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(54) **WASHING MACHINE AND METHOD FOR CONTROLLING SAME**

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(57) **ABSTRACT**

A washer comprising: a first heater to heat washing water; a second heater to heat air; a fan to guide air; a memory to store one or more programs; and a controller which is electrically connectable to the first heater, the second heater, the blower fan, and the memory. The washer is controlled by the controller to sequentially perform a washing cycle, a first rinsing cycle, a second rinsing cycle, a spin-drying cycle, and a drying cycle, wherein the second rinsing cycle includes an operation of heating the washing water through the first heater and an operation of rotating the drum, and the spin-drying cycle may include heating the air through the second heater in at least a part of a section based on a rotation speed of the drum, and guiding the heated air into the drum by using the blower fan.

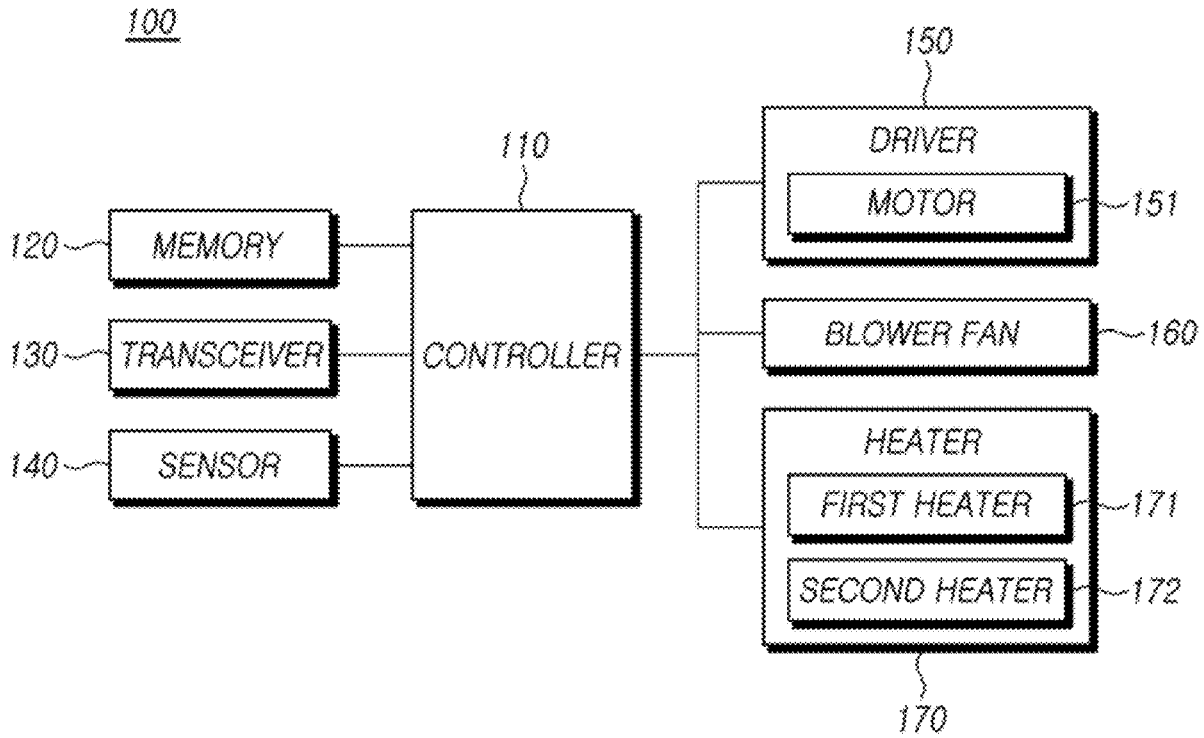


FIG. 1

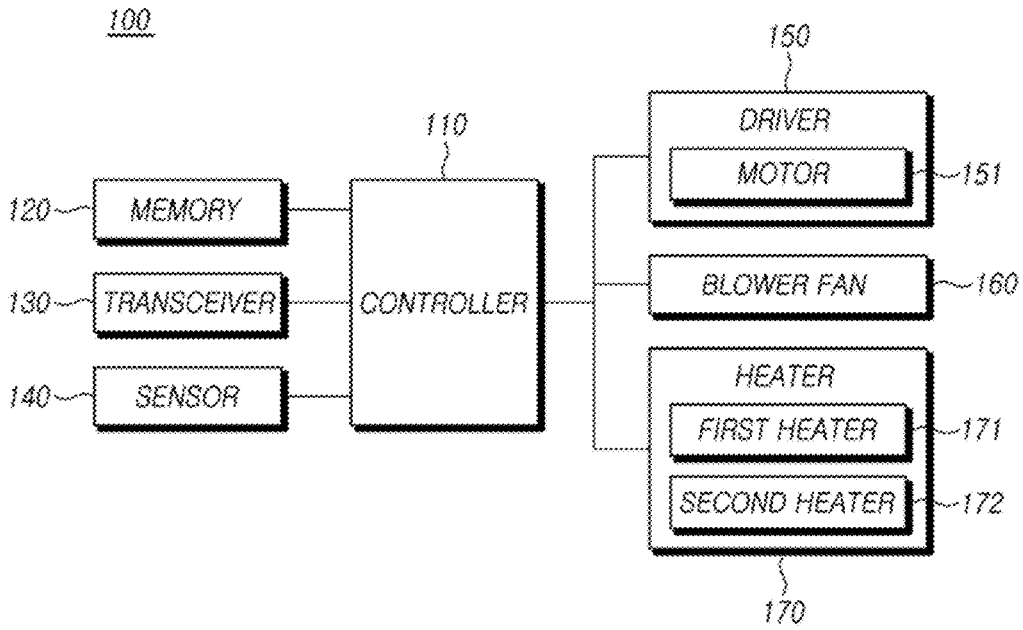

100
150
DRIVER
MOTOR
151
110
120
MEMORY
130
TRANSCEIVER
140
SENSOR
CONTROLLER
BLOWER FAN
160
HEATER
FIRST HEATER
171
SECOND HEATER
172
170

FIG.2

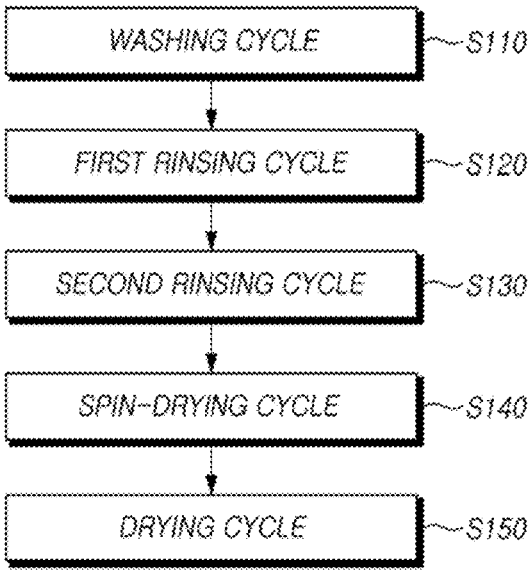

WASHING CYCLE
S110
FIRST RINSING CYCLE
S120
SECOND RINSING CYCLE
S130
SPIN-DRYING CYCLE
S140
DRYING CYCLE
S150

FIG.3

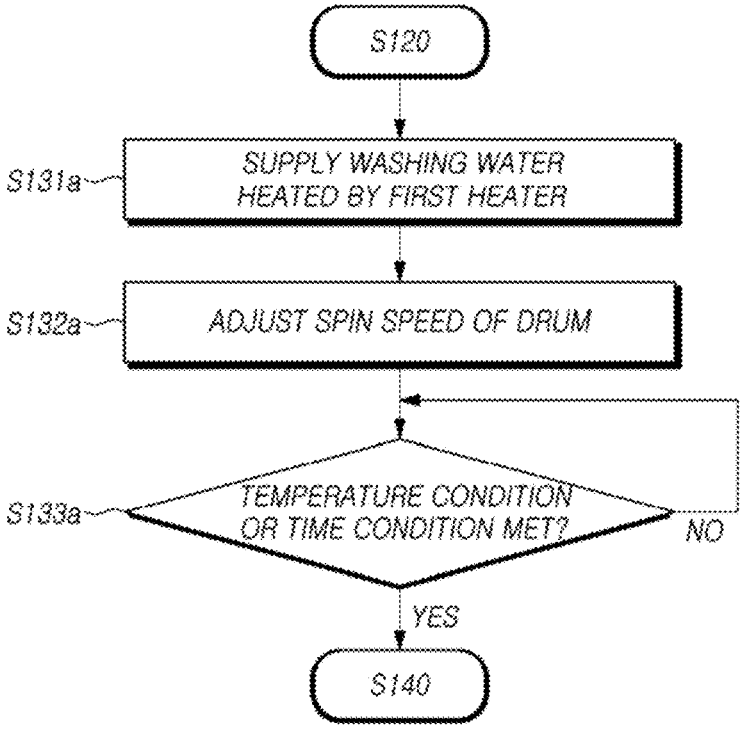

S120
S131a
SUPPLY WASHING WATER HEATED BY FIRST HEATER
S132a
ADJUST SPIN SPEED OF DRUM
S133a
TEMPERATURE CONDITION OR TIME CONDITION MET?
NO
YES
S140

