(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 467 712 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
27.11.2024 Bulletin 2024/48

(21) Application number: **23903835.9**

(22) Date of filing: **30.11.2023**

(51) International Patent Classification (IPC):
D06F 58/40 *(2020.01)* ***D06F 58/26*** *(2006.01)*
D06F 34/26 *(2020.01)* ***D06F 58/46*** *(2020.01)*
D06F 105/12 *(2020.01)* ***D06F 105/20*** *(2020.01)*

(52) Cooperative Patent Classification (CPC):
D06F 34/26; D06F 58/26; D06F 58/40; D06F 58/46;
D06F 2105/12; D06F 2105/20

(86) International application number:
PCT/KR2023/019530

(87) International publication number:
WO 2024/128632 (20.06.2024 Gazette 2024/25)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
KH MA MD TN

(30) Priority: **15.12.2022 KR 20220175595**

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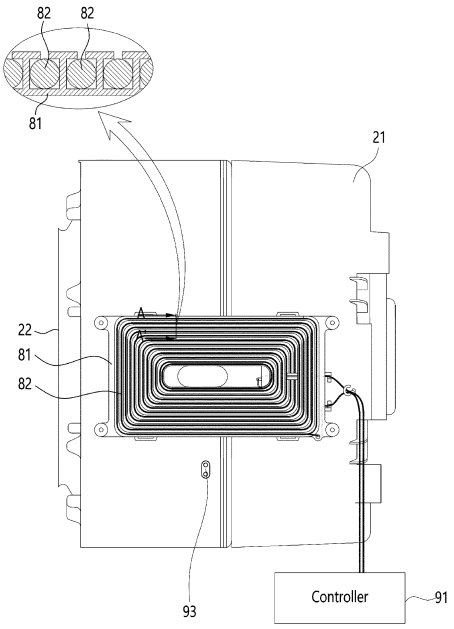
(54) METHOD FOR CONTROLLING LAUNDRY TREATMENT APPARATUS

(57) The present application relates to a method for controlling a laundry treatment apparatus, the method comprising: a heating step of heating a drum by means of a heating unit that induces an eddy current in the drum; and a motion execution step of alternately executing a stirring motion that rotates the drum at a first rotational speed that causes a centrifugal force of less than 1G, and a heat transfer motion that rotates the drum at a second rotational speed that induces a centrifugal force of 1G or more, wherein the ratio between the execution time of the stirring motion and the execution time of the heat transfer motion is set differently depending on the dryness of laundry.

[FIG. 5]



EP 4 467 712 A1

Description

Technical Field

[0001] The present disclosure relates to a method for controlling a laundry treating apparatus.

Background

[0002] A laundry treating apparatus is an apparatus that may wash, dry, or wash and dry laundry (an object-to-be-washed or an object-to-be-dried), and is a concept that includes a washing machine, a dryer, and a dryer combined washing machine.

[0003] A laundry treating apparatus (the dryer) that may dry the laundry supplies heated air (hot air) to the laundry, and is categorized into an exhaust type drying system and a circulation type drying system depending on how air that has completed heat exchange with the laundry is treated.

[0004] The circulation type drying system sequentially dehumidifies and heats air discharged from an accommodating space where the laundry is stored and then re-supplies air to the accommodating space, and the exhaust type drying system supplies heated air to the accommodating space and exhausts air discharged from the accommodating space to the outside of the laundry treating apparatus.

[0005] Because a drying time required for the laundry to reach set target dryness is determined by how effective the heat exchange is between air supplied to the drum and the laundry, regardless of the laundry treating apparatus with any drying system, control to increase efficiency of the heat exchange between air supplied into the drum and the laundry is a very important design consideration in the laundry treating apparatus whose purpose is to dry the laundry.

[0006] Among existing laundry treating apparatuses, there is one that increases the heat exchange efficiency by controlling the number of rotations or a rotation direction of the drum while air is supplied to the drum.

[0007] An existing laundry treating apparatus that controls the number of rotations of the drum to a low level while supplying heated air to the drum may cause the laundry to shrink significantly because the laundry repeatedly ascends and descends inside the drum.

[0008] The shrinkage of the laundry is caused by complex factors such as a magnitude of an external force supplied to the laundry, dryness of the laundry, a temperature of air supplied to the laundry, and a time during which hot air is supplied to the laundry (the drying time). The greatest factor that intensifies the shrinkage may be seen as the magnitude of the external force supplied to the laundry. Therefore, an existing control method of continuously repeating the ascending and the descending of the laundry while heated air is supplied to the drum is highly likely to intensify the shrinkage of the laundry.

[0009] Among the existing laundry treating apparatuses, there is one that rotates the drum with a high number of rotations (the number of rotations that creates a centrifugal force equal to or greater than 1G) while heated air is supplied to the drum (registration number 10-1594368).

[0010] The existing laundry treating apparatus may minimize the external force supplied to the laundry by maintaining the laundry in close contact with a circumferential surface of the drum when heated air is supplied to the drum. Because a drying mechanism of such laundry treating apparatus is heat transfer via convection, the drying may take a long time.

[0011] In addition, in the scheme of supplying heated air while maintaining the laundry in close contact with the circumferential surface of the drum, dryness of a surface exposed to air (one surface of the laundry facing a rotation center of the drum) and a surface not exposed to air (a surface in contact with the circumferential surface of the drum) may be different from each other. This may not only mean that the efficiency of the heat exchange between air supplied to the drum and the laundry may be lowered, but may also has a potential to cause damage of a locally heated portion of the laundry or accelerate the shrinkage.

[0012] In one example, a drying cycle (a drying step) performed by the laundry treating apparatus for drying the laundry may be divided into a preheating period, a constant drying rate period, and a falling drying rate period.

[0013] The preheating period is a period in which there is little change in the dryness and a temperature of the laundry gradually increases (a period in which the temperature of the laundry gradually increases to a temperature at which moisture is discharged from the laundry), the constant drying rate period is a period in which the dryness of the laundry increases rapidly and the temperature of the laundry remains almost constant, and the falling drying rate period is a period in which there is little change in the dryness of the laundry and the temperature of the laundry increases rapidly.

