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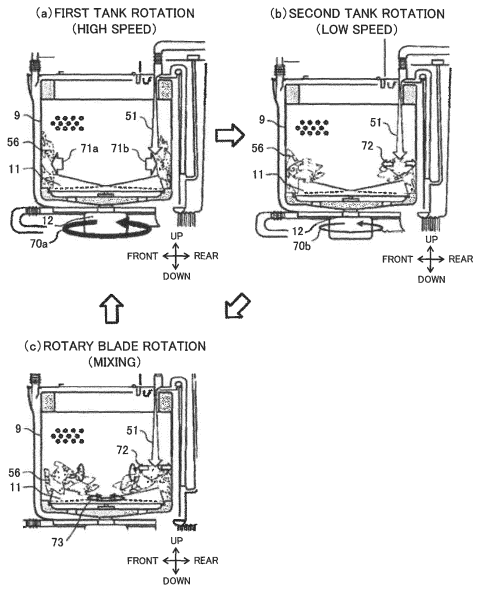
(54) WASHING MACHINE

(57) The present invention provides a washing machine improving the drying efficiency, suppressing wrinkles, and giving excellent finishing condition of drying.. The present invention includes an outer tub 10 housed in a housing 1, an inner tub 9 housed in the outer tub 10, a rotary blade 11 rotatably provided on an inner bottom part of the inner tub, a driving part for rotatably driving the inner tub 9 and the rotary blade 11, a drying part that is housed in the housing 1 and blows drying air from above the inner tub 9 toward the outside of a lower central part of the inner tub 9, and a control part for controlling a washing step, a rinsing step, a dehydration step, and a drying step, wherein the drying step has a first drying step of moving laundry in the inner tub 9 to an outer peripheral side of the inner tub 9 and a second drying step of diffusing the laundry on the outer peripheral side of the inner tub 9 into the inner tub 9 after the first drying step; and the first drying step and the second drying step are taken as one cycle and are repeatedly executed.

FIG. 8



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Description

Technical Field

[0001] The present invention relates to a washing machine.

Background Art

[0002] In general, with respect to a vertical type washing and drying machine, a rotary blade is arranged at the bottom part of the inner tub storing clothes, and washing is effected by rotating the rotary blade forwardly and reversely in a state of storing water in the inner tub and an outer tub that supports rotation of the rotary blade. Also, in a drying step after completing dehydration by rotating the inner tub at a high speed, hot air heated by a heater is blown to the clothes by a blower fan. Moisture included in the clothes evaporates by the hot air, air including the moisture is introduced to a circulation path, and the moisture is removed by a dehumidification mechanism arranged in the circulation path.

[0003] For example, in order to dry clothes effectively, in PTL 1, it is disclosed that the drying step is divided into three of 1, 2, and 3, an operation of rotating the inner tub at a high speed (approximately 700 r/min) and blowing hot air to the clothes while removing moisture of the clothes by a centrifugal force is executed for minimum 20 minutes, an operation of blowing hot air while rotating the inner tub at a low speed (approximately 35 r/min) is executed for minimum 10 minutes in the second drying step, and an operation of blowing hot air while reversing the stirring blade and stirring the clothes is executed sequentially in the third drying step.

[0004] Also, in PTL 2, it is disclosed that, in the drying step, a washing-cum-dehydrating tub is rotated for one minute at a high speed (300 r/min) to spread clothes to produce a hole at the center of the washing-cum-dehydrating tub, the washing-cum-dehydrating tub is rotated thereafter for 14 minutes at a low speed (150 r/min) to dry the clothes, and lastly a step of repeating two times an operation of rotating only the rotary blade alternately seven times to allow the clothes to change places is arranged.

Citation List

Patent Literature

[0005]

PTL 1: Japanese Patent Application Laid-Open No. 2006-014806
PTL 2: Japanese Patent Application Laid-Open No. 2009-101206

Summary of Invention

Technical Problem

[0006] In the vertical type washing and drying machines as described above, a step is arranged that clothes within the inner tub are moved to the outer peripheral side by high speed rotation of the tub and are thereafter rotated at a low speed for some time to proceed with drying. Therefore, with respect to the clothes moved to the outer.peripheral side and stacked by high speed rotation, drying proceeds with the clothes stacked, and the folding line generated by stacking may possibly be attached as wrinkles.

[0007] The present invention is to solve the problem of the prior arts described above, and its object is to provide a washing machine improving the drying efficiency, suppressing wrinkles, and giving excellent finishing condition of drying.

Solution, to Problem

[0008] In order to achieve the object described above, the washing machine of the present invention includes an outer tub housed in a housing, an inner tub housed in the outer tub, a rotary blade rotatably provided on an inner bottom part of the inner tub, a driving part for rotatably driving the inner tub and the rotary blade, a drying part that is housed in the housing and blows drying air from above the inner tub toward the outside of a lower central part of the inner tub, and a control part for controlling a washing step, a rinsing step, a dehydration step, and a drying step, wherein the drying step has a first drying step of moving laundry in the inner tub to an outer peripheral side of the inner tub, and a second drying step of diffusing the laundry on the outer peripheral side of the inner tub into the inner tub after the first drying step; and the first drying step and the second drying step are taken as one cycle and are repeatedly executed.

Advantageous Effects of Invention

[0009] According to the present invention, it is possible to provide a washing machine improving the drying efficiency, suppressing wrinkles, and giving excellent finishing condition of drying.

Brief Description of Drawings

[0010]

Figure 1 is an outer appearance perspective view showing a washing and drying machine of a first example.
Figure 2 is a vertical sectional view of the washing and drying machine shown in Figure 1.
Figure 3 is an outer appearance perspective view showing a rotary blade related to the first example.

Figure 4 is a block diagram of a control device related to the first example.
Figure 5 is a flowchart showing a part of a control process of the washing and drying machine of the first example.
Figure 6 is a flowchart showing a part of the control process of the washing and drying machine of the first example.
Figure 7 is a flowchart showing a part of the control process of the washing and drying machine of the first example.
Figure 8 is a schematic drawing showing operations of the first tub rotation, the second tub rotation, and the rotary blade rotation related to the first example.
Figure 9 is a time chart showing operations of the first tub rotation, the second tub rotation, and the rotary blade rotation related to the first example.
Figure 10 is a time chart showing an intermittent rotating operation in the second tub rotation related to the first example.
Figure 11 is a schematic drawing showing operations of the first tub rotation, the second tub rotation, and the rotary blade rotation related to a second example.
Figure 12 is a time chart showing operations of the first tub rotation, the second tub rotation, and the rotary blade rotation related to the second example.
Figure 13 is a schematic drawing showing an effect of the difference of the tub rotation direction related to the second example.
Figure 14 is a time chart showing a case of executing the tub rotation direction related to the second example in both of the forward and reverse directions.
Figure 15 is a time chart showing a case of executing the tub rotation direction related to the second example in both of the forward and reverse directions.
Figure 16 is a time chart showing a case of executing the tub rotation direction related to the second example in both of the forward and reverse directions.
Figure 17 is a schematic drawing showing a case of tilting a blow-out part related to the second example to blow the air.

Description of Embodiments

[0011] Although explanation will be hereinafter given in detail with respect to embodiment examples of the present invention using the drawings, the present invention is not limited to the examples described below and also includes various modifications and applications in its scope within the technical gist of the present invention.

[Example 1]

[0012] Figure 1 is an outer appearance perspective view of a washing and drying machine 100 which is a washing machine, and Figure 2 is a vertical sectional view of the washing and drying machine 100. Figure 3 is an outer appearance perspective view showing a configuration of a rotary blade. The washing and drying machine 100 includes a housing 1 that configures an outer frame, and incorporates a power switch 5 and a detergent/finishing agent container 28 on the front side of a top cover 2 located in the upper part of the housing 1 and components related to water feeding and drying such as a water feeding solenoid valve 4, a heater 20, and a blower fan 19 in the rear part. Also, the housing 1 is provided with an outer lid 3 to cover a clothes inlet 2a. A grip 3a and an operation panel 8 are arranged on the front side of the outer lid 3, the operation panel 8 including an operation switch 6 and an indicator 7, and the outer lid 3 is configured to be folded at the center and opened as shown in a two-dot chain line of Figure 2 when the grip 3a is pulled upward. Also, the operation panel 8 is electrically connected to a control device 14 that is arranged in the bottom part of the housing 1.

[0013] An inner tub 9 of a washing-cum-dehydrating tub housed in an outer tub 10 and storing clothes 56 includes a number of small through holes 9a for passing water and air in the outer peripheral wall, includes multiple through holes 9b for passing water and air in the bottom wall of the inner tub 9, includes a fluid balancer 9c in the upper edge part of the inner tub 9, and is provided with a rotary blade 11 rotatably arranged in the inner bottom part of the inner tub 9 and mixing the clothes 56. A gentle tilted surface 11h and a bump part 11a repeatedly applying an upward component force to the clothes 56 fed onto the rotary blade 11 by being rotated are formed in the rotary blade 11, and a number of small through holes 11c for passing water and air are arranged in the tilted surface 11h. The inner tub 9 and the rotary blade 11 are rotatably driven respectively independently or integrally by a drive mechanism which is a driving part configured of a clutch mechanism 12 and a washing and dehydration drive motor 13.

[0014] An outer tub 10 housed in the housing 1 and including the inner tub 9 in the inside hangs down at the generally central part of the housing 1 with four orientations of the outer tub 10 engaged with four support bars through buffer devices (not illustrated) to be supported evenly, the support bars being locked to corner plates (not illustrated) arranged at four corner parts of the upper end part of the outer frame of the housing 1 and being suspended. A drive mechanism is attached below the outer tub 10.

[0015] The drive mechanism which is a driving part incorporates the washing and dehydration drive motor 13, the clutch mechanism 12, and a planetary gear reduction mechanism, the washing and dehydration drive motor 13 utilizing an inverter drive motor or a reversible rotation type condenser split-phase single phase induction motor. By controlling the washing and dehydration drive motor 13 and the clutch mechanism 12, the drive mechanism has a drive function of a washing drive mode and a dehydration drive mode, the washing drive mode having the rotary blade 11 repeatedly and reversibly rotated in

a state that the inner tub 9 is stopped or released to be capable of freely rotating, and the dehydration drive mode being the inner tub 9 and the rotary blade 11 rotated integrally in the same direction. A vibration sensor 27 for detecting vibration of the outer tub 10 at the time of washing or dehydration is provided on the outer side of the side surface of the outer tub 10.

[0016] Also, an air trap 21a is arranged on the bottom surface of the outer tub 10, the pressure inside the trap 21a is transmitted to a water level sensor 21 through a tube 21b, and the water level of the water stored within the outer tub 10 is detected.

[0017] A clothes inlet 31a is provided at a portion of approximately 2/3 from the front side of a tub cover 31 arranged in the upper surface of the outer tub 10, and a feed water inlet (not illustrated) and a circulation water inlet 33 are arranged in a rear surface 31b. Also, a detergent/finishing agent inlet 28a is arranged in front of the tub cover 31. An inner lid 23 is attached to be openable/closable by a hinge 23b so as to cover the clothes inlet 31a. Lock (not illustrated) of the inner lid 23 is released by holding a grip 23a upward and the inner lid 23 opens as shown by a single dot chain line in the drawing, and the inner lid 23 is locked by pressing the grip 23a downward. A blow-out part 54 guiding the hot air into the inner tub 9 is provided in the rear surface 31b, and the upstream side of the blow-out part 54 is connected to the heater 20 through a bellows tube 29b. Also, the downstream side of the blow-out part 54 is arranged with the end part being directed toward the outer periphery bottom part of the inner tub 9, and the drying air is blown targeting the outer periphery bottom part of the inner tub 9.

[0018] Further, in order to make getting in/out of the clothes 56 smooth, it is preferable to widen the clothes inlet 31a, and therefore the blow-out part 54 is disposed on the outer peripheral side of the inner tub 9.

[0019] The drying mechanism which is a drying part housed in the housing 1, blows out the drying air to the outside of the lower central part of the inner tub 9 from the upper part of the inner tub 9, and dries the clothes 56 is configured of the blower fan 19, the heater 20, a drying duct 22, and a dehumidification mechanism 22a. The drying duct 22 connects a water and air passing port 10b and the blow-out part 54. with each other. In the middle of the drying duct 22, the dehumidification mechanism 22a, a lint filter (not illustrated), the blower fan 19, the heater 20, and a temperature sensor 26 are arranged. When the blower fan 19 is operated and the heater 20 is energized, the hot air passes through the bellows tube 29b, is blown into the inner tub 9 from the blow-out part 54, and heats the clothes 56, and the moisture evaporates. The hot and humid air goes out to the outer tub 10 through the through holes 9a, 9b, is aspired to the drying duct 22 from the water and air passing port 10b, is cooled and dehumidified by cooling water flowing down through the dehumidification mechanism 22a to become dry cold air, is reheated by the heater 20, and circulates so as to blow into the inner tub 9. Also, with respect to the air cooled and dehumidified within the drying duct 22, the lint is collected by the lint filter (not illustrated). Further, during drying, a water discharging solenoid valve 15 is opened, and the cooling water flowing down through the dehumidification mechanism 22a and the moisture obtained in dehumidification are discharged to the outside through a water discharge hose 24.

[0020] The bellows tubes 29a, 29b, 29c, 29d, 29e, and 29f made of rubber are used for connecting the outer tub 10 and the tub cover 31 deflecting by vibration with the drying duct 22, the water feeding solenoid valve 4, a circulation pump 16, and the like arranged on the fixed side (the outer frame 1, the top cover 2, and the like).

