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(72) Inventors:
• **Jung, Jung Ran**
Yeongtong-Gu, Suwon-Si
Gyeonggi-Do (KR)
• **Sa, Mi Hyun**
Suwon-Si, Gyeonggi-Do (KR)

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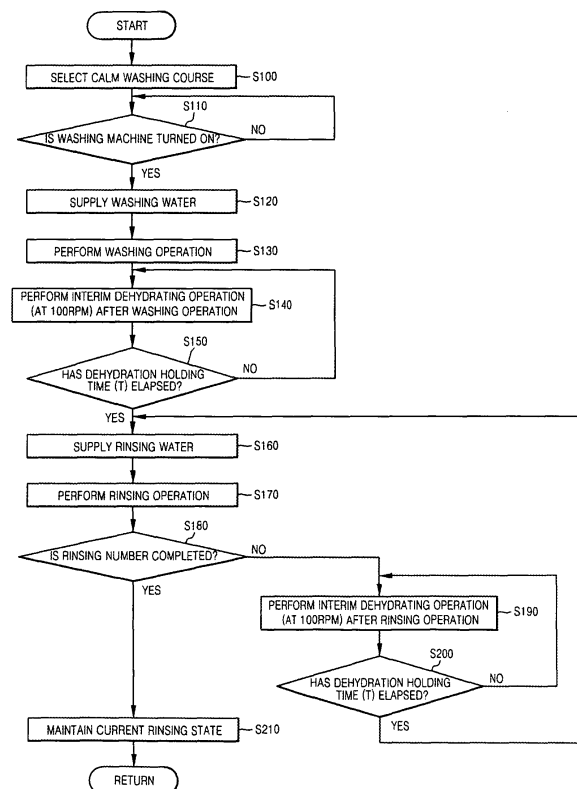
(74) Representative: **Grünecker, Kinkeldey, Stockmair & Schwanhäusser**
Anwaltssozietät
Maximilianstrasse 58
80538 München (DE)

(71) Applicant: **Samsung Electronics Co., Ltd.**
Suwon-si, Gyeonggi-Do (KR)

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

(57) A washing machine which maximally reduces noise generated from a washing process so as to satisfy a low-noise requirement of a user, and a method for controlling the same. The method includes determining whether a calm washing course is selected, and performing low-noise calm washing by controlling a dehydrating operation performed after washing and rinsing operations so that the dehydrating operation is performed at less than a designated speed, when it is determined that the calm washing course is selected.

FIG. 3



Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a washing machine and a method for controlling the same. More particularly, to a washing machine, which maximally reduces noise generated from a washing process and a method for controlling the same.

2. Description of the Related Art

[0002] Generally, a conventional washing machine is an apparatus for washing laundry using force generated by lifting and dropping the laundry placed in a cylindrical rotary drum when the rotary drum is rotated. A dehydrating operation which is carried out after all washing and rinsing operations (i.e., an interim dehydrating operation after washing and rinsing operations, or a final dehydrating operation after a final rinsing operation), is performed at a predetermined high rpm (approximately 800rpm), thereby generating undesirable noise due to driving of a motor or vibration of the rotary drum.

[0003] In order to solve the above problem, Korean Patent Laid-open Publication No. 1999-0055473 discloses a method for reducing noise of a washing machine by minimizing vibration generated in a dehydrating operation.

[0004] In the method disclosed in the above Patent, a first rpm of a motor is set according to a partial disposition state of laundry in an initial stage of a dehydrating operation, the motor is rotated when the set first rpm is decreased or increased within a designated range, the vibration degrees of the motor rotated thereby are measured, and the dehydrating operation is performed at an rpm corresponding to the lowermost value among the measured vibration degrees, thereby reducing noise. This method cannot eliminate noise generated in an interim dehydrating operation performed after all washing and rinsing operations, but can minimize noise generated only in a final dehydrating operation performed after the completion of the washing and rinsing operations, thus causing a difficulty in satisfying a low-noise requirement desired by a user. For example, when the user wants to operate the washing machine during the night.

SUMMARY OF THE INVENTION

[0005] Accordingly, it is an aspect of the invention to provide a washing machine in which a dehydrating operation after all washing and rinsing operations is performed in a low-noise state (i.e., a calm washing state) of less than a designated rpm to maximally reduce noise, and a method for controlling the same.