FIG.4

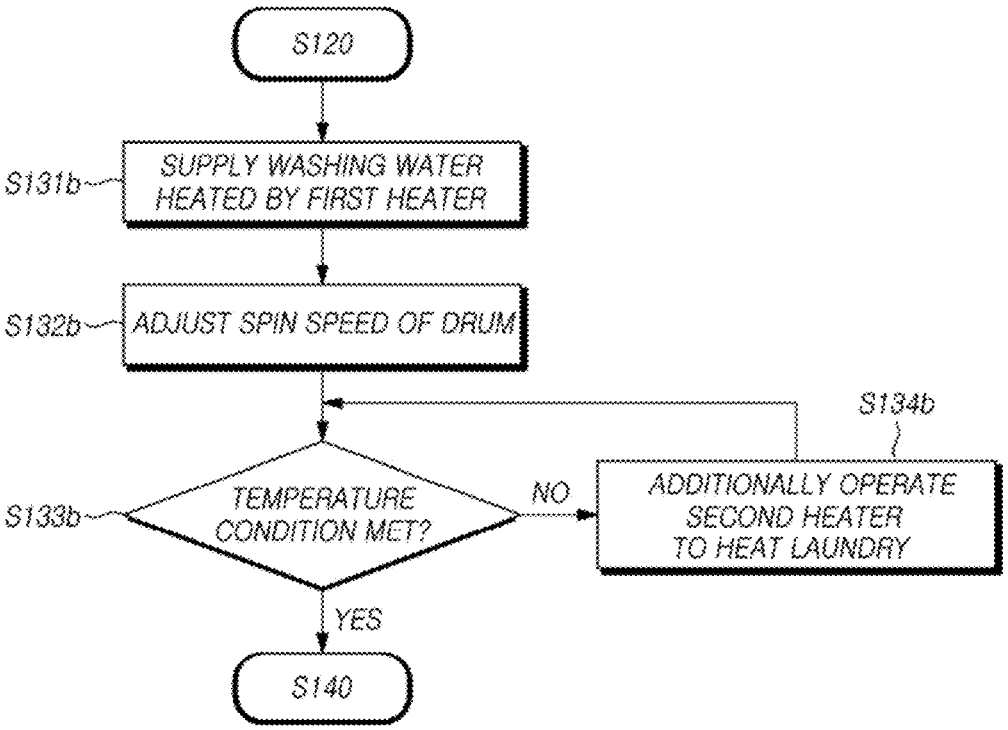

S120
S131b
SUPPLY WASHING WATER HEATED BY FIRST HEATER
S132b
ADJUST SPIN SPEED OF DRUM
S134b
S133b
TEMPERATURE CONDITION MET?
NO
ADDITIONALLY OPERATE SECOND HEATER TO HEAT LAUNDRY
YES
S140

FIG.5

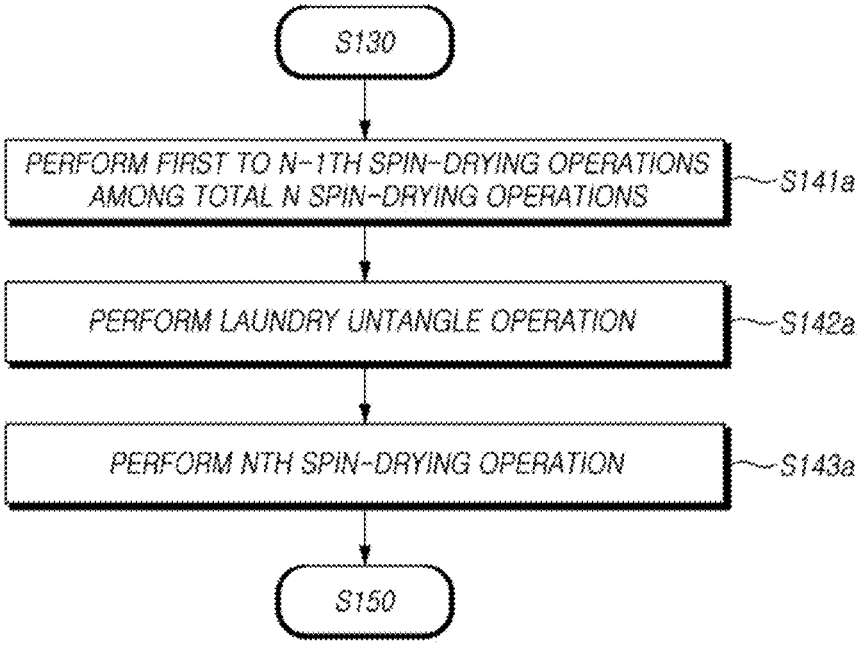

S130
PERFORM FIRST TO N-1TH SPIN-DRYING OPERATIONS AMONG TOTAL N SPIN-DRYING OPERATIONS
S141a
PERFORM LAUNDRY UNTANGLE OPERATION
S142a
PERFORM NTH SPIN-DRYING OPERATION
S143a
S150

FIG.6

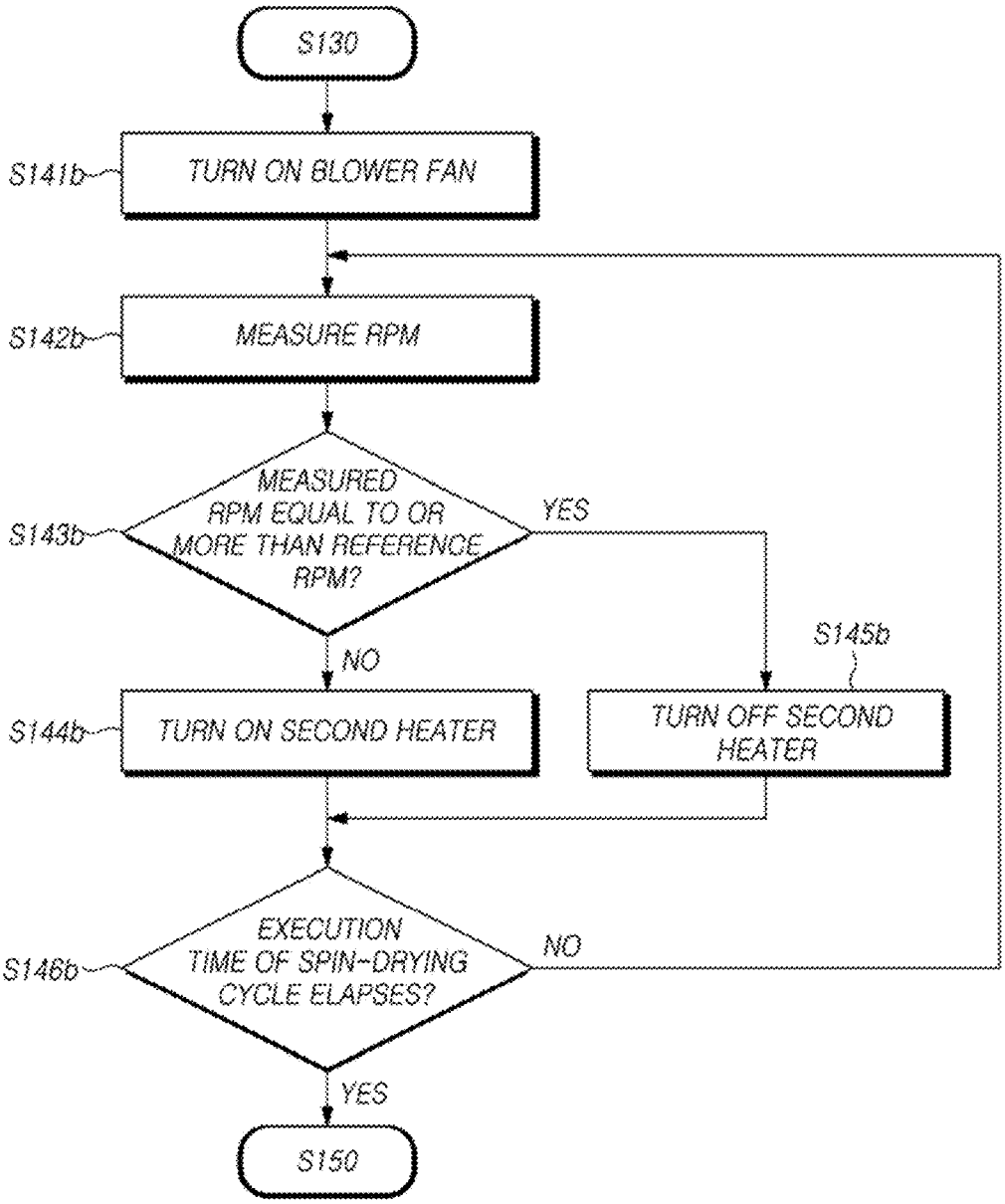

S130
S141b
TURN ON BLOWER FAN
S142b
MEASURE RPM
S143b
MEASURED RPM EQUAL TO OR MORE THAN REFERENCE RPM?
YES
NO
S144b
TURN ON SECOND HEATER
S145b
TURN OFF SECOND HEATER
S146b
EXECUTION TIME OF SPIN-DRYING CYCLE ELAPSES?
NO
YES
S150

FIG. 7

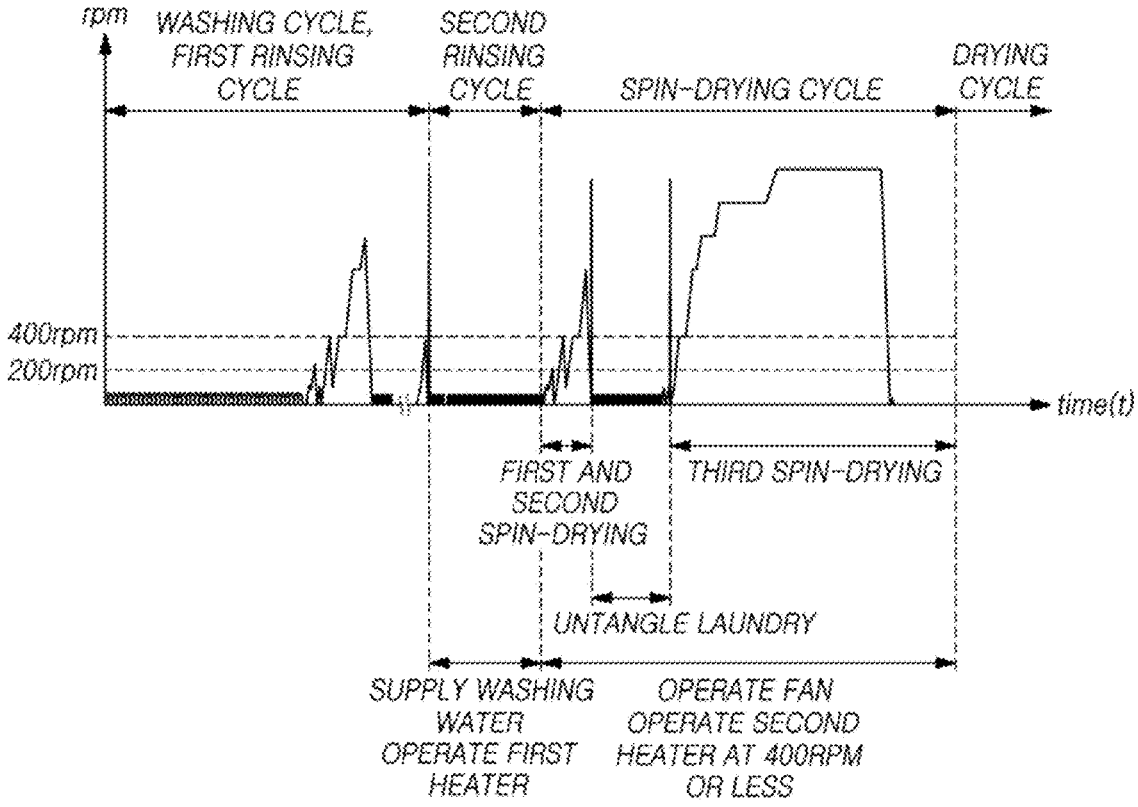

rpm
WASHING CYCLE, FIRST RINSING CYCLE
SECOND RINSING CYCLE
SPIN-DRYING CYCLE
DRYING CYCLE
400rpm
200rpm
time(t)
FIRST AND SECOND SPIN-DRYING
THIRD SPIN-DRYING
UNTANGLE LAUNDRY
SUPPLY WASHING WATER OPERATE FIRST HEATER
OPERATE FAN OPERATE SECOND HEATER AT 400RPM OR LESS

