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(71) Applicant: **SAMSUNG ELECTRONICS CO., LTD.**
Suwon-City, Kyungki-do (KR)

(72) Inventors:
• **Kim, Hyun-Sook**
Seocho-Gu, Seoul (KR)
• **Lee, Ki-Su**
Paldal-Gu, Suwon-City, Kyungki-Do (KR)
• **Lee, Hyun-Mu**
Jangan-Gu, Suwon-City, Kyungki-Do (KR)

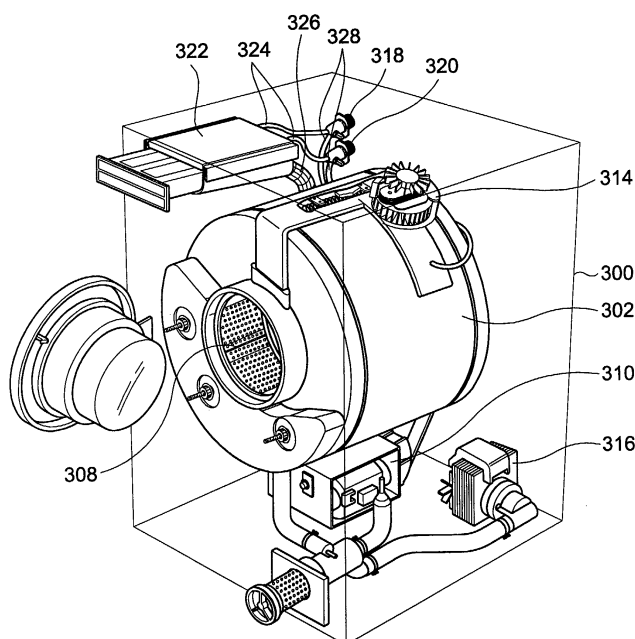
(74) Representative: **Grey, Ian Michael et al**
Venner, Shipley & Co,
20 Little Britain
London EC1A 7DH (GB)

(54) **Washing machine and method of controlling the same**

(57) A washing machine including tub (302) to receive laundry to be washed, a detergent dispenser (322) and control means (402). The control means (402) are

operable to supply water for washing laundry to the tub (302) and are also operable to supply a portion of said water for washing to the tub (302) via the detergent dispenser (322).

FIG. 3



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Description

[0001] The present invention relates to a washing machine including a tub to receive laundry to be washed, a detergent dispenser and control means, the control means being operable to supply water for washing laundry to the tub.

[0002] A conventional drum type washing machine washes laundry by displacing it during rotation of a tub. Another type of conventional washing machine washes laundry by generating water currents by rotating a pulsator mounted adjacent to the bottom of the tub. As the drum-type washing machine washes laundry by displacement only a small quantity of water to soak the laundry is required to wash it. On the contrary, a washing machine equipped with a pulsator has to generate strong water currents and so sufficient water for washing must be supplied to the tub to completely submerge the laundry. Therefore, a pulsator equipped washing machine is not particularly economical because of the amount of water that it consumes.

[0003] A perspective view illustrating the construction of a conventional drum-type washing machine is illustrated in Figure 1 and comprises a fixed tub 102 mounted within a housing 100. A drum 108 is rotatably mounted within the fixed tub 102 and is rotatable in response to operation of a motor to perform washing, rinsing and spin-drying cycles. The drum 108 is perforated so washing water can flow from the drum 108 to the fixed tub 102 and vice versa through the perforations. The washing machine may also be provided with a heater 114 for drying the laundry after washing. When the washing machine is used, hot and cold water is passed through water supply valves 118, 120 and through water pipes 124 to a detergent dispenser 122 containing detergent. The water mixed with detergent then flows into the fixed tub 102 through a water supply pipe 126.

[0004] A flowchart showing a method of controlling the conventional drum-type washing machine of Figure 1 is shown in Figure 2. A wash cycle is initially set by a user at step S202. A quantity of water corresponding to the set wash cycle is supplied to the fixed tub 102 through the detergent dispenser 122 at step S204. Detergent contained in the detergent dispenser 122 is dissolved and supplied to the fixed tub 102 along with the water. After supply of water to the tub 102 is complete, a wash cycle is performed by rotating the drum 108 at step S206. After the washing process has been completed, a rinse cycle is performed by supplying a preset quantity of water and spin-drying at step S208. After the rinse cycle has been completed, a spin-drying cycle is performed by rotating the drum 108 at step S210. After completion of the spin-drying cycle, a drying cycle is performed by operating the drying heater 114 at step S212.

