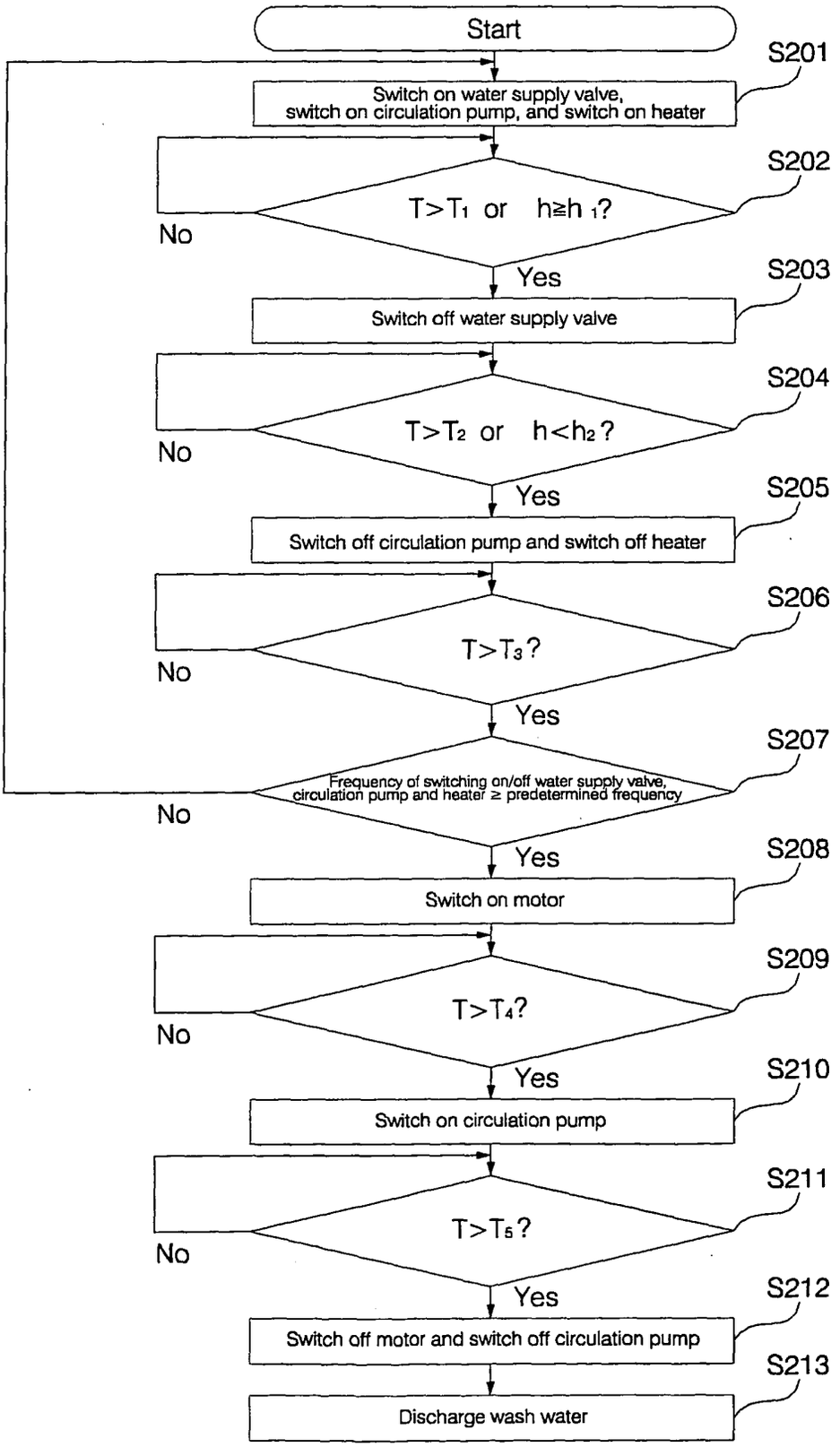

Start
S101
Switch on
water supply valve and switch on circulation pump
S102
T>T1 or h≧h1?
No
Yes
S103
Switch off water supply valve
S104
T>T2 or h<h2?
No
Yes
S105
Switch off circulation pump
S106
T>T3?
No
Yes
S107
Frequency of switching on/off water supply valve and circulation pump ≥ predetermined frequency
No
Yes
S108
Switch on motor
S109
T>T4?
No
Yes
S110
Switch on circulation pump
S111
T>T5?
No
Yes
S112
Switch off motor and switch off circulation pump
S113
Discharge wash water

FIG. 6


Start
S201
Switch on water supply valve, switch on circulation pump, and switch on heater
S202
T>T1 or h≥h1?
No
Yes
S203
Switch off water supply valve
S204
T>T2 or h<h2?
No
Yes
S205
Switch off circulation pump and switch off heater
S206
T>T3?
No
Yes
S207
Frequency of switching on/off water supply valve, circulation pump and heater ≥ predetermined frequency
No
Yes
S208
Switch on motor
S209
T>T4?
No
Yes
S210
Switch on circulation pump
S211
T>T5?
No
Yes
S212
Switch off motor and switch off circulation pump
S213
Discharge wash water