FIG.8

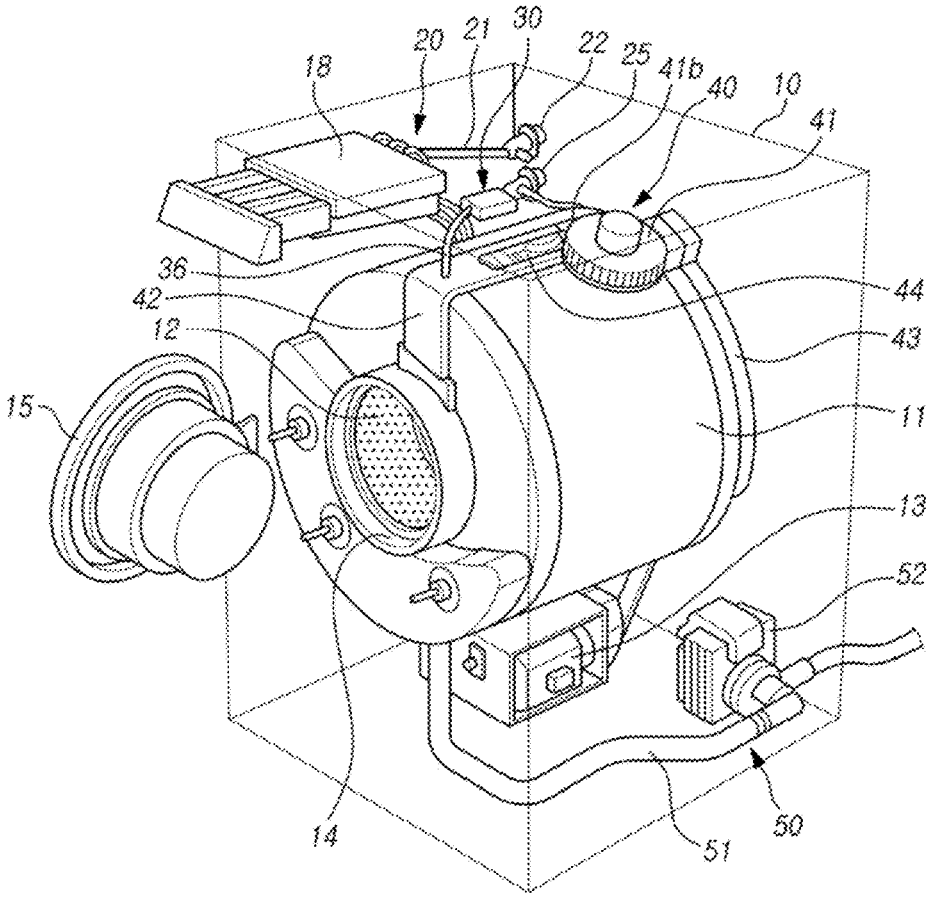
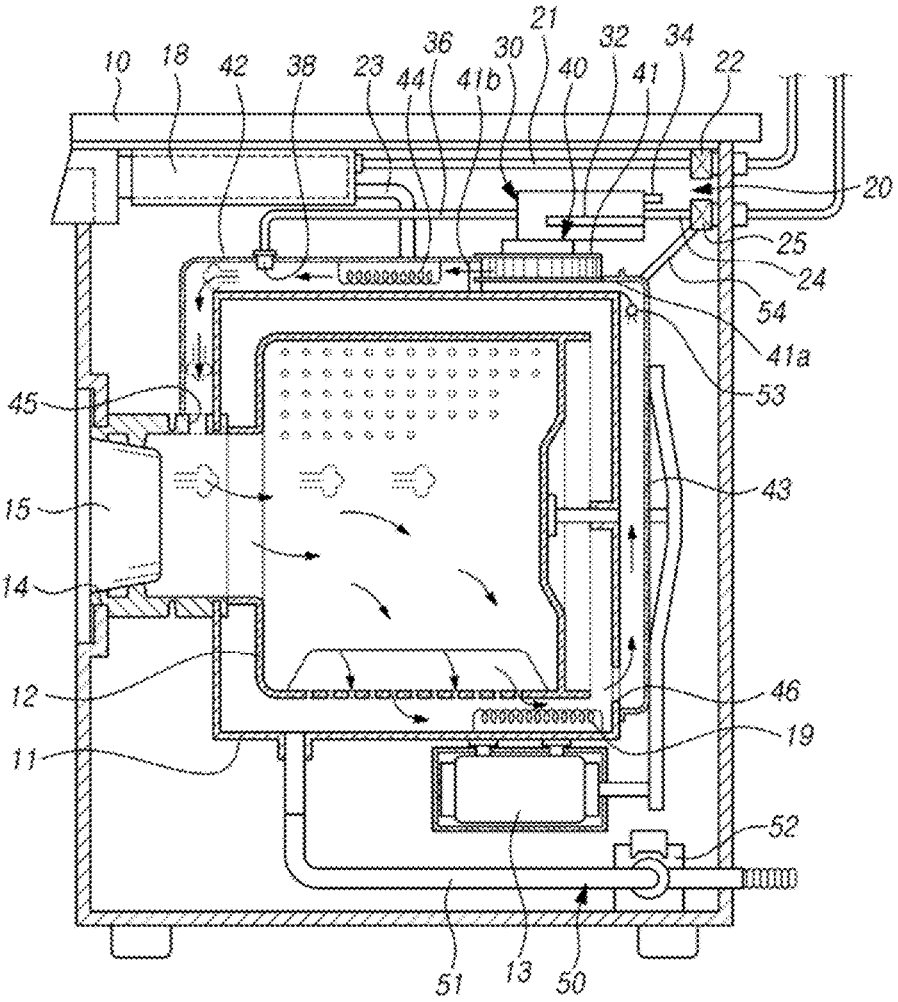


FIG.9


10
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38
23
44
36
41b
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21
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41a
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WASHING MACHINE AND METHOD FOR CONTROLLING SAME

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation application of International Application No. PCT/KR2022/017197, filed on Nov. 4, 2022, in the Korean Intellectual Property Receiving Office, which claims priority from Korean Patent Application No. 10-2022-0001598 filed on Jan. 5, 2022, in the Korean Intellectual Property Office, the disclosures of which are hereby incorporated by reference herein in their entireties.

FIELD

[0002] The disclosure relates to a washer and a method for controlling the same.

BACKGROUND ART

[0003] A washer is an electronic device that includes a drum and removes contaminants from laundry using water and detergent. The washer uses a motor as its main power source to perform the washing cycle, rinsing cycle, and spin-drying cycle, removing contaminants from the laundry loaded into the drum and moisture retained in the laundry during the washing process. Typical types of washers include drum-type washers and electromotive washers. Laundry washed by a washer may be naturally dried by sunlight or air, but recently, laundry may be dried easily and conveniently using a dryer. The dryer is an electronic device that includes a drum and removes moisture from laundry using one or more heaters.

[0004] Meanwhile, the drying cycle may also be performed by the washer. In this case, the washer may perform a washing cycle, a rinsing cycle, and a spin-drying cycle followed by a drying cycle. To perform a drying cycle, a washer capable of performing a drying cycle may further include various components that are different from a typical washer. A washer capable of performing a drying cycle may include, e.g., a drying heater for heating air and a fan for supplying heated air into the drum. To achieve an efficient drying cycle, such a washer performs additional operations that are different from those of a typical washer.

SUMMARY

[0005] A washer according to an embodiment of the disclosure may comprise a first heater to heat water to be introduced to an inside of a drum, a second heater to heat air to be introduced to the inside of the drum, a fan to guide air to the inside of the drum, a memory to store one or more programs, and a controller electrically connectable with the first heater, the second heater, the fan, and the memory so that while the controller is connected with the first heater, the second heater, the fan, and the memory, one or more instructions of the one or more programs stored in the memory is executed. The controller may control the washer to sequentially perform a washing cycle, a first rinsing cycle, a second rinsing cycle, a spin-drying cycle, and a drying cycle. The second rinsing cycle may include heating the water through the first heater and spinning the drum. The spin-drying cycle may include heating the air through the second heater during at least some sections of the spin-drying cycle based on a spin speed of the drum and guiding the heated air to the inside of the drum using the blower fan.

