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(54) **DRYER AND DRYING METHOD THEREOF**

TROCKNER UND TROCKNUNGSVERFAHREN DAFÜR

SÉCHOIR ET SON PROCÉDÉ DE SÉCHAGE

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## Description

### Technical Field

5 [0001] Apparatuses and methods consistent with the disclosure relate to a dryer and a drying method thereof, and more particularly, to a dryer for drying an object to be dried.

### Background Art

10 [0002] Generally, a dryer is a device for performing drying and sterilization by rotating a drum in which a wet object to be dried, for example, clothes or the like, is contained, and applying hot air to the object to be dried for a predetermined time to perform drying and sterilization.

[0003] In this case, however, when drying is performed on a bulky object to be dried (or bulky dry object), a dry level of the dry object cannot be accurately detected because the dry object, in a state of being folded or rolled, is rotated together with the drum, and thus, a dry time is inaccurately calculated.

[0004] Therefore, there is a demand for a method for more efficiently drying a dry object.

15 [0005] KR 2016-0069891 A1 is considered as closest prior art for independent claims 1 and 8. KR2016-0069891A1 and US2016/0160431A1 disclose a method of controlling a dryer includes rotating a drum within the dryer in a first direction, detecting at least one of temperature or relative humidity of air discharged from the drum while the drum is rotating in the first direction, and sensing occurrence of entanglement inside the drum by comparing a variation rate of at least one of the detected temperature or the detected relative humidity with a corresponding reference value.

### Disclosure of Invention

#### 25 Technical Problem

[0006] Embodiments of the disclosure overcome the above disadvantages and other disadvantages not described above. Also, the disclosure is not required to overcome the disadvantages described above, and an embodiment of the disclosure may not overcome any of the problems described above.

30 [0007] The disclosure provides a dryer capable of controlling a rotation direction of a drum on the basis of a dry state of an object to be dried during a dry cycle and controlling termination of the dry cycle on the basis of a temperature of air discharged from the drum.

#### Solution to Problem

35 [0008] In accordance with an aspect of the invention, there is provided a dryer according to claim 1.

[0009] Optional features are set out in the dependent claims.

[0010] The processor changes the rotation direction of the drum on the basis of the dry state of the dry object sensed by the first sensor.

40 [0011] The processor rotates the drum in a first direction during the dry cycle, rotates the drum in a second direction opposite to the first direction for a predetermined time if a value indicating the dry state of the dry object sensed by the first sensor is equal to or less than a predetermined value, and additionally performs the dry cycle when the predetermined time elapses.

[0012] If the value indicating the dry state of the dry object sensed by the first sensor is equal to or less than the predetermined value after the dry cycle is additionally performed, the processor determines a time for which the dry cycle is to be additionally performed on the basis of a time which has elapsed since the start of the dry cycle, and additionally perform the dry cycle for the determined time.

[0013] The processor may rotate the drum in the second direction for the predetermined time at a specific predetermined time period during the additionally performed dry cycle.

50 [0014] The heater may include a compressor configured to heat air supplied into the drum.

[0015] The processor may control ON/OFF of the compressor on the basis of a temperature sensed by the second sensor during the dry cycle performed after the rotation direction of the drum is controlled, and control termination of the dry cycle on the basis of a control state of the compressor.

[0016] The dry cycle performed after the rotation direction of the drum is controlled may be set to be performed for a time determined on the basis of the time which has elapsed from the time point at which the dry cycle was started.

55 [0017] If the number of times the compressor has been turned off is a predetermined value, the processor may terminate the dry cycle even before the determined time has elapsed.

[0018] The processor may turn off the compressor in operation if the temperature sensed by the second sensor is a

predetermined first temperature, and when a temperature sensed by the second sensor after the compressor is turned off is a predetermined second temperature, the processor may turn on the compressor which is in an OFF state.

**[0019]** In accordance with another aspect of the invention, there is provided a drying method of a dryer according to claim 8.

**[0020]** The controlling of a rotation direction includes changing the rotation direction of the drum on the basis of the dry state of the dry object sensed by the first sensor.

**[0021]** The controlling of a rotation direction further includes rotating the drum in a first direction during the dry cycle and rotating the drum in a second direction opposite to the first direction for a predetermined time if a value indicating the dry state of the dry object sensed by the first sensor is equal to or less than a predetermined value, wherein the drying method may further include: resuming the dry cycle after the lapse of the predetermined time.

**[0022]** The drying method further includes: if a value indicating the dry state of the dry object sensed by the first sensor is equal to or less than the predetermined value after the dry cycle is additionally performed, determining a time for which the dry cycle is to be additionally performed on the basis of a time which has elapsed since the start of the dry cycle, and additionally performing the dry cycle for the determined time.

**[0023]** The additionally performing of the dry cycle may further include: rotating the drum in the second direction for the predetermined time at a specific predetermined time period during the additionally performed dry cycle.

**[0024]** The dryer may further include: a compressor configured to heat the air supplied into the drum.

**[0025]** The controlling of termination of the dry cycle may include: controlling ON/OFF of the compressor on the basis of the temperature sensed by the second sensor during the dry cycle performed after the rotation direction of the drum is controlled, and controlling termination of the dry cycle on the basis of a control state of the compressor.

**[0026]** The dry cycle performed after the rotation direction of the drum is controlled may be set to be performed for a time determined on the basis of the time which has elapsed from the time point at which the dry cycle was started.

**[0027]** In the controlling of termination of the dry cycle, if the number of times the compressor has been turned off is a predetermined value, the dry cycle may be terminated even before the determined time has elapsed.

**[0028]** The drying method may further include: turning off the compressor in operation if the temperature sensed by the second sensor is a predetermined first temperature, and turning on the compressor which is in an OFF state if a temperature sensed by the second sensor after the compressor is turned off is a predetermined second temperature.

**[0029]** Additional and/or other aspects and advantages of the disclosure will be set forth in part in the description which follows and, in part, will be obvious from the description, or may be learned by practice of the invention.

### Advantageous Effects of Invention

**[0030]** According to the above various embodiments of the present disclosure, in order to more accurately sense the drying state of the object to be dried during the drying process, the rotation direction of the drum is changed, thereby preventing any drying error due to under-drying. In addition, the drying process is terminated based on the temperature of the air discharged from the drum and thus, the accuracy of predicting the drying degree of the object to be dried can be improved, thereby preventing damage of the object to be dried and energy loss due to over-drying.

### Brief Description of Drawings

**[0031]** The above and/or other aspects of the disclosure will be more apparent by describing certain embodiments of the disclosure with reference to the accompanying drawings, in which:

FIGS. 1 and 2 are perspective views illustrating a dryer according to an embodiment of the disclosure;

FIG. 3 is a block diagram illustrating a configuration of a dryer according to an embodiment of the disclosure;

FIG. 4 is a view illustrating a configuration of a dryer according to an embodiment of the disclosure;

FIGS. 5 through 9 are views illustrating a drying method according to various embodiments of the disclosure; and

FIG. 10 is a flowchart illustrating a drying method according to an embodiment of the disclosure.

### Best Mode for Carrying out the Invention

**[0032]** Hereinafter, various embodiments of the disclosure will be described in detail with reference to the accompanying drawings. It is understood that if embodiments do not fall within the scope of the claims, then they are not covered by the claimed invention.

**[0033]** The terms used in the example embodiments of the disclosure are general terms which are widely used now and selected considering the functions of the disclosure. However, the terms may vary depending on the intention of a person skilled in the art, a precedent, or the advent of new technology. In addition, in a specified case, the term may be arbitrarily selected. In this case, the meaning of the term will be explained in the corresponding description. Therefore,

terms used in the disclosure may be defined on the basis of a meaning of the terms and contents described in the disclosure, not simply on the basis of names of the terms.

**[0034]** Throughout the specification, unless explicitly described to the contrary, the word "comprise" and variations such as "comprises" or "comprising", will be understood to imply the inclusion of stated elements but not the exclusion of any other elements. Further, in the disclosure, a "module" or a "part" performs at least one function or operation and may be realized by hardware or software or a combination of the hardware and the software.

**[0035]** Hereinafter, embodiments of the disclosure will be described in detail with reference to the accompanying drawings. The embodiments most appropriate to help understand the technical features of the disclosure will be described, and the technical features of the disclosure are not limited by the described embodiments and merely illustrate the implementation of the disclosure through the embodiments described hereinafter.

**[0036]** Thus, the disclosure may be variably modified without departing from the scope of the disclosure as defined by the claims. In order to help understand the embodiments described hereinafter, the like or similar reference numerals are used for relevant components among the components having the same function in the respective embodiments in the accompanying drawings. Further, in the drawings, the shapes and dimensions of elements may be exaggerated for clarity.

**[0037]** FIG. 1 is a perspective view illustrating a dryer according to an embodiment of the disclosure.

**[0038]** The dryer 100 (or a clothes dryer) described below is a device for drying an object to be dried (or dry object) by supplying hot and dry air to a dry chamber containing the dry object. The dry object includes any object which can be dried and sterilized through hot air. For example, the dry object includes, but is not limited to, various kinds of fibers, fabrics, such as cloth, clothes, towels, blanket, and the like.

**[0039]** As illustrated in FIG. 1, the dryer 100 includes a main body 10 which forms an appearance. The main body 10 may have a rectangular parallelepiped shape extending in an up-down direction. However, it is to be understood that the body 10 is an example for the purposes of description and may be realized in various other shapes.

**[0040]** The main body 10 may include a front panel 11, an upper panel 12, and a side/rear panel 13.

**[0041]** The main body 10 includes an opening 10H (see FIG. 2) formed on one side thereof and the opening 10H provided on the front panel 11 may be opened to a front side of the main body 10. In this case, a door 14 may be coupled to the main body 10 to open and close the opening 10H.

**[0042]** A control panel 15 may be disposed at an upper end of the front panel 11.

**[0043]** The control panel 15 includes an operating part 15-1 for inputting an operation command for operating the dryer 100 and a display 15-2 for displaying operation information of the clothes dryer 100.

**[0044]** In this case, the user may input various user commands for operating the dryer 100 through the operating part 15-1. To this end, the operating part 15-1 may include a button, an operation dial, and the like.

**[0045]** For example, the user may select a desired course (or cycle) through the button or the operation dial provided on the operating part 15-1.

**[0046]** The display 15-2 may display operation information of the dryer 100 as a visual image. Here, the display 15-2 may be configured as a touch screen capable of receiving a user's operation command.

**[0047]** FIG. 2 is a perspective view illustrating a state in which the door 14 of the dryer 100 illustrated in FIG. 1 is open.

**[0048]** As illustrated in FIG. 2, the opening 10H is formed on one side of the main body 10, and the opening 10H may be formed to have a circular shape on the front panel 11.

**[0049]** A drum 110 may be rotatably disposed inside the main body 10 and may be connected to the opening 10H, and thus, a dry object may be introduced into the drum 10 through the opening 10H.

**[0050]** Specifically, the drum 110 includes a dry chamber (not shown) connected to the opening 10H, and the dry object introduced into the dry chamber (not shown) through the opening 10H may be dried by hot air.

**[0051]** Meanwhile, a motor (not shown) is provided inside the main body 10, and the drum 110 may be rotated according to rotation of the motor (not shown). Accordingly, the dry object (not shown) introduced into the dry chamber (not shown) may be tumbled and hot air may be evenly applied to the dry object.

**[0052]** The door 14 is coupled to the front panel 11 of the main body 10 to open and close the opening 10H.

**[0053]** The door 14 is pivotably coupled to the front panel 11, thereby opening and closing the opening 10H.

**[0054]** Specifically, as illustrated in FIG. 2, a hinge 14-1 may be disposed on one side of the front panel 11 adjacent to the opening 10H, and the door 14 may be connected to the hinge 14-1 and rotated with respect to the hinge 14-1 to thereby open and close the opening 10H.

**[0055]** The door 14 may have a circular shape corresponding to the shape of the opening 10H and has a diameter larger than a diameter of the opening 10H. Accordingly, the dry object may be introduced into the dry chamber (not shown) of the drum 110 through the opening 10H when the door 14 is opened.

**[0056]** FIG. 3 is a block diagram illustrating a configuration of a dryer according to an embodiment of the disclosure.

**[0057]** Referring to FIG. 3, the dryer 100 includes the drum 110, a first sensor 120, a second sensor 130, a heater 140, a blower 150, and a processor 160.

**[0058]** The drum 110 receives a dry object. To this end, the drum 110 includes the dry chamber (not shown) for

receiving the dry object, and the dry object may be dried by air flowing to the dry chamber (not shown).

**[0059]** In this case, the drum 110 is rotatably disposed, and the dry object placed in the dry chamber (not shown) is tumbled according to rotation of the drum 110 and air may be evenly applied to the dry object.

**[0060]** The first sensor 120 senses a dry state of the dry object contained in the drum 110. That is, the first sensor 120 is provided inside the drum 110 to sense a dry state of the dry object. To this end, the first sensor 120 may include a dryness detection sensor.

**[0061]** In this case, the dryness detection sensor includes two electrodes provided inside the drum 110. When the dry object is placed between the two electrodes, the dryness detection sensor detects a dry state of the dry object on the basis of a magnitude of current flowing between the two electrodes and generate a value indicating a dry state of the dry object, i.e., sensing data (e.g., a pulse value). For example, current easily flows between the two electrodes as a moisture content of the dry object placed between the two electrodes is higher and does not easily flow between the two electrodes as the moisture content of the dry object placed between the two electrodes is lower, and thus, the dryness detection sensor may generate low sensing data as the dry object is drier, and generate high sensing data as the dry object is wetter.