[0021] The water feeding solenoid valve 4 uses a four-spool valve in the present example so that water feeding can be executed in four directions. The first one is the washing water feeding solenoid valve, is connected to the feed water inlet, and feeds water into the inner tub 9. The second one is the detergent water feeding solenoid valve, and is connected to the detergent feeding chamber of the detergent/finishing agent container 28. The third one is the finishing agent water feeding solenoid valve, and is connected to the finishing agent feeding chamber of the detergent/finishing agent container 28. The detergent/finishing agent container 28 continues to the detergent/finishing agent inlet 28a, and the detergent and the finishing agent are fed into the outer tub 10. The fourth one is connected to the dehumidification mechanism 22a which will be described below.

[0022] A circulation pipe 17 for the washing water connects the water and air passing port 10b arranged at the outer tub bottom part and the circulation water inlet 33 with each other. In the middle of the circulation pipe 17, the circulation pump 16 and a foreign object trap 18 arranged at the machine body bottom part are provided, and the water discharge hose 24 is connected to the foreign object trap 18 through the water discharging solenoid valve 15. When the circulation pump 16 is operated, the washing water within the outer tub 10 is conveyed from the water and air passing port 10b arranged at the outer tub bottom part to the upper part of the outer tub 10 passing through the circulation pipe 17, enters a circulation water cover 30 disposed on the inner tub 9 side of the rear surface 31b from the circulation water inlet 33 of the rear surface 31b of the tub cover 31, and is scattered into the inner tub 9 from a nozzle 34.

[0023] Figure 4 is a block diagram of the control part of the washing and drying machine 100. A microcomputer 40 is connected to an operation button input circuit 41, the water level sensor 21, the temperature sensor 26, and the vibration sensor 27, the operation button input circuit 41 being connected to respective switches 6a such as the operation switch 6, and receives various information signals in the button operation of the user, the washing step, and the drying step. An output from the microcomputer 40 is connected to drive circuits 42, is connected to the water feeding solenoid valve 4, the clutch mechanism 12, the water discharging solenoid valve 15, the

circulation pump 16, the washing and dehydration drive motor 13 which is a motor, the blower fan 19, the heater 20, and the like, and controls opening/closing, rotation, and energization of them. Also, the microcomputer 40 is connected to a seven-segment light emitting diode display 25, the display 7 of the light emitting diode and the like, and a buzzer 43 for notifying the user of the operation state of the washing machine.

[0024] The microcomputer 40 which is the control part starts up when the power switch 5 is pressed and the power is fed, and executes basic control process programs of the washing step, rinsing step, dehydration step, and drying step as shown in Figure 5 and Figure 6. Its control flow will be hereinafter explained. First, the washing and dehydration step will be explained.

<<Step S101>>

[0025] State confirmation and initial setting of the washing and drying machine are executed.

<<Step S102>>

[0026] The display 7 of the operation panel 8 is lit and displayed, and the washing course is set according to the command input from the operation switch 6. In a state that there is no command input, a standard washing course or the washing course executed last time is automatically set.

<<Step S103>>

[0027] The command input from the switch 6a of the start in the operation switch 6 of the operation panel 8 is monitored, and the process is branched.

<<Step S104>>

[0028] The detergent amount detection process is executed. This detergent amount detection is executed as follows: the washing and dehydration drive motor 13 and the clutch mechanism 12 in the drive mechanism are controlled so that the cloth amount of the clothes 56 is detected based on the rotational load amount applied to the rotary blade 11 when the rotary blade 11 is rotated in one direction is a state the inner tub 9 is stopped in the dry cloth state before feeding the washing water; and an adequate amount of the detergent (detergent amount) is obtained based on the detected cloth amount.

[0029] The detergent amount is obtained by referring to the comparison table of the cloth amount and the detergent amount having been set beforehand. In concrete terms, in the configuration of using an inverter driving motor as the washing and dehydration drive motor 13, detection of the cloth amount is executed by detecting the attained rotation speed when energized for a predetermined time so as to rotate the washing and dehydration drive motor 13. In the configuration of using a condenser split-phase single phase induction motor as the washing and dehydration drive motor 13, detection of the cloth amount is executed by detecting the idling rotation speed reduction characteristic after the power is cut off in a state of energizing the washing and dehydration drive motor 13 so as to be accelerated to the saturated rotation speed. Also, the preferable detergent amount is obtained by referring to the comparison table of the cloth amount and the detergent amount set beforehand.

[0030] The washing water amount is set so as to be stored in the bottom part of the outer tub 10 while keeping the water level not exceeding the rotary blade 11 when the cloth amount is within a predetermined cloth amount range (adequate amount). Also, based on the detection result (cloth amount), the washing time is obtained and set. When cloth amount detection is not executed, the standard washing time is set.

<<Step S105>>

[0031] The detergent amount having been obtained is displayed on the seven-segment light emitting diode display 25 of the operation panel 8.

<<Step S106>>

[0032] The detergent water feeding solenoid valve is opened, and detergent water feeding is executed to the detergent feeding chamber of the detergent/finishing agent container 28. The user feeds the powder detergent and the liquid detergent of a displayed amount to the detergent feeding chamber of the detergent/finishing agent container 28, and thereafter operates to close the outer lid 3. The powder detergent and the liquid detergent fed to the detergent feeding chamber where the detergent feeding water is flowing pass through the detergent/finishing agent inlet 28a along with the water of the detergent water feeding, and fall down to the bottom part of the outer tub 10.

<<Step S107>>

[0033] Water feeding is stopped when the water is fed to the detergent dissolving water level. The detergent dissolving water level is one that is set so that the water amount becomes sufficient for mixing the water fed and the detergent at the bottom of the inner tub 9 when the inner tub 9 is rotated in the detergent dissolving step (Step S108) hereinafter and the water surface becomes lower than the height of the lower surface of the rotary blade 11 (the clothes 56 do not become wet before dissolving the detergent).

<<Step S108>>

[0034] By rotating the inner tub 9 and the rotary blade 11 integrally in one direction at a low speed, detergent dissolving is executed in which the detergent-dissolving

water, the powder detergent, and the liquid detergent fed to the bottom part of the outer tub 10 are mixed at the bottom surface of the inner tub 9 and washing water having high detergent concentration is formed.

<<Step S109>>

[0035] Prewashing is executed. In the prewashing, mixing of rotating the rotary blade 11 forward and reverse in a state of stopping the inner tub 9 is executed intermittently, and the detergent water of the bottom part of the outer tub 10 is poured onto the clothes 56 from the nozzle 34 by operating the circulation pump 16 while the rotary blade 11 is rotated forward and reverse. At this time, since the detergent water having high concentration is scattered to the clothes 56, the detergent water penetrates the clothes 56 evenly by the penetration action of the detergent. The detergent water having high concentration penetrated in the clothes 56 has high dissolving capacity of oil, dissolves fat and oil smear such as the sebum smear, and has a significant effect of allowing the smear to float from the clothes 56, and high washing capacity is secured. Next, while the rotary blade 11 and the circulation pump 16 are stopped, the detergent water feeding solenoid valve and the washing water feeding solenoid valve are opened referring to the detection signal of the water level sensor 21 to feed the water so that the water level does not exceed the set water level. By repeating this operation plural number of times, prewashing is executed so that the clothes 56 are adapted to the washing water and are dispersed onto the rotary blade 11.

<<Step S110>>

[0036] Main washing is executed. In this main washing, first, detection of the clothes amount is executed by a method similar to the method described above, and the washing time having been set is corrected and set. Thereafter, mixing where the circulation pump 16 is operated while the rotary blade 11 is rotated forward and reverse with the inner tub 9 stopped and the washing water stored in the bottom part of the outer tub 10 is poured to the clothes 56 from the nozzle 34 to effect washing water circulation as well as cloth detangling mixing where the rotary blade 11 is rotated forward and reverse with the operation of the circulation pump 16 and the circulation of the washing water stopped are repeated. By forward and reverse rotation of the rotary blade 11, the clothes 56 switch places in the circumferential direction and the radial direction within the inner tub 9 and are washed evenly. Lastly, homogenization mixing of rotating the rotary blade 11 forward and reverse is executed with the operation of the circulation pump 16 and the circulation of the washing water stopped and the main washing time is finished.

<<Step S111>>

[0037] The first storage rinsing is executed. In this storage rinsing, first, the water discharging solenoid valve 15 is opened and the washing water stored at the bottom part of the outer tub 10 is discharged, the inner tub 9 and the rotary blade 11 are thereafter rotated integrally in one direction, and the washing water included in the clothes 56 is centrifugally dehydrated. The rotation speed of the inner tub 9 and the rotary blade 11 at the time of the washing water dehydration is set similarly to the rotation speed in the final dehydration described below (approximately 1,100 r/min), and a dehydration operation is executed so as to achieve a high dehydration rate.

[0038] Thereafter, while the water discharging solenoid valve 15 is closed and the inner tub 9 and the rotary blade 11 are rotated integrally in one direction at a low speed, the washing water feeding solenoid valve is opened, and the tap water is fed from the watering port so as to be poured to the clothes 56 on the rotary blade 11.

[0039] Next, rinsing water feeding is executed so that the water level of the bottom part of the outer tub 10 does not exceed the set water level with the rotation of the inner tub 9 and the rotary blade 11 stopped.

[0040] Next, similarly to the press washing mixing in the main washing, rinsing water circulating mixing rinsing is executed in which the circulation pump 16 is operated while the rotary blade 11 is rotated forward and reverse in a state of stopping the inner tub 9, and the washing water stored in the bottom part of the outer tub 10 is circulated so as to be poured from the nozzle 34 to the clothes 56 on the rotary blade 11. Next, the water is fed so that the water level does not exceed the set water level while detecting the water level of the rinsing water stored in the bottom part of the outer tub 10 with the rotation of the rotary blade 11 and the operation of the circulation pump 16 stopped.

[0041] Next, rinsing water circulating mixing rinsing is executed in which the circulation pump 16 is operated while the rotary blade 11 is rotated forward and reverse with the inner tub 9 stopped, and the rinsing water stored in the bottom part of the outer tub 10 is circulated, so as to be poured from the nozzle 34 to the clothes 56 on the rotary blade 11. Similarly to the time of washing, since the clothes 56 within the inner tub 9 switch places in the circumferential direction and the radial direction, the rinsing water is poured to the clothes 56 evenly, and the detergent portion is diluted.

[0042] Thereafter, homogenization mixing is executed in which rotation of the rotary blade 11 forward and reverse is continued with the operation of the circulation pump 16 and the circulation of the rinsing water stopped.

<<Step S112>>

[0043] The second storage rinsing is executed. In this second storage rinsing, control is added for introducing the soft finishing agent within the soft finishing agent feed-

ing chamber to the bottom part of the outer tub 10 by opening the soft finishing agent water feeding solenoid valve and feeding the water to the soft finishing agent feeding chamber in the detergent/finishing agent container 28. Operation other than that is executed similarly to the first storage rinsing.

<<Step S113>>

[0044] The final dehydration process is executed. Final dehydration is executed so that the drive mechanism is operated to rotate the inner tub 9 and the rotary blade 11 integrally in one direction at a high speed with the water discharging solenoid valve 15 kept open, and the clothes 56 within the inner tub 9 is centrifugally dehydrated. At this time, the rotation speed of the inner tub 9 is increased stepwise from the low speed rotation for the clothes 56 to start to move, namely the first revolution speed allowing the clothes which is the laundry to be moved to the outer peripheral side of the inner tub 9, and the clothes 56 within the inner tub 9 are moved slowly to the outer peripheral side. Thus, the clothes 56 are pressed to the wall evenly without deviation, and the dehydration efficiency improves. In concrete terms, dehydration is started from approximately 140 r/min, the speed is increased therefrom gradually, the clothes 56 are attached eventually to the wall surface of the inner tub 9 at high speed rotation of approximately 1,100 r/min, namely the second revolution speed that is faster than the first revolution speed of removing the moisture from the clothes which are the laundry, and the water included in the clothes 56 is removed. The revolution speed of at least two kinds of the first revolution speed and the second revolution speed is arranged in the dehydration step.

[0045] Also, the operation time of this final dehydration is set to the time with which a desired dehydration rate can be obtained.

[0046] Also, the revolution speed of the first tub rotation operation of the drying step is set to be higher than the first revolution speed of the dehydration step.

<<Step S114>>

[0047] Whether the washing and drying course has been set is confirmed, and the process is branched. When the washing and drying course has not been selected, washing is completed, and this control flow is finished. On the other hand, when the washing and drying course has been selected, the process enters the drying step. Figure 7 is the control flow of this drying step. This control flow will be hereinafter explained.

<<Step S200>>

[0048] In the drying step, in order to further execute dehydration of the clothes 56, the inner tub 9 is rotated at a high speed. Also, when sufficient dehydration has been executed in the past washing step, this step can be omitted.

<<Step S201>>

[0049] Step S201 is a process for executing Step S200 for a predetermined time, and the dehydration step is executed until determined specific time elapses. When sufficient dehydration was executed in the past washing step, this step can also be omitted.

<<Step S202>>

[0050] The blower fan 19 is operated, and the drying air is blown to the clothes 56 within the inner tub 9 from the blow-out part 54. At this time, in order to highly obtain a force for pushing out the clothes 56 and stretching wrinkles, it is preferable to allow the air of the highest possible speed to directly hit the clothes 56. Therefore, in the present example, the air with the air volume of 2.3 m^3/min and the speed of approximately 120 m/s or more is blown to the clothes 56 within the inner tub 9 at the outlet of the blow-out part 54 by rotating the impeller of the blower fan 19 at a high speed of approximately 26,000 r/min. At this time, the air is compressed within the blower fan 19, compression heat is thereby generated, and the air with the temperature sufficient to heat and dry the clothes 56 is blown into the inner tub 9 from the blow-out part 54 even when the heater 20 is not energized.

[0051] Also, at this time, the blow-out part 54 is directed to the outer periphery bottom part of the inner tub 9, and blows drying air 51 of high speed to the outer periphery bottom part.

