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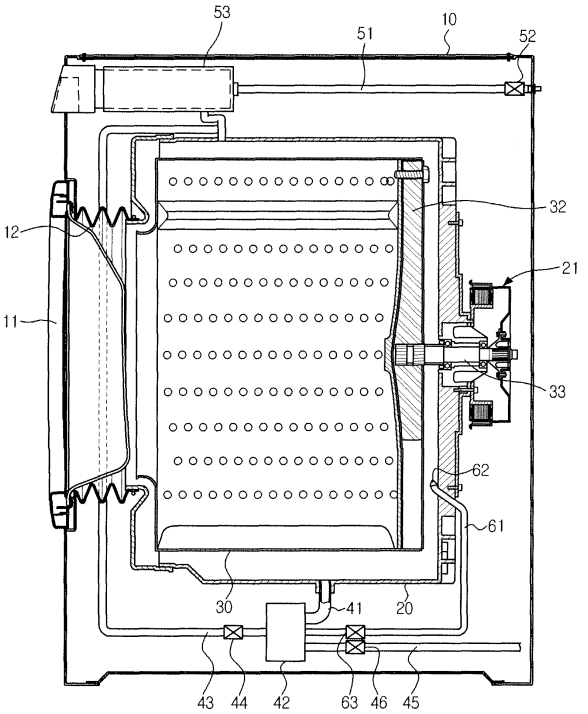
(54) Washing machine and method of washing drum

(57) Disclosed are a washing machine and a method of controlling the same. The washing machine includes a drum (30); a washing device (52) to spray water to perform washing of an outer surface of the drum (30); and a control unit controlling the washing of the outer surface of the drum such that the washing of the outer surface of the drum is performed during a washing or rinsing cycle. The washing machine does not need to be disassembled to wash the drum and tub and thus is easily washed and has the ribs extended in a same direction of an extension direction of the flange shaft to increase the strength of the flange shaft and thus forms channels of water flowing on the flange shaft and reduces the remaining of contaminants on the flange shaft in the washing or rinsing cycle to enhance the washability of the flange shaft.

FIG. 1



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Description

BACKGROUND

[0001]

1. Field

The present invention relates to a washing machine and a method of controlling the same, and more particularly to a washing machine, which increases the washability of a drum when the drum is washed out, and a method of controlling the washing machine.

2. Description of the Related Art

In general, drum washing machines are apparatuses that wash laundry put into a drum installed in a horizontal direction by rotating the drum such that the laundry in the drum is dropped. A drum washing machine includes a main body, a tub installed in the main body, a drum rotatably installed in the tub, a motor to drive the drum, an opening formed through the front surface of the main body such that laundry can be put into the drum therethrough, and a door to open and close the opening.

[0002] The above drum washing machine rotates the drum according to a control signal outputted from a control unit, after laundry and a detergent have been put into the drum, to automatically carry out a washing cycle, a rinsing cycle, and a dehydrating cycle for a designated time, thus washing the laundry.

[0003] In the washing and rinsing cycles of such a drum washing machine, contaminants come from the laundry, residues of the detergent and fabric rinse, and their mixture remain on the inner and outer walls of the drum and the inner wall of the tub and contaminate the drum and the tub. The contamination of the drum and the tub causes re-contamination of laundry, which will be put into the drum later, thus lowering the reliability of the washing machine in terms of sanitation. Further, bacteria being parasitic on the contaminants due to the contamination of the drum and the tub generate a bad smell in the washing machine.

[0004] Thereby, the drum washing machine employs a method, in which a tank (i.e., the drum and the tub) washing detergent is put into the drum to periodically perform a tank washing cycle, or a method in which a contamination level of the drum and the tub is detected and thus a tank washing cycle is performed when the detected contamination level is more than a designated level, that removes various contaminants remaining on the inner and outer walls of the drum and the inner wall of the tub, thus preventing the re-contamination of the drum and the tub.

[0005] However, since the contaminants are separated from the tub and the drum only when the submerged state of the drum in water must be maintained for a long time, the tank washing cycle requires a large amount of water and a long time.

[0006] Although the tank washing cycle is performed, water cannot sufficiently reach the circumference of a flange shaft connected between the rear surface of the drum and a motor from the viewpoint of the position and structure of the flange shaft, and thus it is difficult to wash off contaminants, such as residue of the detergent and strands of the laundry, and mold from the flange shaft.

[0007] Therefore, the contamination level of the rear surface of the drum is continuously increased, and the increased contamination of the rear surface of the drum provides an environment in which microorganisms can propagate, and causes a bad smell due to the contamination and secondary contamination due to the washing of laundry.

SUMMARY

[0008] Therefore, one aspect is to provide a washing machine, which prevents the generation of a microorganism propagating environment due to the contamination of a drum, the generation of a bad smell due to the contamination, and the generation of secondary contamination due to the washing of laundry, and a method of controlling the washing machine.

[0009] Another aspect is to provide a washing machine, which washes a tub and a drum using water used in a washing or rinsing cycle, and washes the tub and the drum simultaneously with the washing, rinsing, or dehydrating cycle, and thus reduces the amount of water, power, and time required to wash the tub and the drum, and a method of controlling the washing machine.

[0010] Additional aspects and/or advantages 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.

[0011] The foregoing and/or other aspects are achieved by providing a washing machine, including a drum configured to receive articles to be washed; a washing device configured to spray water to perform the washing of an outer surface of the drum; and a control unit controlling the washing of the outer surface of the drum such that the washing of the outer surface of the drum is performed during a washing or rinsing cycle.

[0012] The washing machine may further include a tub provided at an outside of the drum, and the washing device may be connected to the tub and may spray the water to a rear surface of the drum.

[0013] The washing device may include a nozzle to adjust a spraying direction of the water; and the nozzle may face a center of the rear surface of the drum.

[0014] The washing machine may further include a circulation device to circulate water in the tub, and the washing device may be connected to the circulation device and spray a portion of the circulated water.

[0015] The control unit may control the washing of the drum such that the washing of the drum is performed during a dehydrating cycle.

[0016] The washing machine may further include a water level sensing unit sensing a level of water in the tub, and the control unit may perform a draining cycle until the level of water in the tub is sensed to have reached a designated level and stop the draining cycle and perform the dehydrating cycle when the level of water in the tub is sensed to have reached the designated level.

[0017] The washing machine may further include a water supply device to supply water, and the control unit may control the water supply device such that a designated level of water is supplied to the tub after a draining cycle has been completed.

[0018] The washing machine may further include a water supply device to supply water, and the washing device may be connected to the water supply device and spray the supplied water.

[0019] The washing machine may further include a flange shaft connected to a rear surface of the drum; and a plurality of ribs protruded from the flange shaft and continuously extended from a center of the flange shaft in a radial direction of the drum to form channels on the flange shaft.

[0020] The washing machine may further include a tub receiving water; the drum installed in the tub; and the washing device installed between the tub and the drum to perform washing of the drum.

[0021] The foregoing and/or other aspects are achieved by providing a method of controlling a washing machine having a tub to contain water and a drum provided in the tub, including performing a washing or rinsing cycle by circulating the water in the tub; and performing washing of an outer surface of the drum using a portion of the circulated water during the washing or rinsing cycle.

[0022] The washing of the drum may be performed by spraying the portion of the circulated water to a rear surface of the drum.

[0023] The method may further include performing a draining cycle to drain the water in the tub; and performing a dehydrating cycle when the level of the water in the tub is sensed to have reached a designated level, the washing of the drum being performed during the dehydrating cycle.

[0024] The method may further include draining the water in the tub; additionally supplying water to the tub when the draining has been completed; and performing a dehydrating cycle when the level of the water in the tub is sensed to have reached a designated level, the washing of the drum being performed during the dehydrating cycle.