[0006] A method for controlling a washer including a first heater to heat water, a second heater to heat air, and a fan to guide air to an inside of a drum. According to another embodiment of the disclosure, the method may comprise receiving a washing course including a washing cycle, a first rinsing cycle, a second rinsing cycle, a spin-drying cycle, and a drying cycle, and controlling the washer to sequentially perform the washing cycle, the first rinsing cycle, the second rinsing cycle, the spin-drying cycle, and the drying cycle based on the received washing cycle. The second rinsing cycle may include heating the water through the first heater and rotating the drum. The spin-drying cycle may include heating the air through the second heater during at least a partial section of the spin-drying cycle based on a spin speed of the drum and guiding the heated air to the inside of the drum using the fan.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] FIG. **1** is a block diagram illustrating a washer according to an embodiment of the disclosure;

[0008] FIG. **2** is a flowchart illustrating all cycles of a washer according to an embodiment of the disclosure;

[0009] FIG. **3** is a flowchart illustrating an embodiment applied to the second rinsing cycle of FIG. **2**;

[0010] FIG. **4** is a flowchart illustrating another embodiment applied to the second rinsing cycle of FIG. **2**;

[0011] FIG. **5** is a flowchart illustrating an embodiment applied to the spin-drying cycle of FIG. **2**;

[0012] FIG. **6** is a flowchart illustrating another embodiment applied to the spin-drying cycle of FIG. **2**;

[0013] FIG. **7** is a reference diagram illustrating the overall cycle of FIG. **2** in a time-RPM graph;

[0014] FIG. **8** is a perspective view illustrating a washer according to an embodiment of the disclosure; and

[0015] FIG. **9** is a cross-sectional view illustrating a washer according to an embodiment of the disclosure.

[0016] Reference may be made to the accompanying drawings in the following description, and specific examples that may be practiced are shown as examples within the drawings. Other examples may be utilized and structural changes may be made without departing from the scope of the various examples.

DETAILED DESCRIPTION

[0017] Embodiments of the disclosure are now described with reference to the accompanying drawings in such a detailed manner as to be easily practiced by one of ordinary skill in the art. However, the disclosure may be implemented in other various forms and is not limited to the embodiments set forth herein. The same or similar reference denotations may be used to refer to the same or similar elements throughout the specification and the drawings. Further, for clarity and brevity, no description is made of well-known functions and configurations in the drawings and relevant descriptions.

[0018] The disclosure provides an electronic device and method for heating the temperature of laundry to a predetermined temperature or more or maintaining the temperature to enhance energy efficiency and time efficiency in a drying cycle.

[0019] The disclosure may enhance energy efficiency and time efficiency in a drying cycle by heating the temperature of laundry to a predetermined temperature or more or maintaining the temperature before starting a drying cycle.

[0020] Effects achievable in example embodiments of the disclosure are not limited to the above-mentioned effects, but other effects not mentioned may be apparently derived and understood by one of ordinary skill in the art to which example embodiments of the disclosure pertain, from the following description. In other words, unintended effects in practicing embodiments of the disclosure may also be derived by one of ordinary skill in the art from example embodiments of the disclosure.

[0021] FIG. **1** is a block diagram illustrating a washer according to an embodiment of the disclosure.

[0022] A washer **100** according to an embodiment of the disclosure includes a controller **110**, a memory **120**, a transceiver **130**, a sensor **140**, a driver **150**, a blower fan **160**, a first heater **171**, and/or a second heater **172**. The plurality of components constituting the washer **100** may be electrically or functionally connected to each other.

[0023] According to an embodiment of the disclosure, the controller **110** in the washer **100** may include a storage and processing circuit unit for supporting the operation of the washer **100**. The storage and processing circuit unit may include storage, such as non-volatile memory (e.g., flash memory, or other electrically programmable ROM configured to form a solid state drive (SSD)) or volatile memory (e.g., static or dynamic RAM). The processing circuit unit in the controller **110** may be used to control the operation of the washer **100**. The processing circuit unit may be based on one or more microprocessor(s), microcontroller(s), digital signal processor(s), baseband processor(s), power management section(s), audio chip(s), or application specific integrated circuit(s). The transceiver **130** and the memory **120** described below may be provided as functional elements performing specific functions or operations as at least part of the controller **110** as an aspect of the controller **110** or may be provided as separate hardware components, as entities performing independent functions or operations.

[0024] According to an embodiment of the disclosure, the memory **120** may include a memory area for one or more controllers **110** for storing variables used in the protocol, configuration, control, and other functions of the washer **100**, including operations corresponding to or including any one of the methods and/or procedures described as an example in the disclosure. Further, the memory **120** may include non-volatile memory, volatile memory, or a combination thereof. Further, the memory **120** may interface with a memory slot that enables insertion and removal of removable memory cards in one or more formats (e.g., SD card, Memory stick, compact flash, etc.).

[0025] According to an embodiment of the disclosure, the transceiver **130** may include a wireless communication module or an RF module. The wireless communication module may include, for example, Wi-Fi, BT, GPS or NFC. For example, the wireless communication module may provide a wireless communication function using a radio frequency. Additionally or alternatively, the wireless communication module may include a network interface or modem for connecting the washer **100** with a network (e.g., Internet, LAN, WAN, telecommunication network, cellular network, satellite network, POTS or 5G network). The RF module may be responsible for data transmission/reception, e.g., transmitting and receiving data RF signals or invoked electronic signals. As an example, the RF module may include, e.g., a power amp module (PAM), a frequency filter, or a low noise amplifier (LNA). The RF module may further include parts (e.g., conductors or wires) for communicating radio waves in a free space upon performing wireless communication.

[0026] According to an embodiment of the disclosure, the sensor unit **140** may detect the operation state of the washer **100**, e.g., power or temperature or external environment state, e.g., the user's state, and generate an electric signal or data value corresponding to the detected state. For example, the sensor **140** may detect the operation state of the washer **100** or the ambient environment while a washing course is performed and obtain diagnosis information about the washer **100**. The diagnosis information refers to information about the state and/or abnormality with components (e.g., the drum, the tub, the water supply valve, the door, etc.) constituting the washer **100**. To that end, the sensor **140** may include at least one of a speed sensor, a weight sensor, a temperature sensor, a water level sensor, a detergent sensor, a leak sensor, a humidity sensor, a turbidity sensor, a door sensor, a vibration sensor, and a valve sensor. Each sensor may be implemented as a separate device physically separated, or the sensors may be integrated and implemented as a single device. The speed sensor may detect the spin speed, the spin angle, the spin direction, etc. of the motor and/or the drum. The weight sensor may detect the weight of the drum. The temperature sensor may detect the temperature inside the tub, the temperature inside the drum, the temperature around the washer **100**, and the like. The water level sensor may detect the water level or flow rate of the washing water. The detergent sensor may detect the remaining amount or type of the detergent. The leak sensor may detect a leak of the washing water. The humidity sensor may detect the amount of moisture in the air. The turbidity sensor may detect the turbidity of the liquid. The door sensor may detect whether the door is opened or closed. The vibration sensor may detect the degree of vibration as the washer **100** operates. The valve sensor may detect whether there is an abnormality in the water supply valve or the drain valve.

[0027] According to an embodiment of the disclosure, the driver **150** may receive a control command from the controller **110** and may include an inverter and/or a motor. Further, the driver **150** may receive a control command of the controller **110** and operate the blower fan **160** in response to the received control command While the drum is spun by the driver **150**, the laundry inside the drum may tumble, i.e., repeatedly rise and fall, which may remove contaminants attached to the laundry.

[0028] According to an embodiment of the disclosure, the blower fan **160** may operate in at least a portion of all the cycles of the washer **100** to enhance the capability of washing, spin-drying, or drying. For example, the driver **150** may spin the drum while the blower fan **160** is operated, thereby facilitating removal of contaminants. Further, the strong air volume introduced into the drum may support effective removal of contaminants attached to the tumbling laundry. Further, the blower fan **160** may introduce air heated by the heater into the drum according to the operation. As such, the surface of the laundry may be dried by the heated air.

[0029] According to an embodiment of the disclosure, the first heater **171** heats the water received in the tub to heat the

water flowing inside the washer **100**. The first heater **171** may be operated so that the temperature of the water received in the tub is heated to a temperature set by the user. Water (heated water or hot water) heated by the first heater **171** is introduced into the tub or drum through a supply pipe. The laundry may be heated by hot water. Such a heater may be referred to as a washing heater or a tub heater. Further, in the disclosure, the water flowing inside the washer **100** may be referred to as washing water.

[0030] According to an embodiment of the disclosure, the second heater **172** may heat the air passing through the drying duct to heat the air flowing inside the washer **100**. Air heated while passing through the drying duct, i.e., hot air, is introduced into the drum by the blower fan **160**. The laundry may be dried by hot air. Such a heater may be referred to as a dry heater or a duct heater.

[0031] According to an embodiment of the disclosure, the controller **110** may sequentially perform a washing cycle, a first rinsing cycle, a second rinsing cycle, a spin-drying cycle, and a drying cycle. Each cycle is for washing, rinsing, spin-drying, and drying laundry and may include one or more operations associated therewith. One or more operations associated with each cycle are stored in the memory **120** and are realized based on a control command of the controller **110**.

[0032] According to an embodiment of the disclosure, the first rinsing cycle and the second rinsing cycle are distinguished from each other due to different constituent operations. The first rinsing cycle is a rinsing cycle typically performed, and includes the operation of supplying water into the drum and spinning the drum through a motor. In contrast, the second rinsing cycle may include the operation of heating water through a heater, preferably the first heater **171**, before supplying water into the drum, or the operation of increasing the temperature in the drum by heating the tub through the first heater **171** and/or the second heater **172** after supplying water into the drum. In other words, the second rinsing cycle is distinguished from the first rinsing cycle in that the second rinsing cycle further includes the operation of increasing the temperature inside the tub or drum and/or the temperature of the laundry using one or more heaters. For example, the second rinsing process may include the operation of preheating the water in the tub by the first heater **171** before supplying the water into the drum. As another example, the second rinsing cycle may include the operation of heating the air and laundry in the drum by heating the tub through the first heater **171** and/or the second heater **172** after supplying water into the drum. In this case, in another example, water supplied into the drum may also be provided as hot water heated by the first heater **171**. Meanwhile, in an embodiment, the first heater **171** may be disposed on a lower inner surface of the tub. The first heater **171** may be disposed to be adjacent to or in direct contact with water contained in the tub. The water contained in the tub may be directly heated by the first heater **171**. When the second heater **172** operates together, as the second heater **172** operates, the air around the second heater **172** may be heated, and the air (warm air or hot air) heated by the blower fan **160** may support heating the laundry inside the tub.