<<Step S203>>

[0052] Concentration blow drying which is a feature of the present invention is executed. Concentration blow drying includes two steps of a clothes concentration step of the first drying step and a clothes diffusion step of the second drying step, and these two steps as one cycle are executed repeatedly. In the clothes concentration step of the first drying step, the clothes 56 which are the laundry are collected (moved) to the outer peripheral side of the inner tub 9 by rotation of the inner tub 9 at a high speed. In the clothes diffusion step of the second drying step, after the clothes concentration step of the first drying step, the clothes 56 which are the laundry collected to the outer peripheral side of the inner tub 9 are diffused to the inside of the inner tub, namely a heap of the clothes 56is broken by blowing the drying air 51 to the clothes 56, and the clothes 56 are spread to the central part within the inner tub 9. Thus, the clothes 56 are collected to the outer peripheral side of the inner tub 9, and the clothes 56 are repeatedly dispersed to the inside of the inner tub 9 while being hit by the drying air 51 thereafter to be pushed out, and therefore drying proceeds while the clothes 56 are not fixed to one attitude and the wrinkles are stretched by the air.

[0053] In the present example, as this clothes concentration step of the first drying step, the first tub rotation operation is effected in which the inner tub 9 and the rotary blade 11 are rotated integrally at a high speed and the clothes 56 are moved to the outer peripheral side of the inner tub 9. Also, as the clothes diffusion step of the second drying step, two operations of the second tub rotation operation and the rotary blade rotation operation are effected. In the second tub rotation operation, the inner tub 9 and the rotary blade 11 are rotated integrally at a low speed, and the clothes 56 are spread by a force of the air. In the rotary blade rotation operation, only the rotary blade 11 is rotated after the second tub rotation operation, or more specifically, the rotary blade 11 is rotated relatively to the inner tub 9, and a heap of the clothes 56 is entirely disintegrated and flattened.

[0054] Figure 8 is a schematic drawing showing these three operations, and shows the first tub rotation operation (a), the second tub rotation operation (b), and the rotary blade rotation operation (c) respectively. Figure 9 is a time chart expressing these three operations. These three operations will be hereinafter explained.

[0055] First, the first tub rotation operation which is the cloths concentration step is executed. In the first tub rotation operation, the inner tub 9 and the rotary blade 11 are integrally rotated in a forward direction 70a at a predetermined revolution speed which is a high speed here to apply a centrifugal force 71 to the clothes 56 on the rotary blade 11. Thus, the clothes 56 are lifted up while moving to the outer peripheral side of the inner tub 9, and a heap of the clothes 56 is formed along the outer peripheral side of the inner tub 9. At this time, when the rotation speed of the inner tub 9 is slow, namely when the centrifugal force 71 applied to the clothes 56 is weak, the clothes 56 do not move, or moving to the outer peripheral side takes time, and the clothes 56 cannot be moved effectively to the outer peripheral side of the inner tub 9. Therefore, it is preferable that the rotation speed of the inner tub 9 is set higher than a rotation speed with which the clothes 56 just starts to move namely the rotation speed of the slow speed rotation executed in the dehydration step described above (Step S113) .

[0056] . On the other hand, when the rotation speed of the inner tub 9 is too fast or the rotation time is too long, since the clothes 56 are pressed strongly to the wall surface of the inner tub 9, wrinkles are attached strongly to the clothes 56, and the finishing degree degrades. Therefore, it is preferable that the rotation speed and the rotation time of the inner tub 9 are fast and short to some degree. Although an optimum rotation speed and rotation time of the inner tub 9 differ according to the inside diameter of the inner tub 9 and the cloth amount of the clothes 56, when the diameter of the inner tub 9 is approximately 520 mm and the cloth amount is approximately 2 kg or less, if the rotation speed of the inner tub 9 is 150 to 500 r/min and the rotation time is 15 to 40 seconds, the clothes 56 can be collected to the outer peripheral side without being pressed to the wall surface of the inner tub 9.

[0057] Next, the process shifts to the clothes diffusion step. In the clothes diffusion step, the second tub rotation operation and the rotary blade rotation operation are executed, and a heap of the clothes 56 is flattened while blowing the drying air 51 to the clothes 56 collected to the outer peripheral side of the inner tub 9 by the clothes concentration step, pushing out the clothes 56 by a force of the air, and allowing the clothes 56 to switch places by mixing, and thereby the clothes 56 are moved from the outer peripheral side of the inner tub 9 to the central side.

[0058] First, the second tub rotation operation will be explained. In the second tub rotation operation, the inner tub 9 and the rotary blade 11 are rotated integrally to a forward direction 70b at a speed slower than the predetermined revolution speed of the first tub rotation operation. Here, the reason for decelerating the rotation speed of the inner tub 9 is to allow a force 72 for pushing out the clothes 56 to be applied effectively by extending the time the clothes 56 receive the air on the downstream side of the drying air 51. Thus, unlike the first tub rotation operation, it is possible to stretch wrinkles of the clothes 56 and to blow the clothes 56 upward to be spread into the inner tub 9 by a force of the air without moving the clothes 56 to the outer peripheral side of the inner tub 9.

[0059] Therefore, the rotation speed of the inner tub 9 in the second tub rotation operation is preferable to be slow. In concrete terms, it is preferable to be 35 r/min or less. Also, by taking a long rotation time, the clothes 56 can be pushed out and the wrinkles can be stretched, and therefore the rotation time is preferable to be taken longer than the rotation time of the first tub rotation operation at a minimum (the execution time of the first tub rotation operation is shorter than the execution time of the second tub rotation operation).

[0060] However, when.the drying air 51 continues to be blown for a certain time, the upper surface side of the clothes 56 is entirely stretched, and the wrinkle stretching effect saturates. Also, since the lower surface side of the clothes 56 is hardly hit by the air and hardly dried, uneven drying and reattaching of wrinkles are caused. Therefore, it is preferable that the process proceeds to the next rotary blade rotation operation without taking too much of the time for the second tub rotation operation. In the case of the present example, when the rotation time is within 60 to 180 seconds, the air can be blown to the clothes 56 without causing uneven drying while sufficiently stretching the upper face side of the clothes 56.

[0061] Also, as the velocity of the drying air 51 blown to the clothes 56 is higher, a stronger force for pushing out the clothes can be secured, and the clothes 56 can be moved more easily. Therefore, in order to blow the drying air 51 to the clothes 56 suppressing drop of the velocity of the drying air 51, it is preferable to blow the drying air 51 from the possibly shortest distance from the clothes 56 and directly. Accordingly, it is preferable that the blow-out part 54 is arranged right above the clothes

56 collected by the first tub rotation operation, namely the outer peripheral side of the inner tub 9.

[0062] Also, when the drying air 51 is blown toward the central part, the air does not hit the clothes 56, and movement of the clothes deteriorates; Therefore, it is preferable to blow the air targeting the generally vertically downward part and the vicinity thereof. As described above, since the clothes inlet 31a can be arranged widely when the blow-out part 54 is disposed on the outer peripheral side of the inner tub 9, it is effective to arrange the blow-out part 54 on the outer peripheral side in that respect as well.

[0063] Further, although the inner tub 9 is rotated continuously and the air is blown to the clothes 56 in the present example, it is also possible to arrange a stopping time for rotation of the inner tub 9 to effect intermittent rotation.

[0064] Although Figure 10 is a time chart showing a case of rotating the inner tub 9 intermittently in the second tub rotation operation, by arranging the stopping time of the tub thus, the clothes 56 stays on the downstream side of the drying air 51, and the time for receiving the air can be secured further, therefore the force 72 for pushing out the clothes is applied more, and the wrinkles can be stretched effectively.

[0065] Lastly, the rotary blade rotation operation will be explained. In the rotary blade rotation operation, mixing is executed and the clothes 56 are allowed to switch places while rotating the rotary blade only in both forward and reverse directions 73 and flattening entirety of the clothes 56 with the inner tub 9 stopped. In the first tub rotation operation described above and the second tub rotation operation, the drying air 51 is blown concentrically to the upper surface side of the clothes 56, and the air hardly hits the lower surface side. Therefore, by mixing the clothes 56 regularly and allowing the clothes 56 to switch places vertically, it is possible to blow the drying air 51 to the entirety of the clothes 56 to stretch the wrinkles and to suppress uneven drying of the clothes. At this time, when mixing is strengthened by extending the rotation time of the rotary blade 11 and increasing the number of times of mixing, the clothes 56 are easily allowed to switch places vertically by rotation of one turn. On the other hand, however, the clothes 56 facing the rotary blade 11 are dragged, and twisting and tangling of the clothes are liable to occur. Therefore, it is preferable to suppress the rotation time of the rotary blade 11 and the number of times of mixing, to suppress twisting and tangling of the clothes by weak mixing, and to allow the clothes to switch places vertically. In other words, the execution time of the rotary blade rotation operation is made shorter than the execution time of the first tub rotation operation and the second tub rotation operation.

[0066] For example, in the case of 2 kg of the clothes amount, when the rotation time is 0.5 to 1.0 second and the number of times of mixing is within the range of two to eight reciprocations, the clothes can be allowed to switch places while comparatively suppressing twisting and tangling of the clothes. Also, even when the clothes 56 are not allowed to switch places vertically, while the cycle of the clothes concentration step and the clothes diffusion step is executed repeatedly, the clothes 56 are allowed gradually to switch places vertically, and therefore the drying air 51 can be blown to the entirety of the clothes 56 without any problem.

[0067] Also, when the rotary blade 11 is rotated, since the clothes 56 are lifted up by the gentle tilted surface 11h of the rotary blade 11, the distance of the blow-out part 54 and the clothes 56 is reduced. Therefore, since the velocity of the drying air 51 blown to the clothes 56 increases, the stronger force 72 for pushing out the clothes 56 can be obtained, and the wrinkles generated during drying are reduced further.

[0068] Further, although the inner tub 9 is stopped in the rotary blade rotation operation in the present example, the present invention is not limited to it. For example, it is also possible to open the clutch mechanism 12 and to rotate only the rotary blade 11 with the inner tub 9 being freely rotatable.

[0069] Here, the time incurred for one cycle of the clothes concentration step and the clothes diffusion step will be explained.

[0070] In the present invention, with respect to the clothes 56, it is repeated to move to the outer peripheral side of the inner tub 9 by the clothes concentration step and to move to the central part of the inner tub 9 by the clothes diffusion step. At this time, when the time of the clothes concentration step or the clothes diffusion step is long and drying proceeds while the clothes 56 remain unmoved within the inner tub 9, folding and twisting are generated in the clothes 56 and the clothes 56 are dried as they are, therefore these folding and twisting are attached as wrinkles, and the finishing condition degrades. Therefore, it is preferable that the clothes 56 within the inner tub 9 are moved constantly and are dried changing the shape.

[0071] Therefore, in the present example, assuming that the time over which the drying degree of the clothes (= weight of dried cloth/weight of wet cloth $\times$ 100) rises by 1% is T, the cycle of the clothes concentration step and the clothes drying step is executed within the time T. The execution time of one cycle is made shorter than the time over which the drying degree of the clothes 56 which are the laundry changes by 1%. In other words, when variation of the drying degree is within 1%, wrinkling caused by folding and twisting are not attached to the clothes 56, and therefore wrinkling is suppressed and the finishing condition of the clothes improves by changing the shape of the clothes 56 finely.

[0072] Also, it is a matter of course that the time T changes according to the clothes amount of the inner tub 9. When the clothes amount is 2 kg, the drying time is 120 minutes, and the drying degree of the clothes after the final dehydration is approximately 65%. Therefore, when the drying time of 120 minutes is divided by the balance of 35%, the time T is obtained which is equivalent

to approximately four minutes. Also, when the clothes, amount is large, the drying time becomes long, and therefore the time T obviously becomes long. However, at any rate, it is preferable that the time incurred for one cycle is made T or less.

[0073] Thus, the first tub rotation operation of bringing the clothes 56 to the outer peripheral side of the inner tub 9, the second tub rotation operation of moving the clothes 56 to the central part of the inner tub 9 while blowing the drying air 51 to the clothes 56 to push out the clothes 56, and the rotary blade rotation operation of flattening the clothes 56 and allowing the clothes 56 to switch places are executed within the time T when wrinkling of the clothes 56 is not fixed, and they are repeated. Thus, the drying air 51 is blown to the clothes 56 with the upper surface thereof allowed to switch places constantly. That is to say, since the drying air 51 comes to be blown to the clothes 56 evenly, the temperature of the clothes rises while the wrinkles are stretched as a whole.

<<Step S204>>

[0074] Executed until the lapse time from the start of drying becomes a given time or until the rate of the temperature change becomes a predetermined value while step S203 is executed monitoring the temperature of the hot air by the temperature sensor 26-. These given time and determined value of the temperature change are set to timing when the drying degree of the clothes exceeds 90%. The reason of doing so is that, when the drying degree of the clothes becomes 90% or more, wrinkling of the clothes is fixed and the wrinkles cannot be removed in the steps thereafter. Therefore, it becomes important to sufficiently push out the clothes and stretch the wrinkles before the drying degree becomes 90% (Step S203). In other words, in the steps thereafter, even when some twisting and tangling may occur in the sleeve and the body, the degree of wrinkling is weak, and drying of the clothes proceeds while keeping excellent finishing condition.

[0075] Also, at the time of actual drying, since the clothes with different material and thickness are dried simultaneously, the time when the drying degree becomes 90% also differs according to the cloth. Therefore, in the present example, the time when the drying degree of a thin cotton cloth where the wrinkles are caused most easily becomes approximately 80 to 85% is set. In other words, one cycle is executed until the drying degree of the clothes which are the laundry reaches at least 80%. Also, since the time when the drying degree reaches 90% differs according to the clothes amount, it is a matter of course that the time should be set according to the clothes amount.

[0076] Also, since the temperature of the clothes 56 is raised evenly and uneven temperature and uneven drying are reduced in Step S203, there is also an advantage that detection of the temperature change is stabilized. Thus, precise and fine control is enabled.