[0025] The method may further include performing washing of an outer surface of the drum during the washing, rinsing, or dehydrating cycle, the washing of the drum being performed by washing the outer surface of the drum with water supplied from the water supply device using a washing device connected to the water supply device.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026] These and/or other aspects and advantages will become apparent and more readily appreciated from the following description of the embodiments, taken in conjunction with the accompanying drawings in which:

FIG. 1 is a schematic view of a drum washing machine in accordance with a first embodiment;

FIGS. 2A and 2B are detailed views of respective examples of a drum of a drum washing machine in accordance with the present embodiments;

FIG. 3 is a schematic view of a drum washing machine in accordance with a second embodiment;

FIG. 4 is a block diagram of a control system of the drum washing machine in accordance with the first embodiment;

FIG. 5 is a block diagram of a control system of the drum washing machine in accordance with the second embodiment;

FIG. 6 is a flow chart illustrating a method of controlling the drum washing machine in accordance with the first embodiment; and

FIG. 7 is a flow chart illustrating a method of controlling the drum washing machine in accordance with the second embodiment.

DETAILED DESCRIPTION OF EMBODIMENTS

[0027] Reference will now be made in detail to the embodiments, examples of which are illustrated in the accompanying drawings, where like reference numerals refer to like elements throughout. The embodiments are described below to explain the present invention by referring to the annexed drawings.

[0028] FIG. 1 is a schematic view of a drum washing machine in accordance with a first embodiment. As shown in FIG. 1, the drum washing machine in this embodiment includes a main body 10, a door 11, a tub 20, a motor 21, a drum 30, a channel pipe 41, a circulation pump 42, a circulation pipe 43, a circulation valve 44, a first washing pipe 61, a first nozzle 62, a first washing valve 63, a drain pipe 45, a water supply pipe 51, and a water supply valve 52.

[0029] The main body 10 forms an external appearance of the drum washing machine, and is provided with an opening through which laundry can be put into or taken out of the drum washing machine. The door 11 to open and close the opening is installed at a portion of the main body 10 provided with the opening, and a diaphragm 12 to tightly close a gap between the door 11 and the opening is installed on the inner circumferential surface of the opening.

[0030] The tub 20 is fixedly installed in the main body 10 and receives water supplied from a water supply device. The drum 30, having a shape corresponding to a shape of the tub 20, is installed in the tub 20, and the motor 21 to rotate the drum 30 in the clockwise or coun-

terclockwise direction is installed at an outside of the tub 20. A hole (not shown) is formed through a rear surface of the tub 20, and the first nozzle 62 of a washing device is inserted into the hole such that water sprayed through the first nozzle 62 can reach the rear surface of the drum 30.

[0031] The drum 30 is rotatably installed in the tub 20. One end of the drum 30 is opened, and the opened end of the drum 30 is located toward the opening of the main body 10. Here, when the door 11 installed at the opening of the main body 10 is opened, laundry is put into the drum 30 through the opened end of the drum 30. Now, the drum 30 will be described in detail with reference to FIGS. 2A and 2B.

[0032] As shown in FIG. 2A, a plurality of holes 31 is formed through the circumferential surface of the drum 30, and washing water (i.e., water) flows into the drum 30 through the plurality of holes 31. A flange shaft 32 and a rotary shaft 33 are provided on the rear surface of the drum 30. One end of the rotary shaft 33 is connected to the center of the flange shaft 32, and the other end of the rotary shaft 33 is extended to the outside of the tub 20 and connected to the motor 21 at the outside of the tub 20.

[0033] The flange shaft 32 includes a plurality of blades (i.e., radial blades) extended from the center of the flange shaft 32, to which the rotary shaft 33 is connected, in a radial direction of the drum 30. The respective tips of the blades are fixed to the drum 30 through fixtures, such as bolts, for example, but is not limited thereto and may be any type of fixing device that fixes the blades to the drum.

[0034] Therefore, when the rotary shaft 33 is rotated by the rotation of the motor 21, the flange shaft 32 connected to the rotary shaft 33 is rotated, and then the drum 30 connected to the flange shaft 32 is rotated, thus washing, rinsing, and dehydrating the laundry in the drum 30.

[0035] Alternately, as shown in FIG. 2B, a plurality of holes 31 is formed through the circumferential surface of the drum 30, and washing water (i.e., water) flows into the drum 30 through the plurality of holes 31. A flange shaft 32 and a rotary shaft 33 are provided on the rear surface of the drum 30. One end of the rotary shaft 33 is connected to the center of the flange shaft 32, and the other end of the rotary shaft 33 is extended to the outside of the tub 20 and connected to the motor 21 at the outside of the tub 20.

[0036] Here, the flange shaft 32 serves to uniformly disperse the rotary force of the rotary shaft 33, and includes a plurality of radial blades 32a, 32b, and 32c extended from the center of the flange shaft 32, to which the rotary shaft 33 is connected, in a radial direction of the drum 30. The respective tips of the radial blades 32a, 32b, and 32c are fixed to the drum 30 through fixtures, such as bolts, for example. Therefore, when the rotary shaft 33 is rotated by the rotation of the motor 21, the flange shaft 32 connected to the rotary shaft 33 is rotated, and then the drum 30 connected to the flange shaft 32 is rotated, thus washing, rinsing, and dehydrating the laundry in the drum 30.

[0037] Ribs 34, which increase the strength of the flange shaft 32, are respectively provided on the radial blades 32a, 32b, and 32c. A plurality of the ribs 34 may be formed on each of the radial blades 32a, 32b, and 32c.

[0038] The ribs 34 are protruded from inner surfaces of the respective radial blades 32a, 32b, and 32c, and are extended from the center of the flange shaft 32 in the radial direction of the drum 30, which is the same as the extension direction of the respective blades 32a, 32b, and 32c. Channels 35 are formed on the flange shaft 32 by the ribs 34, and water flowing in the flange shaft 32 in the washing and rinsing cycles flows along the channels 35 formed by the ribs 34.

[0039] The ribs 34 formed in the same direction as the respective blades 32a, 32b, and 32c of the flange shaft 32 increase the strength of the flange shaft 32 and form the channels 35 in which water flows in the flange shaft 32 to reduce the remaining contaminants on the flange shaft 32 and to easily remove the contaminants remaining on the flange shaft 32 to enhance the washability of the flange shaft 32. Here, the water flowing in the flange shaft 32 is water sprayed onto the rear surface of the drum 30 through a washing device 60 (shown in FIG. 4).

[0040] Further, the contaminants remaining on the flange shaft 32 are minimized, thus preventing the generation of a bad smell due to bacteria and mold. Moreover, the washing of the rear surface of the drum 30 is easily performed under the condition that the washing machine is not disassembled, and thus the washing machine maintains sanitary conditions.

[0041] A circulation device 40 (shown in FIG. 4) supplies the water in the tub 20 to the outside of the tub 20, and then re-supplies the water to the insides of the tub 20 and the drum 30. That is, the circulation device 40 circulates water to the insides of the tub 20 and the drum 30, and thus allows the laundry to be uniformly soaked and be washed and rinsed with a small amount of water.

[0042] More specifically, as shown in FIG. 4, the circulation device 40 includes a circulation pump 42 to pump water discharged through the channel pipe 41 formed under the tub 20, the circulation pipe 43 to inhale the water discharged downwardly from the tub 20 and discharge the inhaled water again to supply the water to the insides of the tub 20 and the drum 30, and the circulation valve 44 to shut out the water supplied to the circulation pipe 43. The circulation pump 42 serves to perform a pumping action such that the water supplied to the inside of the circulation pump 42 is discharged again to the outside of the circulation pump 42, and the water discharged from the circulation pump 42 is raised along the circulation pipe 43 and is supplied again to the side surface of the tub 20.

[0043] Here, the circulation pump 42 may simultaneously serve as a drain pump to drain the water after the washing or rinsing cycle has been completed. That is, in case that the circulation pump 42 simultaneously serves as a drain pump, the circulation pump 42 pumps the water contained in the tub 20, and then opens a drain valve 46

connected to the circulation pump 42, thus discharging the pumped water to the outside of the main body 10 through the drain pipe 45. On the other hand, in case that the circulation pump 42 does not serve as a drain pump, a separate drain pump, which drains water after the washing or rinsing cycle has been completed, is further provided.

[0044] The circulation device 40 operates the circulation pump 42 during the washing or rinsing cycle such that the pumped water can be sprayed to the rear surface of the drum 30 and the flange shaft 32 through the first washing pipe 61, and thus removes contaminants remaining on the rear surface of the drum 30 and the flange shaft 32 during the washing or rinsing cycle.