[0014] According to an experiment, it was found that as an execution time of the falling drying rate period increases and as the temperature of air supplied to the laundry in the falling drying rate period increases, the shrinkage of the laundry becomes more severe. Because there was no control method for shortening the execution time of the falling drying rate period or control method for adjusting the temperature of air supplied to the laundry while executing the falling drying rate period, it was difficult for the existing laundry treating apparatuses described above to prevent the shrinkage.

[Summary]

[Technical Problem]

[0015] The present disclosure is to provide a method for controlling a laundry treating apparatus that reduces a

shrinkage phenomenon of laundry.

[0016] In addition, the present disclosure is to provide a method for controlling a laundry treating apparatus that may minimize a shrinkage phenomenon of laundry by controlling an external force supplied to the laundry.

[0017] In addition, the present disclosure is to provide a method for controlling a laundry treating apparatus that may minimize a shrinkage phenomenon of laundry by shortening a time required to dry the laundry.

[0018] In addition, the present disclosure is to provide a method for controlling a laundry treating apparatus that may minimize a shrinkage phenomenon of laundry by controlling an amount of heat energy supplied to the laundry.

[Technical Solutions]

[0019] The present disclosure provides a method for controlling a laundry treating apparatus including a tub where water is stored, a drum disposed inside the tub to store laundry therein, and a heater that heats the drum by generating an eddy current in the drum.

[0020] The method includes a motion execution step of alternately performing a stirring motion to rotate the drum with a first number of rotations creating a centrifugal force smaller than 1G, and a heat transfer motion to rotate the drum with a second number of rotations creating a centrifugal force equal to or greater than 1G, and a heating step of heating the drum by operating the heater, and a ratio of an execution time of the stirring motion and an execution time of the heat transfer motion are set differently depending on dryness of the laundry.

[0021] When the dryness of the laundry reaches preset reference dryness, the execution time of the heat transfer motion may be set to be greater than the execution time of the stirring motion.

[0022] When the dryness of the laundry is smaller than the preset reference dryness, the execution time of the stirring motion and the execution time of the heat transfer motion may be set to be the same as each other.

[0023] A rotation direction of the drum set in the stirring motion and a rotation direction of the drum set in the heat transfer motion may be the same as each other.

[0024] The first number of rotations may be set to a number of rotations causing the laundry to fall, roll, or slide at a vertical level equal to or lower than a vertical level of a horizontal line passing through a rotation center of the drum.

[0025] A drying step composed of the heating step and a heat exchange step may be divided into a preheating period, a constant drying rate period, and a falling drying rate period, and the reference dryness may be set to a value between highest dryness and lowest dryness defining the constant drying rate period.

[0026] The reference dryness may be set to dryness where a moisture content of the laundry is in a range of 30% to 20%.

[0027] The heating step may be started simultaneously with the motion execution step or may be started after start of the motion execution step.

[0028] The heating step may be executed before start of the motion execution step, and an interval between a start time point of the heating step and a start time point of the motion execution step may be set within a preset reference time.

[0029] The method may further include a dehydration step started before the heating step and the motion execution step are executed, wherein the dehydration step includes removing water from the laundry by rotating the drum with a number of rotations creating the centrifugal force equal to or greater than 1G.

[0030] The method may further include a stirring heating step started before the dehydration step is executed, wherein the stirring heating step includes heating the drum by operating the heater while rotating the drum at a number of rotations creating the centrifugal force smaller than 1G.

[0031] The number of rotations of the drum set in the stirring heating step may be set to be equal to or smaller than the number of rotations of the drum set in the stirring motion.

[0032] The heating step may include controlling a temperature of the drum to maintain a temperature of the laundry equal to or lower than 90 degrees Celsius.

[0033] The heating step may include maintaining the temperature of the drum equal to or lower than 100 degrees Celsius.

[0034] The method may further include a cooling step of lowering the temperature of the laundry by rotating the drum when the heating step and the motion execution step are completed.

[0035] A number of rotations set in the cooling step may be set to be smaller than the first number of rotations.

[Advantageous Effects]

[0036] The present disclosure provides the method for controlling the laundry treating apparatus that reduces the shrinkage phenomenon of the laundry.

[0037] In addition, the present disclosure provides the method for controlling the laundry treating apparatus that may minimize the shrinkage phenomenon of the laundry by controlling the external force supplied to the laundry.

[0038] In addition, the present disclosure provides the method for controlling the laundry treating apparatus that may minimize the shrinkage phenomenon of the laundry by shortening the time required to dry the laundry.

[0039] In addition, the present disclosure provides the method for controlling the laundry treating apparatus that may minimize the shrinkage phenomenon of the laundry by controlling the amount of the heat energy supplied to the laundry.

[Brief Description of the Drawings]

[0040]

FIGS. 1 and 2 show an example of a laundry treating apparatus.

FIGS. 3, 4, and 5 show an example of a heater.

FIG. 6 shows an example of a heating step and a heat transfer step.

(a) in FIG. 7 shows an example of a stirring motion, and (b) in FIG. 7 shows an example of a transfer motion.

FIG. 8 shows an example of a control method composed of a first drying step and a second drying step.

[Best Mode]

[0041] Hereinafter, embodiments of a laundry treating apparatus and a control method will be described in detail with reference to the attached drawings. A configuration of the apparatus or the control method to be described below is only for describing the embodiments of the laundry treating apparatus and is not intended to limit the scope of the present disclosure, and the same reference numerals used throughout the present document refer to the same components.

[0042] As shown in FIG. 1, a laundry treating apparatus 100 may include a cabinet 1 having a laundry inlet 11 defined therein, a tub 2 disposed inside the cabinet 1 to store water therein, and a drum 3 that is rotatably disposed inside the tub and accommodates an object-to-be-treated (hereinafter, referred to as 'laundry') therein.