<<Step S205>>

[0077] Simultaneously with energization of the heater 20, the impeller of the blower fan 19 is rotated at a speed lower than the revolution speed of Step S202. In the case of the present example, the impeller of the blower fan 19 is rotated at a low speed of approximately 15,000 r/min. Here, the reason of reducing the revolution speed of the fan is not to exceed an allowable electric current value.

<<Step S206>>

[0078] By rotating the inner tub 9 and the rotary blade 11 integrally or executing forward and reverse rotation of the rotary blade 11 with the inner tub 9 stopped, finishing drying is executed in which the entirety of the clothes 56 is heated while being mixed. As described above, since the drying degree of the clothes 56 exceeds 90%, even when the clothes may be caught by rotation of the rotary blade 11 and some twisting may occur in a sleeve and a body, the degree of wrinkling is weak, and drying of the clothes proceeds while keeping excellent finishing condition.

<<Step S207>>

[0079] Executed monitoring the temperature of the hot air by the temperature sensor 26, and it is determined that drying has finished when the rate of the temperature change has become the predetermined value. When the clothes 56 are not dry, the inner tub 9 and the rotary blade 11 are rotated as per Step S206, and determination of Step S207 is executed again.

<<Step S208>>

[0080] After the heater 20 is turned off, the blower fan 19 is turned off further, rotation of the inner tub 9 and the rotary blade 11 is stopped, and the drying step is finished.

[0081] As described above, according to the present example, in the drying step, until the drying degree of the clothes becomes 90% or more and the finishing condition is fixed, the first tub rotation operation of bringing the clothes 56 to the outer peripheral side of the inner tub 9, the second tub rotation operation of blowing the drying air 51 to the clothes 56 to push out the clothes 56, and the rotary blade rotation operation of mixing the clothes 56 to promote to allow the clothes 56 to switch places are executed repeatedly, the drying air 51 is blown to the clothes 56 while suppressing twisting and tangling of the clothes, and therefore clothes having excellent finishing condition and less uneven drying can be provided to the user.

[0082] Further, although explanation has been made using the heater 20 as a thermal source in the present example, even when the thermal source is one using a heat pump, a similar effect can be secured.

[Example 2]

[0083] Next, the second example will be explained using Figure 11 and Figure 12. Figure 11 is a schematic drawing expressing three steps executed in Step S203, and shows the first tub rotation operation (a), the second tub rotation operation (b), and the rotary blade rotation operation (c) respectively. Also, Figure 12 is a time chart showing these three operations.

[0084] With respect to the configurations common to the first example, duplicated explanation will be omitted. The point different from the first example is that only the second tub rotation operation is executed in the clothes diffusion step in Step S203 of the drying step.

[0085] According to the second example, the first tub rotation operation is executed in the clothes concentration step, the second tub rotation operation is executed in the clothes diffusion step, they are executed by several cycles, the rotary blade rotation operation is thereafter executed, and execution frequency of the rotary blade rotation operation is reduced compared to the first example. When the velocity of the drying air 51 blown to the clothes 56 is comparatively high and the clothes amount is small, since the clothes 56 can be blown upward by a force of the air, even when the rotary blade rotation operation is not executed in every cycle, the clothes 56 are mixed little by little, end an effect of allowing the clothes 56 to switch places in the vertical direction can be secured. Thus, since occurrence of twisting and tangling of the clothes caused by rotation of the rotary blade 11 can be suppressed, the clothes with better finishing condition can be provided.

[0086] In the case of the present example, the air having the air amount of 2.3 m^3/min and the velocity of approximately 120 m/s at the outlet of the blow-out part 54 is blown. At this time, the clothes 56 can be pushed out and the wrinkles can be stretched when the rotation speed of the inner tub 9 in the second tub rotation operation is 35 r/min or less. However, when the rotation speed of the inner tub 9 in the second tub rotation operation is 20 r/min or less, the clothes 56 are not only pushed out but can be blown upward. The reason is that the time the clothes 56 stay on the downstream side of the drying air 51 becomes long, and the clothes 56 easily receive the force of the air.

[0087] Also, when the clothes amount is small, namely when the clothes amount is 1 kg for example, the clothes are mixed sufficiently by a force of the air even when the rotary blade rotation operation is not executed. However, when the clothes amount becomes 2 kg or larger, there is a case that the air does not reach the lower surface side which is close to the rotary blade 11 and the clothes are not mixed sufficiently. Therefore, according to the present example, the rotary blade rotation operation is arranged every 10 cycles. Thus, uneven drying is suppressed which results in shortening of the drying time.

[0088] Also, according to the present example, since shifting from the tub rotation operation to the rotary blade rotation operation and shifting from the rotary blade rotation operation to the tub rotation operation are suppressed to the minimum, the number of times of switching of the clutch mechanism 12 of the driving part can also be suppressed to the minimum, and the wear can be suppressed.

[0089] Also, in the first tub rotation operation and the second tub rotation operation, the rotation direction of the inner tub 9 is not limited to the forward direction of 70a and 70b, and the inner tub 9 may be rotated in both of forward and reverse directions. Figure 13 is a schematic drawing showing that the movement of the clothes differs according to the difference in the rotation direction of the inner tub 9. As shown in Figure 13, in a case that clothes 56A overlap on top of clothes 56B, when the inner tub 9 is rotated in the forward direction (Figure 13(a)), the force 72 for pushing out the clothes is applied to the direction of lifting the clothes 56A to promote movement of the clothes. However, when the inner tub 9 is rotated in the reverse direction (Figure 13(b)), since the force of the air is applied to the direction of pressing the clothes 56A to the clothes 56B, the clothes hardly move. Therefore, by moving the inner tub 9 in both directions, the clothes can be blown upward easily, and the clothes can be mixed more.

[0090] For example, Figure 14 is a time chart of a case of rotating the inner, tub 9 in both of forward and reverse directions in the first tub rotation operation and the second tub rotation operation, and the clothes can be mixed effectively by rotating the inner tub 9 in this way. Also, it is a matter of course that rotation in both of forward and reverse directions may be executed in either one of the first tub rotation operation and the second tub rotation operation.

[0091] . For example, Figure 15 is a time chart of a case that the inner tub 9 is rotated in both of the forward and reverse directions in the second tub rotation operation. By doing so, since switching of the rotation direction is not required in the first tub rotation operation where the revolution speed is comparative high, the torque applied to the driving part is reduced, and the wear can be suppressed.

[0092] Also, Figure 16 shows a time chart of a case of switching the direction of the tub rotation at every cycle. By doing so, since the number of times for switching the operation direction is reduced further, wear of the driving part can be suppressed further. Also, the way of moving in the first tub rotation operation and the first tub rotation operation is not limited to the above, and it is a matter of course that they can be combined.

[0093] Further, the revolution speed of the first tub rotation operation and the second tub rotation operation in each cycle is made constant in the present example, the present invention is not limited it, and it is also possible to change the revolution speed in each cycle. For example, the revolution speed of the first tub rotation operation may be increase gradually in each cycle. When drying proceeds and the clothes 56 become light in weight, a

centrifugal force applied to the clothes 56 becomes weak. Therefore, by increasing the revolution speed gradually, the clothes 56 are easily moved to the outer peripheral side.

[0094] Further, although the drying air 51 is blown to the generally vertically downward direction along which the drying air 51 can hit the clothes 56 with the shortest distance in the present example, the blowing direction is not limited to the generally vertically downward direction. For example, Figure 17 is a schematic drawing showing a case of tilting the blow-out part and blowing the drying air 51 toward the peripheral direction of the inner tub 9. Thus, by blowing the drying air 51 so as to become the opposing air against the moving direction of the clothes 56, the air blown to the clothes 56 becomes relatively fast, a stronger force for mixing and pushing out the clothes 56 can be secured, therefore the drying efficiency improves, and the wrinkles are reduced.

Reference Signs List

[0095]

1	housing,
2	top cover,
2a	clothes inlet,
3	outer lid,
8	operation panel,
9	inner tub,
10	outer tub,
11	rotary blade,
12	clutch mechanism,
13	washing and dehydration drive motor,
14	control device,
15	water discharging solenoid valve,
16	circulation pump,
19	blower fan,
20	heater,
22	drying duct,
23	inner lid,
24	water discharge hose,
26	temperature sensor,
27	vibration sensor,
31	tub cover,
33	circulation water inlet,
34	nozzle,
40	microcomputer,
42	drive circuit,
51	drying air,
54	blow-out part,
56, 56A, 56B	clothes,
70, 70a, 70b	forward direction,
71, 71a, 71b	centrifugal force,
72	pushing out force,
73	both forward and reverse directions,
100	washing and drying machine

Claims

1. A washing machine, comprising:

a housing;
an outer tub housed in the housing;
an inner tub housed in the outer tub;
a rotary blade rotatably provided on an inner bottom part of the inner tub;
a driving part for rotatably driving the inner tub and the rotary blade;
a drying part that is housed in the housing and blows drying air from above the inner tub toward the outside of a lower central part of the inner tub; and
a control part for controlling a washing step, a rinsing step, a dehydration step, and a drying step,
wherein the drying step has a first drying step of moving laundry in the inner tub to an outer peripheral side of the inner tub and a second drying step of diffusing the laundry on the outer peripheral side of the inner tub into the inner tub after the first drying step, and
the first drying step and the second drying step are taken as one cycle and are repeatedly executed.

2. The washing machine according to claim 1,

wherein the first drying step has a first tub rotation operation of rotating the inner tub and the rotary blade integrally at a predetermined revolution speed, and
the second drying step has a second tub rotation operation of allowing rotation at a revolution speed slower than the predetermined revolution speed of the first tub rotation operation.

3. The washing machine according to claim 2,
wherein the second drying step has a rotary blade rotation operation of rotating only the rotary blade after the second tub rotation operation.

4. The washing machine according to either one of claim 2 and claim 3,
wherein execution time of the one cycle is shorter than time over which a drying degree of the laundry changes by 1%.

5. The washing machine according to any one of claim 2 to claim 4,
wherein execution time of the first tub rotation operation is shorter than execution time of the second tub rotation operation.

6. The washing machine according to any one of claim 3 to claim 5,

wherein execution time of the rotary blade rotation operation is shorter than execution time of the first tub rotation operation.

7. The washing machine according to any one of claim 2 to claim 6,

wherein the dehydration step has at least two kinds of revolution speed of a first revolution speed for moving the laundry to the outer peripheral side of the inner tub and a second revolution speed for removing moisture from the laundry and that is faster than the first revolution speed, and
revolution speed of the first tub rotation operation is higher than the first revolution speed of the dehydration step.

8. The washing machine according to any one of claim 1 to claim 7,
wherein the one cycle is executed until a drying degree of the laundry reaches at least 80%.