[0045] Further, the circulation device 40 pumps the water in the tub 20 simultaneously with the dehydrating cycle such that the pumped water can be supplied to the first washing pipe 61, and thus removes residue of the detergent, mold, and foreign substances remaining on the rear surface of the drum 30 and the flange shaft 32 through the first nozzle 62 installed on the rear surface of the drum 30.

[0046] A water supply device 50 (shown in FIG. 4) supplies water to the insides of the tub 20 and the drum 30, and includes the water supply pipe 51 and the water supply valve 52. The water supply valve 52 of the water supply device 50 is connected to an external water pipe (not shown), and is opened in the washing and rinsing cycles to supply water to the insides of the tub 20 and the drum 30. The water supply pipe 51 of the water supply device 50 is connected to a detergent box 53, and allows detergent to be supplied to the inside of the drum 30 through the detergent box 53 when the water is supplied to the drum 30 through the water supply pipe 51.

[0047] Further, the water supply device 50 supplies water to a designated level in the tub 20 after the draining cycle has been completed, and the supplied water is sprayed to the rear surface of the tub 20 through the first washing pipe 61 according to the operation of the circulation pump 42.

[0048] The washing device 60 is installed in the hole formed through the rear surface of the tub 20, and sprays water to the rear surface of the drum 30, thus removing the residue of the detergent, the mold, and the foreign substances remaining on the rear surface of the drum 30.

[0049] The washing device 60 includes the first washing pipe 61 provided with one end connected to the circulation pump 42 and the other end facing the rear surface of the tub 20, the first nozzle 62 provided with one end connected to the other end of the first washing pipe 61 and the other end of the first nozzle 62 inserted into the rear surface of the tub 20 to spray water toward the flange shaft 32, and the first washing valve 63 provided in the first washing pipe 61 to shut out the water supplied to the first nozzle 62.

[0050] The first nozzle 62 may be installed at a position that does not interfere with a rotating body including the motor 21 on the rear surface of the tub 20, and the spray angle or spray hole of the first nozzle 62 is set such that the first nozzle 62 can spray water to a wide region from an outermost portion of the flange shaft 32 to the center of the rotary shaft 33.

[0051] Here, at least one washing device 60, including the first washing pipe 61, the first nozzle 62, and the first washing valve 63 is provided.

[0052] If two washing devices 60 are provided, it is possible to install the two washing devices 60 at upper and lower regions of the tub 20 adjacent to the rear surface of the drum 30, instead of the rear surface of the tub 20.

[0053] Further, if at least two washing devices 60 are provided, it is possible to spray water to the rear surface of the tub 20 under the condition that the rotation of the drum 30 is stopped.

[0054] FIG. 3 is a schematic view of a drum washing machine in accordance with a second embodiment. The drum washing machine of the second embodiment differs from the drum washing machine of the first embodiment, as shown in FIG. 1, in that the drum washing machine of the second embodiment includes a washing device 60 connected to the water supply pipe 51 of the water supply device 50, instead of the washing device 60 connected to the circulation pump 42, and thus a detailed description of other elements 10, 20, and 30 of the drum washing machine of the second embodiment, which are the same as those of the drum washing machine of the first embodiment, will be omitted.

[0055] The circulation device 40 operates the circulation pump 42 and opens the circulation valve 44 when the washing or rinsing cycle is performed, thus circulating the water in the tub 20 through the circulation pipe 43.

[0056] The water supply device 50 supplies water to the inside of the tub 20 in the washing or rinsing cycle and allows the supplied water to be sprayed to the rear surface of the drum 30 and the flange shaft 32 through a second washing pipe 64 connected to the water supply pipe 51 during the washing or rinsing cycle, thus removing foreign substances remaining on the rear surface of the drum 30 and the flange shaft 32.

[0057] The water supply device 50 supplies water to the water supply pipe 51 and opens a second washing valve 66 connected to the water supply pipe 51 simultaneously with the dehydrating cycle such that the supplied water is sprayed to the rear surface of the drum 30 and the flange shaft 32 through the second washing pipe 64, thus removing mold, residue of the detergent, foreign substances remaining on the rear surface of the drum 30 and the flange shaft 32, etc.

[0058] The washing device 60 includes the second washing pipe 64 provided with one end connected to the water supply pipe 51 of the water supply device 50 and the other end facing the rear surface of the tub 20, a second nozzle 65 provided with one end connected to the other end of the second washing pipe 64 and the other end inserted into the hole formed through the rear surface of the tub 20, and the second washing valve 66

to shut out the water supplied from the second washing pipe 64 to the second nozzle 65.

[0059] Alternatively, the second washing pipe 64 may be connected directly to the water supply valve 52 without using the second washing valve 66 such that the water supplied to the second washing pipe 64 and the second nozzle 65 can be shut out by the operation of the water supply valve 52.

[0060] The second washing pipe 64 and the second nozzle 65 are installed such that they cannot interfere with a rotating body including the motor 21 on the rear surface of the tub 20, and the spray angle or the spray hole of the second nozzle 65 is set such that the second nozzle 65 can spray water to a wide region from the outermost portion of the flange shaft 32 to the center of the rotary shaft 33.

[0061] FIG. 4 is a block diagram of a control system of the drum washing machine in accordance with the first embodiment. The control system includes the circulation device 40, the water supply device 50, the washing device 60, a control unit 70, and a water level sensing unit 80. Now, the control system will be described with reference to FIG. 1.

[0062] The circulation device 40 operates the circulation pump 42 and opens the circulation valve 44 during the washing or rinsing cycle, and thus circulates the water pumped by the circulation pump 42 to the inside of the tub 20 through the circulation pipe 43. Further, the circulation device 40 operates the circulation pump 42 when the drum 30 is rotated, and thus sprays the water pumped by the circulation pump 42 to the rear surface of the tub 20 through the first washing pipe 61.

[0063] The circulation device 40 pumps the water in the tub 20 simultaneously with the dehydrating cycle, supplies the pumped water to the first washing pipe 61, and sprays the water through the first nozzle 62 installed on the rear surface of the tub 20.

[0064] Here, the water sprayed to the rear surface of the tub 20 during the dehydrating cycle is remaining water during the dehydrating cycle or additionally supplied water after the dehydrating cycle.

[0065] The water supply device 50 supplies water, to be used to wash and rinse laundry in the washing and rinsing cycles, to the tub 20.

[0066] The water supply device 50 supplies a designated level of water, to be used to wash the rear surface of the drum 30 after the dehydrating cycle has been completed, to the tub 20.

[0067] The washing device 60 sprays the water pumped by the circulation pump 42 to the rear surface of the drum 30 and the flange shaft 32 according to the opening of the first washing valve 63, and thus removes residue of the detergent, mold, and foreign substances remaining on the rear surface of the drum 30 and the flange shaft 32.

[0068] The control unit 70 controls the operation of the water supply device 50 in the washing or rinsing cycle, and thus allows water to be used in the washing or rinsing cycle to be supplied to the inside of the tub 20.

[0069] The control unit 70 controls the operations of the circulation pump 42 and the circulation valve 44 during the washing or rinsing cycle to circulate the water in the tub 20 through the circulation pipe 43, and controls the operations of the circulation pump 42 and the first washing valve 63 when the drum 30 is rotated during the washing or rinsing cycle to spray water to the rear surface of the drum 30 through the first washing pipe 61.

[0070] The control unit 70 controls the operations of the circulation pump 42 and the first washing valve 63 during the dehydrating cycle to pump the water stored in the tub 20 and spray the pumped water to the rear surface of the tub 20 through the first washing pipe 61.

[0071] The control unit 70 controls the drain valve 46 after the washing or rinsing cycle has been completed to drain the water used in the washing or rinsing cycle.

[0072] The control unit 70 controls the water level sensing unit 80 to sense the level of the water in the tub 20.

[0073] That is, the control unit 70 controls the water level sensing unit 80 to sense the level of the remaining water in the tub 20 during the draining cycle or to sense the level of water additionally supplied to the tub 20 after the draining cycle has been completed.