[0033] According to an embodiment of the disclosure, the motor and/or the drum are controlled to spin at a predetermined reference RPM or less while the second rinsing cycle is performed. Here, the predetermined reference RPM may be set to 200 RPM, but is not limited thereto. The reference RPM in the section where the second rinsing cycle is performed may be set to a value smaller than the reference RPM for determining the section where the second heater **172** operates in the section where the spin-drying cycle to be described below is performed. For example, the second rinsing cycle may be performed at 200 RPM or less, and the second heater **172** may be operated at 400 RPM or less in the spin-drying cycle.

[0034] As such, the surface tension of the laundry is reduced by rinsing the air and/or laundry in the drum through heated water, i.e., hot water or warm water. As the surface tension is reduced, moisture may be easily removed from the laundry in the subsequent spin-drying cycle, which enhances the spin-drying rate and energy efficiency in the spin-drying cycle. Further, as the spin-drying rate in the spin-drying cycle is enhanced, the drying rate and energy efficiency in the drying cycle are also enhanced.

[0035] According to an embodiment of the disclosure, the spin-drying cycle includes a plurality of spin-drying operations. The plurality of spin-drying operations include, e.g., a first spin-drying operation, a second spin-drying operation, . . . , and an Nth spin-drying operation (where N is a natural number of 2 or more). As the order of the spin-drying operation increases, the spin speed of the motor and/or the drum may be adjusted to a larger value. Further, as the order of the spin-drying operation increases, the time during which the spin-drying operation of each order is performed may be adjusted to a larger value. For example, when N is 3, the spin speed in the first spin-drying operation may be set to increase to a maximum RPM of 400 RPM or less, the spin speed in the second spin-drying operation may be set to increase to a maximum RPM between 400 RPM and 800 RPM, and the spin speed in the third spin-drying operation may be set to increase to a maximum RPM of 1200 RPM or more. Each maximum RPM may be preset based on a user input, but is not limited thereto. Meanwhile, after the Nth spin-drying operation is finished, the controller **110** adjusts the spin speed to 0 RPM and performs a laundry untangle operation.

[0036] According to an embodiment of the disclosure, the controller **110** may perform a laundry untangle operation not only after all the spin-drying operations are finished, but also in at least some sections between the plurality of spin-drying operations. The laundry untangle operation performed in at least some sections between the spin-drying operations may be referred to as a first laundry untangle operation, and the laundry untangle operation after all the spin-drying operations are finished may be referred to as a second laundry untangle operation. The first laundry untangle operation is not limited as being performed in one section, but may be performed in one or more sections between the plurality of spin-drying operations. The section where the first laundry untangle operation is performed may be preset based on a user input, but is not limited thereto. While the laundry untangle operation is performed, the controller **110** controls the motor so that the motor and/or the drum has a spin speed of 200 RPM or less.

[0037] According to an embodiment of the disclosure, the controller **110** may perform the first laundry untangle operation between the Nth spin-drying operation and the N-1th spin-drying operation among the plurality of spin-drying operations. In other words, the first laundry untangle operation may be determined to be performed between, e.g., the Nth spin-drying operation and the N-1th spin-drying opera-

tion. The Nth spin-drying operation is a final spin-drying operation, and the controller **110** controls the motor or spins the drum at a maximum RPM of at least 1200 RPM or more. Prior to the final spin-drying operation, the controller **110** performs the first laundry untangle operation. Simultaneously with decreasing the RPM to 200 RPM or less in the first laundry untangle operation, the controller **110** may heat the tumbling laundry using the second heater **172** and the blower fan **160**, which are described below. Before the laundry is spin-dried at high speed in the final spin-drying operation, the laundry is heated through the first laundry untangle operation, and as the temperature of the laundry increases, the spin-drying rate and the drying rate may be remarkably enhanced.

[0038] Further, according to an embodiment of the disclosure, the controller **110** may operate the blower fan **160** during the spin-drying cycle. The blower fan **160** may advantageously operate throughout all the spin-drying cycles. Accordingly, the blower fan **160** provides heated air into the drum in the section where the second heater **172** operates, and provides unheated air into the drum in the section where the second heater **172** does not operate.

[0039] Here, the second heater **172** may be operated by the controller **110** in at least some sections of all the sections where the spin-drying cycle is performed. The section where the second heater **172** operates may be determined based on the spin speed of the motor and/or the drum. The spin speed of the motor and/or the drum may be detected or determined by the connected sensor **140**. When the spin speed of the motor and/or the drum is determined to be equal to or less than a predetermined reference RPM, the second heater **172** is operated in a section where the spin speed is determined to be equal to or less than the reference RPM. Here, the reference RPM may preferably be set to 400 RPM, but is not limited thereto. At 400 RPM or more, the laundry comes in close contact with the inner circumferential surface of the drum in a laundry sticking state. Thus, the second heater **172** operates at a low speed of 400 RPM or less. In other words, in the section where the laundry is tumbled as the drum spins at low speed, the second heater **172** operates, and the air heated by the second heater **172** evenly contacts the tumbling laundry. This contributes to evenly increasing the temperature of the laundry. Further, in the section where the laundry comes in close contact with the inner circumferential surface of the drum in the laundry sticking state, although the air heated by the first heater **171** is supplied, the heated air may not evenly contact the laundry but bypass the drum, leading to energy inefficiency. As such, the washer **100** according to an embodiment of the disclosure may provide an energy efficient spin-drying function of laundry by determining a section where the second heater **172** operates based on the spin speed of the motor and/or the drum. The above-described functions of the washer **100** may be understood with reference to the flowcharts of FIGS. **2** to **6** and the reference view of FIG. **7**.

[0040] FIG. **2** is a flowchart illustrating all cycles of a washer **100** according to an embodiment of the disclosure.

[0041] According to an embodiment of the disclosure, the controller **110** may perform a washing cycle (S**110**).

[0042] According to an embodiment of the disclosure, the controller **110** may supply water and a detergent to the tub. The controller **110** may open the water supply valve to supply water to the tub based on the measured amount of water. By opening the water supply valve, water may be supplied to the tub via the detergent container. The controller **110** may spin the drum for washing. The controller **110** may control the driver **150** to spin the drum at a low speed (e.g., 45 RPM to 60 RPM).

[0043] According to an embodiment of the disclosure, the controller **110** may perform a first rinsing cycle (S**120**).

[0044] According to an embodiment of the disclosure, the controller **110** may supply water to the tub and spin the drum at a low speed for rinsing. The controller **110** may perform the rinsing operation at least twice while changing the RPM or the spin direction in the first rinsing cycle, but is not limited thereto. In an embodiment, in the first rinsing cycle, unheated water may be supplied regardless of the heater, in particular, the first heater **171**. In other words, in the first rinsing cycle, the heater does not operate, and the water supplied to the washer **100** is supplied into the tub or drum as it is.

[0045] According to an embodiment of the disclosure, the controller **110** may perform the second rinsing cycle (S**130**).

[0046] According to an embodiment of the disclosure, the controller **110** may supply water heated by the first heater **171** in the tub into the drum and spin the drum at low speed. This is for heating the laundry Unlike the first rinsing cycle, the second rinsing cycle uses water heated by the first heater **171** during rinsing. The second heater **172** heats water in the tub before entering the second rinsing cycle or during the second rinsing cycle. For example, in the second rinsing cycle section, the controller **110** may preheat the water in the tub by the first heater **171** before supplying the water into the drum, and supply the heated water into the tub. As another example, in the second rinsing cycle section, the controller **110** may heat the air and laundry in the drum by heating the tub through the first heater **171** and/or the second heater **172** after supplying water into the drum.

[0047] According to an embodiment of the disclosure, the controller **110** may spin the drum at low speed and allow heated water and laundry to be evenly mixed. Not only the surface of the laundry but also the inside may be heated by the heated water. As described above, when the laundry is rinsed with the heated water before the spin-drying cycle, the laundry is considerably heated, and the surface tension of the bound water and the free water contained in the laundry is reduced. Since moisture contained in the laundry with reduced surface tension may be more easily separated from the laundry in the spin-drying cycle, the spin-drying rate in the spin-drying cycle is increased. As the spin-drying rate increases, the load required to be dried in the subsequent drying cycle decreases, so that the drying cycle time may be shortened, and since the laundry is already at high temperature when entering the drying cycle, the drying energy required to reach the target dry temperature may be reduced, so that the drying efficiency is also enhanced.

[0048] According to an embodiment of the disclosure, the controller **110** may perform the spin-drying cycle (S**140**).

[0049] According to an embodiment of the disclosure, the controller **110** may spin the drum at high speed. The spin-drying cycle includes two or more spin-drying operations. In other words, the spin-drying cycle may include a first spin-drying operation, a second spin-drying operation, . . . , and an Nth spin-drying operation (where N is a natural number of 2 or more). Meanwhile, the spin-drying cycle may include a laundry untangle operation. The laundry untangle operation may be divided into a first laundry untangle operation and a second laundry untangle operation

performed between spin-drying operations. The first laundry untangle operation is performed in at least one section between the spin-drying operations, and the second laundry untangle operation is performed after the Nth spin-drying operation is finished.

[0050] According to an embodiment of the disclosure, the first laundry untangle operation may be performed between spin-drying operations adjacent to each other. The first laundry untangle operation may be performed, e.g., between the Nth spin-drying operation and the N-1th spin-drying operation. The spin-drying operation increases the maximum RPM and/or the execution time as the order increases. For example, the maximum RPM of the second spin-drying operation may be set to be higher than that of the first spin-drying operation. As another example, the execution time of the second spin-drying operation may be set to be longer than that of the first spin-drying operation. As another example, the maximum RPM and the execution time of the second spin-drying operation may be set to be larger than those of the first spin-drying operation.