FIG. 1

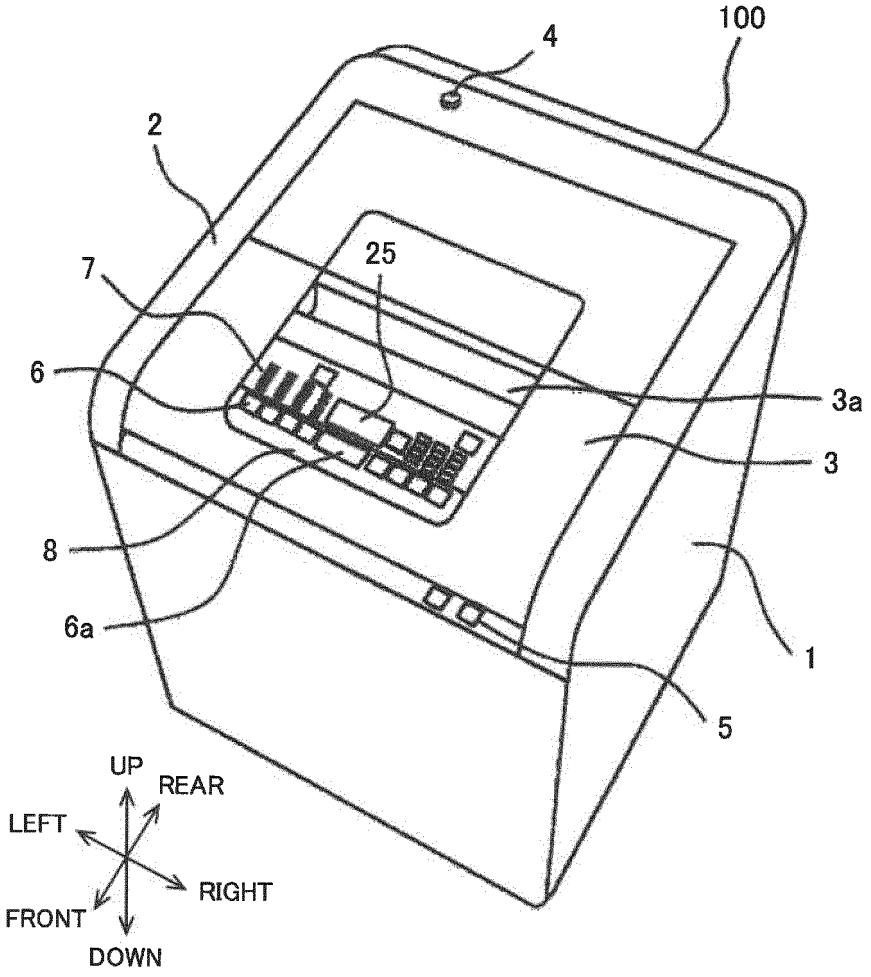


FIG. 2

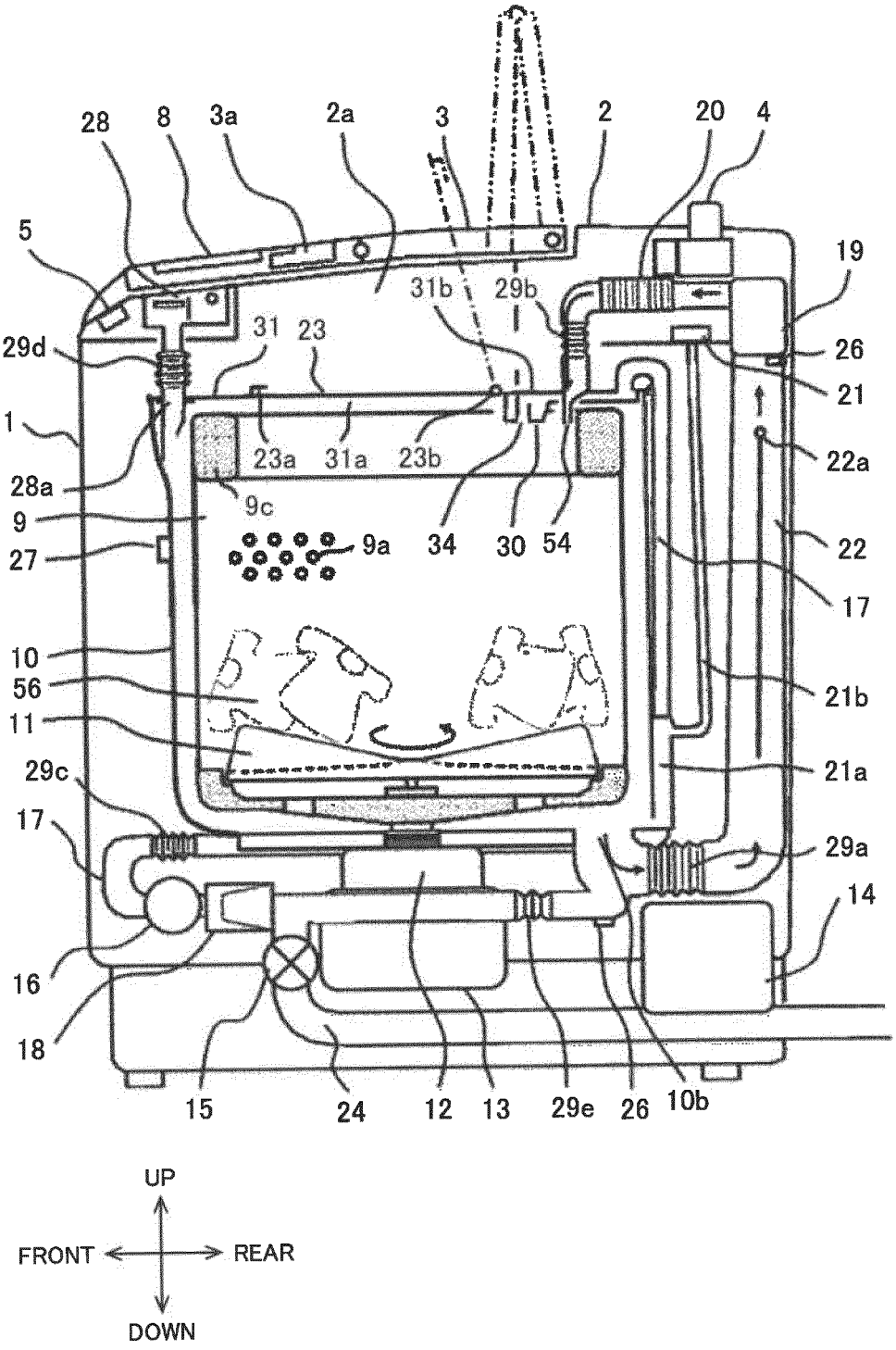

28
8
3a
2a
3
2
20
4
5
19
31b
29b
29d
31
23
26
21
1
22a
23a
31a
23b
28a
9c
9
9a
34
30
54
22
27
17
10
56
21b
11
29c
21a
17
29a
14
16
18
15
24
12
13
29e
26
10b
UP
FRONT
REAR
DOWN

FIG. 3

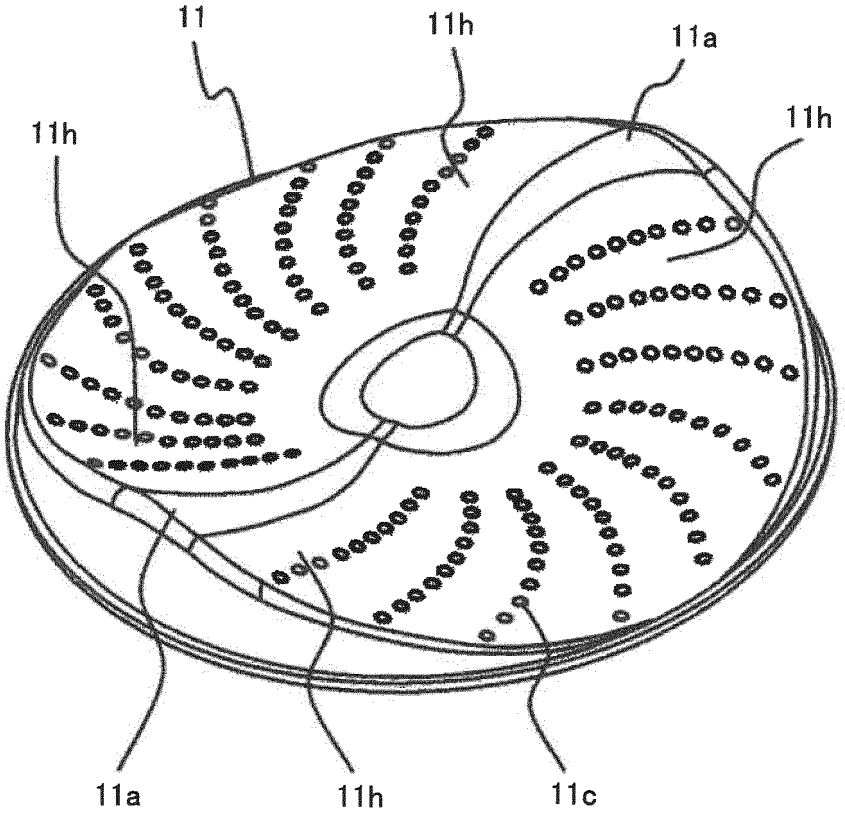


FIG. 4

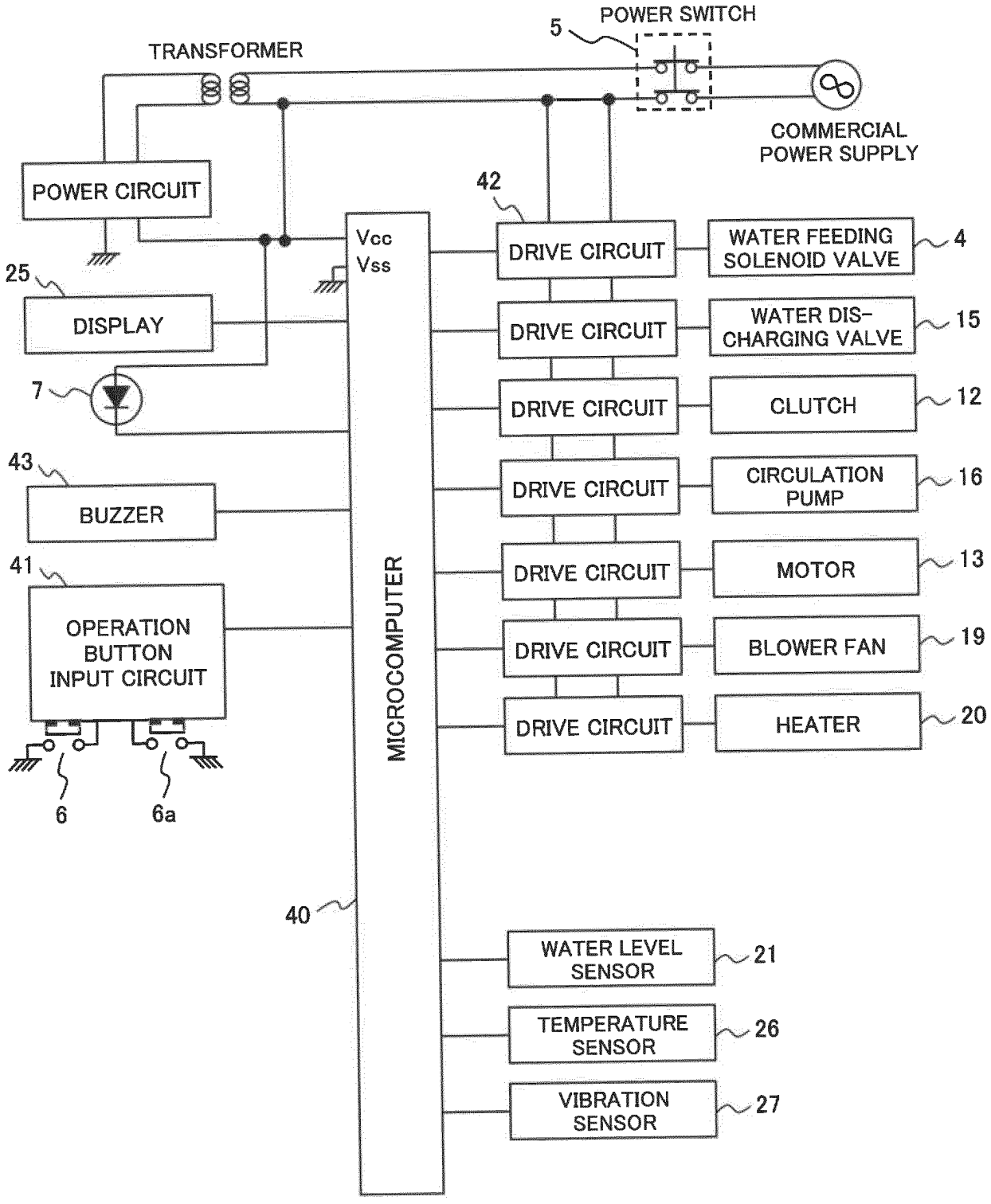

POWER SWITCH
5
TRANSFORMER
COMMERCIAL POWER SUPPLY
POWER CIRCUIT
42
Vcc
Vss
DRIVE CIRCUIT
WATER FEEDING SOLENOID VALVE
4
25
DISPLAY
DRIVE CIRCUIT
WATER DIS-CHARGING VALVE
15
7
DRIVE CIRCUIT
CLUTCH
12
43
BUZZER
DRIVE CIRCUIT
CIRCULATION PUMP
16
41
OPERATION BUTTON INPUT CIRCUIT
DRIVE CIRCUIT
MOTOR
13
DRIVE CIRCUIT
BLOWER FAN
19
DRIVE CIRCUIT
HEATER
20
MICROCOMPUTER
6
6a
40
WATER LEVEL SENSOR
21
TEMPERATURE SENSOR
26
VIBRATION SENSOR
27

FIG. 5

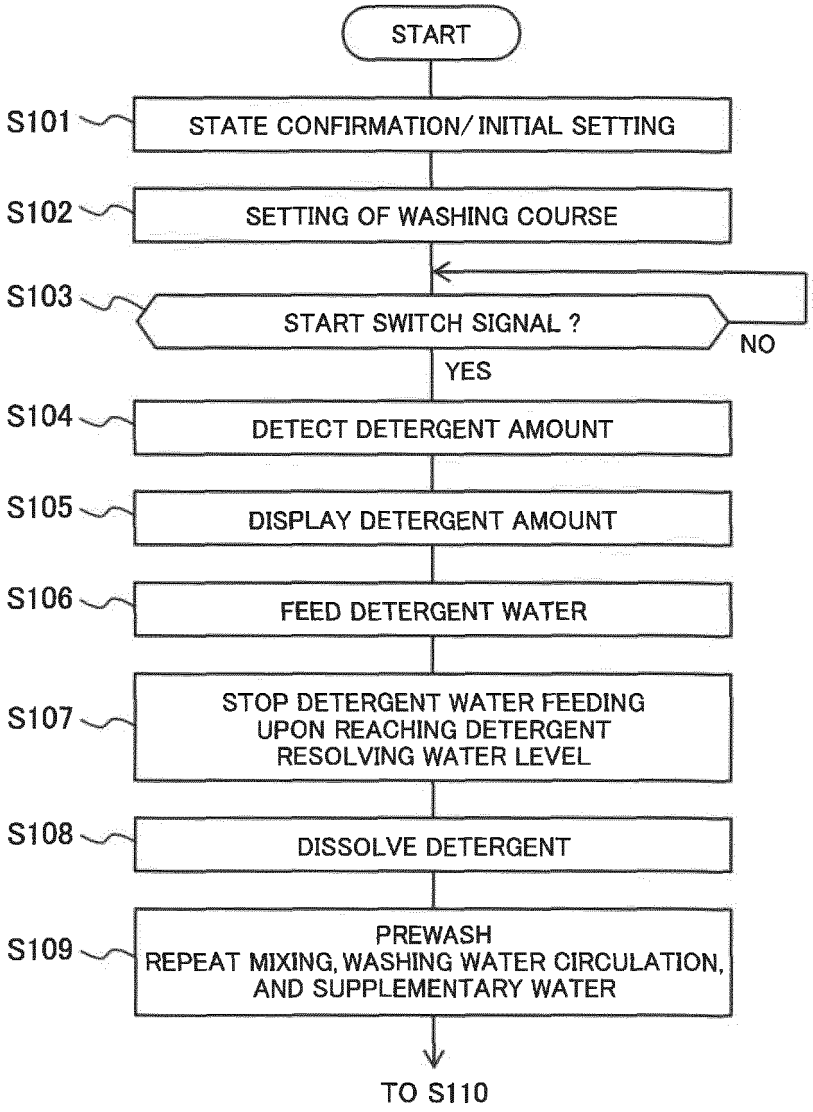

START
S101
STATE CONFIRMATION/ INITIAL SETTING
S102
SETTING OF WASHING COURSE
S103
START SWITCH SIGNAL ?
NO
YES
S104
DETECT DETERGENT AMOUNT
S105
DISPLAY DETERGENT AMOUNT
S106
FEED DETERGENT WATER
S107
STOP DETERGENT WATER FEEDING UPON REACHING DETERGENT RESOLVING WATER LEVEL
S108
DISSOLVE DETERGENT
S109
PREWASH
REPEAT MIXING, WASHING WATER CIRCULATION, AND SUPPLEMENTARY WATER
TO S110