[0006] Additional aspects and/or advantages of the invention will be set forth in part in the description which

follows and, in part, will be apparent from the description, or may be learned by practice of the invention.

[0007] The foregoing and/or other aspects of the present invention are achieved by providing a washing machine in which time and speed of a dehydrating operation after all washing and rinsing operations are controlled, so that the dehydrating operation is performed at less than a designated rpm to achieve calm washing and to have the same effects as a standard washing course, and a method for controlling the same.

[0008] It is another aspect of the present invention to provide a washing machine, in which a dehydration holding time and a rinsing number are controlled so that the dehydrating operation is performed at less than a designated rpm to compensate for rinsing capacity, and a method for controlling the same.

[0009] It is another aspect of the present invention to provide a washing machine in which washing water is not discharged to an outside and a rinsing state is maintained in a final rinsing operation to prevent generation of noise due to a final dehydrating operation and to prevent wrinkling of laundry, and a method for controlling the same.

[0010] It is another aspect of the present invention to provide a method for controlling a washing machine, the method including determining whether a calm washing course is selected, and performing low-noise calm washing by controlling a dehydrating operation performed after washing and rinsing operations so that the dehydrating operation is performed at less than a designated speed, when it is determined that the calm washing course is selected.

[0011] The performing of the low-noise calm washing includes controlling a time and a speed of the dehydrating operation performed after the washing and rinsing operations.

[0012] The performing of the low-noise calm washing includes controlling a time of the dehydrating operation performed after the rinsing operation and a rinsing number in the rinsing operation.

[0013] The designated speed is approximately 100rpm.

[0014] The method further includes preventing washing water from being discharged to the outside in a final rinsing operation and maintaining a final rinsing state, when it is determined that the calm washing course is selected.

[0015] It is another aspect of the present invention to provide a method for controlling a washing machine in which a dehydrating operation after operations for washing laundry is performed at less than a designated speed for a designated time, to perform calm washing in a low-noise state.

[0016] The operations for washing laundry include washing and rinsing operations, and the designated speed is approximately 100rpm.

[0017] When the rinsing operation is a final rinsing operation, a final rinsing state may be maintained without

performing a final dehydrating operation.

[0018] It is another aspect of the present invention to provide a washing machine having a motor and a drain device, the washing machine including a signal input unit to select a calm washing course, and a control unit to control the motor in the calm washing course so that a dehydrating operation after washing and rinsing operations is performed at less than a designated speed.

[0019] The control unit controls a time and a speed of the dehydrating operation after the washing and rinsing operations.

[0020] The control unit controls a time of the dehydrating operation after the rinsing operation and a rinsing number in the rinsing operation are controlled.

[0021] The control unit prevents washing water from being discharged to the outside in a final rinsing operation, and maintain a final rinsing state.

[0022] It is another aspect of the present invention to provide a washing machine including a signal input unit to select a calm washing course, and a control unit to control the motor in the calm washing course so that a dehydrating operation after operations for washing laundry is performed at less than a designated speed for a designated time.

[0023] The operations for washing laundry includes washing and rinsing operations, and, when the rinsing operation is a final rinsing operation, the control unit maintains a final rinsing state without performing a final dehydrating operation.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] These and/or other aspects and advantages of the invention will become apparent and more readily appreciated from the following description of the embodiments, taken in conjunction with the accompanying drawings of which:

FIG. 1 is a sectional view of a washing machine in accordance with an embodiment of the present invention;

FIG. 2 is a schematic view illustrating a controlling system of the washing machine in accordance with an embodiment of the present invention; and

FIG. 3 is a flow chart illustrating a method for controlling a washing machine in accordance with an embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0025] Reference will now be made in detail to the embodiments of the present invention, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to like elements throughout. The embodiments are described below to explain the present invention by referring to the figures.

[0026] FIG. 1 is a sectional view of a washing machine

in accordance with an embodiment of the present invention.

[0027] As shown in FIG. 1, the washing machine of the present invention comprises a tub 11 having a cylindrical shape installed in a main body 10 to contain washing water, and a rotary drum 12 rotatably installed in the tub 11.