**[0062]** However, this is merely an example, and the first sensor 120 may be realized as various types of sensors for measuring dryness (i.e., the degree of drying) of the dry object.

**[0063]** The second sensor 130 senses a temperature of air discharged from the drum 110. To this end, the second sensor 130 may include a temperature detection sensor. In this case, the temperature detection sensor is disposed in a filter (49 in FIG. 4) to sense the temperature of the air discharged from the drum 110 and to generate a value indicating the temperature of the air, that is, sensing data.

**[0064]** However, this is merely an example, and the temperature detection sensor may sense the temperature of the drum 110 at various positions.

**[0065]** The heater 140 heats air supplied into the drum 110.

**[0066]** In this case, the heater 140 may heat the air supplied into the drum 110 through various methods.

**[0067]** For example, the heater 140 includes a compressor (46 in FIG. 4) connected to a flow path and cooling and heating air circulating in the flow path and air supplied into the drum 110 may be heated through the compressor.

**[0068]** The blower 150 may form a flow of air passing through the inside of the drum 110. In this case, the blower 150 may include a fan (41 in FIG. 4) for generating a flow of air according to rotation.

**[0069]** The processor 160 controls an overall operation of the dryer 100.

**[0070]** Specifically, the processor 160 may control a rotation speed and a rotation direction of the drum 110, a temperature of air discharged from the drum 110, and a rotation speed of the fan.

**[0071]** To this end, the processor 160 may be connected to various components included in the dryer 100 and transmit and receive various data and signals. The processor 160 may generate control commands and transmit the generated control command to control various components included in the dryer 100.

**[0072]** In this case, the processor 160 may control hardware or software components connected to the processor 160 and perform various data processing and calculation by driving, for example, an operating system or an application program. In addition, the processor 160 may load instructions or data received from at least one of the other components into a volatile memory, process the loaded command or data, and store various data in a non-volatile memory.

**[0073]** To this end, the processor 160 may be realized as a general-purpose processor (e.g., CPU, GPU or application processor) capable of performing the corresponding operations by executing one or more software programs stored in a memory device or a dedicated processor (e.g., an embedded processor) for performing the corresponding operations.

**[0074]** In particular, the processor 160 may control a rotation direction of the drum 110 in a dry cycle performed according to blanket dry course and control termination of the dry cycle on the basis of a temperature discharged from the drum 110.

**[0075]** Hereinafter, a process performed by the dryer 100 in the blanket dry course according to various embodiments will be described in detail.

**[0076]** According to various embodiments of the disclosure, the dryer 100 may be realized as a heat pump dryer. A configuration of the dryer 100 realized as the heat pump dryer will be described with reference to FIG. 4 hereinafter.

**[0077]** FIG. 4 is a view illustrating a configuration of a dryer according to an embodiment of the disclosure.

**[0078]** The fan 41 generates a flow of air as it rotates. In this case, the fan 41 is driven according to an inverter motor (or motor) (not shown), and a rotation speed and rotation direction of the fan 41 may be changed under the control of the inverter motor (not shown).

**[0079]** Meanwhile, air may be circulated through a flow path 42 according to rotation of the fan 41 and may be introduced into and discharged from the drum 110.

**[0080]** In this case, in order to dry the dry object contained in the drum 110, the air discharged from the drum 110 may flow into the drum 110 again through a condensation and heating process.

**[0081]** That is, the flow path 42 is a circulation passage for air discharged from the drum 110 and flowing into the drum 110, and the fan 41 rotates to cause air to flow into the drum 110 to circulate air through the flow path 42.

**[0082]** Meanwhile, the dryer 100 may include a heat pump system 43 for condensing and heating air through a refrigerant.

**[0083]** In this case, the refrigerant is circulated, while flowing in order of an evaporator (EVA) 45, the compressor 46, a condenser 44, and an expander 48 through a refrigerant pipe 47.

**[0084]** Specifically, the refrigerant absorbs heat and evaporates in the evaporator (EVA) 45. Accordingly, the evaporator (EVA) 45 cools the circulating air through the heat exchange between the refrigerant and the circulating air to condense moisture. In this case, the condensed moisture may be discharged to the outside of the dryer 100 through a pipe (not shown).

**[0085]** Meanwhile, the compressor 46 compresses the refrigerant flowing from the evaporator (EVA) 45 and discharges the compressed refrigerant to the condenser 44.

**[0086]** In this case, the compressor 46 is driven by an inverter motor (not shown), and the rotation speed of the compressor 46 may be varied under the control of the inverter motor (not shown). That is, an operating frequency (or driving frequency) of the compressor 46 may be varied. Alternatively, the compressor 46 may be driven by a constant speed motor (not shown) and may be driven to have a constant operating frequency under the control of the constant speed motor (not shown).

**[0087]** In the condenser 44, the refrigerant emits heat to perform condensing. Therefore, the condenser 44 heats the circulating air through heat exchange between the refrigerant and the circulating air.

**[0088]** The expander 48 expands the refrigerant flowing from the condenser 44 and discharges the expanded refrigerant to the evaporator (EVA) 45.

**[0089]** The condensation process and the heating process of the circulating air are performed through the heat pump system 43, and the circulating air flows again into the drum 110.

**[0090]** Specifically, the high-temperature, low-humidity air heated by the condenser 44, while passing through the dry object in the drum 110, turns to high-temperature, high-humidity air, and the high-temperature, high-humidity air, while passing through the evaporator (EVA) 45, is dehumidified to turn to a low-temperature, low-humidity air. The low temperature, low-humidity air is heated by the condenser 44 to turn to high temperature, low-humidity air and then flows to the drum 110.

**[0091]** The filter 49 may be provided between the drum 110 and the evaporator (EVA) 45 to remove foreign matter such as lint or the like in the air.

**[0092]** As described above, the dryer 100 is realized as a heat pump dryer and dries the dry object through the components illustrated in FIG. 4.

**[0093]** Hereinafter, a method of performing a blanket dry course by the dryer 100 including the configuration as illustrated in FIG. 4 will be described in detail with reference to FIG. 5.

**[0094]** First, referring to FIG. 5, when a user input for selecting a specific course is received, the processor 160 controls the drum 110, the heater 140, and the blower 150 to perform a drying process.

**[0095]** Here, a specific course may include a blanket dry course for drying blanket. In this case, the user input for selecting the blanket dry course may be input through the operating part (15-1 in FIG. 1) provided in the dryer 100. For example, the user may select the blanket dry course by selecting a button provided on the operating part 15-1 or rotating an operation dial provided on the operating part 15-1.

**[0096]** Meanwhile, the processor 160 may perform pre-processing before performing the dry cycle (S510).

**[0097]** Specifically, the processor 160 drives the fan 41 and the drum 110, and may drive the compressor 46 when a specific time expires.

**[0098]** In this case, the processor 160 may drive the fan 41 and the drum 110 at a predetermined speed and drive the compressor 46 at a predetermined operating frequency.

**[0099]** For example, when the compressor 46 is driven by the inverter motor (not shown), the processor 160 may gradually increase the operating frequency for a predetermined time after driving the compressor 46, maintain the increased operating frequency for a predetermined time, and may subsequently gradually increase the operating frequency of the compressor 46 until a target operating frequency is reached.

**[0100]** Thus, the processor 160 may allow an internal temperature of the drum 110 to reach a target temperature by performing pre-processing before performing the dry cycle, thereby increasing drying efficiency.

**[0101]** In another example, when the compressor 46 is driven by the constant speed motor (not shown), the processor 160 may drive the compressor 46 at a constant operating frequency.

**[0102]** Meanwhile, when the pre-processing is completed, the processor 160 may perform dry cycle (S515).

**[0103]** Here, the dry cycle may refer to a cycle for drying the dry object contained in the drum 110.

**[0104]** More specifically, when the dry cycle is started, the processor 160 may drive the compressor 46 at a predetermined operating frequency, drive the fan 41 at a predetermined rotation speed, and drive the drum 110 at a predetermined rotation speed. Here, the processor 160 may rotate the drum 110 in a first direction (e.g., a clockwise direction).

**[0105]** Accordingly, during the dry cycle, high temperature, low humidity air generated by the compressor 46 during the rotation of the drum 110 is supplied into the drum 110 by the fan 41 and the dry object contained in the drum 110

may be dried by the air supplied into the drum 110.

**[0106]** The processor 160 controls a rotation direction of the drum 110 on the basis of a dry state of the dry object detected by the first sensor 120 after the dry cycle is started. Specifically, the processor 160 changes the rotation direction of the drum 110 on the basis of the dry state of the dry object detected by the first sensor 120.

**[0107]** In this case, first, the processor 160 may determine whether a specific time has not elapsed yet since the dry cycle was started (S520). That is, the processor 160 may determine whether a time taken for performing the dry cycle is equal to or less than a predetermined value (T1 minutes, e.g., 357 minutes).

**[0108]** If the specific time has elapsed since the start of the dry cycle (S520-N), the processor 160 may terminate the dry cycle (S555) and perform a cooling process (S560).

**[0109]** However, if the specific time has not elapsed yet since the start of the dry cycle (S520-Y), the processor 160 determines whether a value indicating the dry state of the dry object sensed by the first sensor 120 is a predetermined value (S525).

**[0110]** Specifically, the processor 160 determines whether sensing data sensed by the first sensor 120, for example, a pulse value, is equal to or less than a predetermined value S1. Here, the predetermined value S1 may be 0 or a value close to 0.

**[0111]** In this case, if the value indicating the dry state of the dry object sensed by the first sensor 120 is not equal to or less than the predetermined value (S525-N), the processor 160 may repeatedly determine whether the value sensed by the first sensor 120 is the predetermined value during the dry cycle (S515).

**[0112]** Meanwhile, the processor 160 changes the rotation direction of the drum 110 when the value indicating the dry state of the dry object sensed by the first sensor 120 is equal to or less than the predetermined value. That is, the processor 160 may change the direction of rotation of the drum 110 when the pulse value is equal to or less than the predetermined value S1.

**[0113]** Specifically, the processor 160 changes the rotation direction of the drum 110 in the second direction (e.g., a counterclockwise direction) in that the drum 110 rotates in the first direction during the dry cycle process. Also, the processor 160 rotates the drum 110 in a second direction opposite to the first direction for a predetermined time (t1 seconds) (e.g., 10 seconds) (S530).

**[0114]** In this case, the processor 160 may keep the operating frequency of the compressor 46, the rotation speed of the fan 41, and the rotation speed of the drum 110 the same as in the dry cycle.

**[0115]** Thereafter, the processor 160 performs the dry cycle again when the predetermined time (t1 seconds) has elapsed (S535).

**[0116]** That is, the processor 160 may drive the compressor 46 at the predetermined operating frequency, drive the fan 41 at the predetermined rotation speed, and change the rotation direction of the drum 110 to the first direction, and drive the drum 110 in the first direction at the predetermined rotation speed.

**[0117]** Thereafter, the processor 160 determines whether a value indicating a dry state of the dry object sensed by the first sensor 120 is a predetermined value (S540).

**[0118]** Specifically, the processor 160 determines whether sensing data sensed by the first sensor 120, e.g., the pulse value, is equal to or less than a predetermined value S1. Here, the predetermined value S1 may be 0 or a value close to 0.

**[0119]** In this case, if the value indicating the dry state of the dry object sensed by the first sensor 120 is not equal to or less than the predetermined value (S540-N), the processor may repeatedly determine whether the value sensed by the first sensor 120 is equal to or less than the predetermined value in the drying process (S535).

**[0120]** Meanwhile, if the value indicating the dry state of the dry object sensed by the first sensor 120 is equal to or less than the predetermined value, the processor 160 determines a time for additionally performing the dry cycle on the basis of a time which has elapsed since the start of the dry cycle.

**[0121]** To this end, the processor 160 determines the time which has elapsed from the time point at which the dry cycle was started.

**[0122]** Specifically, the processor 160 may terminate pre-processing, change the rotation direction of the drum 110 one time from the time point at which dry cycle was first started (i.e., time point at which dry cycle was started in S515), return to the original state, and thereafter, determine the elapsed time to a time point at which the value sensed by the first sensor 120 is equal to the predetermined value (that is, a time point at which a pulse value corresponding to a value equal to or less than the predetermined value S1 in S540).

**[0123]** Then, the processor 160 determines a time for additionally performing the dry cycle on the basis of the elapsed time.

**[0124]** In this case, the processor 160 may determine the time for additionally performing the dry cycle using the elapsed time and the information stored in the memory (not shown) of the dryer 100.

**[0125]** Here, the information stored in the memory (not shown) indicates for how long the dry cycle is to be additionally performed according to the measured elapsed time, for example, as illustrated in Table 1 below. The values were experimentally measured for optimal drying of the dry object.

[Table 1]

Measured elapsed time (T)	Additional dry time
$T \leq 8$ minutes	110 minutes - measured elapsed time (T)
8 minutes < $T \leq 15$ minutes	140 minutes - measured elapsed time (T)
15 minutes < $T \leq 20$ minutes	170 minutes - measured elapsed time (T)
20 minutes < $T \leq 25$ minutes	200 minutes - measured elapsed time (T)
25 minutes < T	230 minutes - measured elapsed time (T)

**[0126]** For example, in Table 1, if the elapsed time is 22 minutes (i.e.,  $T = 22$  minutes), the processor 160 may determine 148 minutes (= 170 minutes - 22 minutes) as the time for additionally performing the dry cycle.