FIG. 6

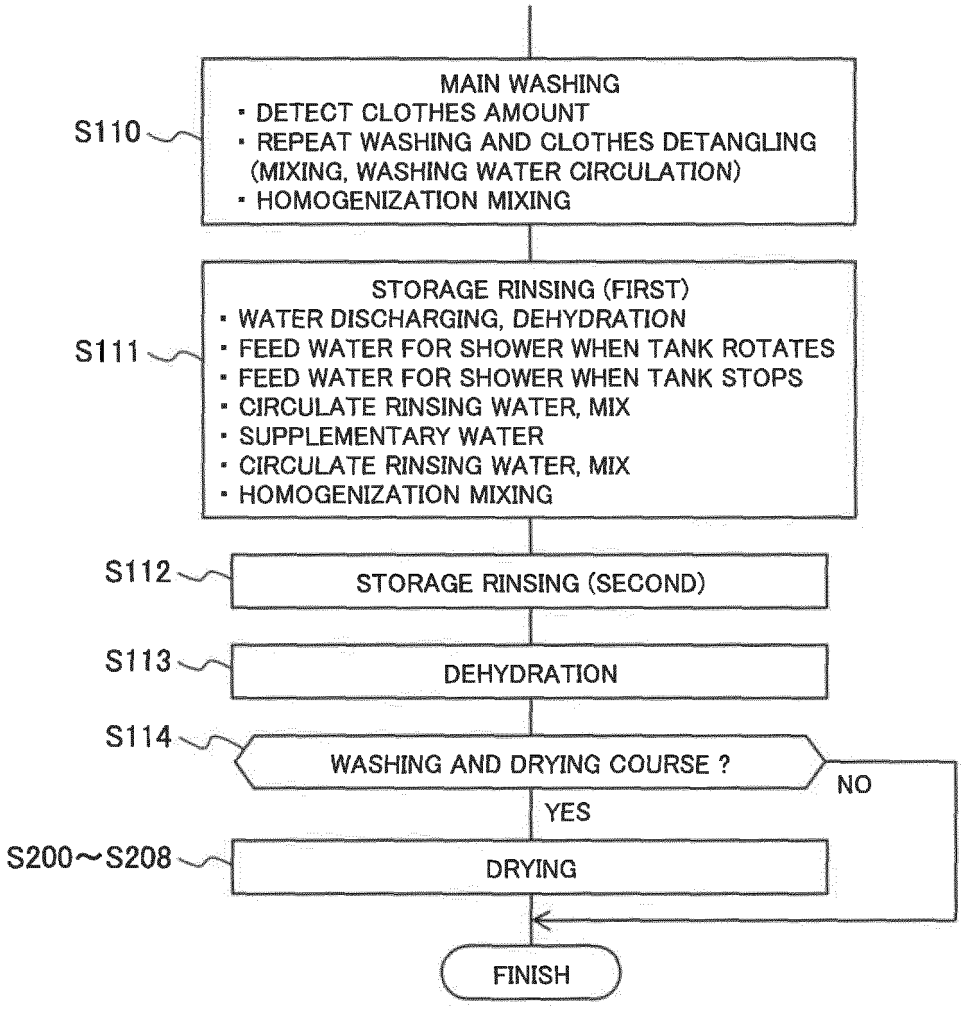

S110
MAIN WASHING
• DETECT CLOTHES AMOUNT
• REPEAT WASHING AND CLOTHES DETANGLING (MIXING, WASHING WATER CIRCULATION)
• HOMOGENIZATION MIXING
S111
STORAGE RINSING (FIRST)
• WATER DISCHARGING, DEHYDRATION
• FEED WATER FOR SHOWER WHEN TANK ROTATES
• FEED WATER FOR SHOWER WHEN TANK STOPS
• CIRCULATE RINSING WATER, MIX
• SUPPLEMENTARY WATER
• CIRCULATE RINSING WATER, MIX
• HOMOGENIZATION MIXING
S112
STORAGE RINSING (SECOND)
S113
DEHYDRATION
S114
WASHING AND DRYING COURSE ?
NO
YES
S200~S208
DRYING
FINISH

FIG. 7

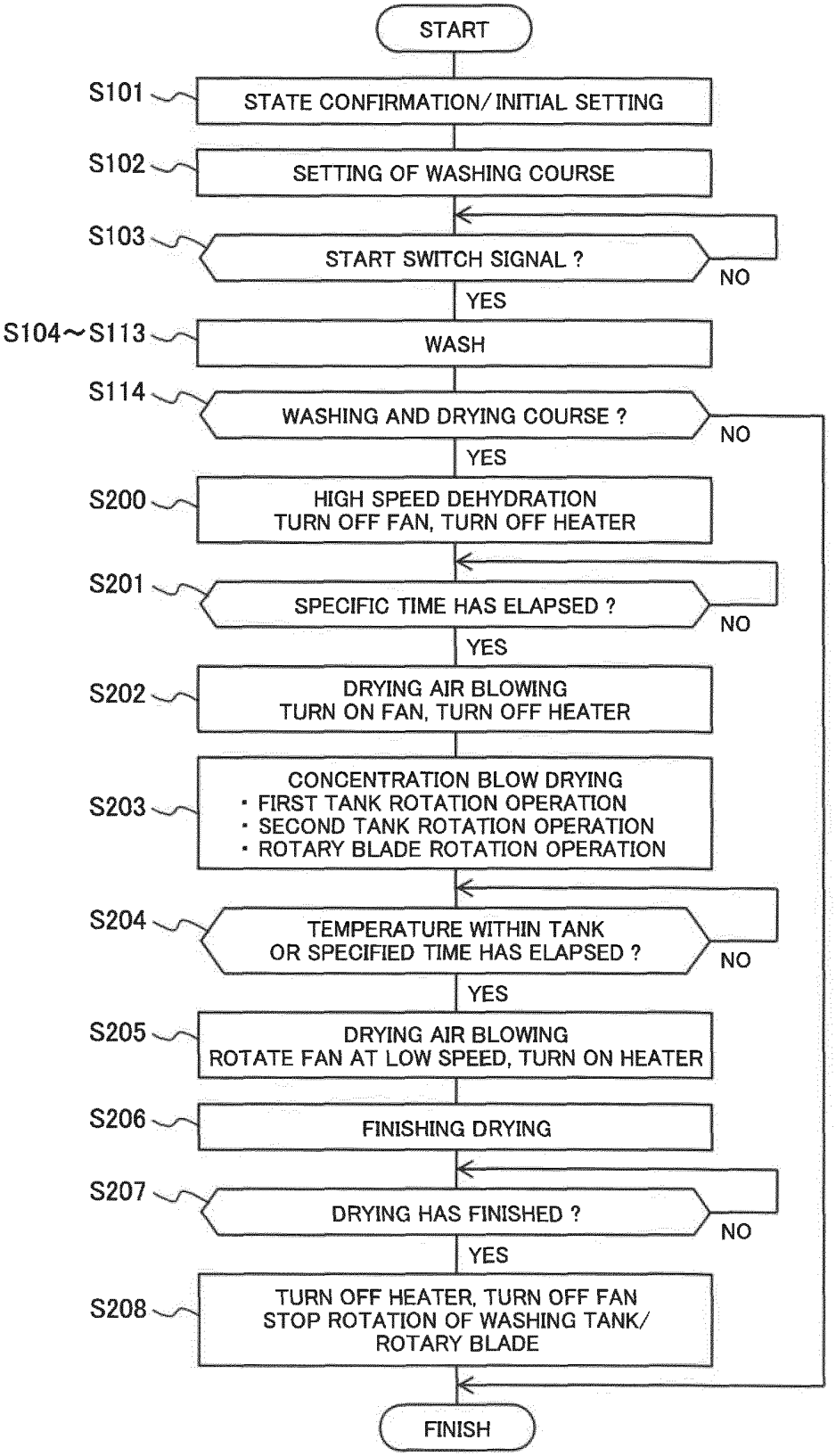

START
S101
STATE CONFIRMATION/ INITIAL SETTING
S102
SETTING OF WASHING COURSE
S103
START SWITCH SIGNAL ?
NO
YES
S104~S113
WASH
S114
WASHING AND DRYING COURSE ?
NO
YES
S200
HIGH SPEED DEHYDRATION
TURN OFF FAN, TURN OFF HEATER
S201
SPECIFIC TIME HAS ELAPSED ?
NO
YES
S202
DRYING AIR BLOWING
TURN ON FAN, TURN OFF HEATER
S203
CONCENTRATION BLOW DRYING
• FIRST TANK ROTATION OPERATION
• SECOND TANK ROTATION OPERATION
• ROTARY BLADE ROTATION OPERATION
S204
TEMPERATURE WITHIN TANK
OR SPECIFIED TIME HAS ELAPSED ?
NO
YES
S205
DRYING AIR BLOWING
ROTATE FAN AT LOW SPEED, TURN ON HEATER
S206
FINISHING DRYING
S207
DRYING HAS FINISHED ?
NO
YES
S208
TURN OFF HEATER, TURN OFF FAN
STOP ROTATION OF WASHING TANK/
ROTARY BLADE
FINISH

FIG. 8

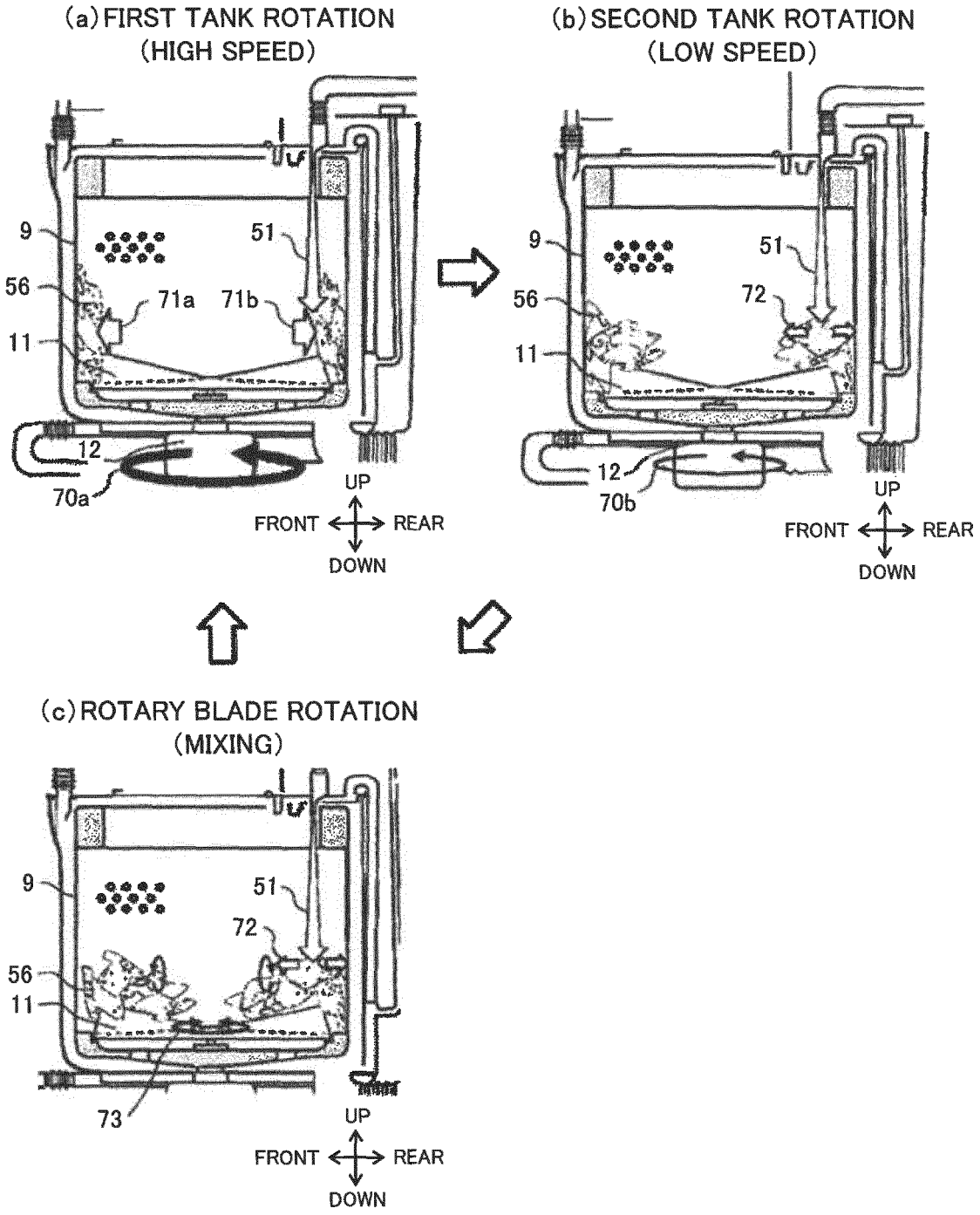

(a) FIRST TANK ROTATION
(HIGH SPEED)
9
51
56
71a
71b
11
12
70a
UP
FRONT
REAR
DOWN
(b) SECOND TANK ROTATION
(LOW SPEED)
9
51
56
72
11
12
70b
UP
FRONT
REAR
DOWN
(c) ROTARY BLADE ROTATION
(MIXING)
9
51
72
56
11
73
UP
FRONT
REAR
DOWN