[0043] The laundry inlet 11 may be defined in a front surface of the cabinet 1 and may be closed by a door 12 pivotably coupled to the cabinet 1.

[0044] The cabinet 1 may have a control panel 13. FIG. 1 shows a case in which the control panel 13 is located on the front surface of the cabinet 1 above the laundry inlet 11 as an example.

[0045] The control panel 13 may include an input unit 131 and a display 132. The input unit 131 may be a means of receiving a control command from a user, and the display 132 may be a means of displaying the control commands selectable by the user and execution information of the control command selected by the user.

[0046] As shown in FIG. 2, the tub 2 may be formed as a tub body 21 disposed inside the cabinet 1 to provide a space for storing water. The tub body 21 may be formed as a hollow cylinder, and a tub inlet 22 may be defined in one surface of the cylinder.

[0047] The tub body 21 may be fixed inside the cabinet 1 via a support. FIG. 2 shows a case in which the support is composed of a spring 24 that connects an upper portion of a circumferential surface of the tub body 21 to the cabinet 1, and a damper 25 that connects a lower portion of the circumferential surface of the tub body 21 to the cabinet 1 as an example.

[0048] The tub inlet 22 may be connected to the laundry inlet 11 via a gasket 23. To prevent water stored inside the tub body 21 from leaking to the cabinet 1, the gasket 23 may be formed as a tube connecting the laundry inlet 11 with the tub inlet 22. Additionally, to minimize transmission of vibration of the tub body 21 to the cabinet 1, the gasket 23 may be made of an elastic material such as rubber.

[0049] The drum 3 may include a drum body 31 that is disposed inside the tub body 21 to provide a space for storing the laundry.

[0050] The drum body 31 may be formed as a hollow cylinder, and may have a drum inlet 32 defined in one surface (a surface facing the tub inlet) of the cylinder. The drum body 31 is preferably made of a conductor.

[0051] A communication hole 33 that allows inside of the drum body 31 to be in communication with inside of the tub body 21 may be defined in a circumferential surface of the drum body 31 or the like, and a lifter that lifts the laundry inside the drum body 31 when the drum body 31 rotates may be disposed on the circumferential surface of the drum body 31.

[0052] The drum body 31 may be rotatably fixed to the tub body 21 via a driver 4.

[0053] The driver 4 may include a stator 41 that is fixed to a rear surface of the tub body 21 and forms a rotating field when current is supplied, a rotor 42 that is located outside the tub body 21 to rotate by the rotating field, and a rotation shaft 43 that extends through the rear surface of the tub body 21 and connects the rotor 42 with a rear surface of the drum body 31.

[0054] The tub body 21 may receive water via a water supply 5, and water stored in the tub body 21 may be discharged to the outside of the tub body 21 via a drainage 6.

[0055] The water supply 5 may include a water supply pipe 52 that connects a water supply source 51 to the tub body 21, and a water supply valve 53 that controls opening and closing of the water supply pipe 52 in response to a control signal of a controller 91.

[0056] The drainage 6 may include a pump 61, a first drain pipe 62 that connects the tub body 21 to the pump 61, and a second drain pipe 63 that guides water discharged from the pump 61 to the outside of the cabinet 1.

[0057] The laundry treating apparatus 100 may further include a supplier 7 that supplies detergent to the tub body 21. The supplier 7 may include a drawer that is extended from the front surface of the cabinet 1, and a storage space defined in the drawer to store the detergent therein.

[0058] FIG. 2 shows a case in which the storage space is defined to connect the water supply pipe 52 with the tub body 21 as an example. In this case, the water supply pipe 52 may be composed of a first water supply pipe 521 that guides water supplied from the water supply source 51 to the storage space, and a second water supply pipe 522 that guides the detergent discharged from the storage space and water to the tub body 21.

[0059] The laundry treating apparatus 100 may further include a heater 8 that heats the drum body 31.

[0060] The heater 8 is as means of heating the drum body 31 by generating an eddy current in the drum body 31 via electromagnetic induction. An induction heater

may be an example of the heater.

[0061] As shown in FIG. 3, the heater 8 is preferably located in a space located above a horizontal line H passing through a center of the tub body (a horizontal line passing through a center of rotation of the drum body) on the circumferential surface of the tub body 21. This is because it is advantageous for heating the drum body 31 that there is no water between the heater 8 and the drum body 31.

[0062] As shown in FIG. 4, the heater 8 may include a housing 81 fixed to an upper space of the tub body 21, a coil 82 fixed to the housing 81, and a cover 83 that is fixed to the housing 81 and prevents exposure of the coil 82.

[0063] To prevent overheating of the coil 82, the cover 83 may further include a cooler 84. The cooler 84 may be formed as a fan that exhausts air in a space created by the housing 81 and the cover 83 to the outside. As shown in FIG. 5, the coil 82 may be fixed to the housing 81, and current supplied to the coil 82 may be controlled by the controller 91.

[0064] As shown in FIG. 2, the laundry treating apparatus 100 may further include a sensor 92 that senses an amount of foam inside the tub body 21. The senser 92 may be formed as a water level sensor that senses an amount of water supplied to the tub body 21.

[0065] As shown in the drawing, the water level sensor may be composed of a communication pipe 921 connected to the first drain pipe 62, and a sensor 922 that generates a control signal based on a pressure inside the communication pipe 921.

[0066] The communication pipe 921 may be formed as a hose fixed inside the cabinet 1 such that one end thereof is connected to the first drain pipe 62 and the other end thereof is located at a point higher than the highest water level of the tub body 21, or a point higher than the horizontal line H.

[0067] The communication pipe 921 is closed by the sensor 922, and a water level inside the communication pipe 921 changes to be the same as a water level inside the tub body 21. Therefore, the sensor 922 may transmit a control signal corresponding to the pressure inside the communication pipe 921, which varies depending on the water level inside the tub body 21, to the controller 91, and the controller 91 may determine the water level inside the tub body 21 via the control signal provided by the sensor 922.