[0005] In the conventional drum-type washing machine, water supplied to the detergent dispenser 122 is supplied to the fixed tub 102 through the detergent dispenser 122. As the water is supplied, the detergent con-

tained in the detergent dispenser 122 is dissolved and supplied to the fixed tub 102 together with the water. However, as the water passes through the detergent dispenser 122 at a high speed, the detergent is insufficiently dissolved and results in stains remaining on the laundry thereby reducing the efficiency of the washing machine. In an attempt to overcome this problem, after supply of washing water and detergent is complete, the detergent is diluted with the washing water by a forward rotation and a reverse rotation of the drum 108.

[0006] To sufficiently dilute the undissolved detergent in the water in the drum, 108 a large quantity of washing water is needed. Although the drum-type washing machine is designed to wash the laundry with a small quantity of the washing water to soak the laundry, a large quantity of washing water has to be supplied to sufficiently dissolve the detergent because the detergent sinks to the bottom of the fixed tub 102 and must be dissolved using water currents generated by the forward rotation and the reverse rotation of the drum 108. Thus, the quantity of washing water is unavoidably increased. The increase in the quantity of washing water causes excessive consumption of water, increases the load on the motor 110, and increases time and energy required to heat the washing water. Power consumption and total operating time is thereby increased.

[0007] A washing machine according to the present invention is characterised in that the control means is operable to supply a portion of said water for washing to the tub via the detergent dispenser.

[0008] In a preferred embodiment, the control means is operable to retain said portion of the water in the detergent dispenser until after the remaining water has been supplied to the tub.

[0009] Preferably, the total amount of water for washing is dependent on a wash cycle selected by a user and the control means is operable to send a portion of the total amount of water for washing to the tub via the detergent dispenser.

[0010] The present invention also provides a method of controlling a washing machine for washing laundry comprising the step of supplying water for washing to a tub containing laundry, characterised by the step of supplying a portion of said water for washing to the tub via a detergent dispenser.

[0011] Embodiments of the invention will now be described, by way of example only, and with reference to Figures 3 to 5 of the accompanying drawings in which:

Figure 1 is a perspective view illustrating a construction of a prior art drum-type washing machine; Figure 2 is a flowchart illustrating a conventional method of controlling the conventional drum-type washing machine;

Figure 3 is a perspective view illustrating the construction of a drum-type washing machine in accordance with an embodiment of the present invention;

Figure 4 is a block diagram illustrating the drum-type washing machine of Figure 3; and

Figure 5 is a flowchart illustrating a method of controlling the drum-type washing machine of Figure 3.

[0012] Reference will now be made to the drawings. As shown in Figure 3, a fixed tub 302 is mounted in a housing 300. A drum 308 is rotatably mounted in the fixed tub 302 to contain laundry to be washed and rotatable in response to operation of a motor 310. The drum 308 is perforated so that the washing water can flow from drum 308 to the fixed tub 302 and vice versa.

[0013] In one embodiment, the washing machine is provided with a drying heater 314 for drying the laundry after washing.

[0014] The drum-type washing machine is also provided with a washing water heating unit 330 which is operable to heat the washing water to a high temperature. The washing water is supplied through a first water supply valve 318 and a second water supply valve 320 to the fixed tub 302 through water supply pipes 328. However, a small quantity of the washing water supplied through the first and second water supply valves 318 and 320 is supplied to a detergent dispenser 322 through the water supply pipes 324 and is used to dissolve the detergent contained in the detergent dispenser 322. The liquid detergent dissolved by the washing water in the detergent dispenser is supplied to the fixed tub 302 after supply of washing water direct to the tub has been completed.

[0015] The small quantity of washing water containing the detergent is sprayed on to the laundry in the drum 308 after direct supply washing water to the tub is completed. As the liquid detergent supplied from the detergent dispenser 322 to the fixed tub 302 is sprayed on the laundry, the liquid detergent is uniformly supplied to the whole laundry.

[0016] In the washing machine a sum of a quantity of the washing water directly supplied to the fixed tub 302 and a quantity of the washing water supplied to the detergent dispenser 322 is less than or equal to a quantity of washing water corresponding to a washing cycle set by a user. For example, when the quantity of washing water corresponding to the set washing cycle is 10 liters, the sum of the quantity of the washing water supplied to the fixed tub 302 and the quantity of the washing water supplied to the detergent dispenser 322 is less than or equal to 10 litres. This prevents the total quantity of washing water from increasing as a result of an addition of the quantity of the washing water to dissolve the detergent to the quantity of washing water corresponding to the set washing cycle.

[0017] Figure 3 shows the construction of a drum-type washing machine according to an embodiment of the present invention. However, it is understood by those of skill in the art that the above-described construction can be applied to general washing machines including those that use pulsators.