FIG. 9

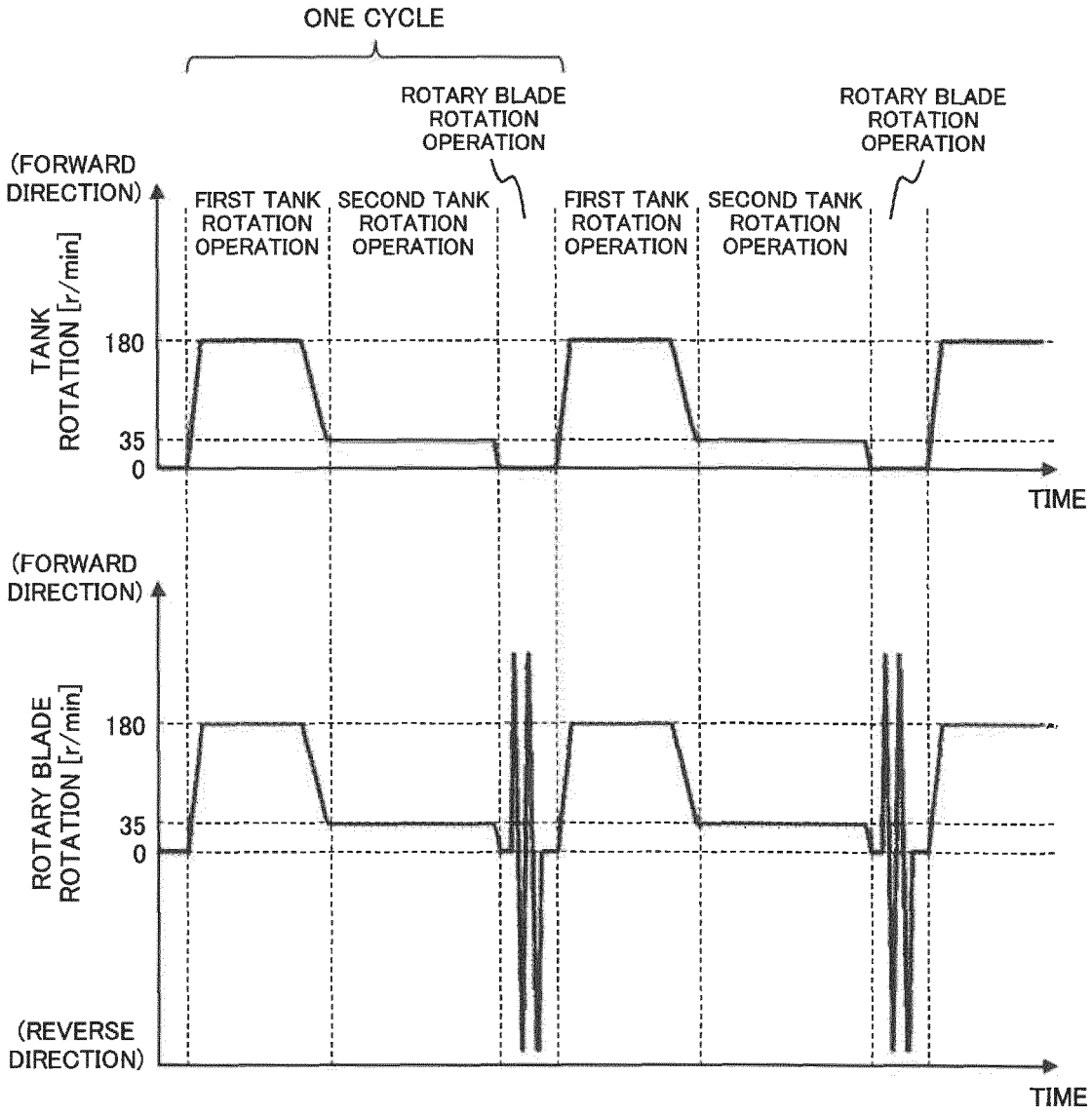

ONE CYCLE
ROTARY BLADE ROTATION OPERATION
ROTARY BLADE ROTATION OPERATION
(FORWARD DIRECTION)
FIRST TANK ROTATION OPERATION
SECOND TANK ROTATION OPERATION
FIRST TANK ROTATION OPERATION
SECOND TANK ROTATION OPERATION
TANK ROTATION [r/min]
180
35
0
TIME
(FORWARD DIRECTION)
ROTARY BLADE ROTATION [r/min]
180
35
0
(REVERSE DIRECTION)
TIME

FIG. 10

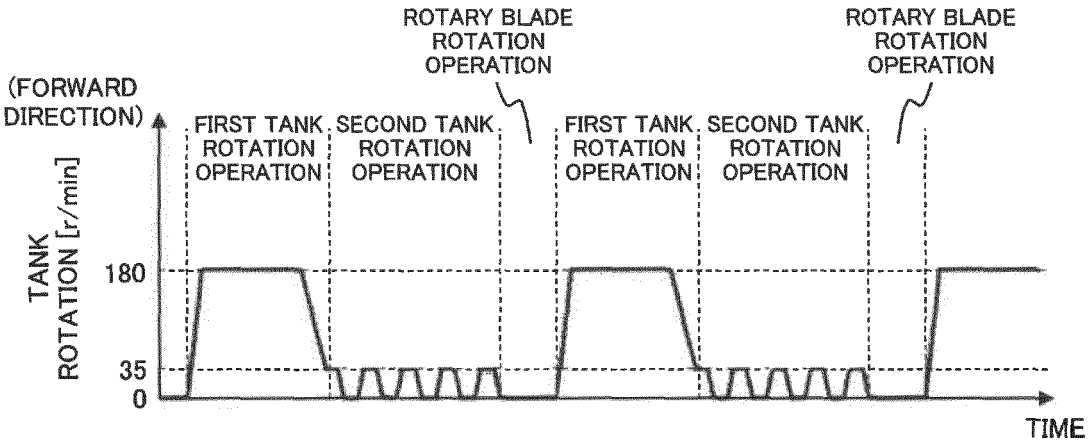

ROTARY BLADE ROTATION OPERATION
ROTARY BLADE ROTATION OPERATION
(FORWARD DIRECTION)
FIRST TANK ROTATION OPERATION
SECOND TANK ROTATION OPERATION
FIRST TANK ROTATION OPERATION
SECOND TANK ROTATION OPERATION
TANK ROTATION [r/min]
180
35
0
TIME

FIG. 11

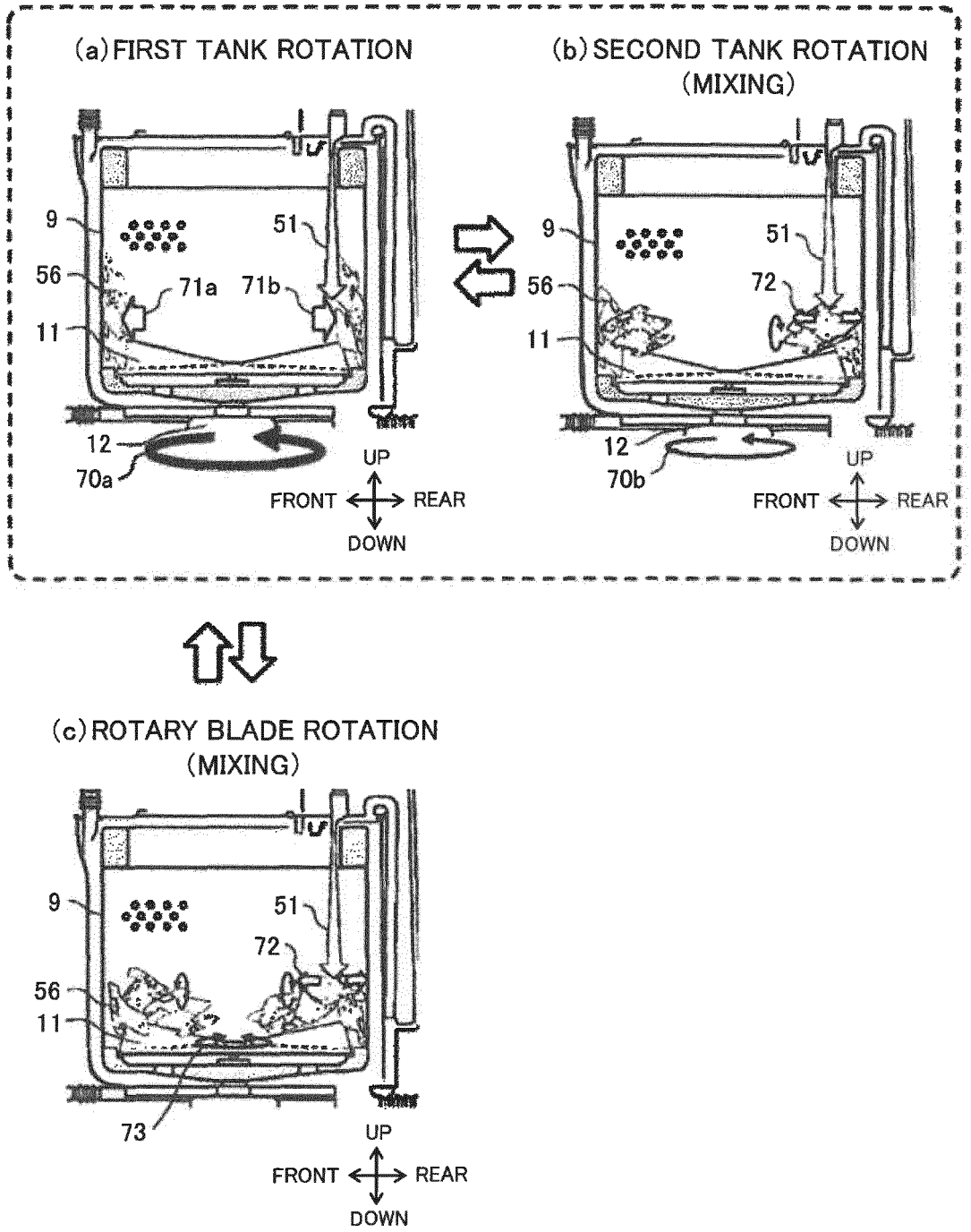

(a) FIRST TANK ROTATION
(b) SECOND TANK ROTATION (MIXING)
(c) ROTARY BLADE ROTATION (MIXING)
9
51
56
71a
71b
11
12
70a
72
70b
73
UP
FRONT
REAR
DOWN

FIG. 12

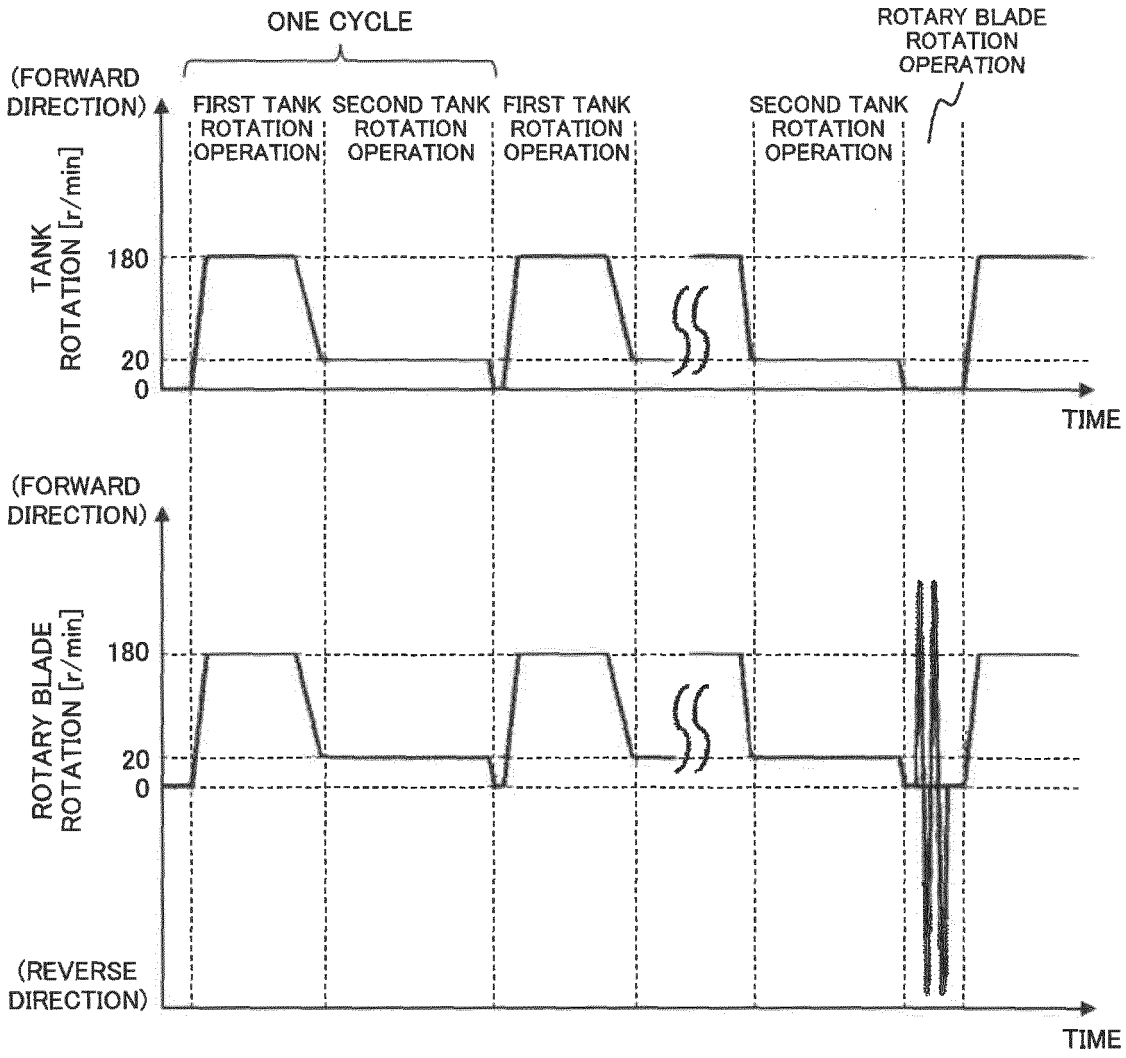
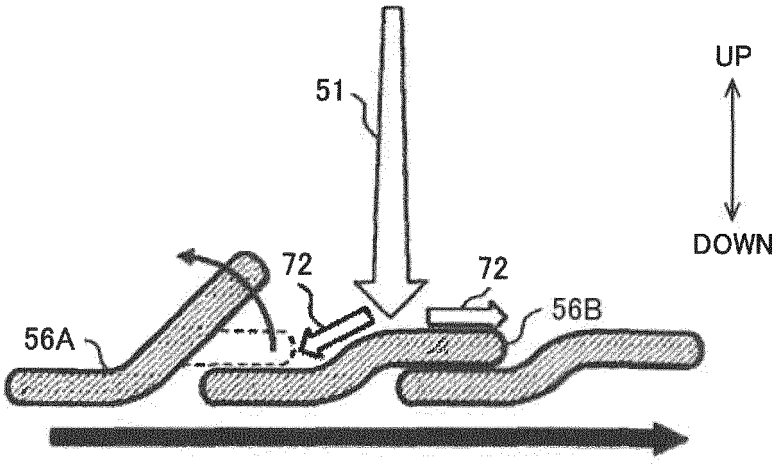