[0068] In one example, when the foam is generated inside the tub body 21 because of the rotation of the drum body 31 or the like, the pressure inside the communication pipe 921 increases. Therefore, when the sensor 922 senses the increase in the pressure inside the communication pipe 921 even though there is no additional water supply via the water supply 5 during operation of the laundry treating apparatus 100, the controller 91 will be able to estimate whether the foam is generated inside the tub body 21 and the amount of foam.

[0069] Although not shown in the drawing, the sensor 92 may be formed as a current amount sensor that senses an amount of current supplied to the stator 41 or a number of rotations sensor that senses the number of rotations of the drum body 31.

[0070] When the foam is generated inside the tub body 21, a resistance that hinders the rotation of the drum body 31 increases, so that an amount of current that should be supplied to the stator 41 to rotate the drum body 31 with a preset number of rotations increases. In one example, when the foam is generated inside the tub body 21 while maintaining the amount of current supplied to the stator 41 constant, the number of rotations of the drum body 31 is lowered. Accordingly, the controller 91 may estimate whether the foam is generated in the tub body 21 and the amount of foam via the control signal provided by the current amount sensor or the number of rotations sensor.

[0071] The laundry treating apparatus 100 may further include a temperature sensor 93 that measures a temperature inside the tub body 21. FIG. 2 shows a case in which the temperature sensor 93 is fixed to the upper space of the circumferential surface of the tub body 21 and senses a temperature of a space between the tub body 21 and the drum body 31.

[0072] FIG. 6 shows an example of a method for controlling a laundry treating apparatus to minimize shrinkage of laundry.

[0073] In the control method, a first drying step (S10) and a second drying step (S20) may be sequentially executed, or the second drying step (S20) may only be executed.

[0074] The second drying step (S20) may include a heating step (S21) of heating the drum body 31 by operating the heater 8, and a motion execution step (S22) of moving the laundry inside the drum body to transfer heat energy of the drum body 31 to the laundry.

[0075] In the motion execution step (S22), a stirring motion M1 of rotating the drum body 31 with a first number of rotations that creates a centrifugal force smaller than 1G and a heat transfer motion M2 of rotating the drum body 31 with a second number of rotations that creates a centrifugal force equal to or greater than 1G are alternately executed.

[0076] As shown in (a) in FIG. 7, the stirring motion M1 is the motion of rotating the drum body 31 with the number of rotations that creates the centrifugal force smaller than 1G in the laundry. When the stirring motion M1 is executed, the laundry will repeat the motion of ascending and descending inside the drum body 31.

[0077] In one example, the heat transfer motion M2 is the motion of rotating the drum body 31 with the number of rotations that creates the centrifugal force equal to or greater than 1G in the laundry. When the heat transfer motion M2 is executed, the laundry will rotate in close contact with the circumferential surface of the drum body 31 as shown in (b) in FIG. 7.

[0078] Because the motion execution step (S22) is executed together with the heating step (S21), the heat transfer motion M2 becomes a motion for transferring the heat energy to the laundry via heat conduction, and the

stirring motion M1 becomes a motion that transfers the heat energy to the laundry via the heat conduction and a change in an area of the laundry in contact with the circumferential surface of the drum body 31. That is, the stirring motion M1 changes the area of the laundry in contact with the drum body to induce the heat energy to be evenly supplied to all areas of the laundry, and the heat transfer motion M2 quickly supplies the heat energy to one surface of the laundry in contact with the drum body.

[0079] Because the second drying step (S20) transfers the heat energy to the laundry via the conduction, the heat energy may be supplied to the laundry more effectively than in an existing scheme of supplying the heat energy to the laundry via air convection.

[0080] The first number of rotations set in the stirring motion M1 may be set as a number of rotations that causes the laundry to fall from above the horizontal line H passing through the rotation center of the drum, or may be set as a number of rotations that causes the laundry to fall from near the horizontal line H. Considering a tendency that the smaller the external force supplied to the laundry, the lower the possibility of shrinkage of the laundry, the first number of rotations may be preferably set as a number of rotations that causes the laundry to fall from a vertical level of the horizontal line H or a vertical level lower than that of the horizontal line H.

[0081] It is preferable that a rotation direction of the drum in the stirring motion M1 and a rotation direction of the drum in the heat transfer motion M2 are set to be the same. This is because, when switching from the stirring motion M1 to the heat transfer motion M2 and when switching from the heat transfer motion M2 to the stirring motion M1, time and energy required for the motion switching and the vibration of the drum body may be minimized when the rotation directions of the two motions are set to be the same.

[0082] In one example, a ratio T1:T2 of an execution time T1 of the stirring motion and an execution time T2 of the heat transfer motion is preferably set differently depending on the dryness of the laundry.

[0083] As shown in FIG. 8, a drying step of the laundry may be divided into a preheating period (S201), a constant drying rate period (S202), and a falling drying rate period (S203).

[0084] The preheating period (S201) is a section in which there is little change in the dryness (a section in which there is little change in a moisture content), the constant drying rate period (S202) is a section in which the dryness of the laundry increases rapidly (a section in which the moisture content decreases rapidly), and the falling drying rate period (S203) is a section in which there is little change in the dryness of the laundry and the temperature of the laundry increases rapidly.

[0085] In the preheating period (S201), because the laundry contains a lot of moisture, even when the number of falls of the laundry increases, it does not significantly affect the shrinkage of the laundry. However, in the constant drying rate period (S202) and falling drying rate period (S203), the moisture content of the laundry is low, so that when the number of falls of the laundry increases, the shrinkage of the laundry may worsen. Accordingly, the motion execution step (S22) may be set such that as the dryness of the laundry increases (as the moisture content decreases), the execution time T2 of the heat transfer motion becomes greater than the execution time T1 of the stirring motion.