[0018] Figure 4 is a block diagram illustrating the drum-type washing machine of Figure 3. As shown in Figure 4, a control unit 402 controls the overall operation of the washing machine, such as washing, rinsing, spin-drying, and drying processes. An input unit 406 sets washing conditions desired by a user, or selectively commands only processes needed by a user. The washing conditions and commands set by the input unit 406 are transmitted to the control unit 402. A water level sensor 404 is used to detect a quantity of washing water supplied, and detects the quantity of the washing water supplied to the fixed tub 302 and provides information about the detected quantity of the washing water to the control unit 402.

[0019] A drive unit 410 drives the motor 310, a drain pump 316, the drying heater 314, a display unit 412, the first and second water supply valves 318 and 320 and the like. The motor 310 periodically rotates the drum 308 in forward and reverse directions at a high speed during washing or rinsing processes, and rotates the drum 308 in a forward direction at the high speed during a spin-drying process. The drain pump 316 discharges the washing water from the fixed tub 302. The drying heater 314 dries the laundry by circulating heated air through the fixed tub 302. The display unit 412 visually displays an operating state of the drum-type washing machine. The first and second water supply valves 318 and 320 control the supplying of hot and cold water, respectively.

[0020] Referring to Figure 5, a method of controlling the drum-type washing machine of Figure 3 is described. Figure 5 is a flowchart illustrating the drum-type washing machine control method. As shown in Figure 5, if a washing cycle is set by a user at step S502, a preset small quantity of washing water is supplied to the detergent dispenser 322 through the first and second water supply valves 318 and 320, and the detergent contained in the detergent dispenser 322 is dissolved at step S504a. Simultaneously, the washing water of a quantity obtained by subtracting the preset small quantity of the washing water supplied to the detergent dispenser 322 from a total quantity of the washing water corresponding to the washing cycle set by the user is directly supplied to the fixed tub 302 through the water supply pipes 328 and sprayed on the laundry at step S504b. Accordingly, the laundry is uniformly soaked by spraying a large part of the washing water thereon.

[0021] After supplying of a large part of the washing water to the fixed tub 302 is completed, a high concentration liquid dissolved by the washing water in the detergent dispenser 322 is sprayed on to the sufficiently soaked laundry at step S506. Since the sufficiently dissolved liquid detergent is sprayed onto the laundry after the large part of the washing water has been supplied to the laundry and the laundry has been sufficiently soaked, the generation of stains on the laundry, as a result of insufficiently dissolved detergent, is prevented. Further, as the detergent is dissolved by a small quantity of wash water, the total required quantity of the wash

water is decreased in comparison with a case where the total quantity of the washing water and the detergent have been supplied together and then the detergent is dissolved in the fixed tub 302. Therefore the total required quantity of wash water is decreased. As the previously dissolved detergent is supplied to the fixed tub 302, no undissolved detergent remains, so the wash performance of the washing machine is maximized.

[0022] After supply of washing water and the liquid detergent is complete, the wash process is performed by rotating the drum 308 at step S508. Thereafter, the rinsing process is performed by repeating the supply of washing water and spin-drying at step S510. Thereafter, the spin-drying process is performed by rotating the drum 308 at step S512. After the spin-drying process is complete, the drying process that removes water soaked in the laundry in the drum 308 is performed by operating the drying heater 314 at step S514.

[0023] The drum-type washing machine is constructed so that a large quantity of the water for washing water is directly supplied to the fixed tub and drum without passing through the detergent dispenser, and a small quantity of the water for washing is supplied to the detergent dispenser separately from the large part of the washing water to dissolve the detergent at a high concentration in the detergent dispenser so that the generation of stains due to undissolved detergent remaining on laundry, are prevented and the wash performance of a drum-type washing machine is improved. Further, as the previously dissolved detergent is supplied, a total quantity of washing water can be greatly decreased in comparison with a case where the washing water and the detergent are supplied together, and a power consumption and a total time required to wash the laundry are decreased by a reduction in an amount of load on the rotating tub driving motor. Further, since the total quantity of the washing water is decreased, a time required to heat the washing water is greatly decreased in washing machines that perform a boiling process by heating the washing water.

[0024] Although preferred embodiments of the present invention have been shown and described, it would be appreciated by those skilled in the art that changes may be made in this embodiment without departing from the principles of the invention, the scope of which is defined in the claims.

Claims

1. A washing machine including a tub (302) to receive laundry to be washed, a detergent dispenser (322) and control means (402), the control means (402) being operable to supply water for washing laundry to the tub (302), **characterised in that** the control means (402) is operable to supply a portion of said water for washing to the tub (302) via the detergent dispenser (322).

2. A washing machine according to claim 1, wherein the control means (402) is operable to retain said portion of the water in the detergent dispenser (322) until after the remaining water has been supplied to the tub (302).

3. A washing machine according to claim 2, wherein the total amount of water for washing is dependent on a wash cycle selected by a user and the control means (402) is operable to send a portion of the total amount of water for washing to the tub (302) via the detergent dispenser (322).