[0028] The tub 11 is slantingly installed at an angle of a designated degree of α with an installation plane of the washing machine such that a front surface portion 11a thereof having an opening 11b is located at a position higher than that of a rear surface portion 11c thereof. In the same manner as the tub 11, the rotary drum 12 is slantingly installed in the tub 11 such that a front surface portion 12a thereof having an opening 12b is located at a position higher than that of a rear surface portion 12c thereof.

[0029] That is, a rotary central line of the rotary drum 12 meets the installation plane of the washing machine at an angle of a designated degree of α such that the front surface portion 12a having the opening 12b faces upward. A rotary shaft 13 connected with a center of the rear surface portion 12c of the rotary drum 12 is rotatably supported by the center of the rear surface portion 11c of the tub 11, thereby allowing the rotary drum 12 to be rotatable in the tub 11.

[0030] A plurality of through holes 12d are formed through a circumferential surface of the rotary drum 12, and a plurality of lifters 14 to lift and drop the laundry when the rotary drum 12 is rotated are installed on an inner surface of the rotary drum 12.

[0031] A motor 15 serving as a driving device for rotating the rotary shaft 13 connected with the rotary drum 12 to perform washing, rinsing and dehydrating operations is installed on an outer surface of the rear surface portion 11c of the tub 11, and a washing heater 16 to heat washing water supplied to an inside of the tub 11 is installed in a lower portion of the tub 11.

[0032] The motor 15 comprises a stator 15a fixed to the rear surface portion 11c of the tub 11, a rotor 15b rotatably installed around the stator 15a, and a rotating plate 15c to connect the rotor 15b to the rotary shaft 13.

[0033] An opening 17b is formed through a front surface of the main body 10 at a position corresponding to the opening 12b of the rotary drum 12 and the opening 11b of the tub 11 so that laundry is taken into and out of the rotary drum 12 through the opening 17b, and a door 17 to open and close the opening 17b is installed at the opening 17b.

[0034] A detergent supply device 18 to supply detergent and a water supply device 20 to supply washing water are installed above the tub 11, and a drain device 19 comprising a drain pipe 19a, a drain valve 19b, and a drain pump 19c to discharge water in the tub 11 is installed below the tub 11.

[0035] An inside of the detergent supply device 18 is divided into multiple chambers, and the detergent supply device 18 is installed in the front surface of the main body

10 so that a user easily puts the detergent and a fabric softener into the corresponding chambers.

[0036] The water supply device 20 comprises cold and warm water supply pipes 21 and 22 to respectively supply cold and warm water, and water supply valves 23 and 24 installed in the cold and warm water supply pipes 21 and 22 to control the supply of the water through the cold and warm water supply pipes 21 and 22.

[0037] The cold and warm water supply pipes 21 and 22 are connected with the detergent supply device 18 so that water supplied from the outside is supplied towards the detergent supply device 18. A separate water supply pipe 25 is installed between the detergent supply device 18 and the tub 11 so that the water having passed through the detergent supply device 18 is supplied to the tub 11, and a water supply nozzle 26 is installed at an outlet of the water supply pipe 25. Thereby, the water supplied to the tub 11 passes through the detergent supply device 18 to solve the detergent in the detergent supply device 18, and the water containing the detergent is supplied to the tub 11.

[0038] FIG. 2 is a schematic view illustrating a controlling system of the washing machine in accordance with an embodiment of the present invention. The washing machine further comprises a signal input unit 100, a temperature sensing unit 110, a water level sensing unit 120, a control unit 130, a driving unit 140, and a speed sensing unit 150.

[0039] The signal input unit 100 serves to input operating data, such as a washing course, a washing temperature, a dehydrating rpm, and whether a rinsing operation is added, which are selected by a user according to materials of the laundry, to the controller 130. The signal input unit 100 allows the user to select a calm washing course (i.e., a low speed course) for controlling the rpm of an interim dehydrating operation, performed after washing and rinsing operations, so that the interim dehydrating operation is performed in a low-noise state.

[0040] The temperature sensing unit 110 senses the temperature of the washing water supplied to the tub 11, and the water level sensing unit 102 senses the level of the washing water supplied to the tub 11.

[0041] The control unit 130 is a microcomputer for controlling the washing machine according to the operating data inputted from the signal input unit 100. When the calm washing course is selected, the control unit 130 controls the operation of the motor 15 so that a dehydrating operation after all washing and rinsing operations (i.e., the interim dehydrating operation after the washing and rinsing operations) is performed at less than a designated rpm.