[0051] According to an embodiment of the disclosure, the controller **110** may operate the blower fan **160** while the spin-drying cycle is performed. For example, the controller **110** may operate the blower fan **160** in all the sections where the spin-drying cycle is performed. Meanwhile, according to an embodiment of the disclosure, the controller **110** may operate the second heater **172** in at least some of all the sections where the spin-drying cycle is performed. In the section where the second heater **172** operates, the controller **110** may control the blower fan **160** to supply the heated air into the drum. In a section where the second heater **172** does not operate, the controller **110** may control the blower fan **160** to supply unheated air into the drum. According to an embodiment of the disclosure, the section where the second heater **172** operates is determined based on the spin speed of the motor and/or the drum. For example, if the RPM of the motor and/or the drum is determined to be less than or equal to a reference value, the controller **110** may control the second heater **172** to supply the heated air into the drum. Here, the reference value may be set to 400 RPM. When the drum spins at 400 RPM or more, laundry sticks to the inner surface of the drum. This state is referred to as laundry sticking. If the second heater **172** operates in the laundry sticking state, even if the air heated by the blower fan **160** is supplied into the drum, the heated air does not pass through the laundry but bypasses. In other words, although heated air is supplied, the heated air merely contacts one surface of the laundry which comes in close contact with the inner circumferential surface of the drum, but seldom contacts the other surfaces. Accordingly, a temperature difference occurs between the one surface and the other surface of the laundry, rendering it difficult to expect an energy benefit from supplying the heated air.

[0052] According to an embodiment of the disclosure, the air heated using the second heater **172** is supplied only when the motor or drum spins at the reference value (e.g., 400 RPM) or less. At this time, laundry sticking does not occur, and the laundry tumbles. In other words, the laundry may be effectively heated by supplying the air heated by the second heater **172** at a tumblable RPM.

[0053] According to an embodiment of the disclosure, the controller **110** may perform a drying cycle (S**150**).

[0054] According to an embodiment of the disclosure, the controller **110** may operate the second heater **172** to heat the air inside the drum. For example, if the temperature of the air inside the tub reaches a predetermined value, the controller **110** may control the driver **150** to spin the drum while maintaining the operation of the second heater **172**.

[0055] FIG. **3** is a flowchart illustrating an embodiment applied to the second rinsing cycle of FIG. **2**.

[0056] According to an embodiment of the disclosure, if the first rinsing cycle is finished, the controller **110** may provide water heated by the first heater **171** to the inside of the tub or the drum (S**131***a*). According to another embodiment of the disclosure, if the first rinsing cycle is finished, the controller **110** may supply water to the inside of the tub or the drum, and may heat the water inside the tub or the drum using the first heater **171**. Here, the amount of water supplied into the tub or the drum is set to be smaller than the amount of water supplied in other rinsing operations included in the first rinsing cycle. In other words, the amount of water supplied in the second rinsing cycle is set to the minimum amount among the rinsing operations. This is because as the amount of water supplied increases, the time for heating the laundry increases. Water supplied or to be supplied into the tub or drum may be heated to a predetermined target temperature by the first heater **171** or may be heated for a predetermined time. Here, the target temperature may be set based on the temperature of the thermistor, but is not limited thereto.

[0057] According to an embodiment of the disclosure, the controller **110** may adjust the spin speed of the drum (S**132***a*). Here, the spin speed of the drum may be adjusted to 200 RPM or less. 200 RPM may be preset as a reference RPM while the second rinsing cycle is performed. Since the drum spins at 200 RPM or less, the internal temperature of the laundry tumbling with the heated water may be uniformly increased. The controller **110** may adjust the spin speed of the drum after the heated water is supplied, or adjust the spin speed of the drum while heating the water inside the tub or drum.

[0058] According to an embodiment of the disclosure, the controller **110** finishes or continues the second rinsing cycle based on the temperature condition or the time condition (S**133***a*). For example, the controller **110** may heat the laundry through the first heater **171** until the temperature of the laundry or the drum reaches a preset temperature, and if the temperature of the laundry or the drum reaches the preset temperature, the controller **110** may finish the second rinsing cycle and enter the spin-drying cycle. As another example, the controller **110** may heat the laundry through the first heater **171** for a preset time, and if the preset time elapses, the controller **110** may finish the second rinsing cycle and enter the spin-drying cycle.

[0059] FIG. **4** is a flowchart illustrating another embodiment applied to the second rinsing cycle of FIG. **2**. S**131***b* and S**132***b* correspond to S**131***a* and S**131***a*, respectively, of FIG. **3**, and repeated descriptions will be omitted.

[0060] According to an embodiment of the disclosure, the controller **110** additionally operates the second heater **172** or finishes the second rinsing cycle based on the temperature condition (S**133***b* and S**134***b*). For example, the controller **110** supplies water heated by the first heater **171** or unheated water and heats laundry inside the drum through the first heater **171** for a predetermined time. The section where the first heater **171** is so operated is referred to as a first section. The controller **110** identifies the temperature through the sensor **140** at the end of the first section and, if the identified

temperature is lower than a preset target value, operates the first heater and the second heater **172** at the same time. The section where the first heater and the second heater **172** both operate is referred to as a second section. In other words, the section where the second rinsing cycle is performed may include the first section and the second section, and the second section may be provided when the temperature of the laundry or the inside of the tub or the drum is lower than the target value at the end of the first section. In other words, if the temperature of the laundry or the inside of the tub or drum at the end of the first section is equal to or higher than the target value, the second section may be omitted.

[0061] FIG. **5** is a flowchart illustrating an embodiment applied to the spin-drying cycle of FIG. **2**.

[0062] According to an embodiment of the disclosure, the controller **110** may perform first to N-1th spin-drying operations among all of the N spin-drying operations (S**141***a*). The spin-drying cycle may include a plurality of spin-drying operations, and up to N spin-drying operations (where N is a natural number of 2 or more) may be performed. Each spin-drying operation may be performed at a different spin speed and/or execution time.

[0063] According to an embodiment of the disclosure, the controller **110** may perform a laundry untangle operation after the N-1th spin-drying operation (S**142***a*). When the N-1th spin-drying operation is completed, the controller **110** transmits a control command for performing the laundry untangle operation to the driver **150**. The laundry untangle operation of S**142***a* is included in the first laundry untangle operation. The first laundry untangle operation refers to a laundry untangle operation performed between two adjacent spin-drying operations. The controller **110** may adjust the spin speed of the motor and/or the drum to, e.g., 200 RPM or less while the first laundry untangle operation is performed. Accordingly, the laundry that was in close contact with the inner circumferential surface of the drum is removed from the inner circumferential surface and tumbled according to the spinning of the drum. Since the spin speed in the section where the first laundry untangle operation is performed falls within the range (e.g., a range of 0 to 400 RPM) of the spin speed at which the second heater **172** operates, the controller **110** may operate the second heater **172** in the entire section where the first laundry untangle operation is performed. The air heated by the second heater **172** is supplied into the drum by the blower fan **160**. The air supplied into the drum contacts the tumbling laundry and evenly increases or maintains the temperature of the laundry. Meanwhile, the laundry untangle operation may be terminated, e.g., in response to elapse of a preset time.

[0064] When the laundry untangle operation is completed, the controller **110** may perform the Nth spin-drying operations (S**143***a*). The Nth spin-drying operation is a final spin-drying operation, and the controller **110** spins the drum at a high speed of up to 1200 RPM or more. The second heater **172** operates when the spin speed of the motor and/or the drum is less than or equal to a preset reference value (e.g., 400 RPM) in the section where the Nth spin-drying operation is performed, but the second heater **172** does not operate when the spin speed of the motor and/or the drum is larger than or equal to the preset reference value (e.g., 400 RPM). However, even when the spin speed of the motor and/or the drum is larger than or equal to such a reference value, the blower fan **160** may continue to operate. When the Nth spin-drying operation is completed, the controller **110** performs a laundry untangle operation and a drying cycle.

[0065] FIG. **6** is a flowchart illustrating an embodiment applied to the spin-drying cycle of FIG. **2**.

[0066] According to an embodiment of the disclosure, the controller **110** may operate the blower fan **160** in response to entering the spin-drying cycle (S**141***b*). The blower fan **160** may operate throughout all the sections where the spin-drying cycle is performed. The controller **110** may supply air into the drum through the blower fan **160**.

[0067] According to an embodiment of the disclosure, the controller **110** may measure the spin speed of the motor and/or the drum (S**142***b*). One or more sensors **140** connected to the motor and/or the drum may measure the spin speed of the motor and/or the drum, and the measured spin speed is expressed in RPM. The measurement of the spin speed may be performed at a predetermined time period or in real time, but is not limited thereto.

[0068] According to an embodiment of the disclosure, when the spin speed of the motor and/or the drum is detected as equal to or less than a predetermined reference RPM, the controller **110** may operate the second heater **172** (S**143***b* and S**144***b*). Further, when the spin speed of the motor and/or the drum is detected as larger than or equal to the predetermined reference RPM, the controller **110** may not operate the second heater **172** or stop the operation (S**143***b* and S**145***b*).

[0069] According to an embodiment of the disclosure, the spin-drying cycle may be performed for a predetermined time and, if the predetermined time elapses, the controller **110** may finish the spin-drying cycle and enter the drying cycle (Yes in S**146***b*). When the preset time does not elapse, the controller **110** may continue the drying cycle and may measure the RPM in real time or at a predetermined time period while operating the second heater **172** or may stop such an operation while adjusting the temperature of the laundry or the inside of the tub and/or the drum (No in S**146***b*).

[0070] FIG. **7** is a reference diagram illustrating the overall cycle of FIG. **2** in a time-RPM graph.

[0071] Referring to FIG. **7**, all the cycles applied to an embodiment of the disclosure may include a washing cycle, a first rinsing cycle, a second rinsing cycle, a spin-drying cycle, and a drying cycle, and the cycles may be performed sequentially.

[0072] The second rinsing cycle is performed after the first rinsing cycle. The second rinsing cycle is performed at a predetermined reference RPM or less (e.g., 200 RPM or less). For example, in a section where the second rinsing cycle is performed, the controller **110** may supply water to the inside of the tub or the drum, and heat the inside of the tub or the drum through the first heater **171** to heat laundry inside the drum. As another example, in a section where the second rinsing cycle is performed, the controller **110** may supply water heated by the first heater **171** to the inside of the tub or the drum, and heat the inside of the tub or the drum through the first heater **171** to heat laundry inside the drum. In the section where the second rinsing cycle is performed, the controller **110** may spin the drum at a predetermined reference RPM or less (e.g., 200 RPM or less) to evenly mix water or heated water and laundry.