4. A washing machine according to any preceding claim, wherein the portion of water supplied to the tub (302) via the detergent dispenser (322) is smaller than the amount of water supplied directly to the tub (302).

5. A washing machine according to any preceding claim, comprising a first water supply path (328) for supplying water directly to the tub (302) and a second water supply path (324) for supplying water to the tub (302) via the detergent dispenser (322).

6. A method of controlling a washing machine for washing laundry comprising the step of supplying water for washing to a tub (302) containing laundry, **characterised by** the step of supplying a portion of said water for washing to the tub (302) via a detergent dispenser (322).

7. A method of controlling a washing machine according to claim 6, including the step of retaining said portion of water in the detergent dispenser (322) until the remaining water has been supplied to the tub (302).

8. A washing machine having a fixed tub and a rotating tub, comprising:

a detergent dispenser containing a detergent, receiving a smaller part of washing water, and allowing the detergent to be dissolved therein to form a liquid detergent; and
a control unit controlling the liquid detergent contained in the detergent dispenser to be sprayed on laundry in the rotating tub after a larger part of the washing water is directly supplied to one or more of the fixed tub and the rotating tub.

9. The washing machine according to claim 8, further comprising:

a first supply path directly supplying the larger part of the washing water to one or more of the fixed tub and the rotating tub; and a second

supply path supplying the smaller part of the washing water to the detergent dispenser, the first and second supply paths being separately formed.

10. The washing machine according to claim 8, wherein the control unit controls the smaller part of the washing water to be supplied to the detergent dispenser to dissolve the detergent while the larger part of the washing water is directly supplied to one or more of the fixed tub and the rotating tub.

11. The washing machine according to claim 8, wherein the control unit controls the liquid detergent contained in the detergent dispenser to be supplied to one or more of the fixed tub and the rotating tub to which the larger part of the washing water has been directly supplied.

12. The washing machine according to claim 8, wherein a sum of a first quantity of the washing water supplied to the detergent dispenser and a second quantity of the washing water directly supplied to one or more of the fixed tub and the rotating tub is less than or equal to a respective quantity of the washing water corresponding to a washing course set by a user.

13. The washing machine according to claim 8, wherein the washing machine is a drum-type washing machine having a washing water heating unit.

14. A method of controlling a washing machine having a rotating tub, comprising:

when a washing course is set, supplying washing water corresponding to the set washing course, forming a liquid detergent by dissolving a detergent contained in a detergent dispenser, and supplying the washing water of a quantity corresponding to the set washing course to the rotating tub;
after the supplying of the washing water to the rotating tub is completed, spraying and supplying the liquid detergent to the rotating tub; and
after the spraying of the liquid detergent is completed, performing washing, rinsing and spin-drying processes.

15. The method according to claim 14, wherein the detergent is dissolved by supplying a first quantity of the washing water to the detergent dispenser while a second quantity of the washing water is directly supplied to the rotating tub.

16. The method according to claim 15, wherein a sum of the first quantity of the washing water supplied to the detergent dispenser and the second quantity of the washing water directly supplied to the rotating

tub is less than or equal to the quantity of the washing water corresponding to the set washing course set by a user.

17. The method according to claim 14, wherein the washing machine is a drum-type washing machine.

18. A washing machine having a tub and a detergent dispenser therein, the detergent dispenser being provided with detergent, comprising:

a control unit controlling a first quantity of washing water to dissolve the detergent forming liquid detergent to be applied to laundry in the tub and a second quantity of the washing water which is directly supplied to the tub, the liquid and a second quantity of the washing water which is directly supplied to the tub, the liquid detergent and the second quantity of the washing water being provided in separate operations.

19. The washing machine according to claim 18, further comprising:

a first supply path supplying the first quantity of the washing water to the detergent dispenser; and
a second supply path directly supplying the second quantity of the washing water to the tub, the first and second supply paths being separately formed.

20. The washing machine according to claim 18, wherein the control unit controls the liquid detergent contained in the detergent dispenser to be supplied to the tub to which the second quantity of the washing water has been directly supplied.

21. The washing machine according to claim 18, wherein a sum of the first quantity of the washing water supplied to the detergent dispenser and the second quantity of the washing water directly supplied to the tub is less than or equal to a respective quantity of the washing water corresponding to a washing course set by a user.

22. The washing machine according to claim 18, wherein the washing machine is a drum-type washing machine.

23. The washing machine according to claim 18, further comprising:

a washing water heating unit to heat the washing water prior to the supplying of the washing water to the tub.

- 24.** The washing machine according to claim 18, further comprising:

a water level sensor to detect a quantity of the washing water supplied to the tub and to communicate the detected quantity of the washing water to the control unit.

- 25.** The washing machine according to claim 18, wherein the first quantity of the washing water is less than the second quantity of the washing water.