[0074] The control unit 70 receives the level of the remaining water during the draining cycle or the level of water supplied from the water supply device 50 from the water level sensing unit 80, and compares the received level of the water in the tub 20 with a predetermined level.

[0075] When it is determined that the level of the water in the tub 20 reaches the predetermined level, the control unit 70 performs the dehydrating cycle. The water level sensing unit 80 senses the level of the water in the tub 20 in the dehydrating cycle, and then transmits the sensed level of the water to the control unit 70.

[0076] FIG. 5 is a block diagram of a control system of the drum washing machine in accordance with the second embodiment. The control system includes the circulation device 40, the water supply device 50, the washing device 60, and a control unit 70. Now, the control system will be described with reference to FIG. 3.

[0077] The circulation device 40 operates the circulation pump 42 and opens the circulation valve 44 during the washing or rinsing cycle, and thus circulates the water in the tub 20 through the circulation pipe 43.

[0078] The water supply device 50 supplies water to the inside of the tub 20 in the washing or rinsing cycle, and supplies water to the second washing pipe 64 connected to the water supply pipe 51 during the washing or rinsing cycle.

[0079] The water supply device 50 supplies water to the second washing pipe 64 connected to the water supply pipe 51 simultaneously with the dehydrating cycle, and thus sprays the water to the rear surface of the drum 30 and the flange shaft 32.

[0080] The control unit 70 controls the operations of the circulation pump 42 and the circulation valve 44 of

the circulation device 40 during the respective washing or rinsing cycle, and thus circulates the water in the tub 20 through the circulation pipe 43.

[0081] The control unit 70 controls the operation of the second washing valve 66 connected to the water supply pipe 51 when the drum 30 is rotated during the respective washing or rinsing cycle, and thus sprays water to the rear surface of the drum 30 through the second washing pipe 64.

[0082] The control unit 70 controls the operation of the second washing valve 66 connected to the water supply pipe 51 during the dehydrating cycle, and thus sprays the water supplied from the water supply pipe 51 to the rear surface of the drum 30 through the second washing pipe 64.

[0083] The control unit 70 controls the operation of the drain valve 46 after the washing or rinsing cycle, and thus drains the water used in the washing or rinsing cycle.

[0084] FIG. 6 is a flow chart illustrating a method of controlling the drum washing machine in accordance with the first embodiment. The method will be described with reference to FIGS. 1, 2A, 2B, and 4.

[0085] In the washing or rinsing cycle, water is supplied to the inside of the tub 20 through the water supply pipe 51 of the water supply device 50, and the washing or rinsing cycle is started using the supplied water.

[0086] During the washing or rinsing cycle, the circulation pump 42 is operated to pump the water in the tub 20, and the circulation valve 44 is opened to supply the pumped water again to the inside of the tub 20 through the channel pipe 41 and the circulation pipe 43. Then, the circulation pump 42 is stopped, and the circulation valve 44 is closed.

[0087] Thereafter, the drum 30 is rotated and the washing or rinsing cycle of laundry in the drum 30 is performed using the water circulated by the circulation pump 42 (operation 101).

[0088] At this time, the circulation pump 42 and the first washing valve 63 are operated to supply the water in the tub 20 pumped by the circulation pump 42 to the nozzle 62 installed on the rear surface of the tub 20 through the channel pipe 41 and the first washing pipe 61, thus washing the rear surface of the drum 30 while soaking residue of the detergent and foreign substances remaining on the rear surface of the drum 30 (operation 102).

[0089] The operation of the circulation pump 42 to remove the foreign substances, etc. on the rear surface of the drum 30 may be periodically carried out after the operation of the circulation pump 42 to wash or rinse the laundry has been carried out at least one time.

[0090] For example, the operation of the circulation pump 42 to wash or rinse the laundry is repeated three times, and then the operation of the circulation pump 42 to remove the foreign substances, etc. on the rear surface of the drum 30 is carried out one time.

[0091] Further, the washing of the rear surface of the drum 30 may be performed for each of the washing cycle and plural rinsing cycles or for at least one cycle of the washing cycle, plural rinsing cycles, or dehydrating cycle, or be periodically performed according to the number of used times of the washing machine by a user.

[0092] Through the above process, the laundry in the drum 30 is washed or rinsed and the rear surface of the drum 30 is washed while the washing or rinsing of the laundry is performed, and thus residue of the detergent, mold, contaminants remaining on the rear surface of the drum 30 and the flange shaft 32 can be immediately removed.

[0093] Thereafter, when the washing or rinsing cycle has been completed, the draining cycle is performed (operation 103). When the draining cycle has been completed, the dehydrating cycle to dehydrate the laundry is performed and simultaneously, the circulation pump 42 is operated to pump the water in the tub 20 and the pumped water is supplied to the first washing pipe 61 and the first nozzle 62 to wash the rear surface of the drum 30 and the flange shaft 32 (operation 107).

[0094] Here, since the circulation pump 42 is operated under the condition that water remains in the tub 20, a designated level of water remains in the tub 20 during the draining cycle and then the draining cycle is stopped, or water is additionally supplied to the tub 20 after the draining cycle has been completed.

[0095] More specifically, the water level sensor 80 senses the level of the water in the tub 20 from this point of time when the draining cycle is started, and the draining cycle is stopped when the sensed level reaches a predetermined level.

[0096] Alternately, when the draining cycle has been completed, water is supplied from the water supply device 50 to the tub 20 (operation 104). Then, the level of the supplied water is sensed and is compared with the predetermined level (operation 105). When the sensed water reaches the predetermined level, the supply of water is stopped (operation 106). If the sensed water does not reach the predetermined level, water is continuously supplied until the water level is sensed to reach the designated level.

[0097] Then, the water is sprayed to the drum 30, which is rotated at a dehydration speed. Since collision power generated when the rotary power of the drum 30 and the jet force of the water collide with each other is larger than that in the washing or rinsing cycle, it is possible to more effectively remove the contaminants on the rear surface of the drum 30.

[0098] Further, if warm water rather than cold water is used, the effect of removing the contaminants on the rear surface of the drum 30 is more maximized.

[0099] FIG. 7 is a flow chart illustrating a method of controlling the drum washing machine in accordance with the second embodiment. The method will be described with reference to FIGS. 2A, 2B, 3, and 5.

[0100] In the washing or rinsing cycle, water is supplied to the inside of the tub 20 through the water supply pipe 51 of the water supply device 50, and the washing or

rinsing cycle is started using the supplied water.

[0101] During the washing or rinsing cycle, the circulation pump 42 is operated to pump the water in the tub 20, and the circulation valve 44 is opened to supply the pumped water again to the inside of the tub 20 through the channel pipe 41 and the circulation pipe 43. Then, the circulation pump 42 is stopped, and the circulation valve 44 is closed.

[0102] Thereafter, the drum 30 is rotated and the washing or rinsing cycle of laundry in the drum 30 is performed using the water circulated by the circulation pump 42 (operation 201).

[0103] At this time, the second washing valve 66 connected to the water supply pipe 51 is operated to spray the water to the rear surface of the drum 30 through the second washing pipe 64 and the second nozzle 65, thus washing the rear surface of the drum 30 while soaking residue of the detergent and foreign substances remaining on the rear surface of the drum 30 (operation 202).

[0104] The washing operation to remove the foreign substances, etc. on the rear surface of the drum 30 may be periodically carried out after the operation of the circulation pump 42 to wash or rinse the laundry has been carried out at least one time.

[0105] For example, the operation of the circulation pump 42 to wash or rinse the laundry is repeated three times, and then the washing operation to remove the foreign substances, etc. on the rear surface of the drum 30 is carried out one time.

[0106] Further, the washing of the rear surface of the drum 30 may be performed for each of the washing cycle and plural rinsing cycles or for at least one cycle of the washing cycle, plural rinsing cycles, or dehydrating cycle, or be periodically performed according to the number of used times of the washing machine by a user.

[0107] Through the above process, the laundry in the drum 30 is washed or rinsed and the rear surface of the drum 30 is washed while the washing or rinsing of the laundry is performed, and thus residue of the detergent, mold, contaminants remaining on the rear surface of the drum 30 and the flange shaft 32 can be immediately removed.