[0086] FIG. 8 shows a case in which, when the dryness of the laundry is smaller than preset reference dryness, the execution time T1 of the stirring motion and the execution time T2 of the heat transfer motion are set to be the same, and when the dryness of the laundry reaches the reference dryness, the execution time T2 of the heat transfer motion is set to be greater than the execution time T1 of the stirring motion as an example.

[0087] When the dryness of the laundry is smaller than the preset reference dryness, the execution time T1 of the stirring motion may be set to be greater than the execution time T2 of the heat transfer motion. However, when the execution time T2 of the heat transfer motion is shortened while the laundry has not reached the reference dryness, a time of the preheating period (S201) is increased, resulting in an increase in an execution time of the second drying step (S20).

[0088] The reference dryness (or a reference moisture content) may be set to dryness (or a moisture content) of the laundry entering the constant drying rate period (S202). FIG. 8 shows a case in which the reference dryness is set to dryness at which the moisture content of the laundry is in a range of 30% to 20% as an example.

[0089] The heating step (S21) may be started simultaneously with the motion execution step (S22) or may be started after the motion execution step (S22) is started. This is because when the heater 8 operates while the drum body 31 does not rotate, there is a possibility that the laundry may be damaged. Therefore, when the heating step (S21) is started before the start of the motion execution step (S22), it is desirable to set an interval between a start time point of the heating step (S21) and a start time point of the motion execution step (S22) within a preset reference time.

[0090] The reference time may be set by the controller 91 based on a type of the laundry. That is, when the user selects the type of the laundry, which is an object-to-be-dried, via the input unit 131, the controller 91 may set the reference time differently depending on the type of the laundry. It is preferable that the reference time is set shorter for laundry with lower durability.

[0091] In one example, even when the execution time T2 of the heat transfer motion is set to be great than the execution time T1 of the stirring motion in a second half of the second drying step (S20), when a time of the falling drying rate period (S203) increases, there is a possibility that the shrinkage of the laundry will become more severe as there will be a lot of heat energy supplied to the laundry.

[0092] To shorten the execution time of the second drying step (S20), the control method may further include

the first drying step (S10).

[0093] The first drying step (S10) may be composed of a stirring heating step (S11) and a dehydration step (S12) performed sequentially before the start of the second drying step (S20), or may be composed only of the dehydration step (S12).

[0094] The dehydration step (S12) is a step of removing water from the laundry by rotating only the drum body 31 with a number of rotations for dehydration without operating the heater 8. The number of rotations for the dehydration is a number of rotations that creates the centrifugal force equal to or greater than 1G in the laundry, and is preferably set to a number of rotations greater than the second number of rotations.

[0095] Because the dehydration step (S12) is performed before the start of the second drying step (S20) to remove water from the laundry, the control method may reduce water contained in the laundry via the dehydration step (S12), and accordingly, the control method may shorten the execution time of the second drying step (S20). The shortening of the second drying time (S20) means that a time during which the laundry is exposed to a high temperature in a second half of the constant drying rate period (S202) and the falling drying rate period (S203) is shortened, so that the control method with the dehydration step (S12) may more effectively prevent the shrinkage of the laundry.

[0096] An amount of moisture removed from the laundry via the dehydration step (S12) increases as the temperature of the laundry increases. Therefore, the first drying step (S10) may further include a stirring and heating step (S11) performed before the dehydration step (S12).

[0097] The stirring heating step (S11) is a step of operating the heater 8 while rotating the drum body 31 with a number of rotations that creates the centrifugal force smaller than 1G in the laundry.

[0098] The number of rotations of the drum body 31 set in the stirring heating step (S 11) may be set to be the same as the first number of rotations, or may be set to a number of rotations smaller than the first number of rotations. However, when the number of rotations of the drum body set in the stirring heating step (S11) is set smaller than the first number of rotations, the laundry may perform a rolling or sliding motion along the circumferential surface of the drum body 31, which may be expected to have an effect of increasing a time during which the laundry is in contact with the drum body 31 (an effect of quickly increasing the temperature of the laundry).

[0099] In one example, the shrinkage phenomenon of the laundry tends to worsen as the temperature of the laundry increases. Therefore, the control method may control a temperature of the drum body 31 such that the temperature of the laundry is maintained equal to or lower than 90 degrees Celsius in the second drying step (S20).

[0100] Existing laundry treating apparatuses supply heated air to the drum body, and the laundry exchanges heat with air via the convection, making it difficult to control the temperature of the laundry. However, because the laundry treating apparatus 100 heats the drum body 31 via the heater 8 and the laundry is heated via the conduction heat transfer, the temperature of the laundry may be controlled relatively easily. An example of a method for maintaining the temperature of the laundry equal to or lower than 90 degrees Celsius may be maintaining the temperature of the drum body 31 equal to or lower than 100 degrees Celsius.

[0101] Furthermore, the control method may further include a laundry amount determination step of determining an amount of laundry put into the drum body 31, and a temperature setting step of setting a maximum temperature of the drum body 31 based on the amount of laundry.

[0102] The maximum temperature determined in the temperature setting step is preferably set to a temperature at which a temperature inside the tub is equal to or lower than 90 degrees Celsius. The temperature inside the tub 2 may be measured via the temperature sensor 93.

[0103] When the second drying step (S20) is completed, the control method may execute a cooling step (S30). The cooling step (S30) is a step of lowering the temperature of the laundry by rotating only the drum body 31 without operating the heater 8. The smaller the number of rotations of the drum body 31 set in the cooling step (S30), the more advantageous it is to prevent the shrinkage or the damage of the laundry. Therefore, it is preferable that, in the cooling step (S30), the number of rotations of the drum body 31 is set to a number of rotations that creates the centrifugal force smaller than 1G in the laundry, but is set to a number of rotations smaller than the first number of rotations.

[0104] The laundry treating apparatus described above may be modified and implemented in various forms, so that the scope of rights of the present disclosure is not limited to the above-described embodiments.