[0042] The control unit 130 controls the time and speed of the dehydrating operation after all washing and rinsing operations so that the dehydrating operation is performed at less than a designated rpm, thus allowing the calm washing course to have the same effects as a standard washing course. In the rinsing operation, the control unit 130 controls a dehydration holding time and a rinsing

time so that the dehydrating operation is performed at a designated rpm, thereby compensating for rinsing effects.

[0043] The control unit 130 controls an operation of the drain device 19 so that the washing water is not discharged to the outside of the washing machine in a final rinsing operation and the rinsing state is maintained.

[0044] The driving unit 140 drives the motor 15, the washing heater 16, the drain valve 19b, the drain pump 19c, and the water supply valves 23 and 24 according to a driving control signal of the control unit 130, and the speed sensing unit 150 senses the rotational speed of the motor 15 and inputs the sensed rotational speed to the control unit 130.

[0045] Hereinafter, the function and effects of the above washing machine and a process for controlling the washing machine will be described.

[0046] FIG. 3 is a flow chart illustrating a method for controlling the washing machine of the present invention so as to achieve calm washing. In the method of the present invention, a calm washing operation may be set as default such that an interim dehydrating operation is performed after all washing and rinsing operations is performed in a low-noise state, or as an alternative, may be performed only when a user presses a separate option key.

[0047] When a user puts laundry into the rotary drum 12, selects operating data, such as a washing course, a washing temperature, a dehydrating rpm, and whether a rinsing operation is added, according to materials of the laundry, and then selects the calm washing course, the operating data, which are selected by the user, are inputted to the control unit 130 through the signal input unit 100 in operation 100.

[0048] From operation 100, the process moves to operation 110 where the control unit 130 performs washing and rinsing operations according to the operating data inputted from the signal input unit 100. First, the control unit 130 determined whether the washing machine is turned on.

[0049] When it is determined that the washing machine is turned on in operation 110, the process moves to operation 120 where the control unit 130 switches the water supply valves 23 and 24 on so that washing water is supplied to the detergent supply device 18 through the water supply pipes 21 and 22, and the washing water supplied to the detergent supply device 18 is supplied to the tub 11 through the water supply pipe 25.

[0050] When the washing water is supplied to the tub 11, the control unit 130 drives the motor 15 at a predetermined rpm and a predetermined operation rate (on/off rate), thereby rotating the rotary drum 12. Thereby, the washing water and the detergent are well mixed with the laundry, and the washing operation for washing the laundry by falling force of the laundry is performed in operation 130.

[0051] After the washing operation performed in operation 130, the process moves to operation 140 where the

interim dehydrating operation is performed at less than a designated rpm (approximately 100rpm) such that the user cannot feel the revolution of the motor 15. The rpm in the interim dehydrating operation in the calm washing course is lower than the rpm (approximately 600 rpm) in the interim dehydrating operation in the standard washing course. Thereby, it is possible to maximally reduce noise generated in the interim dehydrating operation after the washing operation, thus providing calm environment.

[0052] From operation 140, the process moves to operation 150 where the control unit 130 determines whether a designated holding time (T) (i.e., a time to remove the minimum amount of water from the laundry by controlling the rpm so that the interim dehydrating operation is performed in a low-noise state, approximately three minutes) of the interim dehydrating operation, which is performed at less than the designated rpm after the washing operation, has elapsed. That is, the interim dehydrating operation is performed at less than a designated rpm during the dehydration holding time (T).

[0053] Since the rpm (approximately 100rpm) in the interim dehydrating operation in the calm washing course is considerably lower than the rpm (approximately 600rpm) in the interim dehydrating operation in the standard washing course, the dehydration holding time (T) of the interim dehydrating operation in the calm washing course must be elongated so as to obtain the same capacity as that in the standard washing course. Accordingly, the dehydrating holding time (T) (approximately, 3 minutes) is maintained.

[0054] When it is determined that the dehydration holding time (T) has elapsed the designated time in operation 150, the process moves to operation 160 where the control unit 130 controls the water supply valves 23 and 24 to perform the rinsing operation, thereby allowing rinsing water to be supplied to the tub 11.