**[0127]** Thereafter, the processor 160 additionally performs the dry cycle for the determined time (S545).

**[0128]** Here, the processor 160 may display the time for additionally performing the dry cycle on the display 15-2.

**[0129]** In case of the above example, if the time for additionally performing the dry cycle is determined to be 148 minutes, the processor 160 may display text such as "148 minutes remains" on the display 15-2.

**[0130]** Meanwhile, the processor 160 may rotate the drum 110 in the second direction for a predetermined time ( $t_1$  sec) at a specific time ( $T_2$  minutes) period in the additional dry cycle (S545).

**[0131]** That is, when the dry cycle is performed, the processor 160 may drive the compressor 46 at a predetermined operating frequency, drive the fan 41 at a predetermined rotation speed, and drive the drum 110 at a predetermined rotation speed. Here, the processor 160 may rotate the drum 110 in the first direction.

**[0132]** In this case, the processor 160 may rotate the drum 110 in the second direction for  $t_1$  seconds (e.g., 10 seconds) every  $T_2$  minutes (e.g., 10 minutes), while the dry cycle is performed.

**[0133]** That is, when  $T_2$  minutes has elapsed since the dry cycle was started, the processor 160 changes the rotation direction of the drum 110 rotating in the first direction to the second direction, rotates the drum 110 in the second direction for  $t_1$  seconds, and when  $t_1$  seconds has elapsed, the processor 160 changes the rotation direction of the drum 110 to the first direction and rotates the drum 110 in the first direction. Thereafter, when  $T_2$  minute has elapsed, the processor 160 may change the rotation direction of the drum 110 rotating in the first direction to the second direction, rotate the drum 110 in the second direction for  $t_1$  seconds, and when  $t_1$  seconds has elapsed, the processor 160 may change the rotation direction of the drum 110 to the first direction. The processor 160 may repeatedly perform this process.

**[0134]** Meanwhile, while the dry cycle is being performed, the processor 160 may determine whether a temperature of the air inside the drum 110 has reached a predetermined target temperature on the basis of a temperature sensed by the second sensor 130.

**[0135]** That is, during the dry cycle, the temperature of the air inside the drum 110 gradually increases due to the high-temperature, low-humidity air generated by the compressor 46, and thus, a temperature sensed by the second sensor 130 also increases gradually.

**[0136]** Accordingly, when the temperature sensed by the second sensor 130 reaches a predetermined value, the processor 160 may determine that the temperature of the air inside the drum 110 has reached the predetermined target temperature.

**[0137]** In this case, if the temperature sensed by the second sensor 130 is a predetermined first temperature, the processor 160 may turn off the compressor 46 being driven. For example, the processor 160 may turn off the compressor 46 when the temperature sensed by the second sensor 130 increases to 57°C.

**[0138]** Meanwhile, when the compressor 46 is stopped, the temperature of the air inside the drum 110 gradually decreases. Accordingly, the temperature sensed by the second sensor 130 also gradually decreases.

**[0139]** In this case, when the temperature sensed by the second sensor 130 is a predetermined second temperature, the processor 160 may turn on the compressor 46. For example, the processor 160 may turn on the compressor 46 in the OFF state when the temperature sensed by the second sensor 130 gradually decreases to 56°C.

**[0140]** In this way, the processor 160 may control ON/OFF of the compressor 46 on the basis of the temperature sensed by the second sensor 130, thereby performing the dry cycle.

**[0141]** Thereafter, the processor 160 may terminate the dry cycle (S555) when the dry time set for the additional dry cycle has elapsed (S550-Y). That is, the processor 160 may perform the dry cycle by the set dry time and terminate the dry cycle.

**[0142]** The processor 160 may perform a cooling process (S560).

**[0143]** Specifically, the processor 160 may stop the operation of the compressor 46 and increase the rotation speed of the fan 41. This is to increase an air volume by the fan 41 to lower the temperature in the drum 110 rapidly.



**[0144]** Thereafter, the processor 160 may terminate the cooling process when the temperature sensed by the second sensor 130 reaches a predetermined temperature.

**[0145]** That is, the temperature inside the drum 110 gradually decreases as the fan 41 is driven, and thus, the temperature value indicated by data sensed by the second sensor 130 also gradually decreases.

**[0146]** Accordingly, when the temperature sensed by the second sensor 130 gradually decreases to a predetermined temperature, the processor 160 may stop driving the fan 41, the drum 110, and the like, to terminate the cooling process.

**[0147]** Meanwhile, in the disclosure, as described above, the rotation direction of the drum 110 is changed in the course of performing the dry cycle on the dry object, and thereafter, a time for additionally performing the dry cycle is determined, and a reason therefor is as follows.

**[0148]** The fact that the pulse value sensed by the first sensor 120, e.g., the dryness detection sensor, corresponds to 0 (or a value close to 0) or less means that the dry object or part of the dry object in contact with the dryness detection sensor has been dried.

**[0149]** Meanwhile, in case of a blanket, the blanket has a large volume, and thus, if the drum 110 is rotated in one direction, the blanket, which is maintained in a folded or rolled state, rotates together with the drum 110, without a head motion or without being rarely changed in position inside the drum. Accordingly, a portion in direct contact with the dryness detection sensor is limited, and therefore, a value sensed by the dryness detection sensor may be considered to be a value indicating a dry state of a partial surface of the blanket which is exposed to hot air and rapidly dried, rather than a dry state of the entire blanket.

**[0150]** Thus, if the time for performing the dry cycle is determined on the basis of such a dry state, the dry cycle may be terminated in a state that a folded inner side of the blanket is not dried but still wet and drying needs to be performed repeatedly, causing user inconvenience.

**[0151]** Therefore, in the disclosure, a dry state of the dry object is more accurately measured by changing a position of the load, that is, a position of the dry object, as much as possible in the drum 110 by reversely rotating the drum 110, and a time for additionally performing the dry cycle is determined accordingly, whereby the dry object may be more effectively dried.

**[0152]** In addition, because the rotation direction of the drum 110 is periodically changed during the dry cycle, the blanket may be dried as a whole.

**[0153]** Meanwhile, in case of the blanket, the time required for drying the blanket varies depending on a thickness, a material, and a type and density of a filler thereof, and even the same blanket may be varied in the time required for drying depending on a difference in an initial moisture content according to a degree of dewatering.

**[0154]** For example, a summer blanket is thinner and has a less amount of filler than a winter blanket, and thus, a time required for drying the summer blanket is generally shorter than a time required for drying the winter blanket. Also, a blanket which is smaller or has less initial moisture content requires a shorter dry time than a blanket which is larger or has a greater initial moisture content.

**[0155]** Therefore, performing additional dry cycle without considering these points may damage the blanket due to overdrying or may not be desired in terms of energy efficiency.

**[0156]** Accordingly, in the disclosure, the additional dry cycle may be terminated depending on the temperature of the air discharged from the drum 110 even before the set time for the additional dry cycle arrives.

**[0157]** Specifically, the processor 160 may control ON/OFF of the compressor 46 on the basis of the temperature sensed by the second sensor 130 in the dry cycle performed after the rotation direction of the drum 110 is controlled, and terminate the dry cycle on the basis of a control state of the compressor 46.

**[0158]** Here, the dry cycle, which is performed after the rotation direction of the drum 110 is controlled, may be a dry cycle set to be performed for the time determined on the basis of the time which has elapsed since the start of the dry cycle.

**[0159]** That is, as described above, in the disclosure, the rotation direction of the drum 110 is changed in the course of performing the drying process on the dry object, the time for the additional drying process is determined according to the measured elapsed time, and the dry cycle is additionally performed for the determined time. Here, the dry cycle performed after the rotation direction of the drum 110 is controlled may refer to a dry cycle which is additionally performed.

**[0160]** In this case, if the control state of the compressor 46 satisfies a specific condition (S550-Y) while the dry cycle is additionally performed, the processor 160 may terminate the dry cycle (S555). Then, the processor 160 may proceed with the cooling process (S560).

**[0161]** Specifically, when the number of times the compressor 46 is turned off is a predetermined value, the processor 160 may terminate the dry cycle even before the determined time expires.

**[0162]** That is, as described above, when the temperature detected by the second sensor 130 is a predetermined first temperature during the dry cycle, the processor 160 turns off the compressor 46. In this case, the processor 160 may count and store the number of times the compressor 46 is turned off.

**[0163]** Accordingly, when the number of times the compressor 46 is turned off is a predetermined value (e.g., three times), the processor 160 may terminate the dry cycle even before the set time for performing the dry cycle expires.

**[0164]** As in the above example, it is assumed that the time for performing the dry cycle is set to 148 minutes. In this

case, if the compressor 46 is turned off three times, the processor 160 may terminate the dry cycle, rather than further performing the dry cycle, although 148 minutes has not elapsed since the start of the additional dry cycle.

[0165] That is, as described above, in the dry cycle, the temperature of the inside of the drum 110 gradually rises as the compressor 46 is driven. The processor turns off the compressor 46 when the temperature of the inside of the drum 110 reaches a target temperature, and turns on again the compressor 46 when the temperature inside the drum 110 falls to a specific temperature.

[0166] In this case, a large number of times the compressor 46 is turned off within a predetermined time means that the temperature inside the drum 110 rapidly rises from the specific temperature to the target temperature, which may mean that the dry object contained in the drum 110 has been dried to some extent.

[0167] Therefore, performing the dry cycle continuously on the dry object which has been completely dried may damage the dry object and may not be desirable in terms of energy efficiency.

[0168] Accordingly, in the disclosure, in order to reduce damage to the dry object and increase energy efficiency, the dry cycle is terminated if the dry object is determined to have been completely dried to some extent, although the time set for performing the dry cycle on the dry object has not elapsed yet.

[0169] In the above-described example, the drum 110 is reversely rotated once, but this is merely an example. That is, according to various embodiments, the number of times the drum 110 is rotated in the reverse direction may vary depending on a dry state of the dry object, details of which will be described with reference to FIG. 6.

[0170] FIG. 6 is a view illustrating a method of performing a dry cycle according to an embodiment of the disclosure.

[0171] In FIG. 6, operations of S610, S615, S625, S630, S635, S640, S645, S650, S655, and S660 are the same steps S510, S515, S525, S530, S535, S540, S545, S550, S555, S560 of FIG. 5, and thus, details descriptions thereof will be omitted. In addition, although the operation of determining whether a specific time has elapsed since the dry cycle was started (e.g., S520 of FIG. 5) is not illustrated, such an operation may also be performed in FIG. 6.

[0172] Referring to FIG. 6, the processor 160 may determine whether a value indicating a dry state of the dry object sensed by the first sensor 120 is equal to or less than a predetermined value (S640).

[0173] Specifically, the processor 160 may determine whether the sensing data sensed by the first sensor 120, i.e., a pulse value, is equal to or less than the predetermined value  $S_1$ . Here, the predetermined value  $S_1$  may be 0 or a value close to 0.

[0174] In this case, when the value indicating the dry state of the dry object sensed by the first sensor 120 is equal to or less than the predetermined value, the processor 160 may determine a time taken for a value sensed by the first sensor to reach the predetermined value since the drum 110 was reversely rotated, and determine whether the determined time is equal to or less than a predetermined time ( $T_3$  minutes) (S670). Here, the predetermined value ( $T_3$  minutes) may be, for example, 1 minute.

[0175] In this case, if the determined time is greater than the predetermined value (S670-N), the processor 160 may reversely rotate the drum 110 again and perform the dry cycle and determine whether a value sensed by the first sensor 120 is equal to or less than the predetermined value.

[0176] Here, if the determined time is equal to or less than the predetermined value (S670-Y), the processor 160 may perform an additional dry cycle (S645).

[0177] The value indicating the dry state of the dry object, which has reached the predetermined value within a short time after the drum 110 is reversely rotated may indicate that the blanket has been dried as a whole, and according to an embodiment of this disclosure, the number of times the drum 110 is reversely rotated may be adjusted until the blanket is dried as a whole, and thereafter, the additional dry cycle may be performed. In this case, the additional dry cycle time may be less than the dry cycle time performed in FIG. 5.

[0178] In the example described above, when the number of times the compressor 46 is turned off reaches the predetermined value, the additional dry cycle is terminated, but this is merely an example. That is, according to various embodiments, the number of times the compressor 46 is turned off and the temperature of the air inside the drum 110 that turns off the compressor 46 may be set to be varied depending on a dry level, a dry temperature, and the like. This will be described in more detail with reference to FIGS. 7 and 8.

[0179] FIG. 7 is a view illustrating a method of performing a dry cycle according to an embodiment of the disclosure.

[0180] In FIG. 7, operations of S710, S715, S725, S730, S735, S740, S745, S755 and S760 are the same as S510, S515, S525, S530, S535, S540, S545, S555 and S560 in FIG. 5, and thus, a detailed description will be omitted. In addition, although FIG. 7 does not show the operation of determining whether a specific time has elapsed since the start of the dry cycle (e.g., S520 in FIG. 5), this operation may also be performed in FIG. 7.

[0181] Referring to FIG. 7, the processor 160 may receive a user input for selecting a dry level (S705).

[0182] For example, the user may select a blanket dry course and may select a dry level by selecting a button provided on the operating part 15-1 or using an operation dial provided in the operating part 15-1.

[0183] Here, dry level may include a first level (e.g., standard) and a second level (e.g., strong) higher in dry level than the first level.

[0184] Meanwhile, after starting the additional dry cycle, the processor 160 may determine whether the dry level

selected by the user corresponds to the first level (S770).