ONE CYCLE
ROTARY BLADE ROTATION OPERATION
(FORWARD DIRECTION)
FIRST TANK ROTATION OPERATION
SECOND TANK ROTATION OPERATION
FIRST TANK ROTATION OPERATION
SECOND TANK ROTATION OPERATION
TANK ROTATION [r/min]
180
20
0
TIME
(FORWARD DIRECTION)
ROTARY BLADE ROTATION [r/min]
180
20
0
(REVERSE DIRECTION)
TIME

FIG. 13

(a) IN LIFTING CLOTHES



(b) IN PRESSING CLOTHES

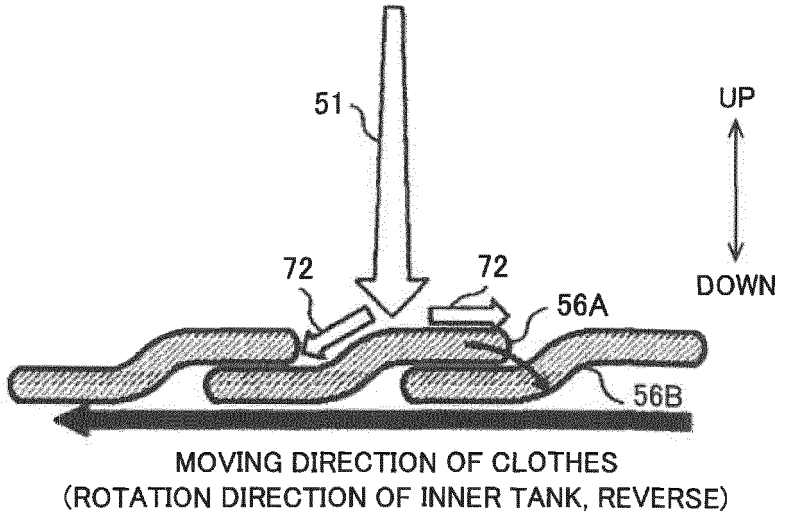


FIG. 14

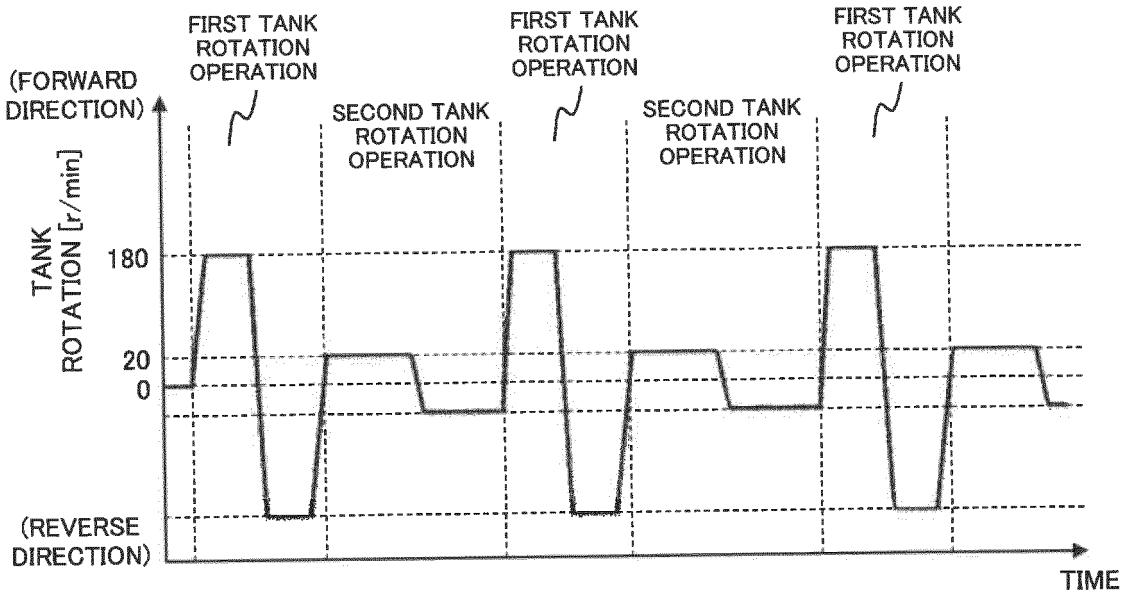

FIRST TANK ROTATION OPERATION
SECOND TANK ROTATION OPERATION
FIRST TANK ROTATION OPERATION
SECOND TANK ROTATION OPERATION
FIRST TANK ROTATION OPERATION
(FORWARD DIRECTION)
TANK ROTATION [r/min]
180
20
0
(REVERSE DIRECTION)
TIME

FIG. 15

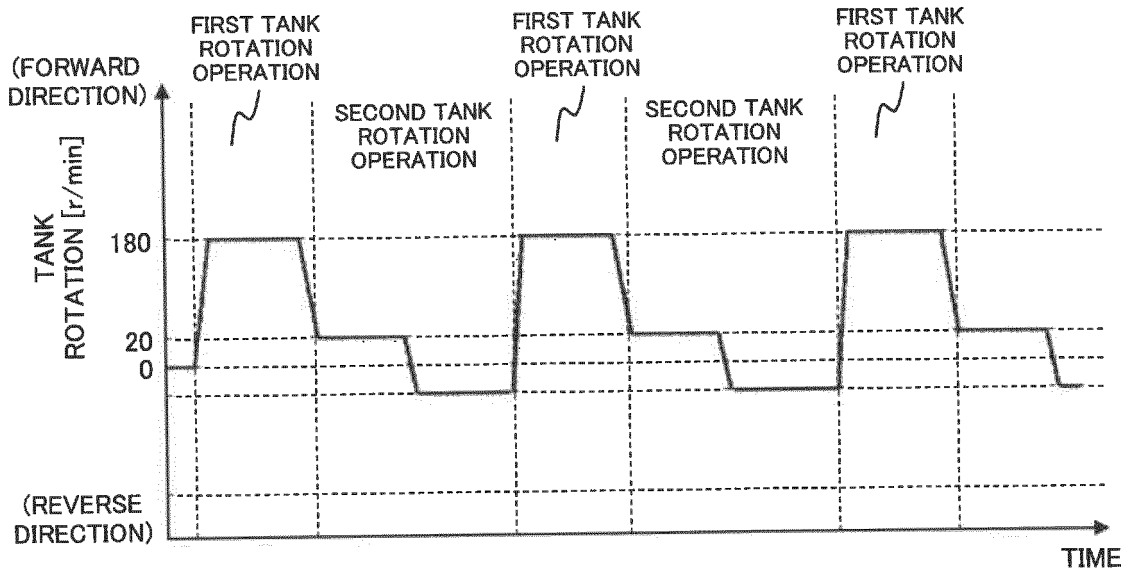

FIRST TANK ROTATION OPERATION
SECOND TANK ROTATION OPERATION
FIRST TANK ROTATION OPERATION
SECOND TANK ROTATION OPERATION
FIRST TANK ROTATION OPERATION
(FORWARD DIRECTION)
TANK ROTATION [r/min]
180
20
0
(REVERSE DIRECTION)
TIME

FIG. 16

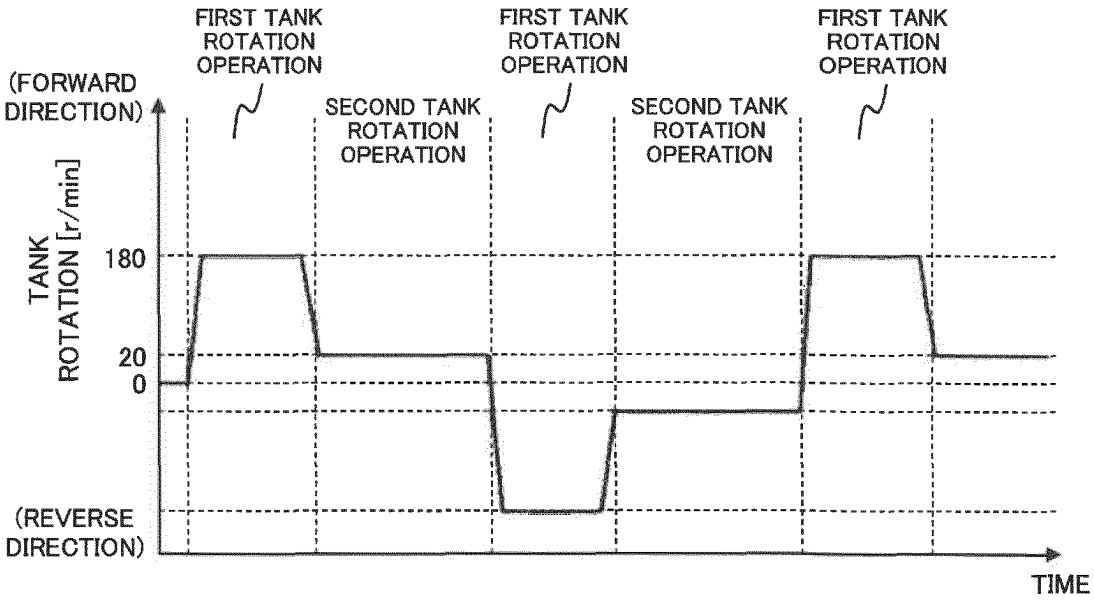
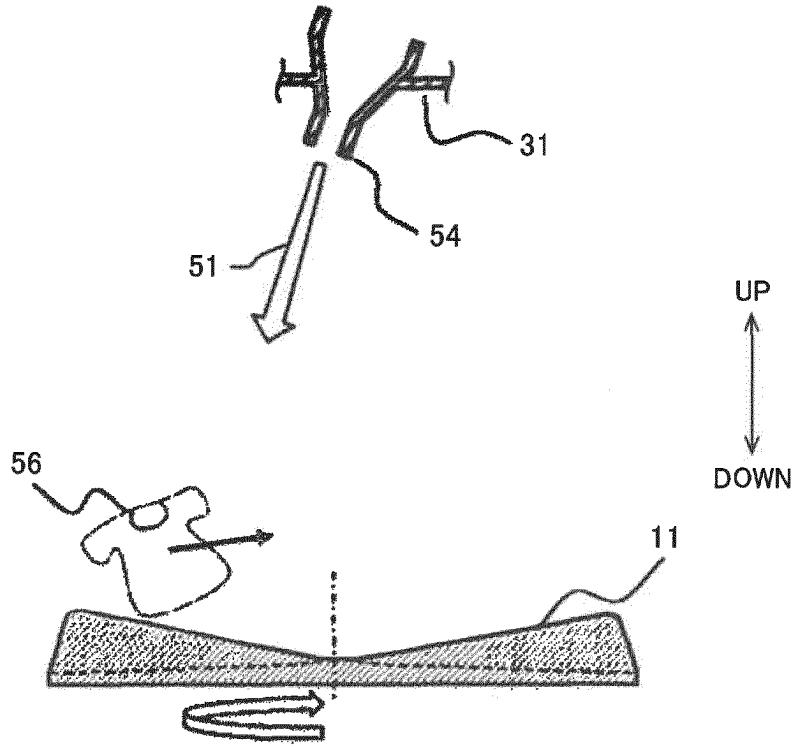

FIRST TANK ROTATION OPERATION
SECOND TANK ROTATION OPERATION
FIRST TANK ROTATION OPERATION
SECOND TANK ROTATION OPERATION
FIRST TANK ROTATION OPERATION
(FORWARD DIRECTION)
TANK ROTATION [r/min]
180
20
0
(REVERSE DIRECTION)
TIME

FIG. 17


31
54
51
UP
DOWN
56
11

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2021/005662

A. CLASSIFICATION OF SUBJECT MATTER
Int. Cl. D06F33/68(2020.01)i, D06F58/38(2020.01)i
FI: D06F58/38, D06F33/68

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int. Cl. D06F33/68, D06F58/38

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Published examined utility model applications of Japan 1922-1996
Published unexamined utility model applications of Japan 1971-2021
Registered utility model specifications of Japan 1996-2021
Published registered utility model applications of Japan 1994-2021

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2002-58893 A (MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD.) 26 February 2002, paragraphs [0013]-[0033], [0040]-[0043], fig. 1-3, 5, 6	1-8
X	JP 2007-313140 A (HITACHI APPLIANCES, INC.) 06 December 2007, paragraphs [0020]-[0025], fig. 6, 7	1-8

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
08.04.2021	20.04.2021
Name and mailing address of the ISA/ Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2021/005662

Patent Documents referred to in the Report	Publication Date	Patent Family	Publication Date
JP 2002-58893 A	26.02.2002	(Family: none)	
JP 2007-313140 A	06.12.2007	CN 101082163 A p. 6, line 17 to p. 7, line 24, fig. 6, 7	

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Patent documents cited in the description

- JP 2006014806 A **[0005]**
- JP 2009101206 A **[0005]**