[0055] When the rinsing water is supplied to the tub 11, the control unit 130 drives the motor 15 at a predetermined rpm and a predetermined operation rate (on/off rate), thereby performing the rinsing operation in operation 170.

[0056] After the rinsing operation is performed in operation 170, the process moves to operation 180 where the control unit 130 determines whether an adjusted rinsing number (i.e., the number of times a rinsing operation is to be performed) is completed. The rinsing number in the calm washing course is automatically adjusted so that the rinsing number is obtained by adding one to the rinsing number in the standard washing course, which is based upon the amount of the laundry and the operating data selected by the user.

[0057] Since the rpm (approximately 100rpm) in the interim dehydrating operation after the rinsing operation in the calm washing course is considerable lower than the rpm (approximately 800rpm) in the interim dehydrating operation after the, rinsing operation in the standard washing course, the rinsing number of the calm washing course must be larger than that of the standard washing

course so as to obtain the same capacity as that in the standard washing course. Of course, in the same manner as the interim dehydrating operation after the washing operation, the dehydration holding time (T) of the interim dehydrating operation after the rinsing operation is elongated.

[0058] When it is determined that the adjusted rinsing number is not completed in operation 180, the process moves to operation 190, where the interim dehydrating operation is performed at less than a designated rpm (approximately 100rpm) such that the user cannot feel the revolution of the motor 15. The rpm in the interim dehydrating operation in the calm washing course is lower than the rpm (approximately 800 rpm) in the interim dehydrating operation in the standard washing course. Thereby, it is possible to maximally reduce noise generated in the interim dehydrating operation after the washing operation, thus providing calm environment.

[0059] From operation 190, the process moves to operation 200, where the control unit 130 determines whether a designated holding time (T) (a time to remove the minimum amount of water from the laundry by controlling the rpm so that the interim dehydrating operation is performed in a low-noise state, approximately 3 minutes, in the same manner as the interim dehydrating operation after the washing operation) of the interim dehydrating operation, which is performed at less than the designated rpm after the rinsing operation, has elapsed. That is, the interim dehydrating operation at less than a designated rpm is performed during the dehydration holding time (T).

[0060] On the other hand, when it is determined that the adjusted rinsing number is completed in operation 180, the process moves to operation 210, where the control unit 130 stops operation of all loads including the drain device 19 so that the washing water is not discharged to the outside of the washing machine and the rinsing state is maintained without operating a final dehydrating operation.

[0061] The above process allows the laundry to be dried without wrinkle after the washing operation is completed and predetermined amount of time has passed.

[0062] As apparent from the above description, the present invention provides a washing machine, in which a dehydrating operation performed after all washing and rinsing operations is controlled so that the dehydrating operation is performed in a low-noise state at less than a designated rpm to achieve calm washing, and in which time and speed of the dehydrating operation performed after all washing and rinsing operations are controlled so that the dehydrating operation is performed at less than a designated rpm to have the same effects as a standard washing course, and a method for controlling the same.

[0063] Further, the washing machine controls a holding time of an interim dehydrating operation and a rinsing number so that the dehydrating operation is performed at less than a designated rpm to compensate for rinsing capacity, and does not discharge washing water to the

outside and maintains a rinsing state in a final rinsing operation to prevent generation of noise due to a final dehydrating operation and to dry the laundry without wrinkling.

[0064] Although a few 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 these embodiments without departing from the principles and spirit of the invention, the scope of which is defined in the claims and their equivalents.

Claims

1. A method for controlling a washing machine comprising:

determining whether a calm washing course is selected; and
performing low-noise calm washing by controlling a dehydrating operation performed after washing and rinsing operations so that the dehydrating operation is performed at less than a designated speed, when it is determined that the calm washing course is selected.

2. The method as set forth in claim 1, wherein, the performing of the low-noise calm washing comprises controlling a time and a speed of the dehydrating operation performed after the washing and rinsing operations.

3. The method as set forth in claim 1, wherein, the performing of the low-noise calm washing comprises controlling a time of the dehydrating operation performed after the rinsing operation and a rinsing number in the rinsing operation.

4. The method as set forth in claim 1, wherein the designated speed is approximately 100rpm.

5. The method as set forth in claim 1, further comprising preventing washing water from being discharged to an outside in a final rinsing operation and maintaining a final rinsing state, when it is determined that the calm washing course is selected.