**[0185]** In this case, when dry level corresponds to the first level, the processor 160 may determine whether the additional dry time has been completed or whether a control state of the compressor 46 satisfies a specific first condition (S780). If the additional dry time has been completed or the control condition of the compressor 46 satisfies the first specific condition (S780-Y), the processor may terminate the dry cycle (S755).

**[0186]** Here, the specific first condition may include whether the number of times the compressor 46 was turned off has reached a predetermined value (e.g., three times).

**[0187]** If the dry level corresponds to the second level, the processor 160 may determine whether the additional dry time has been completed or the control state of the compressor 46 satisfies the first specific condition (S790). If the additional dry time has been completed or if the control condition of the compressor 46 satisfies the specified second condition (S790-Y), the dry cycle may be terminated (S755).

**[0188]** Here, the specific second condition may include whether the number of times the compressor 46 was turned off has reached a predetermined value (e.g., five times).

**[0189]** As described above, according to an embodiment of the disclosure, the number of times that the compressor 46 is turned off, which is required for termination of the dry cycle according to levels of a dry level, may be set to be different. That is, the number of times the compressor 46 is turned off required for termination of the dry cycle may be increased as the level of dry level is higher.

**[0190]** Thus, a more efficient dry cycle may be performed to meet a dry level requested by the user.

**[0191]** FIG. 8 is a view illustrating a method of performing a dry cycle according to an embodiment of the disclosure.

**[0192]** The operations of S810, S815, S825, S830, S835, S840, S845, S855 and S860 are the same as S510, S515, S525, S530, S535, S540, S545, S555 and S560 in FIG. 5, and thus, a detailed description thereof will be omitted. In addition, although the operation of determining whether a specific time has elapsed since the dry cycle was started (e.g., S520 of FIG. 5) is not illustrated, such an operation may also be performed in FIG. 8.

**[0193]** Referring to FIG. 8, the processor 160 may receive a user input for selecting a dry temperature (S805).

**[0194]** For example, the user may select a blanket dry course and select a dry temperature by selecting a button provided in the operating part 15-1 or using an operation dial provided in the operating part 15-1.

**[0195]** Here, the dry temperature may include a first temperature (e.g., medium temperature) and a second temperature (e.g., low temperature) lower than the first temperature.

**[0196]** Meanwhile, after starting the additional dry cycle, the processor 160 may determine whether the dry temperature selected by the user corresponds to the first temperature (S870).

**[0197]** In this case, when the dry temperature is the first temperature, the processor 160 may determine whether the additional dry time has been completed or whether a control state of the compressor 46 satisfies the first specific condition (S880). If the additional dry time has been completed or the control condition of the compressor 46 satisfies the first specific condition (S880-Y), the processor 160 may terminate the dry cycle (S855).

**[0198]** Here, the specific first condition may include whether the number of times the compressor 46 has been turned off has reached a predetermined value (e.g., three times).

**[0199]** Meanwhile, the temperature of the air inside the drum 110 gradually increases with the driving of the compressor 46 during the dry cycle. In this case, the processor 160 may determine whether the temperature of the air inside the drum 110 has reached a predetermined target temperature on the basis of the temperature sensed by the second sensor 130, and turn off the compressor 46 when it is determined that the temperature of the air inside the drum 110 has reached to the predetermined target temperature.

**[0200]** More specifically, the processor 160 may turn off the compressor 46 being driven if the temperature sensed by the second sensor 130 is the predetermined first temperature. For example, the processor 160 may turn off the compressor 46 when the temperature sensed by the second sensor 130 gradually increases to reach 57°C.

**[0201]** Meanwhile, when driving of the compressor 46 is stopped, the temperature of the air inside the drum 110 gradually decreases and the temperature sensed by the second sensor 130 also gradually decreases.

**[0202]** In this case, the processor 160 may turn off the compressor 46 when the temperature sensed by the second sensor 130 is the predetermined second temperature. For example, the processor 160 may turn on the compressor 46 in the OFF state when the temperature sensed by the second sensor 130 gradually decreases to 56°C.

**[0203]** Thus, when the dry temperature is selected as the first temperature, the temperatures used for the ON/FF control of the compressor 46 may be set to 57°C and 56°C.

**[0204]** If the dry temperature is the second temperature, the processor 160 may determine whether the additional dry time is completed or whether the control state of the compressor 46 satisfies a specific second condition (S890). If the additional dry time is completed or the control state of the compressor 46 satisfies the specified second condition (S890-Y), the processor 160 may terminate the dry cycle (S855).

**[0205]** Here, the specific second condition may correspond to whether the number of times the compressor 46 is turned off reaches a predetermined value (e.g., seven times).

**[0206]** Meanwhile, the temperature of the air inside the drum 110 gradually increases with the driving of the compressor

46 during the dry cycle. In this case, the processor 160 may determine whether the temperature of the air inside the drum 110 has reached the predetermined target temperature on the basis of the temperature sensed by the second sensor 130, and turn off the compressor 47 when the temperature of the air inside the drum 110 has reached to the predetermined target temperature.

**[0207]** More specifically, the processor 160 may turn off the compressor 46 being driven if the temperature sensed by the second sensor 130 is the predetermined first temperature. For example, the processor 160 may turn off the compressor 46 when the temperature sensed by the second sensor 130 gradually increases to reach 50°C.

**[0208]** Meanwhile, when the driving of the compressor 46 is stopped, the temperature of the air inside the drum 110 gradually decreases and the temperature sensed by the second sensor 130 also gradually decreases.

**[0209]** In this case, the processor 160 may turn on the compressor 46 in an OFF state when the temperature sensed by the second sensor 130 is the predetermined second temperature. For example, the processor 160 may turn on the compressor 46 in the OFF state when the temperature sensed by the second sensor 130 gradually decreases to reach 49°C.

**[0210]** Thus, when the dry temperature is selected as the second temperature, the temperatures used for ON/OFF control of the compressor 46 may be set to 50°C and 49°C.

**[0211]** As a result, according to an embodiment of the disclosure, the number of times the compressor 46 is turned off required for termination of the additional dry cycle and the temperature of the air inside the drum 110 for turning off the compressor 46 may be set to be different according to dry temperatures. That is, the number of times the compressor 46 is turned off required for termination of the dry cycle may be set to be larger and the temperature of the air inside the drum 110 for turning off the compressor 46 is set to be lower as the dry temperature is lower.

**[0212]** Accordingly, a more efficient dry cycle may be performed to meet the dry temperature requested by the user.

**[0213]** According to various embodiments of the disclosure, the dry cycle may be performed in various manners depending on the type of the dry object, and this will be described in detail with reference to FIG. 9.

**[0214]** FIG. 9 is a view illustrating a method of performing a dry cycle according to an embodiment of the disclosure.

**[0215]** In FIG. 9, pre-processing, the dry cycle, reverse rotation of the drum 110, the additional dry cycle, and the like, are the same as those described above in FIG. 5, so a detailed description of the redundant portions will be omitted.

**[0216]** Referring to FIG. 9, the processor 160 may receive a user input for selecting a type of a dry object (S905).

**[0217]** Here, the type of the dry object may include a first type, a second type, and a third type. In this case, for example, the first type may include a blanket, the second type may include a pillow and a cushion, and the third type may include clothes (paddings).

**[0218]** Meanwhile, the user input for selecting the type of the dry object may be input by selecting a button provided on the operating part 15-1 or through an operation dial provided on the operating part 15-1.

**[0219]** For example, the user may select the first type by selecting a blanket dry course, select the second type by selecting a cushion dry course, and select the third type by selecting a clothes dry course.

**[0220]** First, when the type of the dry object is selected as the first type (i.e., a blanket), the processor 160 may perform pre-processing and the dry cycle (S911, 912) and determine whether a pulse value sensed by the first sensor 120 is equal to or less than the predetermined value  $S_1$  (S913). Here, the predetermined value  $S_1$  may be 0 or a value close to 0, for example.

**[0221]** If the pulse value sensed by the first sensor 120 is equal to or less than the predetermined value  $S_1$  (S913-Y) the processor 160 may reversely rotate the drum 110 for  $t_1$  seconds (e.g., 10 seconds) (S914) and perform the dry cycle again (S915).

**[0222]** Then, the processor 160 may determine whether the pulse value sensed by the first sensor 120 is equal to or less than the predetermined value  $S_1$  (S916). Here, the predetermined value  $S_1$  may be 0 or a value close to 0, for example.

**[0223]** Thereafter, when the pulse value sensed by the first sensor 120 is equal to or less than the predetermined value  $S_1$ , the processor 160 may determine a time for additionally performing the dry cycle and perform the additional dry cycle for the determined time (S940). Here, the processor 160 may reversely rotate the drum 110 for a predetermined time ( $t_1$  seconds) at every specific time period ( $T_2$  minutes) during the dry cycle.

**[0224]** Meanwhile, when the predetermined time for performing the dry cycle has elapsed or when a control state of the compressor 46 satisfies a specific condition (S950-Y), the processor 160 may terminate the dry cycle (S970) and perform a cooling process (S980).

**[0225]** Here, the specific condition may include a condition that the compressor 46 is terminated a predetermined number of times. For example, the processor 160 may terminate the dry cycle if the compressor 46 is turned off three times during the additional dry cycle.

**[0226]** When the type of the dry object is selected as the second type (e.g., pillow or cushion), the processor 160 may perform pre-processing and the dry cycle (S921 and 922) and determine whether a pulse value sensed by the first sensor 120 is equal to or less than the predetermined value  $S_2$  (S923). Here, the predetermined value  $S_2$  may be 5 or a value close to 5, for example.

**[0227]** When the pulse sensed by the first sensor 120 is equal to or less than the predetermined value  $S_2$  (S923-Y),

the processor 160 may reversely rotate the drum 110 for  $t_1$  seconds (e.g., 10 seconds) (S924) and perform the dry cycle again (S925).

**[0228]** Thereafter, the processor 160 may determine whether the pulse value sensed by the first sensor 120 is equal to or less than the predetermined value  $S_2$  (S926). Here, the predetermined value  $S_2$  may be 5 or a value close to 5, for example.

**[0229]** Thereafter, if the pulse value sensed by the first sensor 120 is equal to or less than the predetermined value  $S_2$ , the processor 160 may determine a time for additionally performing the dry cycle and perform the additional dry cycle for the determined time (S945). Here, the processor 160 may reversely rotate the drum 110 for a predetermined time ( $t_1$  seconds) (e.g., 10 seconds) at every predetermined time period ( $T_2$  minutes) (e.g., 10 minutes) during the dry cycle.

**[0230]** If the predetermined time set for additionally performing the dry cycle has elapsed (S960-Y), the processor 160 may terminate the dry cycle (S970) and proceeds with the cooling process (S980).

**[0231]** Meanwhile, when the type of the dry object is selected as the third type (e.g., clothes (paddings)), the processor 160 may performs pre-processing and the dry cycle (S931, 932) and determine whether the sensed pulse value is equal to or less than a predetermined value  $S_3$  (S933). Here, the predetermined value  $S_3$  may be 10 or a value close to 10, for example.

**[0232]** If the pulse value sensed by the first sensor 120 is equal to or less than the predetermined value  $S_3$  (S933-Y), the processor 160 may reversely rotate the drum 110 for  $t_1$  seconds (e.g., 10 seconds) (S934) and perform the dry cycle again (S935).

**[0233]** Thereafter, the processor 160 may determine whether the pulse value sensed by the first sensor 120 is equal to or less than the predetermined value  $S_3$  (S936). Here, the predetermined value  $S_3$  may be 10 or a value close to 10, for example.

**[0234]** Thereafter, when the pulse value sensed by the first sensor 120 is equal to or less than the predetermined value  $S_3$ , the processor 160 may determine a time for additionally performing the dry cycle and perform the additional dry cycle for the determined time (S945). Here, the processor 160 may reversely rotate the drum 110 for a predetermined time ( $t_1$  seconds) (e.g., 10 seconds) at every predetermined time period ( $T_2$  minutes) (e.g., 10 minutes) during the dry cycle.

**[0235]** If the predetermined time set for additionally performing the dry cycle has elapsed (S960-Y), the processor 160 may terminate the dry cycle (S970) and proceed with the cooling process (S980).

**[0236]** Meanwhile, the processor 160 may determine a time for additionally performing the dry cycle according to types of dry objects. Here, the processor 160 may determine a time for additionally performing the dry cycle using the time which has elapsed since the start of the dry cycle and information stored in a memory (not shown).

**[0237]** Here, the information stored in the memory (not shown) indicates for how long the dry cycle is to be additionally performed according to the measured elapsed time, for example, as illustrated in Table 2 below. The values were experimentally measured for optimal drying of the dry object.

[Table 2]

Measured elapsed time (T)	Additional dry time for blanket	Additional dry time for pillow and cushion	Additional dry time for paddings or clothes
$T \leq 8$ minutes	110 minutes - measured elapsed time (T)	60 minutes - measured elapsed time (T)	40 minutes - measured elapsed time (T)
8 minutes < $T \leq 15$ minutes	140 minutes - measured elapsed time (T)	75 minutes - measured elapsed time (T)	50 minutes - measured elapsed time (T)
15 minutes < $T \leq 20$ minutes	170 minutes - measured elapsed time (T)	90 minutes - measured elapsed time (T)	60 minutes - measured elapsed time (T)
20 minutes < $T \leq 25$ minutes	200 minutes - measured elapsed time (T)	105 minutes - measured elapsed time (T)	70 minutes - measured elapsed time (T)
25 minutes < T	230 minutes - measured elapsed time (T)	120 minutes - measured elapsed time (T)	80 minutes - measured elapsed time (T)

**[0238]** As described above, according to the embodiment of the disclosure, time points for reversely rotating the drum 110 may be different according to types of dry objects. That is, in consideration of the fact that a thickness, a material, a filler, and the like, of dry objects vary according to the types thereof, the drum 110 may be reversely rotated in a state in which paddings (clothes), pillow/cushions, and blanket are more dried in this order. In this case, the time for additional dry cycle may also be set to be longer in order of paddings (clothes), pillows/cushions, and blanket.