Claims

1. A method for controlling a laundry treating apparatus including a tub where water is stored, a drum disposed inside the tub to store laundry therein, and a heater configured to heat the drum by generating an eddy current in the drum, the method comprising:

   a motion execution step of alternately performing a stirring motion to rotate the drum with a first number of rotations creating a centrifugal force smaller than 1G, and a heat transfer motion to rotate the drum with a second number of rotations creating a centrifugal force equal to or greater than 1G; and

   a heating step of heating the drum by operating the heater,

   wherein when dryness of the laundry reaches

preset reference dryness, an execution time of the heat transfer motion is set to be greater than an execution time of the stirring motion.

2. The method of claim 1, wherein when the dryness of the laundry is smaller than the preset reference dryness, the execution time of the stirring motion and the execution time of the heat transfer motion are set to be the same as each other.

3. The method of claim 1, wherein a rotation direction of the drum set in the stirring motion and a rotation direction of the drum set in the heat transfer motion are the same as each other.

4. The method of claim 1, wherein the first number of rotations is set to a number of rotations causing the laundry to fall, roll, or slide at a vertical level equal to or lower than a vertical level of a horizontal line passing through a rotation center of the drum.

5. The method of claim 1, wherein a drying step composed of the heating step and a heat exchange step is divided into a preheating period, a constant drying rate period, and a falling drying rate period, and the reference dryness is set to a value between highest dryness and lowest dryness defining the constant drying rate period.

6. The method of claim 1, wherein the reference dryness is set to dryness where a moisture content of the laundry is in a range of 30% to 20%.

7. The method of one of claims 1 to 6, wherein the heating step is started simultaneously with the motion execution step or is started after start of the motion execution step.

8. The method of one of claims 1 to 6, wherein the heating step is executed before start of the motion execution step, and an interval between a start time point of the heating step and a start time point of the motion execution step is set within a preset reference time.

9. The method of claim 1, further comprising a dehydration step started before the heating step and the motion execution step are executed, wherein the dehydration step includes removing water from the laundry by rotating the drum with a number of rotations creating the centrifugal force equal to or greater than 1G.

10. The method of claim 9, further comprising a stirring heating step started before the dehydration step is executed, wherein the stirring heating step includes heating the drum by operating the heater while rotating the drum at a number of rotations creating the centrifugal force smaller than 1G.

11. The method of claim 10, wherein the number of rotations of the drum set in the stirring heating step is set to be equal to or smaller than the number of rotations of the drum set in the stirring motion.

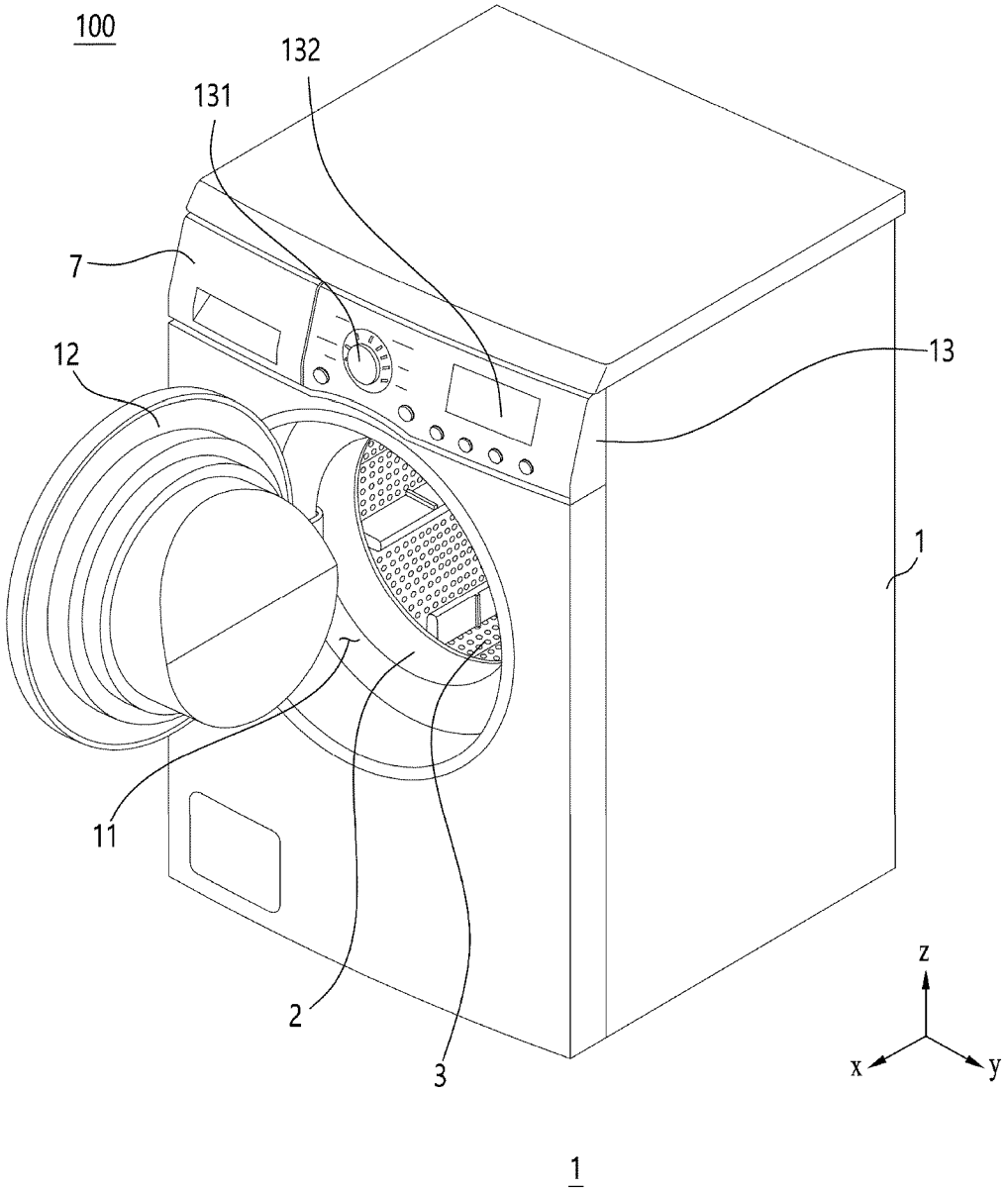
12. The method of claim 1, wherein the heating step includes controlling a temperature of the drum to maintain a temperature of the laundry equal to or lower than 90 degrees Celsius.