6. A method for controlling a washing machine, in which a dehydrating operation after operations for washing laundry is performed at less than a designated speed for a designated time, to perform calm washing in a low-noise state.

7. The method as set forth in claim 6, wherein the operations for washing laundry comprise washing and rinsing operations.

8. The method as set forth in claim 6, wherein the des-

ignated speed is approximately 100rpm.

9. The method as set forth in claim 7, wherein when the rinsing operation is a final rinsing operation, a final rinsing state is maintained without performing a final dehydrating operation.

10. A washing machine having a motor and a drain device, comprising:

a signal input unit to select a calm washing course; and

a control unit to control the motor in the calm washing course so that a dehydrating operation after washing and rinsing operations is performed at less than a designated speed.

11. The washing machine as set forth in claim 10, wherein the control unit controls a time and a speed of the dehydrating operation after the washing and rinsing operations.

12. The washing machine as set forth in claim 10, wherein the control unit controls a time of the dehydrating operation after the rinsing operation and a rinsing number in the rinsing operation.

13. The washing machine as set forth in claim 10, wherein the designated speed is approximately 100rpm.

14. The washing machine as set forth in claim 10, wherein the control unit prevents washing water from being discharged to an outside in a final rinsing operation, and maintains a final rinsing state.

15. A washing machine comprising:

a signal input unit to select a calm washing course; and

a control unit to control the motor in the calm washing course so that a dehydrating operation after operations for washing laundry is performed at less than a designated speed for a designated time.

16. The washing machine as set forth in claim 15, wherein the operations for washing laundry comprise washing and rinsing operations.

17. The washing machine as set forth in claim 16, wherein, when the rinsing operation is a final rinsing operation, the control unit maintains a final rinsing state without performing a final dehydrating operation.