**[0239]** Thus, a more efficient dry cycle may be performed depending on the type of the dry object.

[0240] FIG. 10 is a flowchart illustrating a drying method of a dryer according to an embodiment of the disclosure.

[0241] Here, the dryer may include a drum that receives a dry object, a first sensor sensing a dry state of the dry object contained in the drum, and a second sensor sensing a temperature of air discharged from the drum.

[0242] First, when a user input for selecting a specific course is received, a dry cycle is performed (S1010).

[0243] After the dry cycle is started, a rotation direction of the drum is controlled on the basis of the dry state of the dry object sensed by the first sensor (S1020).

[0244] Thereafter, termination of the dry cycle is controlled on the basis of the temperature of the air sensed by the second sensor (S1030).

[0245] Specifically, in operation S1020, the rotation direction of the drum may be changed on the basis of the dry state of the dry object sensed by the first sensor. That is, in operation S1020, during the dry cycle, the drum may be rotated in a first direction, and if a value indicating the dry state of the dry object sensed by the first sensor is equal to or less than a predetermined value, the drum may be rotated in a second direction opposite to the first direction for a predetermined time. In this case, the dry cycle may be performed again when a predetermined time has elapsed.

[0246] Meanwhile, if the value indicating the dry state of the dry object sensed by the first sensor is equal to or less than the predetermined value after the dry cycle is performed again, a time for additionally performing the dry cycle may be determined on the basis of the time which has elapsed since the start of the dry cycle, and the dry cycle may be additionally performed for the determined time.

[0247] In this case, in the additional dry cycle, the drum may be rotated in the second direction for a predetermined time.

[0248] The dryer may further include a compressor for heating air supplied into the drum.

[0249] In this case, in the dry cycle performed after the rotation direction of the drum is controlled, ON/OFF of the compressor may be controlled on the basis of a temperature sensed by the second sensor and termination of the dry cycle may be controlled on the basis of a control state of the compressor.

[0250] Here, the dry cycle, which is performed after the rotation direction of the drum is controlled, may be set to be performed for a time determined on the basis of the time which has elapsed since the start of the dry cycle.

[0251] In operation S1030, if the number of times the compressor is turned off is a predetermined value, the dry cycle may be terminated even before the determined time has elapsed.

[0252] In this case, if the temperature sensed by the second sensor is a predetermined first temperature, the compressor being driven is turned off, and if the temperature sensed by the second sensor after the compressor is turned off is a predetermined second temperature, the compressor in the OFF state may be turned on.

[0253] The drying method of such a dryer has been described in detail above.

[0254] A non-transitory computer readable medium storing a program for sequentially performing the drying method according to the disclosure may be provided.

[0255] The non-transitory computer readable medium refers to a medium which semi-permanently stores data, rather than a medium which stores data for a short period of time, such as a register, a cache, a memory, etc., and which is readable by a device. Specifically, the various applications or programs described above may be stored in the non-transitory computer readable medium such as CD, DVD, hard disk, Blu-ray disk, USB, memory card, ROM, and the like.

[0256] Also, although a bus is not illustrated in the above-described block diagram of the dryer, communication between the components of the dryer may be performed through the bus. In addition, the dryer may further include a processor such as a CPU, a microprocessor, or the like, that performs the various steps described above.

[0257] While the disclosure has been described and illustrated with reference to the embodiments, the disclosure is not limited to the above-described specific embodiments, and it will be understood that various modifications and variations may be made therein by those skilled in the art to which the disclosure pertains, without departing from the scope of the present invention as defined by the appended claims.

[0258] According to various embodiments of the disclosure as described above, an occurrence of defective drying due to non-drying may be prevented by changing the rotation direction of the drum to more accurately sense a dry state of the dry object. In addition, because termination of the dry cycle is controlled on the basis of the temperature of the air discharged from the drum, accuracy of predicting the dry level of the dry object may be increased to thus prevent damage to the dry object and energy loss caused by over-drying.

## Claims

### 1. A dryer comprising:

- a drum (110) configured to receive a dry object;
- a first sensor (120) provided inside the drum and configured to sense a dry state of the dry object received in the drum;
- a heater (140) configured to heat air supplied into the drum;

a blower (150) configured to form a flow of air passing through the inside of the drum;  
 a second sensor (130) configured to sense a temperature of air discharged from the drum; and  
 a processor (160) configured, in response to a user input selecting a specific course of operation of the dryer  
 being received, to:

control the drum, the heater, and the blower to perform a dry cycle,  
 control the drum to rotate in a first direction when the dry cycle is started,  
 change the rotation direction of the drum to a second direction opposite to the first direction on the basis  
 of a dry state of the dry object sensed by the first sensor after the dry cycle is started,  
 rotate the drum in the second direction for a predetermined time in response to a value indicating the dry  
 state of the dry object sensed by the first sensor being equal to or less than a predetermined value,  
 additionally perform the dry cycle when the predetermined time elapses, and  
 control termination of the dry cycle on the basis of a temperature of air sensed by the second sensor,

wherein in response to the value indicating the dry state of the dry object sensed by the first sensor being equal  
 to or less than the predetermined value after the dry cycle is additionally performed, the processor is configured  
 to determine a time for which the dry cycle is to be further additionally performed on the basis of a time which  
 has elapsed since the start of the dry cycle, and further additionally perform the dry cycle for the determined time.

2. The dryer as claimed in claim 1, wherein the processor is configured to rotate the drum in the second direction for  
 the predetermined time at a specific predetermined time period during the further additionally performed dry cycle.

3. The dryer as claimed in claim 1, wherein the heater includes a compressor (46) configured to heat air supplied into  
 the drum.

4. The dryer as claimed in claim 3, wherein the processor is configured to:

control ON/OFF of the compressor on the basis of a temperature sensed by the second sensor during the dry  
 cycle performed after the rotation direction of the drum is controlled, and  
 control termination of the dry cycle on the basis of a control state of the compressor.

5. The dryer as claimed in claim 4, wherein the dry cycle performed after the rotation direction of the drum is controlled  
 is set to be performed for a time determined on the basis of the time which has elapsed from the time point at which  
 the dry cycle was started.

6. The dryer as claimed in claim 5, wherein, in response to the number of times the compressor is turned off being a  
 predetermined value, the processor is configured to terminate the dry cycle even before the determined time elapsed.

7. The dryer as claimed in claim 6, wherein the processor is configured to turn off the compressor in operation in  
 response to the temperature sensed by the second sensor being a predetermined first temperature, and  
 in response to a temperature sensed by the second sensor after the compressor is turned off being a predetermined  
 second temperature, the processor is configured to turn on the compressor which is in an OFF state.

8. A drying method of a dryer including a drum (110) configured to receive a dry object, a first sensor (120) provided  
 inside the drum and configured to sense a dry state of the dry object received in the drum, and a second sensor  
 (130) configured to sense a temperature of air discharged from the drum, the drying method comprising:

in response to a user input selecting a specific course of operation of the dryer being received, performing, by  
 the dryer, a dry cycle;

controlling the drum to rotate in a first direction when the dry cycle is started;  
 changing a rotation direction of the drum to a second direction opposite to the first direction on the basis of a  
 dry state of the dry object sensed by the first sensor after the dry cycle is started;  
 controlling the drum to rotate in the second direction for a predetermined time in response to a value indicating  
 the dry state of the dry object sensed by the first sensor being equal to or less than a predetermined value;  
 additionally performing the dry cycle when the predetermined time elapses; and  
 controlling termination of the dry cycle on the basis of a temperature of air sensed by the second sensor,  
 wherein the method further comprises:

in response to a value indicating the dry state of the dry object sensed by the first sensor being equal to or less

than the predetermined value after the dry cycle is additionally performed, determining a time for which the dry cycle is to be further additionally performed on the basis of a time which has elapsed since the start of the dry cycle, and further additionally performing the dry cycle for the determined time.

- 5 9. The drying method as claimed in claim 8, wherein the further additionally performing of the dry cycle further includes rotating the drum in the second direction for the predetermined time at a specific predetermined time period during the further additionally performed dry cycle.

## 10 Patentansprüche

### 1. Trockner, umfassend:

15 eine Trommel (110), die konfiguriert ist, um ein Trockenobjekt aufzunehmen;  
einen ersten Sensor (120), der innerhalb der Trommel bereitgestellt ist und konfiguriert ist, um einen Trocken-  
zustand des Trockenobjekts zu erfassen, das in der Trommel aufgenommen ist;  
einen Heizkörper (140), der konfiguriert ist, um Luft zu erhitzen, die in die Trommel zugeführt wird;  
ein Gebläse (150), das konfiguriert ist, um einen Luftstrom zu bilden, der durch das Innere der Trommel strömt;  
einen zweiten Sensor (130), der konfiguriert ist, um eine Temperatur der Luft zu erfassen, die aus der Trommel  
20 ausgestoßen wird; und  
einen Prozessor (160), der als Reaktion auf eine empfangene Benutzereingabe, die einen bestimmten Betriebs-  
ablauf des Trockners auswählt, konfiguriert ist, um:

25 die Trommel, den Heizkörper und das Gebläse zu steuern, um einen Trockengang durchzuführen, die  
Trommel zu steuern, um sich in einer ersten Richtung zu drehen, wenn der Trockengang gestartet wird,  
die Drehrichtung der Trommel in eine zweite Richtung entgegengesetzt zu der ersten Richtung auf der  
Grundlage eines Trockenzustands des Trockenobjekts zu wechseln, der durch den ersten Sensor erfasst  
wird, nachdem der Trockengang gestartet wurde,  
30 die Trommel in der zweiten Richtung für eine vorbestimmte Zeit als Reaktion darauf zu drehen, dass ein  
Wert, der den Trockenzustand des Trockenobjekts angibt, gleich oder kleiner als ein vorbestimmter Wert ist,  
zusätzlich den Trockengang durchzuführen, wenn die vorbestimmte Zeit verstrichen ist, und  
die Beendigung des Trockengangs auf der Grundlage einer Lufttemperatur zu steuern, die durch den  
zweiten Sensor erfasst wird,  
35 wobei als Reaktion darauf, dass der Wert, der den durch den ersten Sensor erfassten Trockenzustand des  
Trockenobjekts angibt, gleich oder kleiner als der vorbestimmte Wert ist, nachdem der Trockengang zu-  
sätzlich durchgeführt wurde, der Prozessor konfiguriert ist, um eine Zeit zu bestimmen, für die der Trocken-  
gang ferner zusätzlich auf der Grundlage einer Zeit durchgeführt werden soll, die seit dem Start des Tro-  
ckengangs verstrichen ist, und ferner zusätzlich den Trockengang für die bestimmte Zeit durchzuführen.

40 2. Trockner nach Anspruch 1, wobei der Prozessor konfiguriert ist, um die Trommel in der zweiten Richtung für die  
vorbestimmte Zeit zu einem bestimmten vorbestimmten Zeitraum während des weiteren zusätzlich durchgeführten  
Trockengangs zu drehen.

45 3. Trockner nach Anspruch 1, wobei der Heizkörper einen Kompressor (46) beinhaltet, der konfiguriert ist, um in die  
Trommel zugeführte Luft zu erwärmen.

4. Trockner nach Anspruch 3, wobei der Prozessor konfiguriert ist, um: das EIN/AUS des Kompressors auf der Grund-  
lage einer Temperatur zu steuern, die durch den zweiten Sensor während des Trockengangs erfasst wird, der  
durchgeführt wird, nachdem die Drehrichtung der Trommel gesteuert wurde, und  
50 die Beendigung des Trockengangs auf der Grundlage eines Steuerzustands des Kompressors zu steuern.

5. Trockner nach Anspruch 4, wobei der Trockengang, der durchgeführt wird, nachdem die Drehrichtung der Trommel  
gesteuert wurde, so eingestellt ist, dass er für eine Zeit durchgeführt wird, die auf der Grundlage der Zeit bestimmt  
wird, die seit dem Zeitpunkt verstrichen ist, an dem der Trockengang gestartet wurde.

55 6. Trockner nach Anspruch 5, wobei als Reaktion darauf, dass die Anzahl der Abschaltungen des Kompressors ein  
vorbestimmter Wert ist, der Prozessor konfiguriert ist, um den Trockengang zu beenden, sogar bevor die bestimmte  
Zeit verstrichen ist.



7. Trockner nach Anspruch 6, wobei der Prozessor konfiguriert ist, um den Kompressor im Betrieb als Reaktion darauf abzuschalten, dass die durch den zweiten Sensor erfasste Temperatur eine vorbestimmte erste Temperatur ist, und als Reaktion darauf, dass eine Temperatur, die durch den zweiten Sensor erfasst wird, nachdem der Kompressor abgeschaltet wurde, eine vorbestimmte zweite Temperatur ist, der Prozessor konfiguriert ist, um den Kompressor einzuschalten, der sich in einem AUS-Zustand befindet.