13. The method of claim 12, wherein the heating step includes maintaining the temperature of the drum equal to or lower than 100 degrees Celsius.

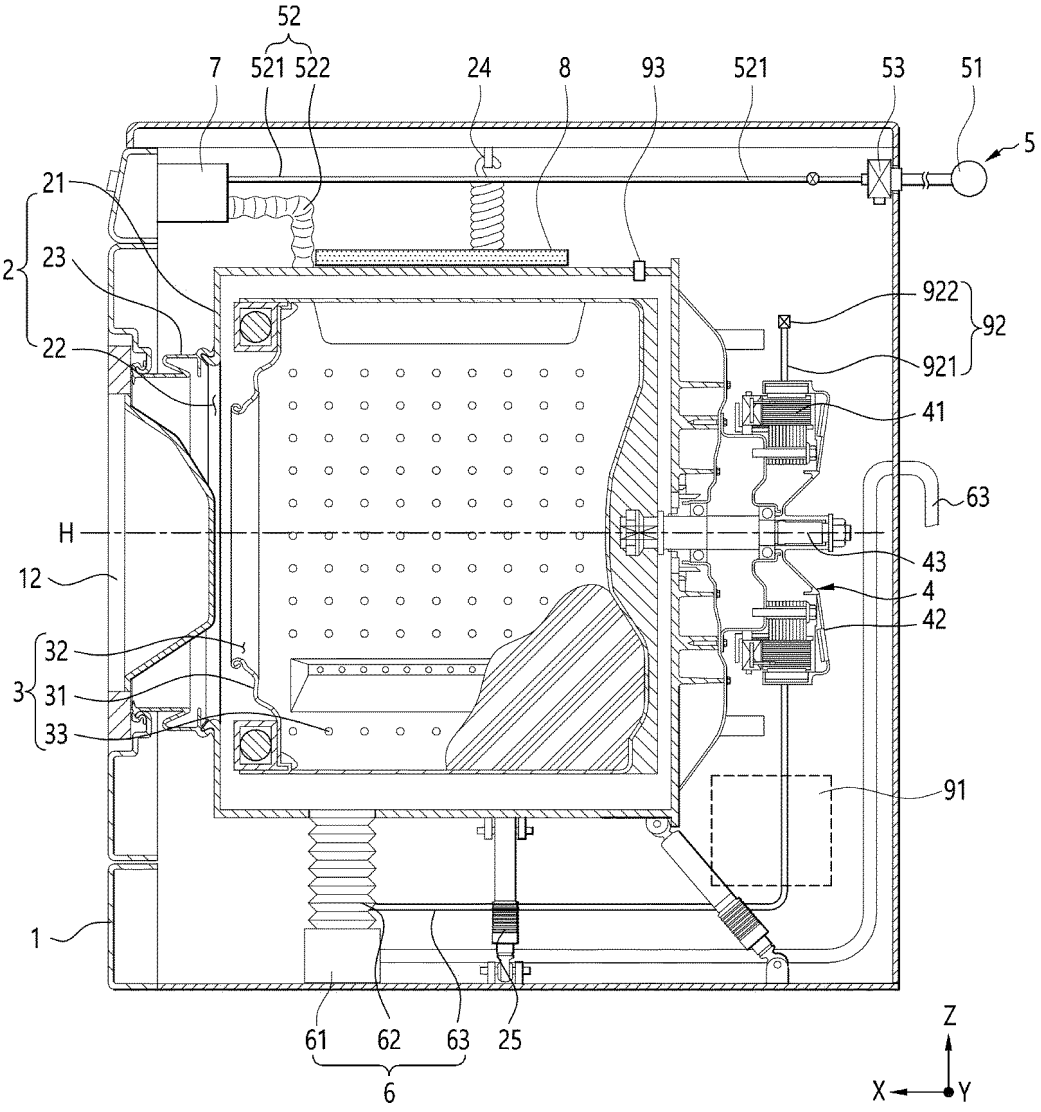
14. The method of claim 12, further comprising a cooling step of lowering the temperature of the laundry by rotating the drum when the heating step and the motion execution step are completed.

15. The method of claim 14, wherein a number of rotations set in the cooling step is set to be smaller than the first number of rotations.

[FIG. 1]