FIG. 1

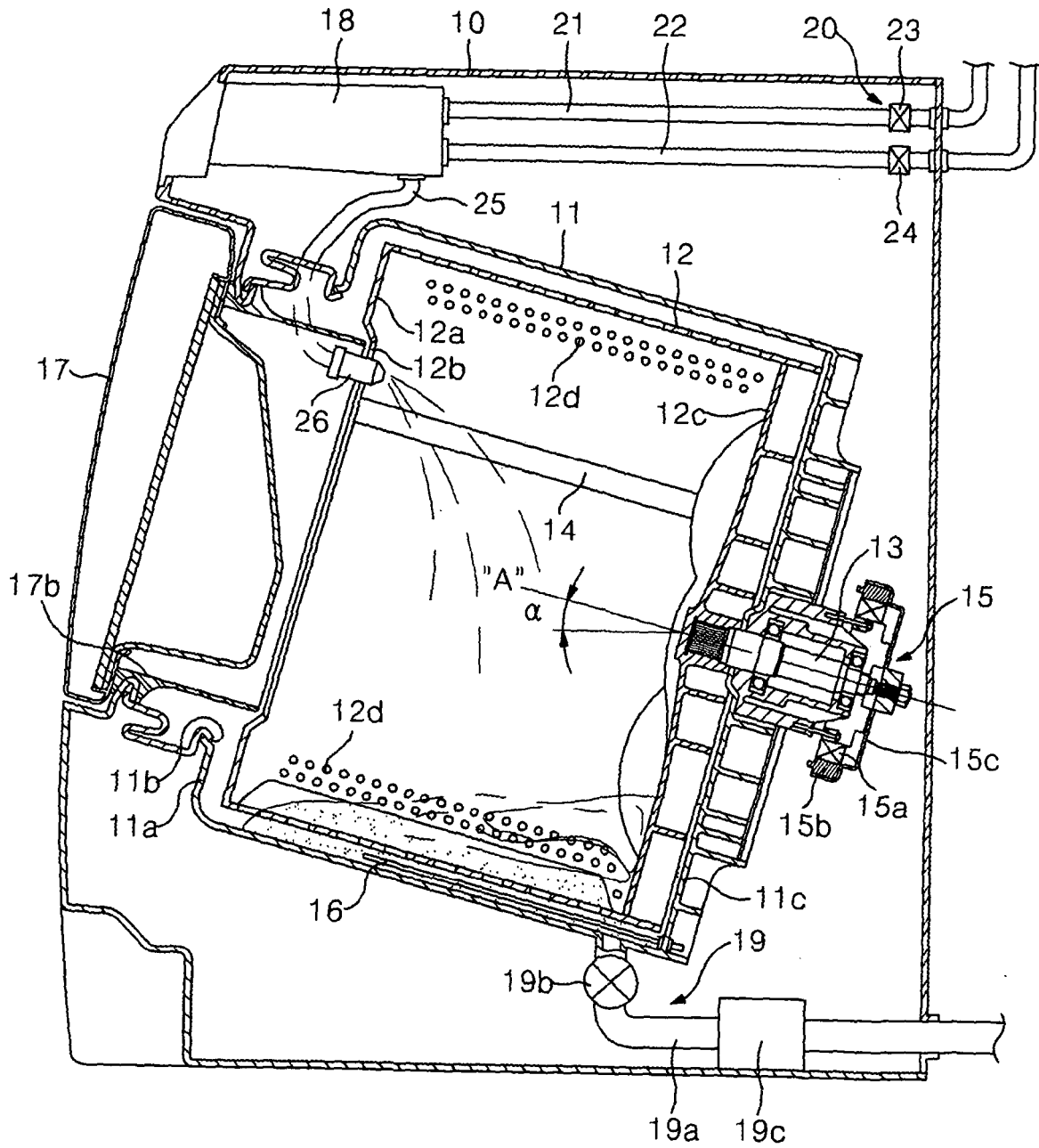


FIG. 2

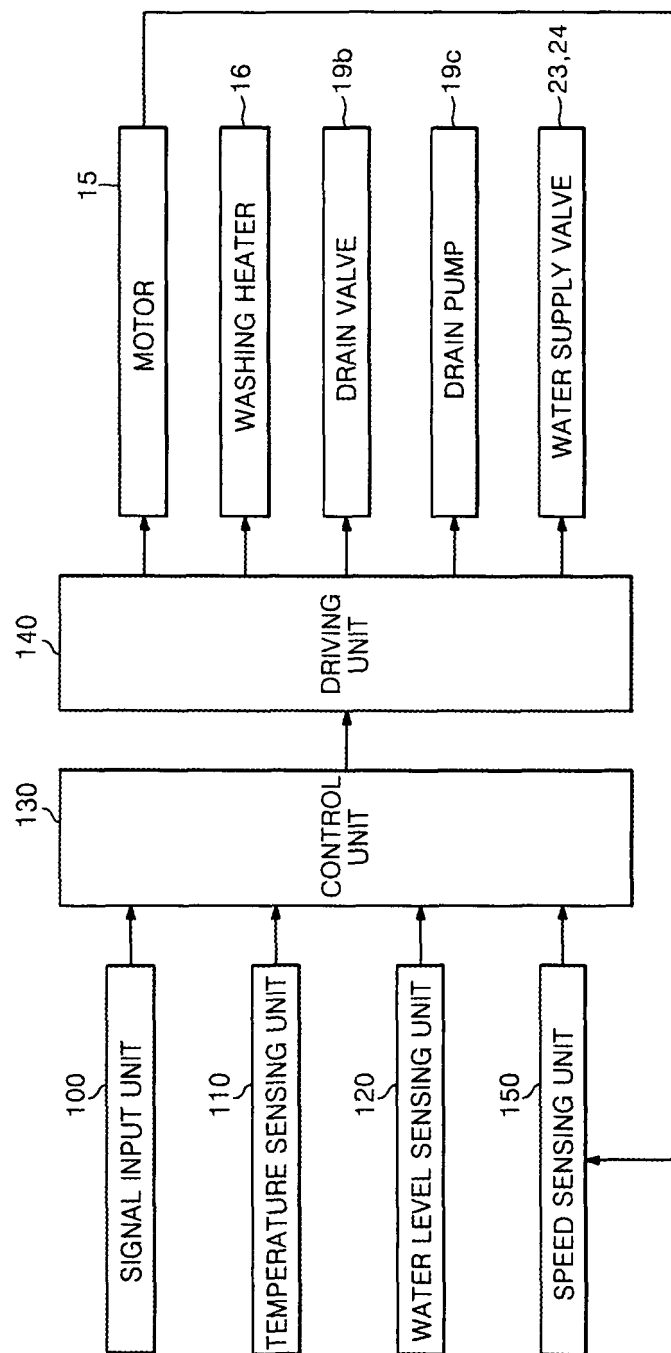
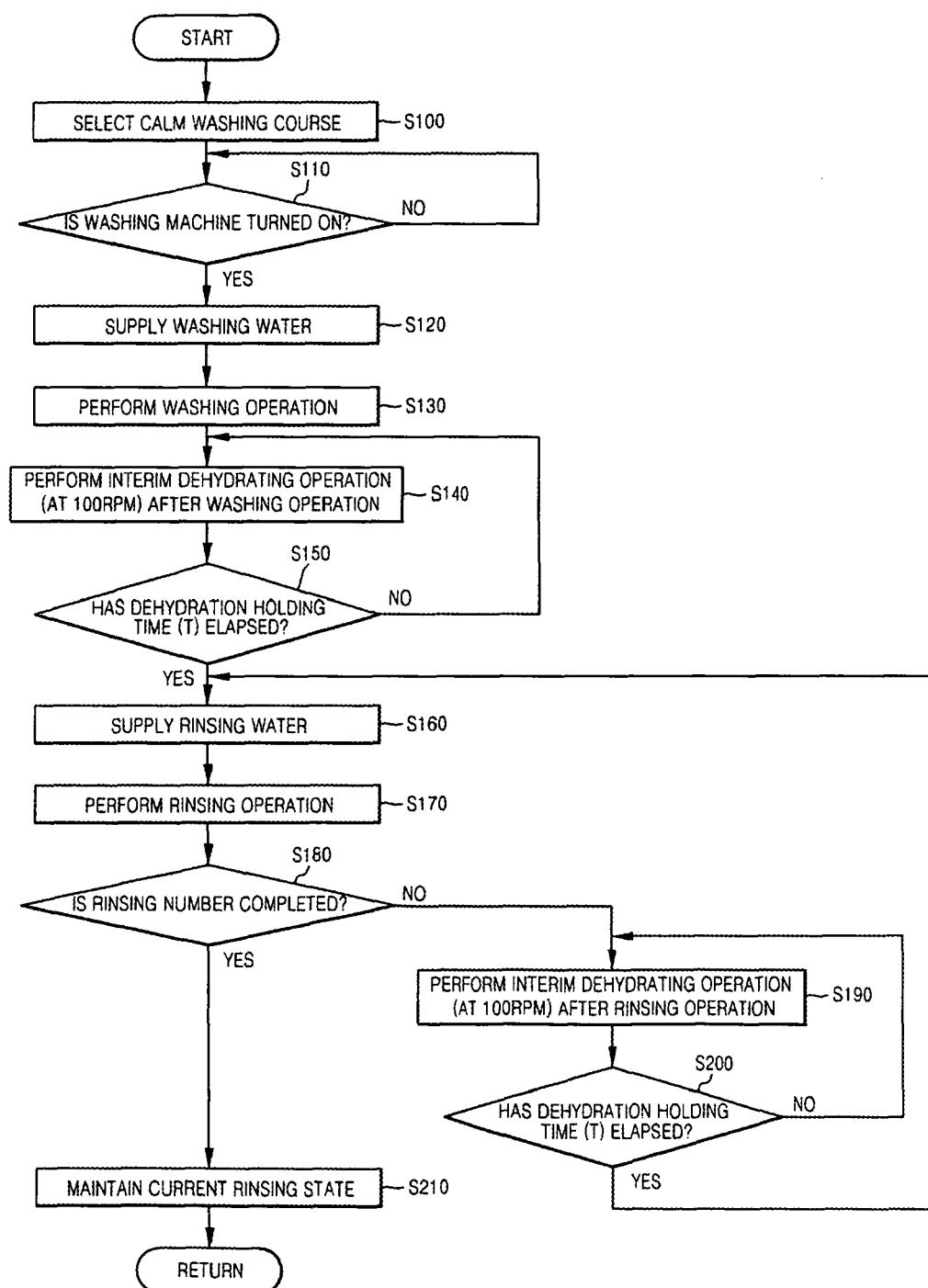


FIG. 3



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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