[0108] Thereafter, when the washing or rinsing cycle has been completed, the draining cycle is performed (operation 203). When the draining cycle has been completed, the dehydrating cycle to dehydrate the laundry is performed and simultaneously, the second washing valve 66 connected to the water supply pipe 51 is operated to spray water to the rear surface of the drum 30 through the second washing pipe 64 and the second nozzle 65, thus washing the rear surface of the drum 30 and the flange shaft 32 (operation 204).

[0109] Here, water is sprayed to the drum 30, which is rotated at a dehydration speed. Since collision power generated when the rotary power of the drum 30 and the jet force of the water collide with each other is larger than that in the washing or rinsing cycle, it is possible to more effectively remove the contaminants on the rear surface of the drum 30.

[0110] Further, if warm water rather than cold water is used, the effect of removing the contaminants on the rear surface of the drum 30 is more maximized.

[0111] As apparent from the above description, in accordance with one aspect, the washing machine does not need to be disassembled to wash the drum and tub and thus is easily washed, and the washing method performs the washing of the drum for each of washing, rinsing, and dehydrating cycles and thus maintains sanitary conditions without leaving residue of the detergent and foreign substances. Thereby, contamination of the insides of the drum and tub is minimized.

[0112] Further, since water used to perform the washing or rinsing cycle is also used to wash the drum, the tub and the supply of additional water is not required, and thus the consumption of water is reduced. Moreover, since the rear surface of the drum is washed simultaneously with the washing, rinsing, or dehydrating cycle, the consumption of time and power required to wash the tub and drum is reduced.

[0113] In accordance with another aspect, the ribs are formed on the flange shaft, which thus increases the strength of the flange shaft. The ribs are extended in the same direction of the extension direction of the flange shaft, and thus form channels of water flowing on the flange shaft in the washing or rinsing cycle and reduce the remaining of contaminants on the flange shaft. Further, the contaminants remaining on the flange shaft are easily removed and thus the washability of the flange shaft is enhanced.

[0114] Moreover, the washing machine minimizes the contaminants remaining on the flange shaft, and thus prevents the generation of a bad smell caused by bacteria and mold and maintains sanitary conditions.

[0115] Although embodiments have been shown and described, it would be appreciated by those skilled in the art that changes may be made in these embodiments without departing from the principles and spirit of the invention, the scope of which is defined in the claims and their equivalents.

Claims

1. A washing machine, comprising:

a drum configured to receive articles to be washed;

a washing device configured to spray water to perform washing of an outer surface of the drum; and

a control unit controlling the washing of the outer surface of the drum such that the washing of the outer surface of the drum is performed during a washing or rinsing cycle of the washing machine.

2. The washing machine according to claim 1, further comprising a tub provided at an outside of the drum, the washing device being connected to the tub and spraying the water to a rear surface of the drum.

3. The washing machine according to claim 2, wherein:

the washing device includes a nozzle to adjust a spraying direction of the water; and
the nozzle faces a center of the rear surface of the drum.

4. The washing machine according to claim 2, further comprising a circulation device to circulate water in the tub, the washing device being connected to the circulation device and spraying a portion of the circulated water.

5. The washing machine according to claim 4, wherein the control unit controls the washing of the drum such that the washing of the drum is performed during a dehydrating cycle.

6. The washing machine according to claim 5, further comprising a water level sensing unit sensing a level of water in the tub, the control unit performing a draining cycle until the level of water in the tub is sensed to have reached a designated level, and stopping the draining cycle and performing the dehydrating cycle when the level of water in the tub is sensed to have reached the designated level.

7. The washing machine according to claim 5, further comprising a water supply device to supply water, the control unit controlling the water supply device such that a designated level of water is supplied to the tub after a draining cycle has been completed.

8. The washing machine according to claim 2, further comprising a water supply device to supply water, the washing device being connected to the water supply device and spraying the supplied water.

9. A washing machine a ccording to claim 1, further comprising a flange shaft connected to a rear surface of the drum; and a plurality of ribs protruded from the flange shaft and continuously extended from a center of the flange shaft in a radial direction of the drum to form channels on the flange shaft.

10. A washing machine according to claim 1, further comprising a tub receiving water, the drum installed in the tub and the washing device installed between the tub and the drum to perform washing of the drum.

11. A method of controlling a washing machine having a tub to contain water and a drum provided in the tub, comprising:

performing a washing or rinsing cycle by circulating the water in the tub; and
performing washing of an outer surface of the drum using a portion of the circulated water during the washing or rinsing cycle.

12. The method according to claim 11, wherein the washing of the drum is performed by spraying the portion of the circulated water to a rear surface of the drum.

13. The method according to claim 11, further comprising:

performing a draining cycle to drain the water in the tub; and
performing a dehydrating cycle when the level of the water in the tub is sensed to have reached a designated level, the washing of the drum being performed during the dehydrating cycle.

14. The method according to claim 11, further comprising:

draining the water in the tub;
additionally supplying water to the tub when the draining has been completed; and
performing a dehydrating cycle when the level of the water in the tub is sensed to have reached a designated level, the washing of the drum being performed during the dehydrating cycle.

15. The method according to claim 11, further comprising:

performing washing of an outer surface of the drum during the washing, rinsing, or dehydrating cycle, the washing of the outer surface of the drum being performed by washing the drum with water supplied from a water supply device using a washing device connected to the water supply device.