- 26.** The washing machine according to claim 18, wherein the first quantity of the washing water is a preset quantity.

- 27.** The washing machine according to claim 18, wherein the second quantity of the washing water soaks the laundry in the tub prior to the liquid detergent being applied to the laundry.

- 28.** A method of operating a washing machine having a tub and a detergent dispenser therein, the detergent dispenser being provided with detergent, comprising:

controlling a first quantity of washing water to dissolve the detergent to form liquid detergent to be applied to the tub and a second quantity of the washing water which is directly supplied to the tub, the liquid detergent and second quantity of washing water being provided to the tub in separate operations

- 29.** The method according to claim 28, further comprising:

supplying the first quantity of the washing water to the detergent dispenser while the second quantity of the washing water is directly supplied to the tub.

- 30.** The method according to claim 28, further comprising:

prior to the controlling, determining both the first quantity of the first quantity of washing water and the second quantity of the washing water corresponding to a set washing course.

- 31.** The method according to claim 30, wherein the determining comprises:

calculating a sum of the first quantity of the washing water supplied to the detergent dispenser and the second quantity of the washing water directly supplied to the tub, which is less than or equal to a quantity of the washing water

corresponding to the set washing course.

- 32.** The method according to claim 28, wherein the washing machine is a drum-type washing machine.

- 33.** The method according to claim 28, further comprising:

heating the washing water prior to the supplying of the washing water to the tub; and detecting a quantity of the washing water supplied to the tub; and communicating the detected quantity of the washing water so as to control the quantity of the washing water supplied.

- 34.** The method according to claim 28, wherein the first quantity of the washing water is less than the second quantity of the washing water.

- 35.** The method according to claim 28, wherein the first quantity of the washing water is a preset quantity.

- 36.** The method according to claim 28, further comprising:

soaking the laundry in the tub by the second quantity of the washing water prior to the liquid detergent being applied to the laundry.

- 37.** A method of operating a washing machine having a tub and a detergent dispenser therein, the detergent dispenser being provided with detergent, comprising:

controlling a first quantity of washing water to dissolve the detergent to form liquid detergent and a second quantity of the washing water which is directly supplied to the tub; and applying the liquid detergent to laundry in the tub after the second quantity of the washing water is directly supplied to the tub.

- 38.** A method of operating a washing machine having a tub and a detergent dispenser therein, the detergent dispenser being provided with detergent, comprising:

supplying a first washing water to the detergent dispenser; dissolving detergent in the first washing water to form liquid detergent; supplying a second washing water directly to the tub; and supplying the liquid detergent to the tub in a separate operation from the supplying of the second washing water.

- 39.** A method of controlling a washing machine having a tub therein, comprising:

setting a washing course;
 determining a first portion of watering water and a second portion of the washing water corresponding to the set washing course;
 forming liquid detergent by dissolving detergent by the first portion of the washing water;
 supplying the second portion of the washing water directly to the tub;
 after the spraying of the second portion of the washing water to the tub, spraying liquid detergent into the tub; and
 performing washing, rinsing, and spin-drying operations after the supplying.

ing water to the detergent dispenser;
 a first water supply valve opening and closing the one or more first water supply pipes;
 a second water supply valve opening and closing the one or more second water supply pipes, and
 the control unit controlling the first water supply valve to supply a first quantity of water to dissolve the detergent forming liquid detergent to be applied to laundry in the tub and the second water supply valve to directly supply a second quantity of the water to the tub.

- 40.** A method of operating a washing machine having a tub, a detergent dispenser, and first and second water supply valves therein, the detergent dispenser being provided with detergent, comprising:

first controlling a supply of water to the tub by opening or closing a first water supply valve; and
 second controlling a supply of the water to the detergent dispenser by opening or closing a second water supply valve.

wherein the first controlling provides a first quantity of the water to dissolve the detergent forming liquid detergent to be applied to laundry in the tub and the second controlling provides a second quantity of the water to be directly supplied to the tub prior to applying the liquid detergent.

- 41.** A washing machine having a tub and a detergent dispenser therein, the detergent dispenser being provided with the detergent and receiving a first quantity of washing water to allow the detergent to be dissolved in the first quantity of the washing water to form liquid detergent to be applied to laundry in the tub, comprising:

a control unit controlling the liquid detergent applied to the laundry in the tub, after the first quantity of the washing water is directly supplied to the tub.