[0073] In response to termination of the second rinsing cycle, the controller **110** may perform the spin-drying cycle. The spin-drying cycle includes a plurality of spin-drying

operations and a plurality of laundry untangle operations. The spin-drying operations may include, e.g., first to Nth spin-drying operations (where N is a natural number of 2 or more). FIG. **7** exemplifies a case where N is 3. In this case, the first to N-1th spin-drying operations may be performed, and the first laundry untangle operation may be performed in response to termination of the N-1th spin-drying operation. The first laundry untangle operation may be performed in one or more sections between the spin-drying operations, and in the corresponding sections, the controller **110** controls the motor and/or the drum to spin at a predetermined RPM (e.g., 200 RPM) or less. The first laundry untangle operation is advantageously performed immediately before the Nth spin-drying operation (i.e., the final spin-drying operation). In the Nth spin-drying operation, the controller **110** spins the drum at high speed to bring the laundry into close contact with the inner circumferential surface of the drum Immediately before the final spin-drying operation is performed, the controller **110** performs the first laundry untangle operation while sufficiently heating the laundry inside the drum through the second heater **172**. The laundry heated through the first laundry untangle operation exhibits a significantly high spin-drying rate as compared with unheated laundry. After the Nth spin-drying operation is completed, the controller **110** performs a second laundry untangle operation. The second laundry untangle operation is an operation for removing the laundry from the inner circumferential surface of the drum before entering the drying cycle, and the controller **110** spins the drum at a low speed (e.g., 200 RPM or less).

[0074] Meanwhile, the blower fan **160** may operate in all the sections where the spin-drying cycle is performed, and the second heater **172** may operate in at least some sections of all the sections where the spin-drying cycle is performed. As described above, the second heater **172** may operate in a section where the first laundry untangle operation is performed, but is not limited to the corresponding section. The controller **110** may determine a section where the second heater **172** operates based on the spin speed of the motor and/or the drum. When the spin speed is less than or equal to a preset reference RPM (e.g., 400 RPM), the controller **110** may determine it as the section where the second heater **172** operates. Here, the reference RPM is determined as a value at which the laundry is removed from the inner circumferential surface of the drum and the laundry may tumble.

[0075] As such, the device and method according to an embodiment of the disclosure may maintain or increase the temperature of laundry by increasing the temperature of the laundry by performing the second rinsing cycle through hot water before entering the spin-drying cycle and performing preliminary drying by the first heater **171** and the blower fan **160** in a low RPM section of the spin-drying cycle. Further, in the section where the preliminary drying is performed, the controller **110** spins the drum at a predetermined RPM or less so that the laundry does not stick to the inner circumferential surface of the drum, thus allowing the laundry to have a larger contact surface with hot air. As such, if a sufficiently high surface temperature and internal temperature are secured, the surface tension of the laundry is reduced and the spin-drying rate is enhanced. As the spin-drying rate is enhanced, the amount of moisture to be dried is reduced, so that the time of the drying cycle may be reduced, and laundry may be prevented from sticking to the inner circumferential surface of the drum after the spin-drying cycle is finished. Further, as preliminary drying is performed at a low RPM in at least some of the sections where the spin-drying cycle is performed, overheating due to abnormal flow of the circulation airflow in the drum caused when spin-drying is performed at a high RPM may also be prevented.

[0076] Hereinafter, a washer applied to a device and method according to an embodiment of the disclosure is described as an example. However, the disclosure is not limited to the structure of the washer illustrated in FIGS. **8** and **9**, and the position and size of each component may be changed as necessary. Further, among the components, additional components that are not used in the device and method according to the above-described embodiment of the disclosure may be omitted as necessary, and various embodiments of the disclosure are not necessarily limited to the washer including all of the components illustrated in FIGS. **8** and **9**.

[0077] FIG. **8** is a perspective view illustrating a configuration of a washer according to various embodiments of the disclosure. FIG. **9** is a cross-sectional view illustrating a configuration of a washer according to various embodiments of the disclosure.

[0078] Referring to FIGS. **8** and **9**, the washer may include a drum-type tub **11** installed inside the main body **10** for containing the washing water, and a drum **12** rotatably installed inside the tub **11** and having a plurality of spin-drying holes. A motor **13** for spinning the drum **12** in a forward direction or a reverse direction to perform a washing operation, first and second rinsing operations, a spin-drying operation, and a drying operation is installed under the tub **11**, and a first heater **19** for heating the washing water supplied into the tub **11** is installed inside a lower side of the tub **11**.

[0079] An opening **14** is formed in front of the tub **11** and the drum **12** to allow the user to pull laundry out from the front of the main body **10**, and a door **15** for opening and closing the opening **14** is installed in front of the main body **10**.

[0080] A detergent supply device **18** for supplying detergent into the tub **11**, a steam generator **30** for supplying steam into the tub **11**, a tub **11**, and a water supply device **20** for supplying water to the steam generator **30** are installed above the tub **11**. The detergent supply device **18** has a receiving space for receiving the detergent therein, and is installed on the front side of the main body **10** to allow the user to easily inject the detergent.

[0081] The water supply device **20** includes a water supply pipe **21** for supplying water to the tub **11** and a water supply valve **22** installed in the water supply pipe **21** to control the water supply of the water supply pipe **21**. The water supply pipe **21** is connected to the detergent supply device **18** so that water supplied from the outside may be supplied toward the detergent supply device **18**. A separate connection pipe **23** is installed between the detergent supply device **18** and the tub **11** so that water passing through the detergent supply device **18** may be supplied to the tub **11**. This allows the water supplied to the inside of the tub **11** to pass through the detergent supply device **18**, thereby allowing the detergent inside the detergent supply device **18** to be supplied to the tub **11** while being dissolved in water.

[0082] The water supply device **20** includes a steam water supply pipe **24** for water supply to the steam generator **30** as

well as water supply to the detergent supply device **18**, and a steam valve **25** installed in the steam water supply pipe **24** to control water supply to the steam generator **30**. Meanwhile, the water supply valve **22** and the steam valve **25** are separately configured, but various embodiments of the disclosure are not limited thereto, and the water supply valve **22** and the steam valve **25** may be integrally configured using a conventional electromotive three-way valve or four-way valve.

[0083] The steam generator **30** includes a U-shaped third heater (steam heater **32**) installed therein to generate steam at a high temperature of 100° C. or more by instantly heating the water passing therethrough, a temperature sensor **34** installed on one side of the steam generator **30** to detect the temperature of the steam generator **30**, a steam supply pipe **36** extending from the steam generator **30** to the drying duct **42**, and a spray nozzle **38** installed at the outlet of the steam supply pipe **36**.

[0084] Here, it has been described that the third heater **32** is mounted inside the steam generator **30**, but various embodiments of the disclosure are not limited thereto, and the same goals and effects as those of various embodiments of the disclosure may be achieved even when an external heater is installed so that the third heater **32** contacts the upper or lower outer surface of the steam generator **30**, or the third heater **32** is installed in a structure surrounding the outer circumferential surface of the steam generator **30**.

[0085] There is included a drying device **40** for drying the laundry after spin-drying the laundry. The drying device **40** includes a blower fan **41**, a drying duct **42**, and a condensing duct **43**. Here, the blower fan **41** is installed above the tub **11**, and the drying duct **42** is configured to connect the discharge port **41***b* of the blower fan **41** and the air inlet **45** formed above the opening **14** of the tub **11**. Further, the condensing duct **43** is configured at the rear of the tub **11** to connect the air outlet **46** formed at the rear lower portion of the tub **11** and the suction port **41***a* of the blower fan **41**.

[0086] The drying device **40** includes a second heater **44** installed inside the drying duct **42** to supply hot air to the inside of the tub **11**, and a condensing device installed in the condensing duct **43** to allow moisture to be condensed and removed while wet steam generated through drying of laundry passes through the condensing duct **43**.

[0087] This configuration allows the air blown by the operation of the blower fan **41** to be heated through the second heater **44** and then supplied to the inside of the tub **11**, thereby heating and drying the laundry inside, and allows moisture in the air to be removed while the wet steam generated through the drying of the laundry is sucked toward the blower fan **41** through the condensing duct **43**.

[0088] The condensing device includes a cooling water injection nozzle **53** installed on an inner upper portion of the condensing duct **43** to inject cooling water into the condensing duct **43**, and a cooling water supply pipe **54** connected to the water supply device **20** to supply cooling water to the cooling water injection nozzle **53**. The configuration of the condensing device allows the cooling water injected from the upper cooling water injection nozzle **53** to flow down to the lower portion along the inner surface of the condensing duct **43** so that the contact between the moist air rising from the lower portion and the cooling water increases, thereby enhancing the dehumidification effect.

[0089] Further, various embodiments of the disclosure include a drain device **50** for draining water inside the tub **11**. The drain device **50** includes a drain pipe **51** connected to a lower portion of the tub **11** to guide water in the tub **11** to the outside, and a drain pump **52** installed in the drain pipe **51**.

[0090] When the washer is operated while laundry is placed inside the drum **12** and detergent is put into the detergent supply device **18**, the water supply valve **22** of the water supply device **20** is opened to supply water to the detergent supply device **18**. The detergent inside the detergent supply device **18** is dissolved by the washing water supplied to the tub **11** via the detergent supply device **18** and supplied to the tub **11**.

[0091] After the water supply operation is completed, the first heater **19** is operated to heat the washing water filled in the tub **11**, and after a predetermined time elapses and it is heated to a temperature required for washing, the drum **12** is spun in the forward or reverse direction by the driving of the motor **13**. At this time, as the laundry is moved by the lift formed inside the drum **12**, the laundry is washed by the frictional force with the drum **12** and the decomposability of the detergent. When the user selects the steam course, the steam valve **25** is opened while the washing water is heated by the first heater **19**, and the water is supplied to the steam generator **30** through the steam water supply pipe **24**, and the washing water supplied to the steam generator **30** is instantaneously heated by the third heater **32** to generate steam at a high temperature of 100° C. or more. The high-temperature steam is supplied to the inside of the tub **11** through the steam supply pipe **36** and the drying duct **42** and sprayed to the washing water and laundry inside the tub **11** heated through the first heater **19**. Accordingly, the temperature of the laundry sufficiently soaked in the detergent solution and the water is rapidly increased by the hot steam, so that the detergent solution contained in the laundry becomes an active state and, if the steam supply is stopped after a predetermined period of time, the drum **12** is spun by the driving of the motor **13**, so that decontamination of the laundry is quickly performed due to the frictional force with the drum **12** and the active state of the detergent solution, and thus washing with enhanced washing performance is performed.