FIG. 1

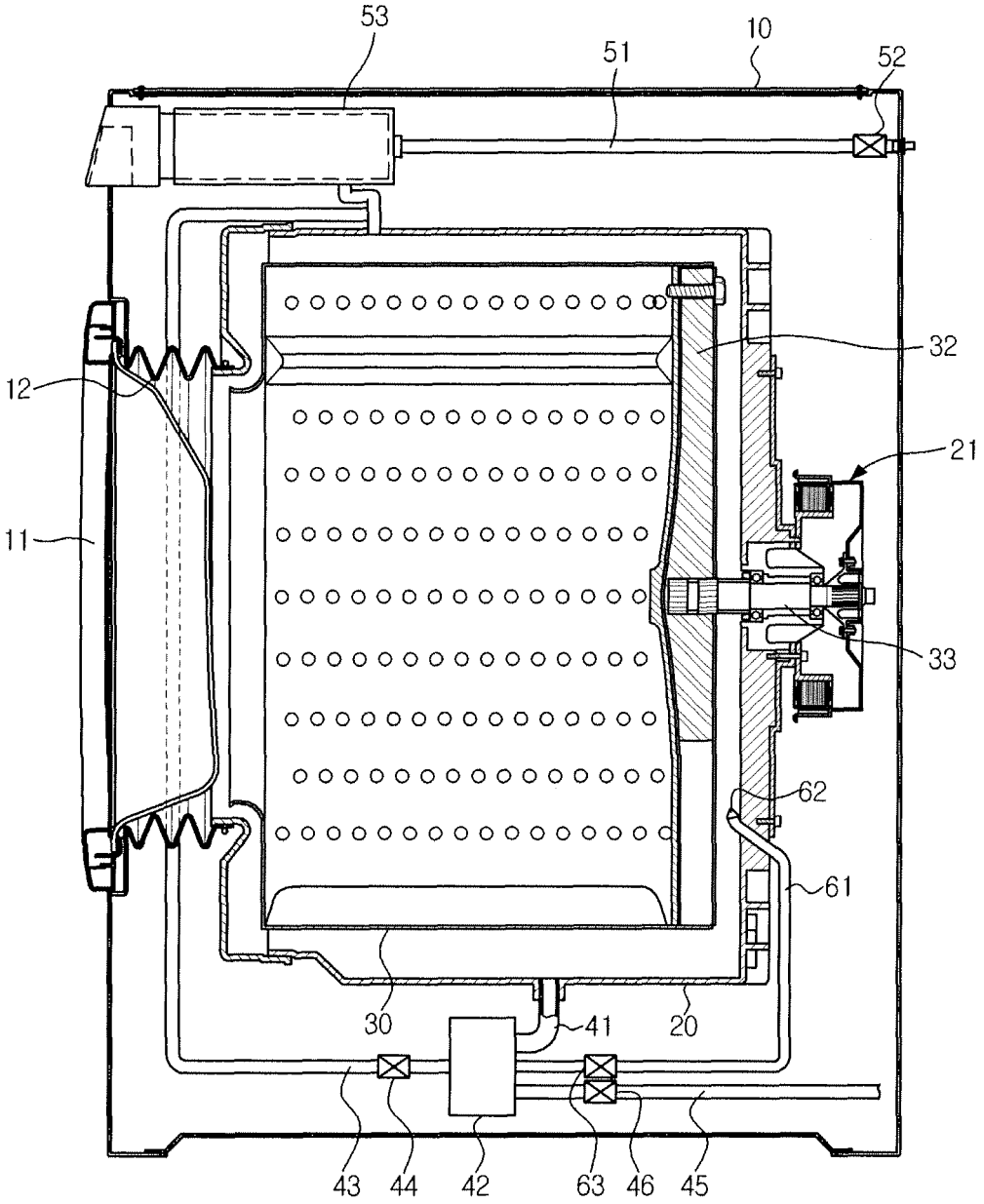


FIG. 2A

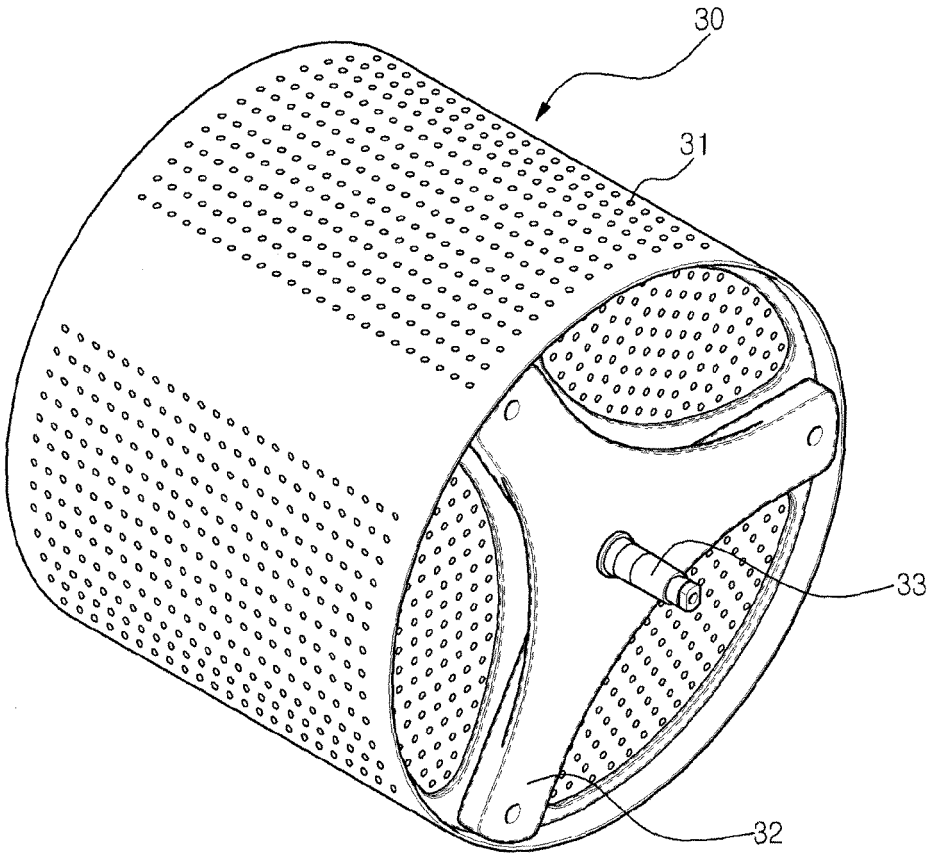


FIG. 2B

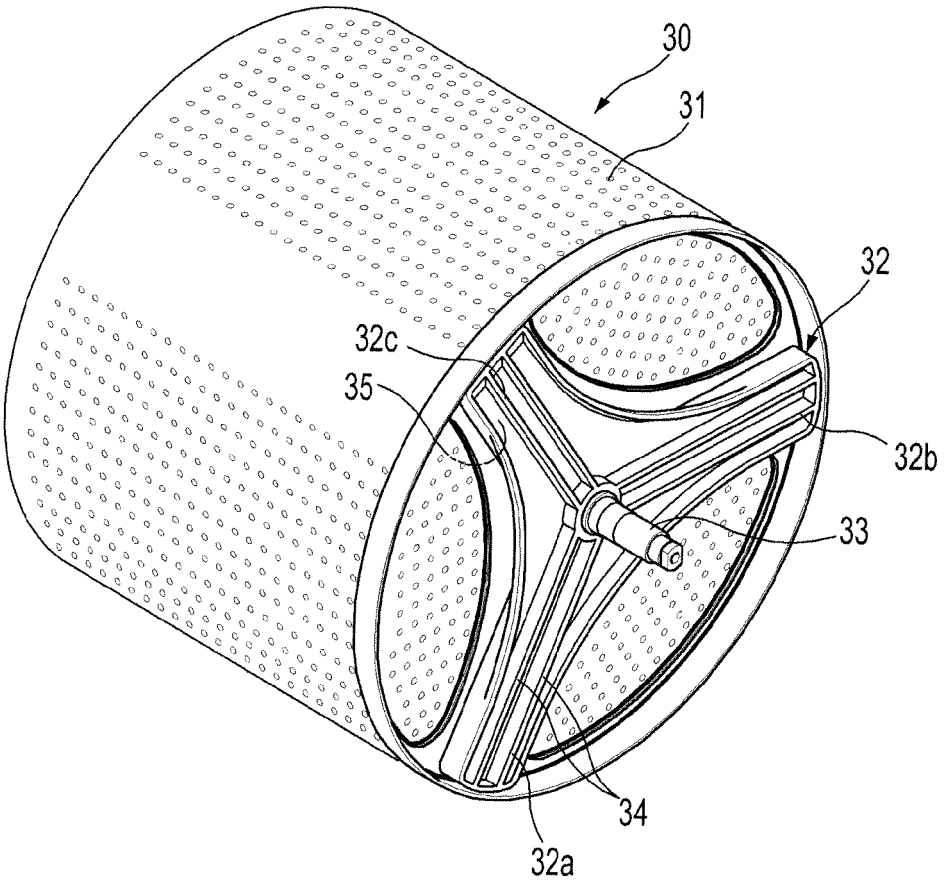