8. Trocknungsverfahren eines Trockners, der eine Trommel (110), die konfiguriert ist, um ein Trockenobjekt aufzunehmen, einen ersten Sensor (120), der innerhalb der Trommel vorgesehen ist und konfiguriert ist, um einen Trockenzustand des Trockenobjekts zu erfassen, das in der Trommel aufgenommen ist, und einen zweiten Sensor (130) beinhaltet, der konfiguriert ist, um eine Temperatur von Luft zu erfassen, die von der Trommel ausgestoßen wird, wobei das Trocknungsverfahren umfasst:

als Reaktion auf eine empfangene Benutzereingabe, die einen bestimmten Betriebsablauf des Trockners auswählt, Durchführen eines Trockengangs durch den Trockner;

Steuern der Trommel, um sich in einer ersten Richtung zu drehen, wenn der Trockengang gestartet wird; Wechseln der Drehrichtung der Trommel in eine zweite Richtung entgegengesetzt zur ersten Richtung auf der Grundlage eines Trockenzustands des Trockenobjekts, der durch den ersten Sensor erfasst wird, nachdem der Trockengang gestartet wurde,

Steuern der Trommel, um sich in der zweiten Richtung für eine vorbestimmte Zeit als Reaktion darauf zu drehen, dass ein Wert, der den Trockenzustand des Trockenobjekts angibt, der durch den ersten Sensor erfasst wird, gleich oder kleiner als ein vorbestimmter Wert ist,

zusätzliches Durchführen des Trockengangs, wenn die vorbestimmte Zeit verstrichen ist; und Steuern der Beendigung des Trockengangs auf der Grundlage einer Lufttemperatur, die durch den zweiten Sensor erfasst wird,

wobei das Verfahren ferner umfasst:

als Reaktion darauf, dass der Wert, der den durch den ersten Sensor erfassten Trockenzustand des Trockenobjekts angibt, gleich oder kleiner als der vorbestimmte Wert ist, nachdem der Trockengang zusätzlich durchgeführt wurde, Bestimmen einer Zeit, für die der Trockengang ferner zusätzlich auf der Grundlage einer Zeit durchgeführt werden soll, die seit dem Start des Trockengangs verstrichen ist, und ferner zusätzlich Durchführen des Trockengangs für die bestimmte Zeit.

9. Trocknungsverfahren nach Anspruch 8, wobei das weitere zusätzliche Durchführen des Trockengangs ferner das Drehen der Trommel in der zweiten Richtung für die vorbestimmte Zeit zu einen bestimmten vorbestimmten Zeitraum während des weiteren zusätzlich durchgeführten Trockengangs beinhaltet.

## Revendications

1. Sécheur comprenant :

un tambour (110) configuré pour recevoir un objet sec ;  
un premier capteur (120) prévu à l'intérieur du tambour et configuré pour détecter un état sec de l'objet sec reçu dans le tambour ;

un élément chauffant (140) configuré pour chauffer l'air délivré dans le tambour ;

une soufflante (150) configurée pour former un flux d'air traversant l'intérieur du tambour ;

un second capteur (130) configuré pour détecter une température de l'air évacué du tambour ; et

un processeur (160) configuré, en réponse à la réception d'une entrée d'utilisateur sélectionnant un programme de fonctionnement spécifique du sécheur, pour :

commander au tambour, à l'élément chauffant et à la soufflante d'effectuer un cycle de séchage, commander au tambour de tourner dans un premier sens lorsque le cycle de séchage a démarré, changer le sens de rotation du tambour dans un second sens inverse au premier sens sur la base d'un état sec de l'objet sec détecté par le premier capteur après que le cycle de séchage a démarré, faire tourner le tambour dans le second sens pendant un temps prédéterminé en réponse au fait qu'une valeur indiquant l'état sec de l'objet sec détecté par le premier capteur est égale ou inférieure à une valeur prédéterminée,

exécuter en plus le cycle de séchage lorsque le temps prédéterminé s'est écoulé, et commander la fin du cycle de séchage sur la base d'une température de l'air détectée par le second capteur,

dans lequel en réponse au fait que la valeur indiquant l'état sec de l'objet sec détecté par le premier capteur est égale ou inférieure à la valeur prédéterminée après que le cycle de séchage a été exécuté en plus, le processeur est configuré pour déterminer un temps pendant lequel le cycle de séchage doit être exécuté encore en plus sur la base d'un temps qui s'est écoulé depuis le démarrage du cycle de séchage, et exécuter encore en plus le cycle de séchage pendant le temps déterminé.

2. Sécheur selon la revendication 1, dans lequel le processeur est configuré pour faire tourner le tambour dans le second sens pendant le temps prédéterminé à une période de temps prédéterminée spécifique pendant le cycle de séchage exécuté encore en plus.

3. Sécheur selon la revendication 1, dans lequel l'élément chauffant comprend un compresseur (46) configuré pour chauffer l'air délivré dans le tambour.

4. Sécheur selon la revendication 3, dans lequel le processeur est configuré pour :

commander la MARCHE/ARRÊT du compresseur sur la base d'une température détectée par le second capteur pendant le cycle de séchage exécuté après que le sens de rotation du tambour a été commandé, et commander la fin du cycle de séchage sur la base d'un état de commande du compresseur.

5. Sécheur selon la revendication 4, dans lequel le cycle de séchage exécuté après que le sens de rotation du tambour a été commandé est réglé pour être exécuté pendant un temps déterminé sur la base du temps qui s'est écoulé depuis le point temporel auquel le cycle de séchage a commencé.

6. Sécheur selon la revendication 5, dans lequel, en réponse au fait que le nombre de fois que le compresseur est mis à l'arrêt est une valeur prédéterminée, le processeur est configuré pour terminer le cycle de séchage avant même que le temps déterminé ne se soit écoulé.

7. Sécheur selon la revendication 6, dans lequel le processeur est configuré pour mettre à l'arrêt le compresseur en fonctionnement en réponse au fait que la température détectée par le second capteur est une première température prédéterminée, et en réponse au fait qu'une température détectée par le second capteur après l'arrêt du compresseur est une seconde température prédéterminée, le processeur est configuré pour mettre en marche le compresseur qui est dans un état ARRÊT.

8. Procédé de séchage d'un sécheur comprenant un tambour (110) configuré pour recevoir un objet sec, un premier capteur (120) prévu à l'intérieur du tambour et configuré pour détecter un état sec de l'objet sec reçu dans le tambour, et un second capteur (130) configuré pour détecter une température de l'air évacué du tambour, le procédé de séchage comprenant :

en réponse à la réception d'une entrée d'utilisateur sélectionnant un programme de fonctionnement spécifique du sécheur, l'exécution, par le sécheur, d'un cycle de séchage ;  
la commande au tambour de tourner dans un premier sens lorsque le cycle de séchage est démarré ;  
le changement d'un sens de rotation du tambour dans un second sens inverse au premier sens sur la base d'un état sec de l'objet sec détecté par le premier capteur après le démarrage du cycle de séchage ;  
la commande au tambour de tourner dans le second sens pendant un temps prédéterminé en réponse au fait qu'une valeur indiquant l'état sec de l'objet sec détecté par le premier capteur est égale ou inférieure à une valeur prédéterminée ;  
l'exécution en plus du cycle de séchage lorsque le temps prédéterminé s'est écoulé ; et  
la commande de la fin du cycle de séchage sur la base d'une température de l'air détectée par le second capteur, dans lequel le procédé comprend en outre :  
en réponse au fait qu'une valeur indiquant l'état sec de l'objet sec détecté par le premier capteur est égale ou inférieure à la valeur prédéterminée après que le cycle de séchage a été exécuté en plus, la détermination d'une durée pendant laquelle le cycle de séchage doit être exécuté encore en plus sur la base d'un temps qui s'est écoulé depuis le démarrage du cycle de séchage, et l'exécution encore en plus du cycle de séchage pendant le temps déterminé.

9. Procédé de séchage selon la revendication 8, dans lequel l'exécution encore en plus du cycle de séchage comprend en outre la rotation du tambour dans le second sens pendant le temps prédéterminé à une période de temps

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prédéterminée spécifique pendant l'exécution encore en plus du cycle de séchage.

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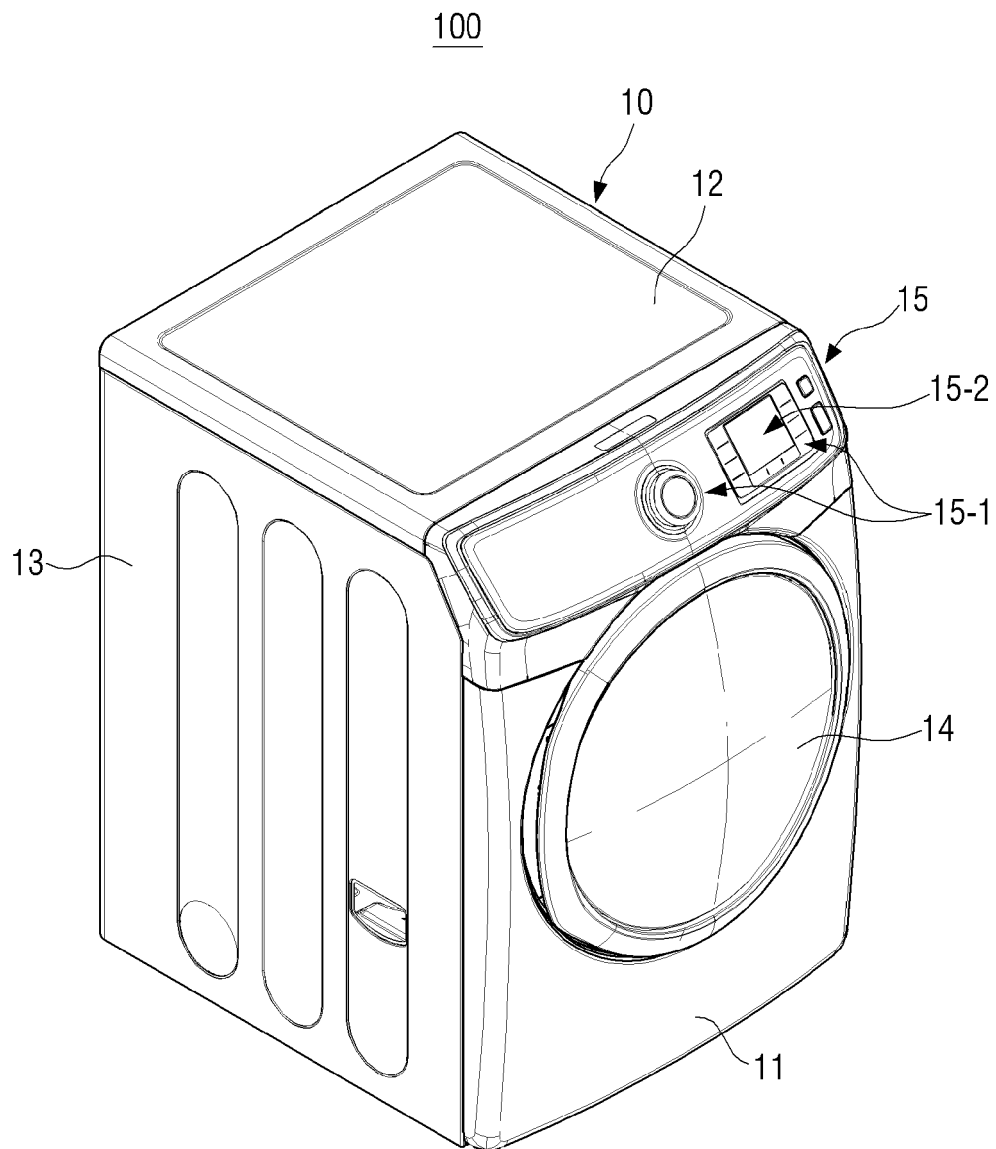
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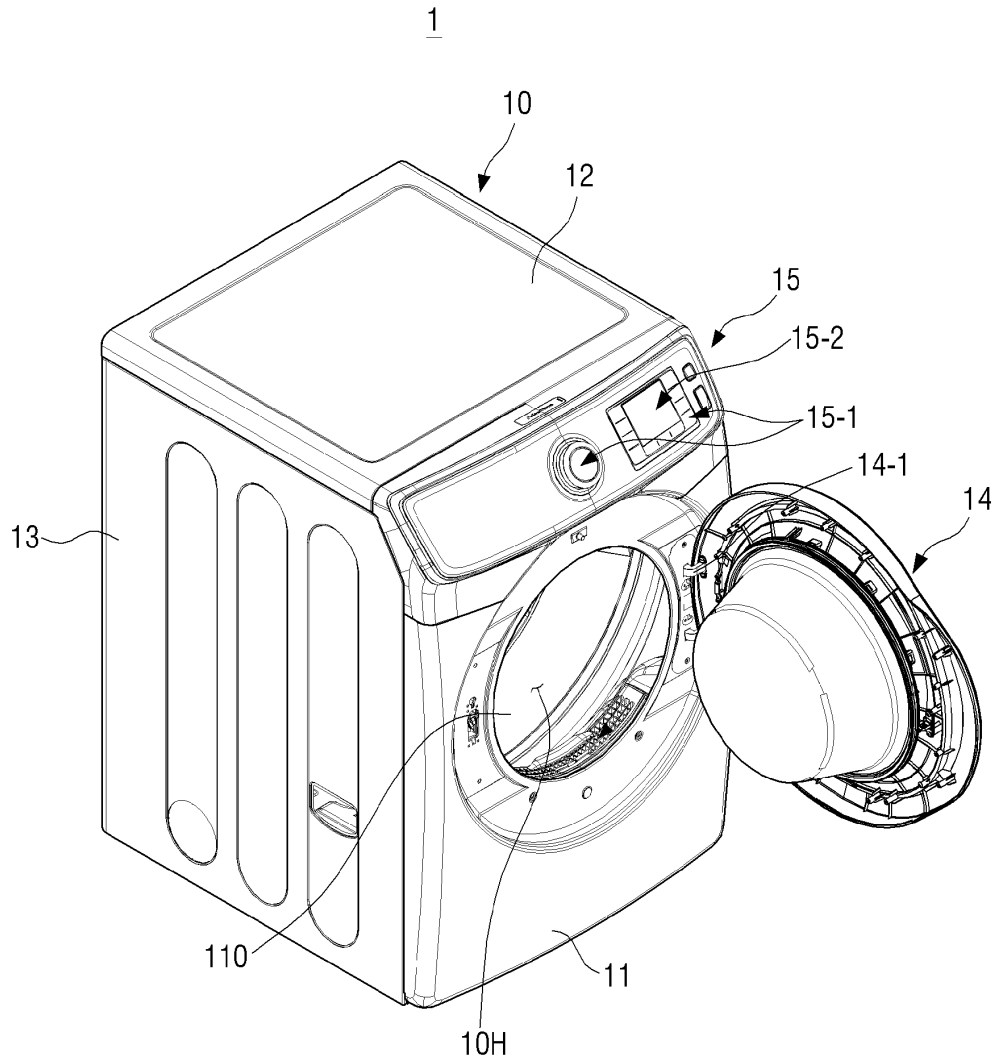
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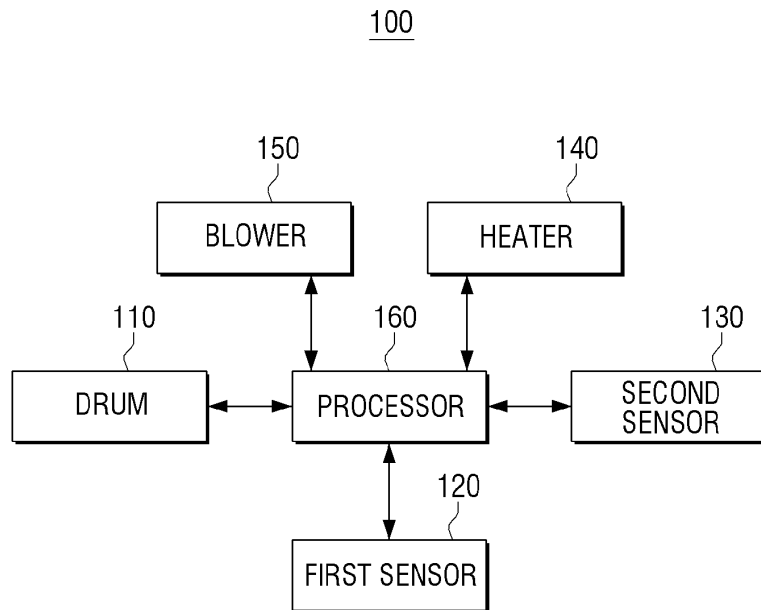
[Fig. 1]