- 42.** A washing machine having a tub and a detergent dispenser therein, the detergent dispenser being provided with detergent, comprising:

a control unit;
 one or more first water supply pipes directly supplying water from outside the washing machine to the tub;
 one or more second water supply pipes supply-

FIG. 1
(Prior Art)

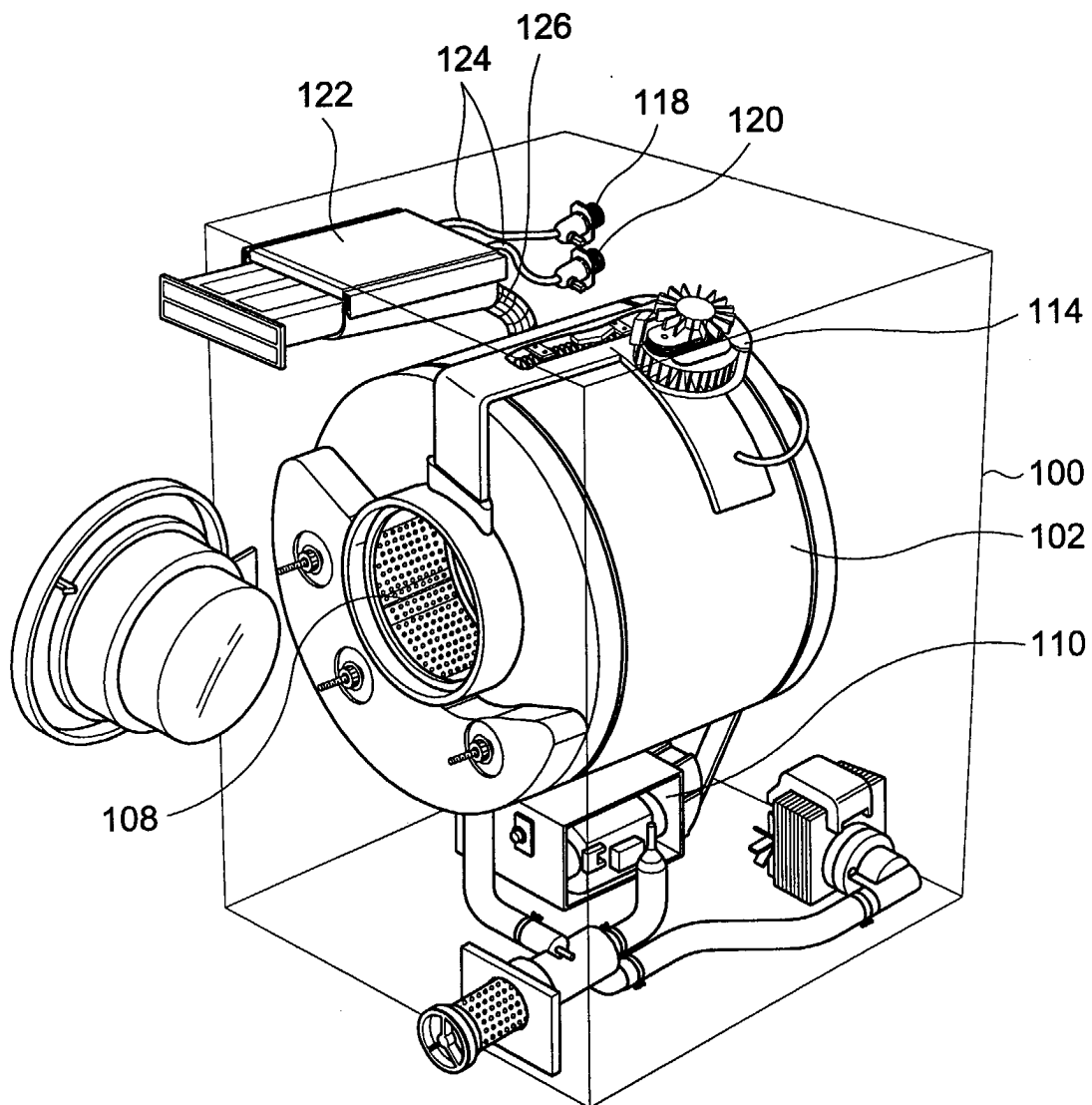


FIG. 2
(Prior Art)