[0092] After the washing operation is completed, a rinsing operation in which spin-drying and water supply are repeated is performed. The water supplied into the tub **11** while rinsing proceeds is supplied through the water supply pipe **21** as the water supply valve **22** is opened, and the tub **11** is drained through the drain pipe **51** by the operation of the drain pump **52**.

[0093] When the final spin-drying is performed after rinsing, the drain pump **52** operates, and the drum **12** spins at high speed for a predetermined time to spin-dry the laundry.

[0094] When the drying operation is performed in a state in which the spin-drying of the laundry has been completed, the drum **12** is gradually spun by the operation of the motor **13** so that the laundry inside the drum **12** falls. In this state, if the blower fan **41** operates, the air repeats circulation of being discharged to the inside of the tub **11** through the drying duct **42** after being sucked toward the blower fan **41** through the condensing duct **43**. At this time, the air in the drying duct **42** is introduced into the drum **12** while being heated by the second heater **44**, and the laundry inside the drum **12** is dried while being dried by the hot air. The moist air generated during the drying process is introduced into the condensing duct **43**, and moisture is condensed and removed

through the condensing device inside the condensing duct **43** while flowing toward the blower fan **41**.

[0095] The electronic device according to various embodiments of the disclosure may be one of various types of electronic devices. The electronic devices may include, for example, a display device, a portable communication device (e.g., a smartphone), a computer device, a portable multimedia device, a portable medical device, a camera, a wearable device, or a home appliance. According to an embodiment of the disclosure, the electronic devices are not limited to those described above.

[0096] It should be appreciated that various embodiments of the present disclosure and the terms used therein are not intended to limit the technological features set forth herein to particular embodiments and include various changes, equivalents, or replacements for a corresponding embodiment. As used herein, the singular forms "a," "an," and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. As used herein, the term 'and/or' should be understood as encompassing any and all possible combinations by one or more of the enumerated items. As used herein, the terms "include," "have," and "comprise" are used merely to designate the presence of the feature, component, part, or a combination thereof described herein, but use of the term does not exclude the likelihood of presence or adding one or more other features, components, parts, or combinations thereof. As used herein, each of such phrases as "A or B," "at least one of A and B," "at least one of A or B," "A, B, or C," "at least one of A, B, and C," and "at least one of A, B, or C," may include all possible combinations of the items enumerated together in a corresponding one of the phrases. As used herein, such terms as "**1**st" and "**2**nd," or "first" and "second" may be used to simply distinguish a corresponding component from another, and does not limit the components in other aspect (e.g., importance or order).

[0097] As used herein, the term "part" or "module" may include a unit implemented in hardware, software, or firmware, and may interchangeably be used with other terms, for example, "logic," "logic block," "part," or "circuitry". A part or module may be a single integral component, or a minimum unit or part thereof, adapted to perform one or more functions. For example, according to an embodiment, 'part' or 'module' may be implemented in a form of an application-specific integrated circuit (ASIC).

[0098] As used in various embodiments of the disclosure, the term "if" may be interpreted as "when," "upon," "in response to determining," or "in response to detecting," depending on the context. Similarly, "if A is determined" or "if A is detected" may be interpreted as "upon determining A" or "in response to determining A", or "upon detecting A" or "in response to detecting A", depending on the context.

[0099] The program executed by the washer **100** described herein may be implemented as a hardware component, a software component, and/or a combination thereof. The program may be executed by any system capable of executing computer readable instructions.

[0100] The software may include computer programs, codes, instructions, or combinations of one or more thereof and may configure the processing device as it is operated as desired or may instruct the processing device independently or collectively. The software may be implemented as a computer program including instructions stored in computer-readable storage media. The computer-readable storage media may include, e.g., magnetic storage media (e.g., read-only memory (ROM), random-access memory (RAM), floppy disk, hard disk, etc.) and an optically readable media (e.g., CD-ROM or digital versatile disc (DVD). Further, the computer-readable storage media may be distributed to computer systems connected via a network, and computer-readable codes may be stored and executed in a distributed manner The computer program may be distributed (e.g., downloaded or uploaded) via an application store (e.g., Play Store™), directly between two UEs (e.g., smartphones), or online. If distributed online, at least part of the computer program product may be temporarily generated or at least temporarily stored in the machine-readable storage medium, such as memory of the manufacturer's server, a server of the application store, or a relay server.

[0101] According to various embodiments, each component (e.g., a module or a program) of the above-described components may include a single entity or multiple entities. Some of the plurality of entities may be separately disposed in different components. According to various embodiments, one or more of the above-described components may be omitted, or one or more other components may be added. Alternatively or additionally, a plurality of components (e.g., modules or programs) may be integrated into a single component. In such a case, according to various embodiments, the integrated component may still perform one or more functions of each of the plurality of components in the same or similar manner as they are performed by a corresponding one of the plurality of components before the integration. According to various embodiments, operations performed by the module, the program, or another component may be carried out sequentially, in parallel, repeatedly, or heuristically, or one or more of the operations may be executed in a different order or omitted, or one or more other operations may be added.

What is claimed is:

1. A washer, comprising:

a first heater to heat water;

a second heater to heat air;

a fan to guide air to an inside of a drum;

a memory to store one or more programs; and

a controller electrically connectable with the first heater, the second heater, the fan, and the memory so that while the controller is connected with the first heater, the second heater, the fan, and the memory, one or more instructions of the one or more programs stored in the memory is executed to thereby control the washer by the controller to sequentially perform a washing cycle, a first rinsing cycle, a second rinsing cycle, a spin-drying cycle, and a drying cycle,

wherein the second rinsing cycle includes heating the washing water through the first heater and spinning the drum, and

wherein the spin-drying cycle includes heating the air through the second heater in at least some sections based on a spin speed of the drum and guiding the heated air to the inside of the drum using the blower fan.

2. The washer of claim **1**, wherein the controller spins the drum at a first RPM or less in the second rinsing cycle and spins the drum at a second RPM or less in at least some sections of the spin-drying cycle, and

wherein the first RPM is set to a value smaller than the second RPM.

3. The washer of claim 2, wherein the at least some sections of the spin-drying cycle where the second heater operates is identified as a section during which a spin speed of the drum is the second RPM or less.

4. The washer of claim 2, wherein the first RPM is set in a range of 0 to 200 RPM, and the second RPM is set in a range of 10 to 400 RPM.

5. The washer of claim 1, wherein the controller operates the fan while the spin-drying cycle is performed, and operates the second heater during a section where a spin speed of the drum is the second RPM or less among sections during which the spin-drying cycle is performed.

6. The washer of claim 1, wherein the second rinsing cycle is performed includes a first section during which the first heater is operated and a second section during which the first heater and the second heater are operated, and

wherein the first section and the second section are identified based on a temperature of the inside of the drum or laundry in the inside of the drum.

7. The washer of claim 6, wherein the controller compares the temperature of the inside of the drum or the laundry in the inside of the drum that is detected at an end of the first section with a target temperature and, when the temperature of the inside of the drum or the laundry in the inside of the drum is lower than the target temperature, operates the second heater during at least a portion of the second section.

8. The washer of claim 1, wherein the spin-drying cycle includes N spin-drying operations (where N is a natural number of 2 or more) and a laundry untangle operation, and

wherein the controller performs the laundry untangle operation between an N-1th spin-drying operation and an Nth spin-drying operation, and

wherein the laundry untangle operation includes spinning the drum at a second RPM or less and supplying air heated by the second heater to the inside of the drum.

9. The washer of claim 1, wherein the spin-drying cycle includes N spin-drying operations (where N is a natural number of 2 or more), and

wherein the controller further increases at least one of a maximum RPM or an execution time as an order of the spin-drying operations increases.

10. The washer of claim 1, wherein the second rinsing cycle is performed for a preset time or until a temperature of the inside of the drum or laundry in the inside of the drum reaches a target temperature.

11. The washer of claim 1, wherein the first heater and the second heater are disposed on an inner circumferential surface of a tub to face each other.

12. The washer of claim 1, wherein the first heater is disposed on a lower inner circumferential surface of a tub, and the second heater is disposed on an upper inner circumferential surface of the tub.

13. The washer of claim 1, wherein the second heater is disposed adjacent to the fan.

14. The washer of claim 1, wherein the washing water supplied to an inside of a tub in the second rinsing cycle is smaller in amount than the washing water supplied in the first rinsing cycle.

15. The washer of claim 1, wherein the second rinsing cycle is performed for at least twice as long as the first rinsing cycle, for three times as long as the first rinsing cycle, or performed for up to 10 minutes.

16. A method for controlling a washer including a first heater to heat washing water, a second heater to heat air, and a blower fan to guide air to an inside of a drum, the method comprising:

receiving a washing course including a washing cycle, a first rinsing cycle, a second rinsing cycle, a spin-drying cycle, and a drying cycle; and

controlling the washer to sequentially perform the washing cycle, the first rinsing cycle, the second rinsing cycle, the spin-drying cycle, and the drying cycle based on the received washing course,

wherein the second rinsing cycle includes heating the washing water through the first heater and spinning the drum, and

wherein the spin-drying cycle includes heating the air through the second heater in at least some sections based on a spin speed of the drum and supplying the heated air to the inside of the drum using the blower fan.

17. The method of claim 16, wherein spinning the drum at a first RPM or less during the second rinsing cycle and spinning the drum at a second RPM or less during at least some section of the spin-drying cycle, and

wherein the first RPM is set to a value smaller than the second RPM.

18. The method of claim 17, wherein the at least some sections of the spin-drying cycle where the second heater operates is identified as a section during which a spin speed of the drum is the second RPM or less.

19. The method of claim 16, wherein operating the fan while the spin-drying cycle is performed, and operating the second heater during a section where a spin speed of the drum is the second RPM or less among sections during which the spin-drying cycle is performed.

20. The method of claim 16, wherein the second rinsing cycle is performed includes a first section during which the first heater is operated and a second section during which the first heater and the second heater are operated, and

wherein the first section and the second section are identified based on a temperature of the inside of the drum or laundry in the inside of the drum.

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