FIG. 3

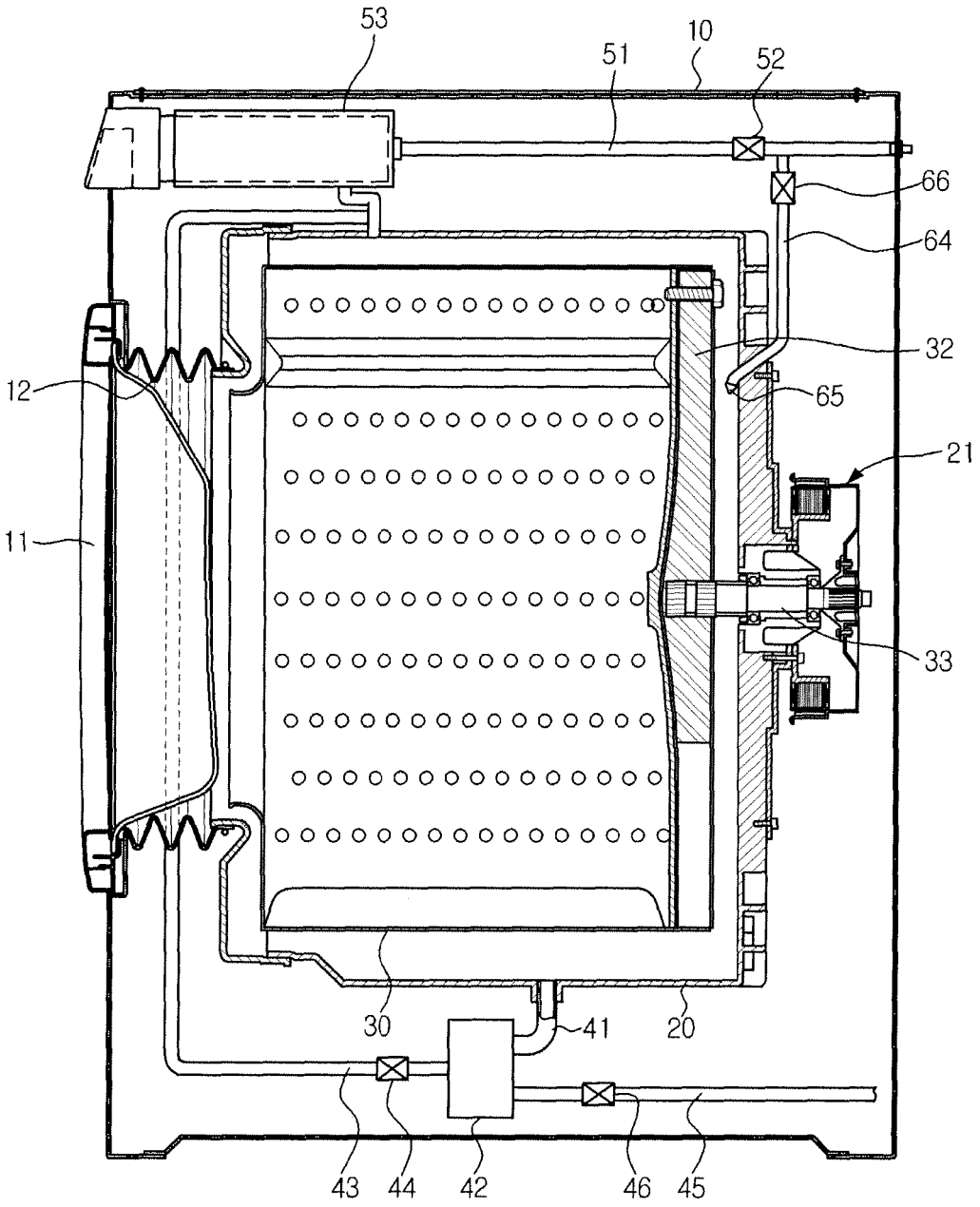


FIG. 4

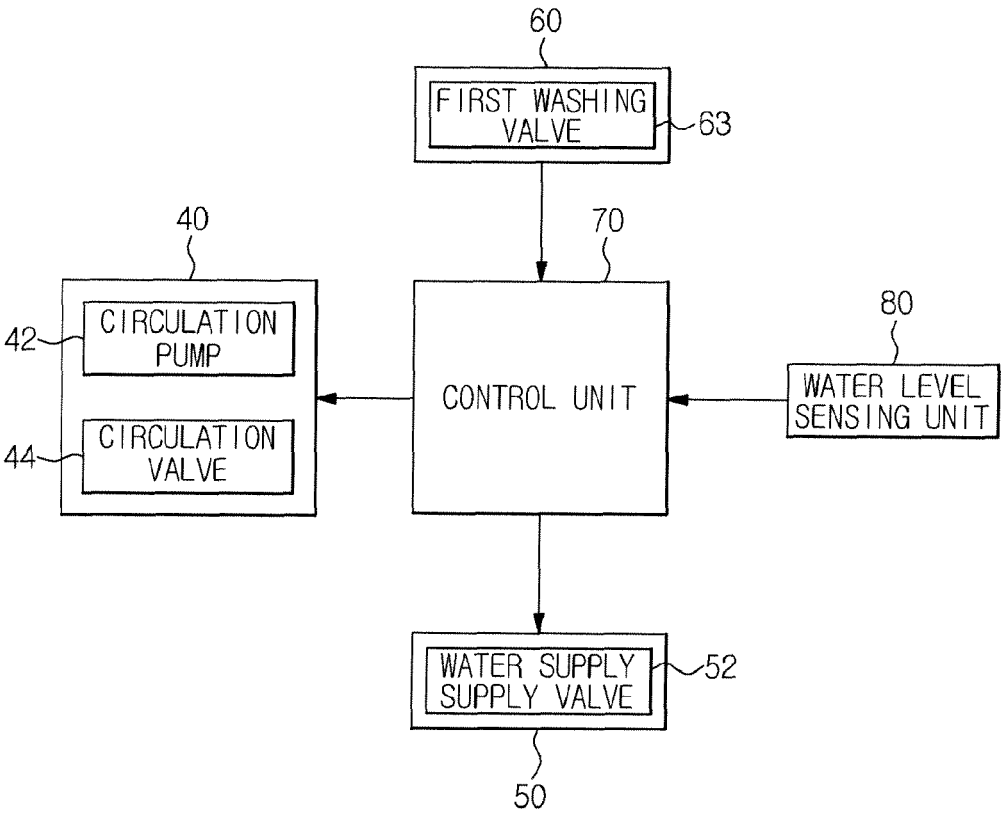
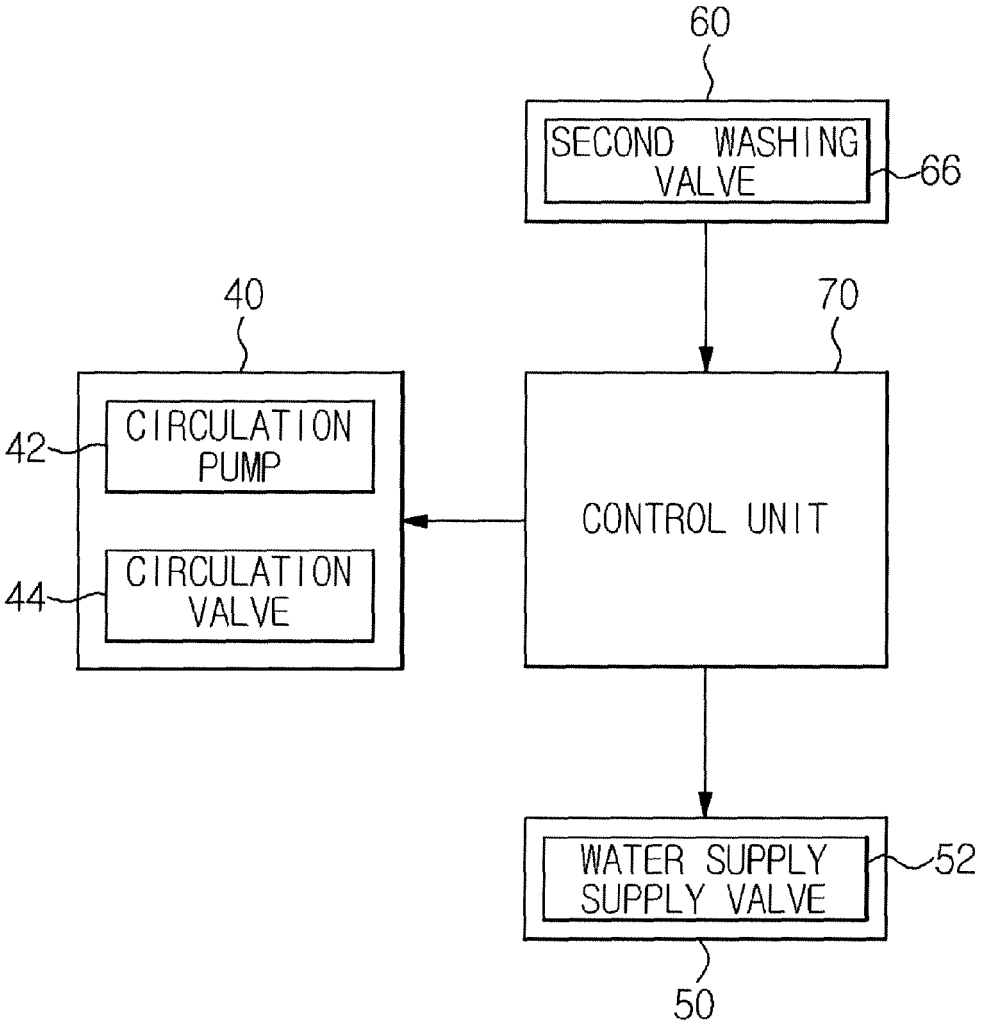