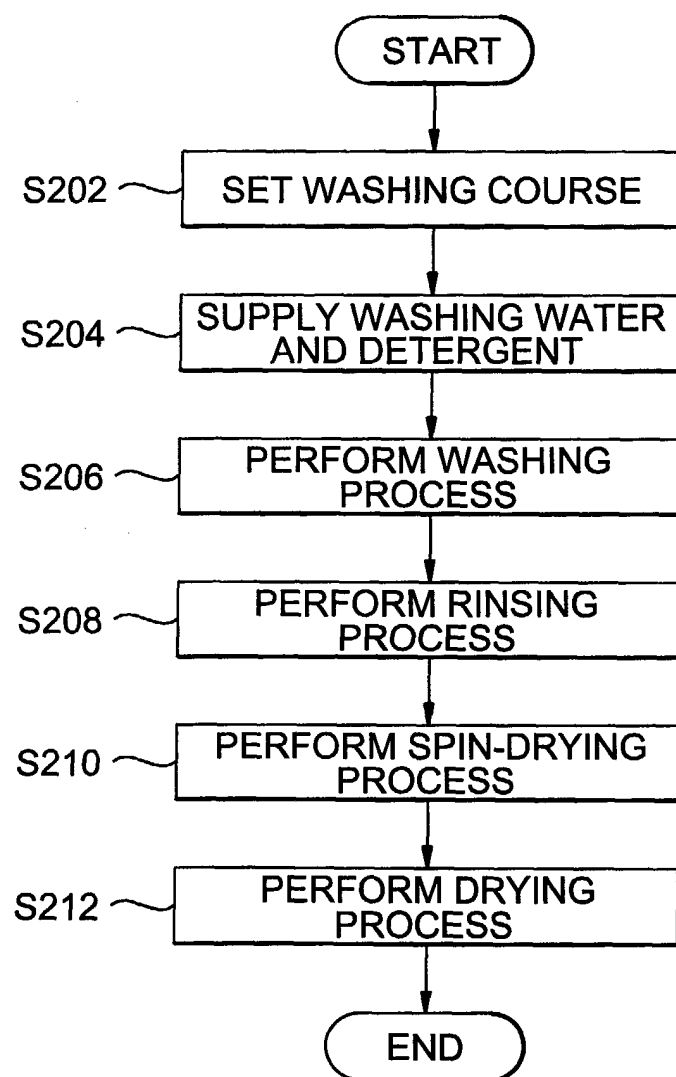


FIG. 3

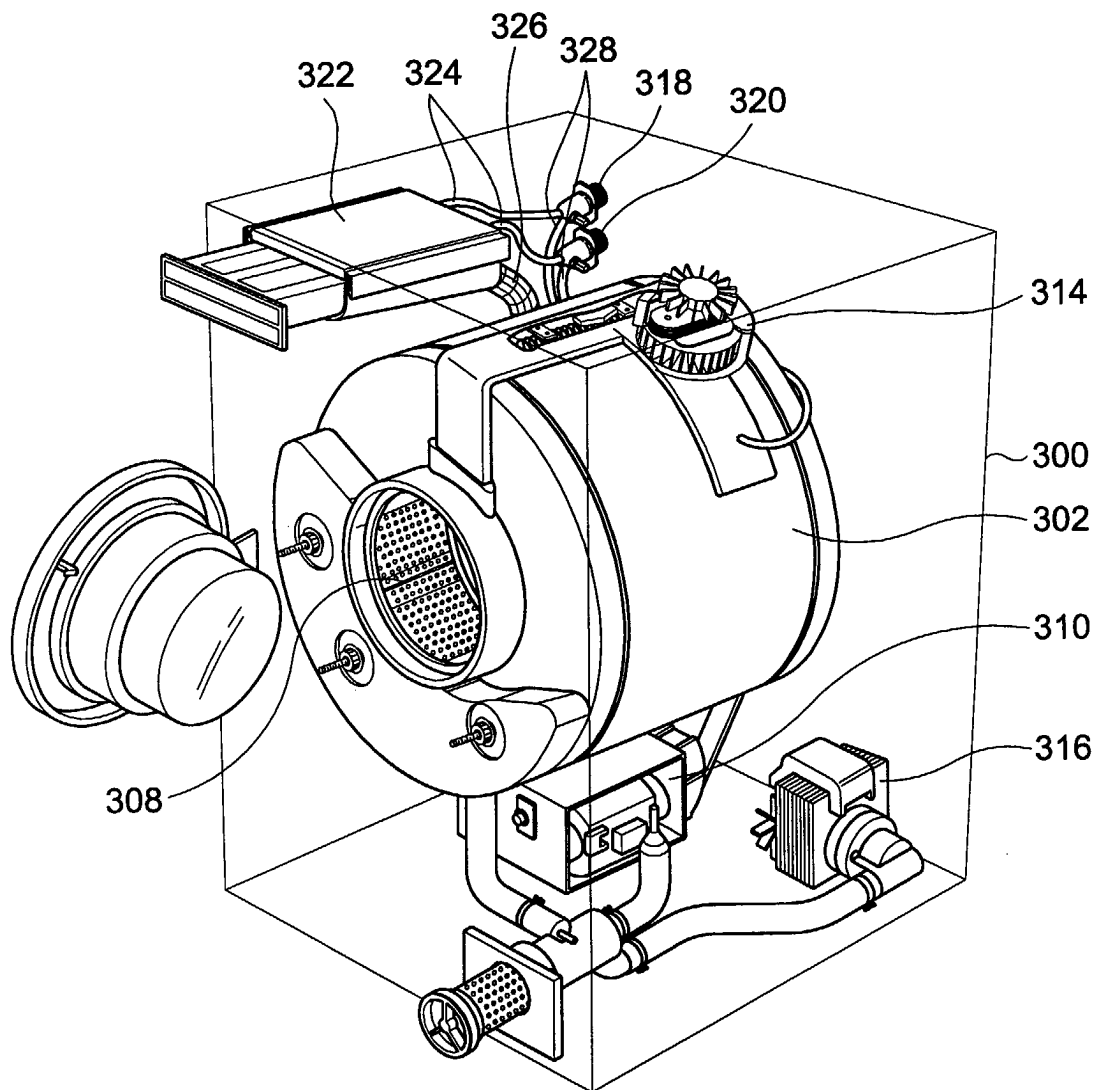