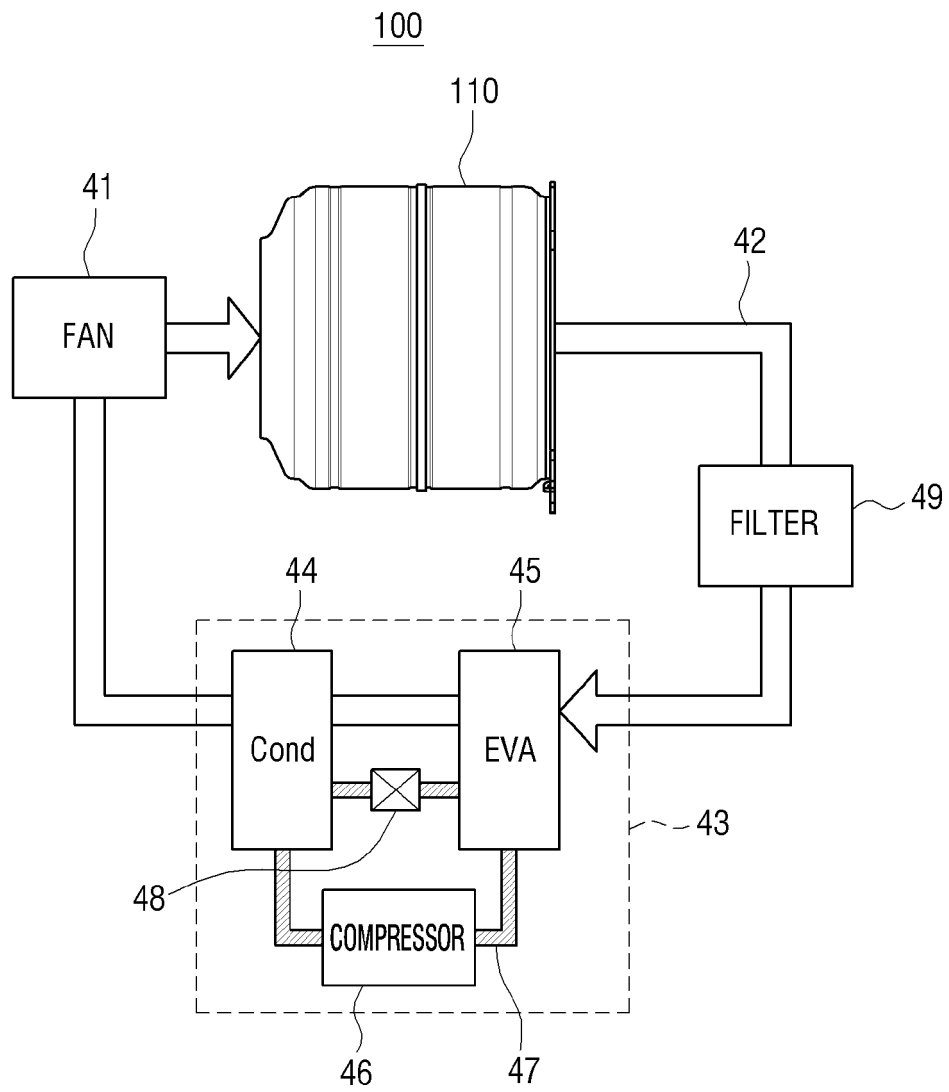
[Fig. 2]



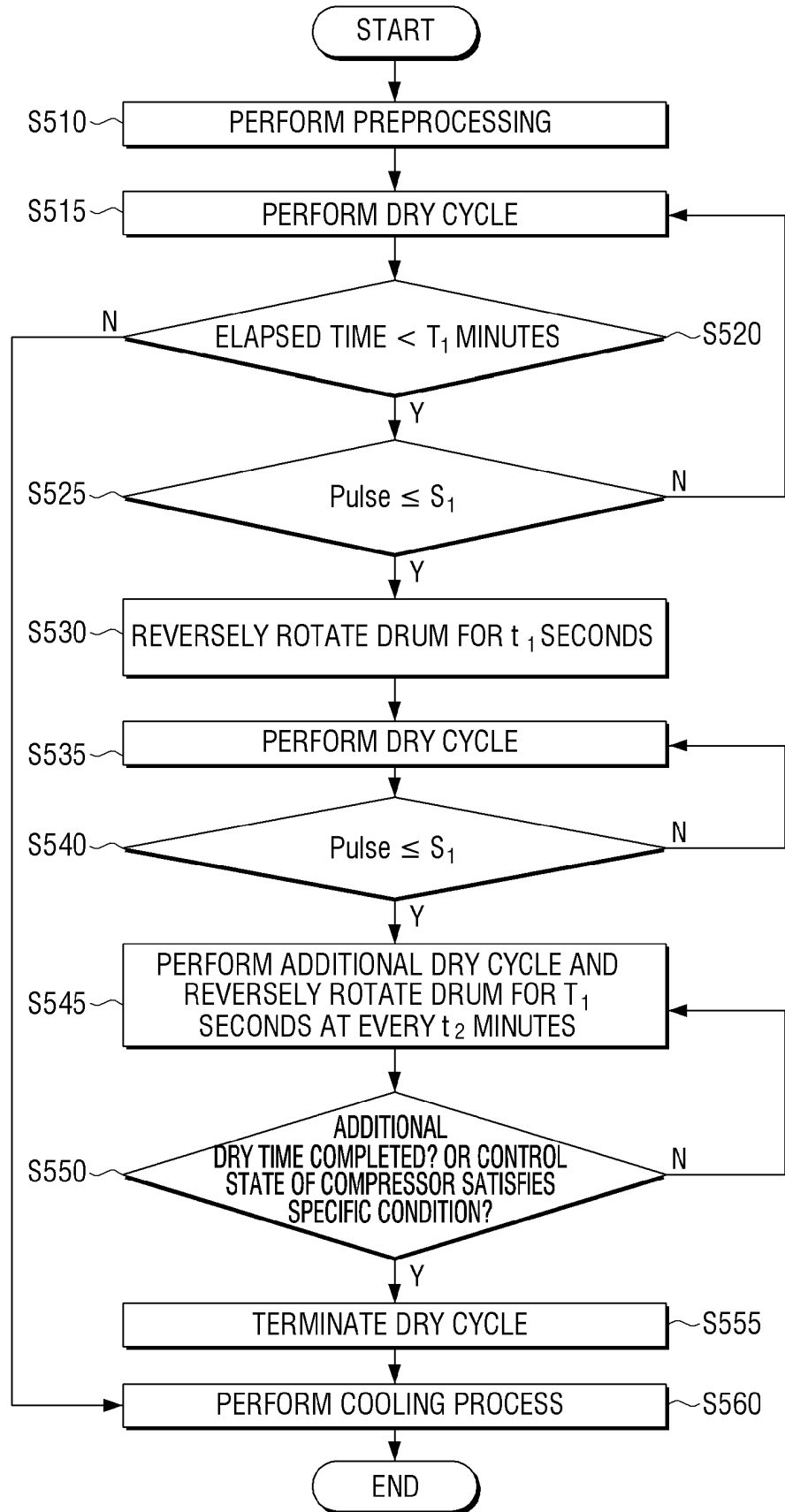
[Fig. 3]



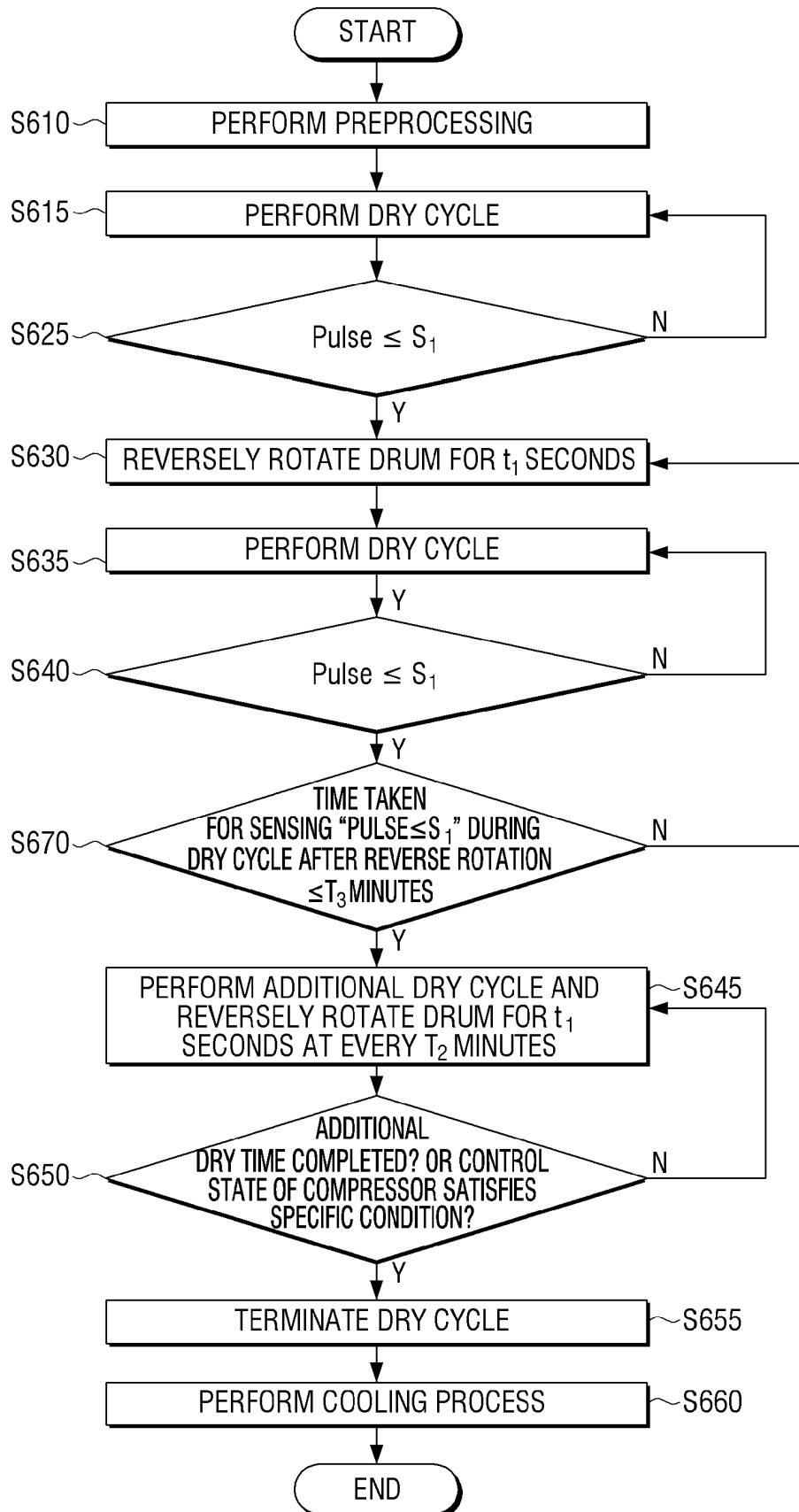
[Fig. 4]