60
FIRST WASHING VALVE
63
40
70
80
CIRCULATION PUMP
42
CIRCULATION VALVE
44
CONTROL UNIT
WATER LEVEL SENSING UNIT
WATER SUPPLY SUPPLY VALVE
52
50

FIG. 5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66
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70
42
CIRCULATION PUMP
CONTROL UNIT
44
CIRCULATION VALVE
WATER SUPPLY SUPPLY VALVE
52
50

FIG. 6

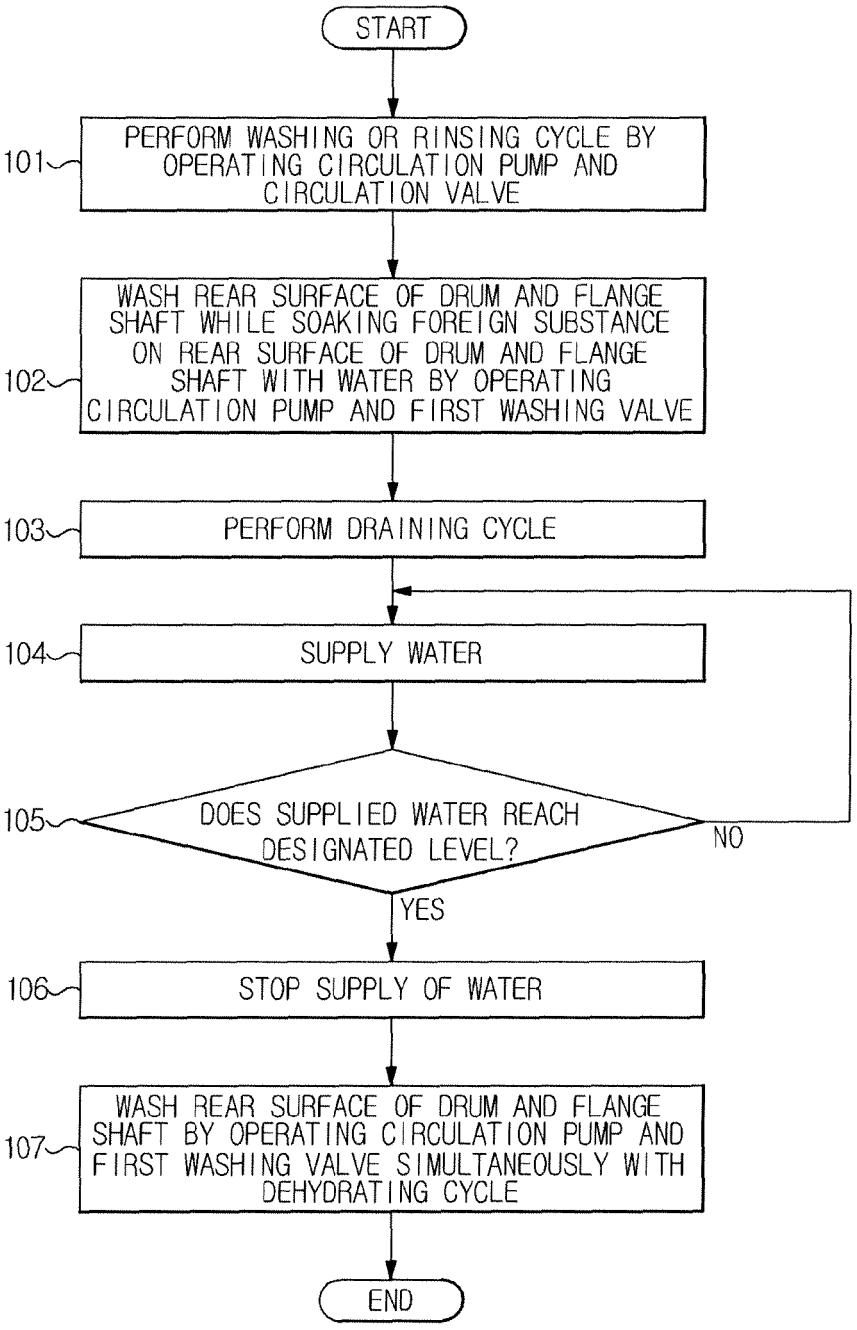
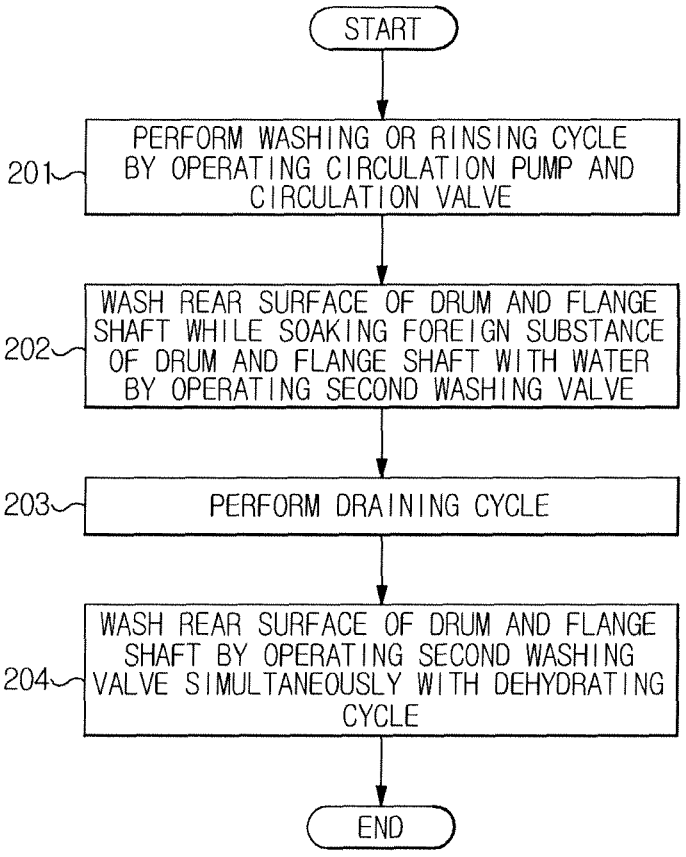

START
101
PERFORM WASHING OR RINSING CYCLE BY OPERATING CIRCULATION PUMP AND CIRCULATION VALVE
102
WASH REAR SURFACE OF DRUM AND FLANGE SHAFT WHILE SOAKING FOREIGN SUBSTANCE ON REAR SURFACE OF DRUM AND FLANGE SHAFT WITH WATER BY OPERATING CIRCULATION PUMP AND FIRST WASHING VALVE
103
PERFORM DRAINING CYCLE
104
SUPPLY WATER
105
DOES SUPPLIED WATER REACH DESIGNATED LEVEL?
NO
YES
106
STOP SUPPLY OF WATER
107
WASH REAR SURFACE OF DRUM AND FLANGE SHAFT BY OPERATING CIRCULATION PUMP AND FIRST WASHING VALVE SIMULTANEOUSLY WITH DEHYDRATING CYCLE
END

FIG. 7


START
201
PERFORM WASHING OR RINSING CYCLE BY OPERATING CIRCULATION PUMP AND CIRCULATION VALVE
202
WASH REAR SURFACE OF DRUM AND FLANGE SHAFT WHILE SOAKING FOREIGN SUBSTANCE OF DRUM AND FLANGE SHAFT WITH WATER BY OPERATING SECOND WASHING VALVE
203
PERFORM DRAINING CYCLE
204
WASH REAR SURFACE OF DRUM AND FLANGE SHAFT BY OPERATING SECOND WASHING VALVE SIMULTANEOUSLY WITH DEHYDRATING CYCLE
END

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EUROPEAN SEARCH REPORT

Application Number
EP 09 15 6313

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	JP 2005 065923 A (MATSUSHITA ELECTRIC IND CO LTD) 17 March 2005 (2005-03-17) * abstract; figure 1 *	1-15	INV. D06F35/00
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A	GB 2 432 577 A (ANDREW REASON LTD [GB]) 30 May 2007 (2007-05-30) * claim 1; figure 1 *	1-15	

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D06F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	6 August 2009	Dupuis, Jean-Luc

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1

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06-08-2009

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		CN 201206214 Y	11-03-2009
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82