FIG. 4

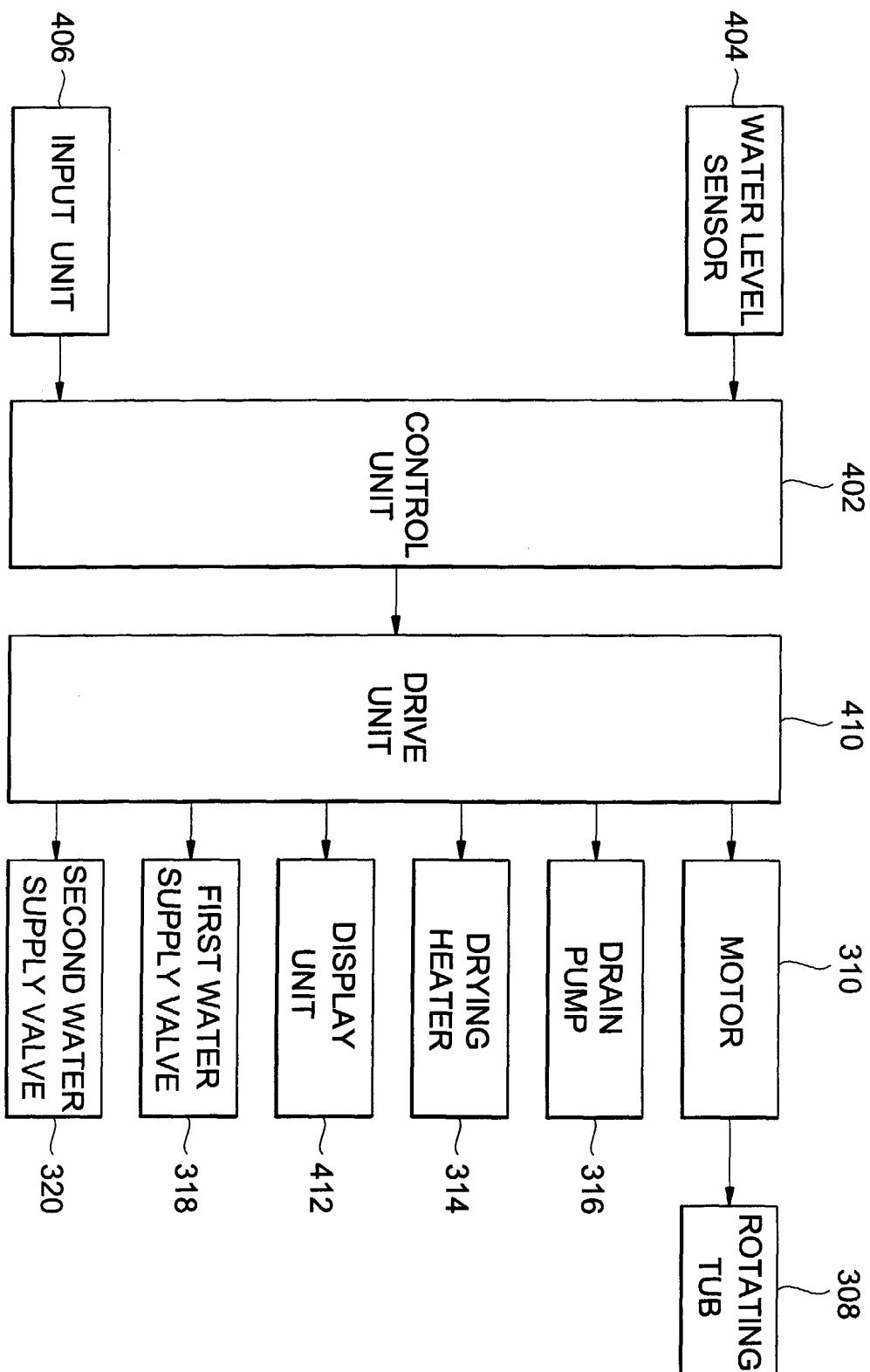


FIG. 5