[Fig. 5]

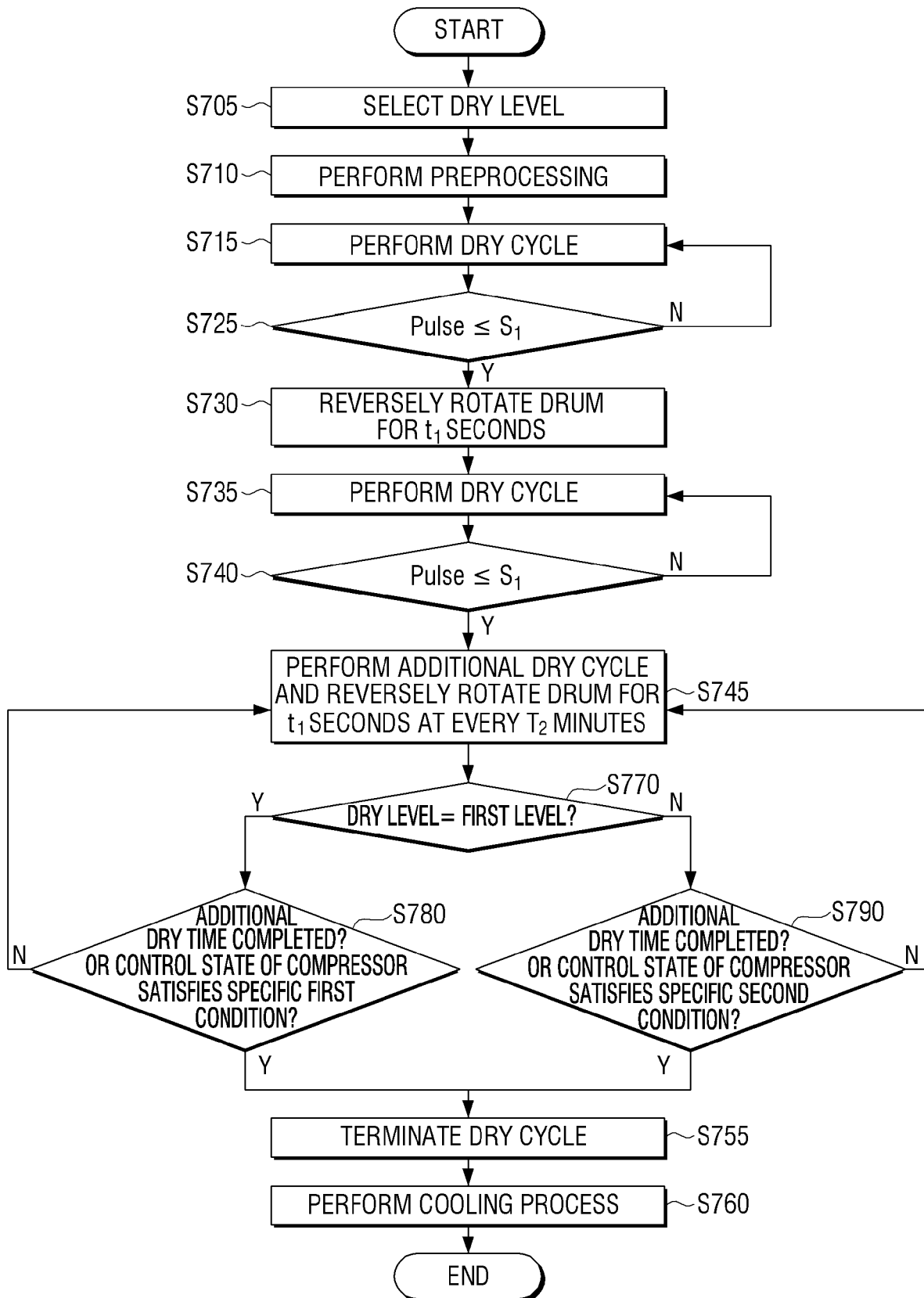


[Fig. 6]

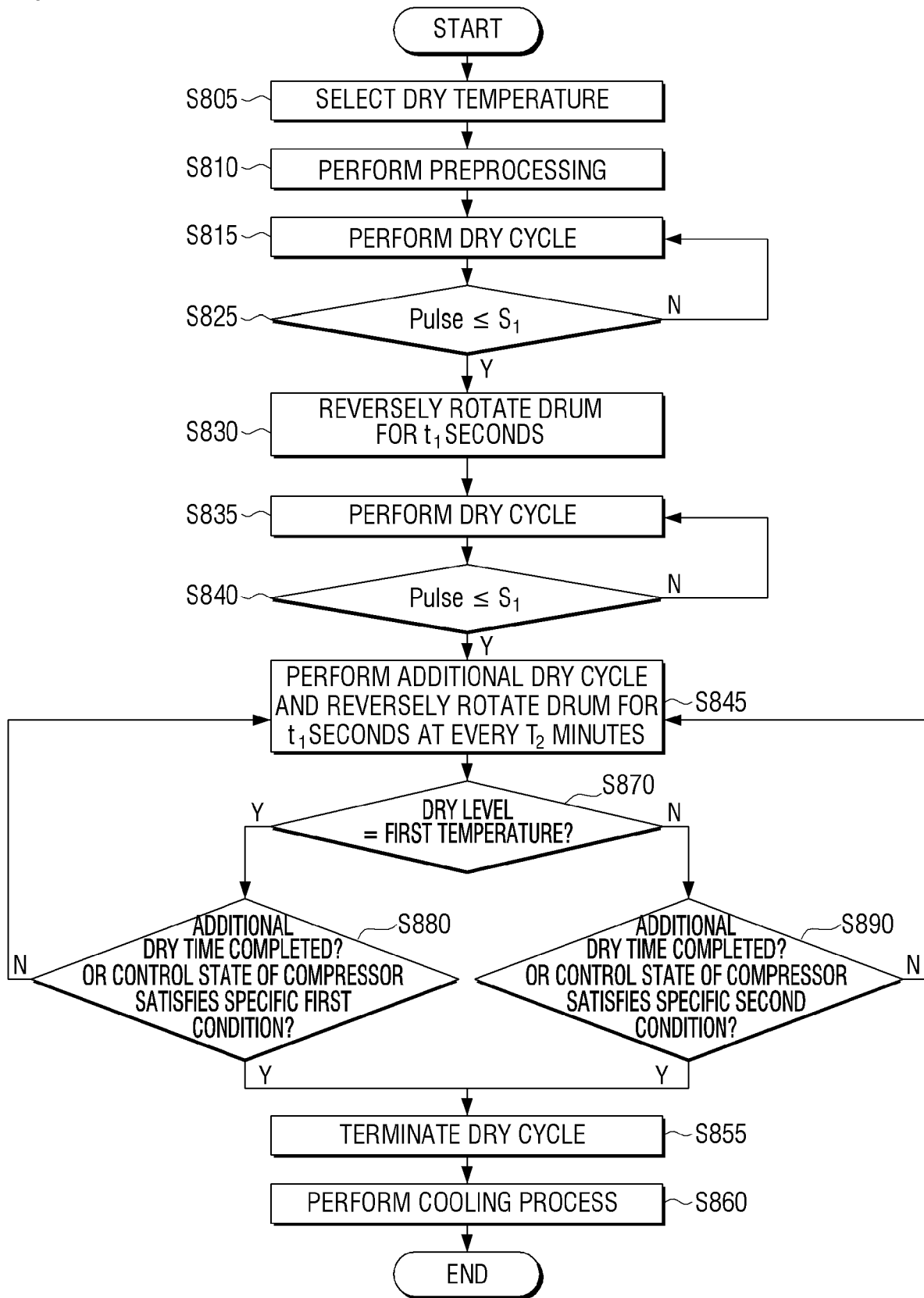




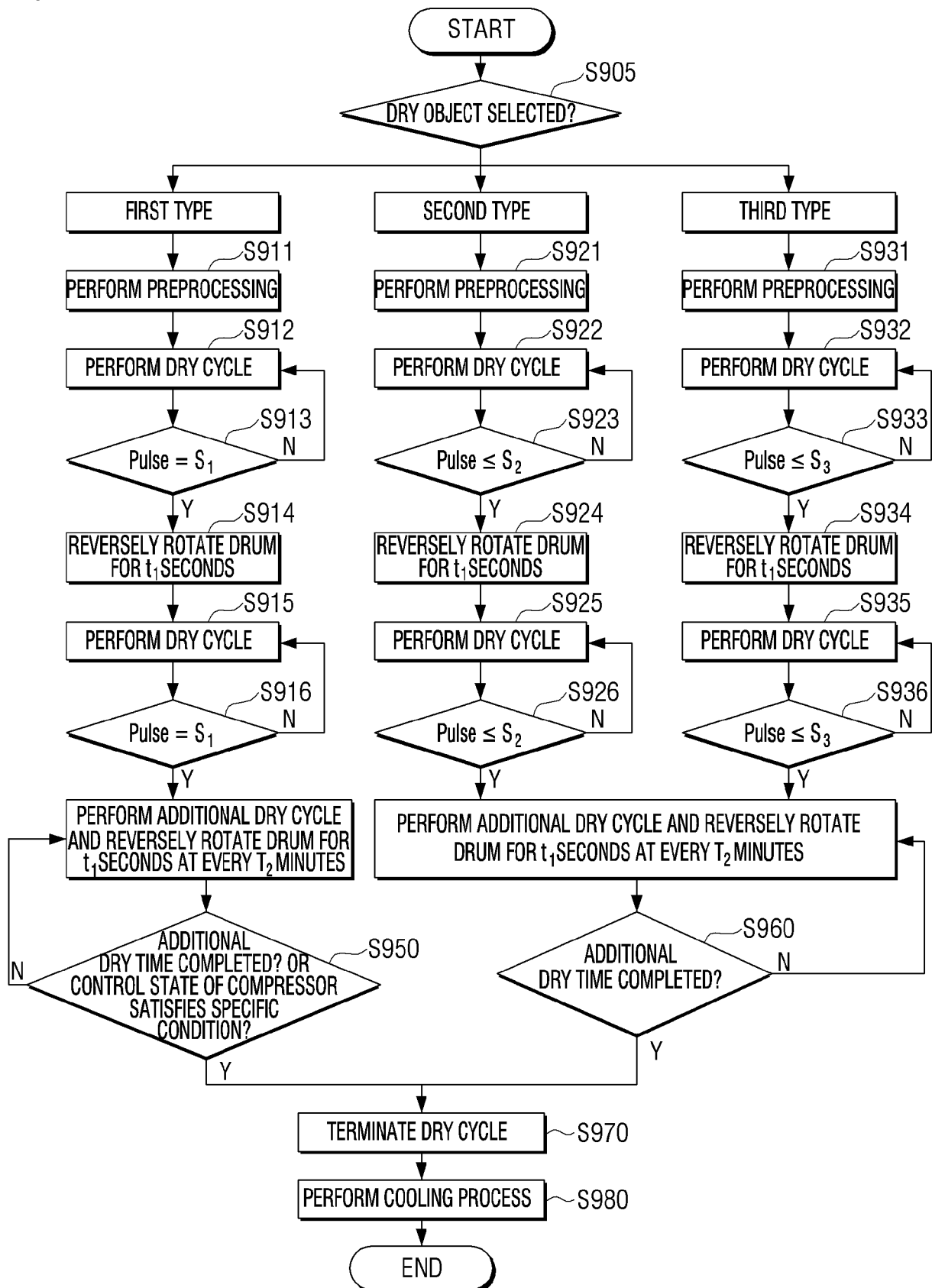
[Fig. 7]



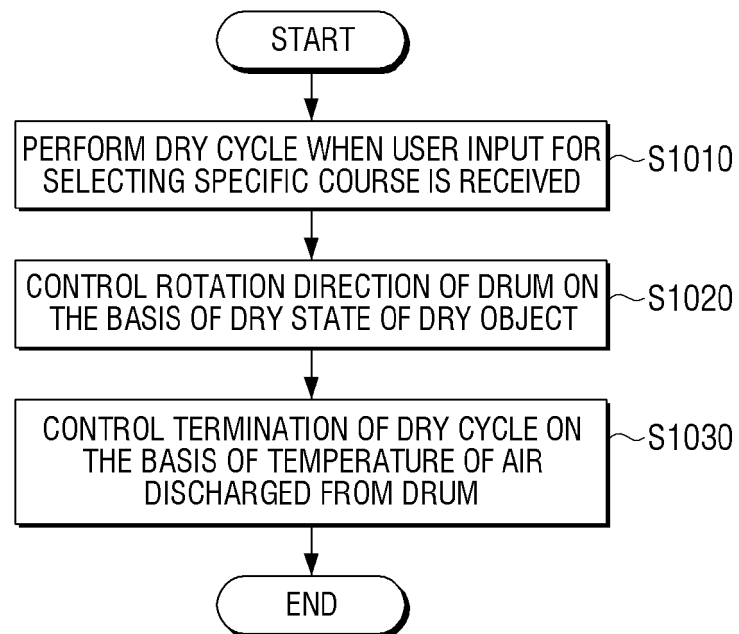
[Fig. 8]



[Fig. 9]



[Fig. 10]



**REFERENCES CITED IN THE DESCRIPTION**

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