[FIG. 2]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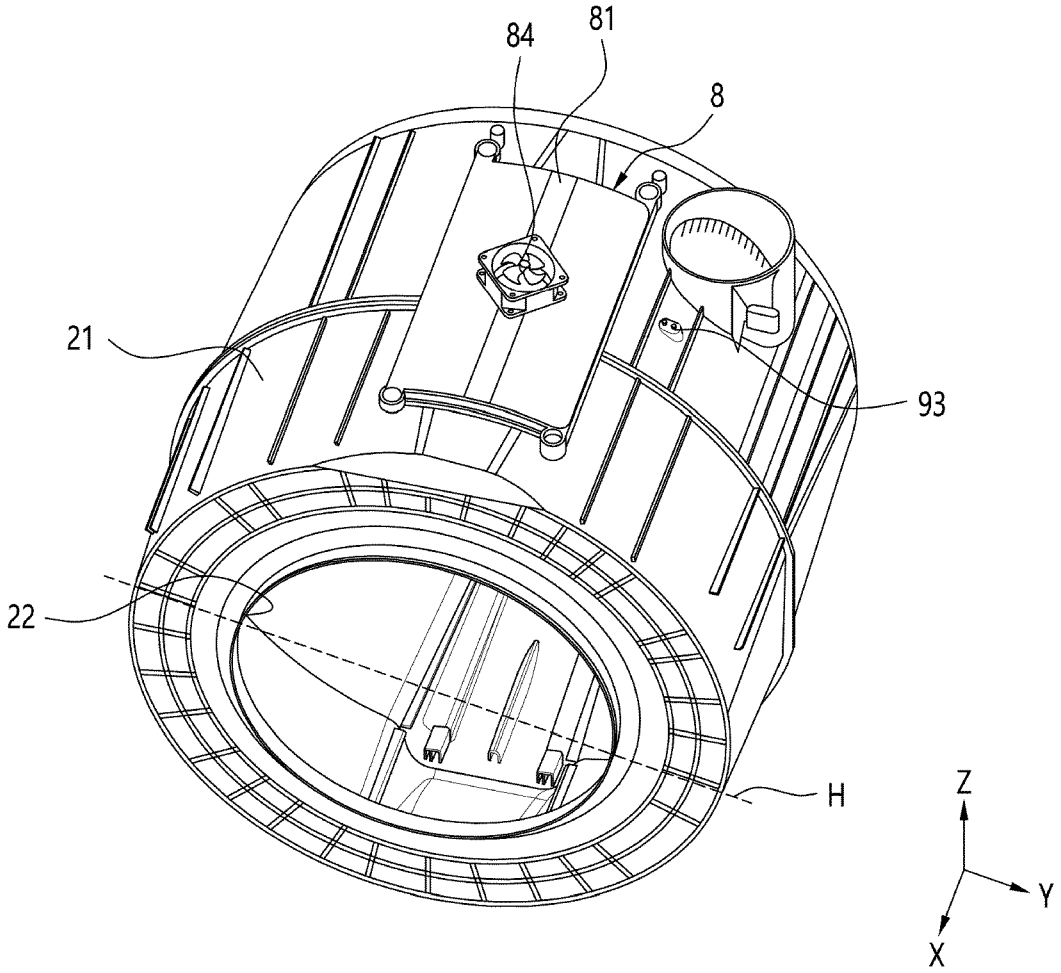
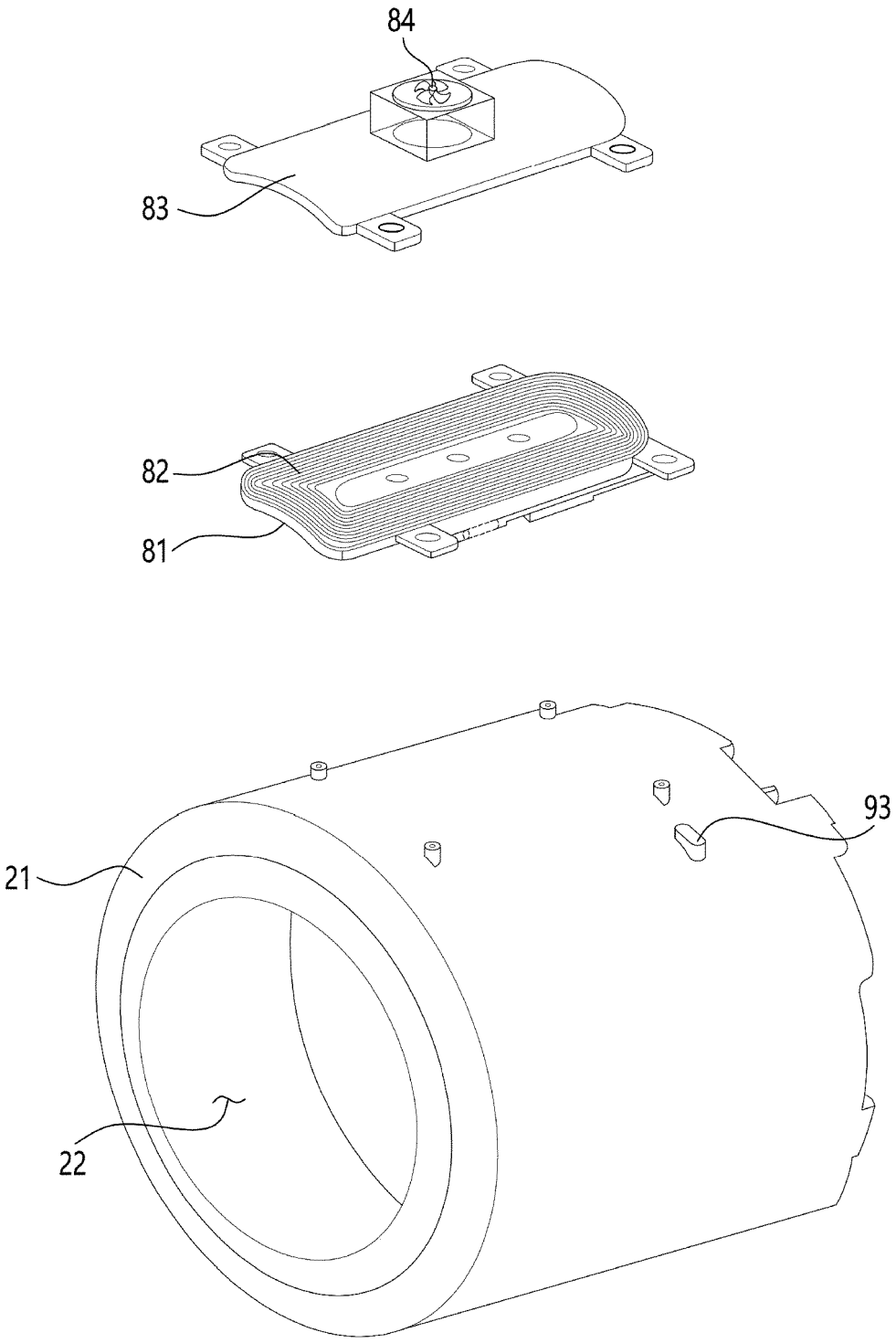
6
Z
X
Y

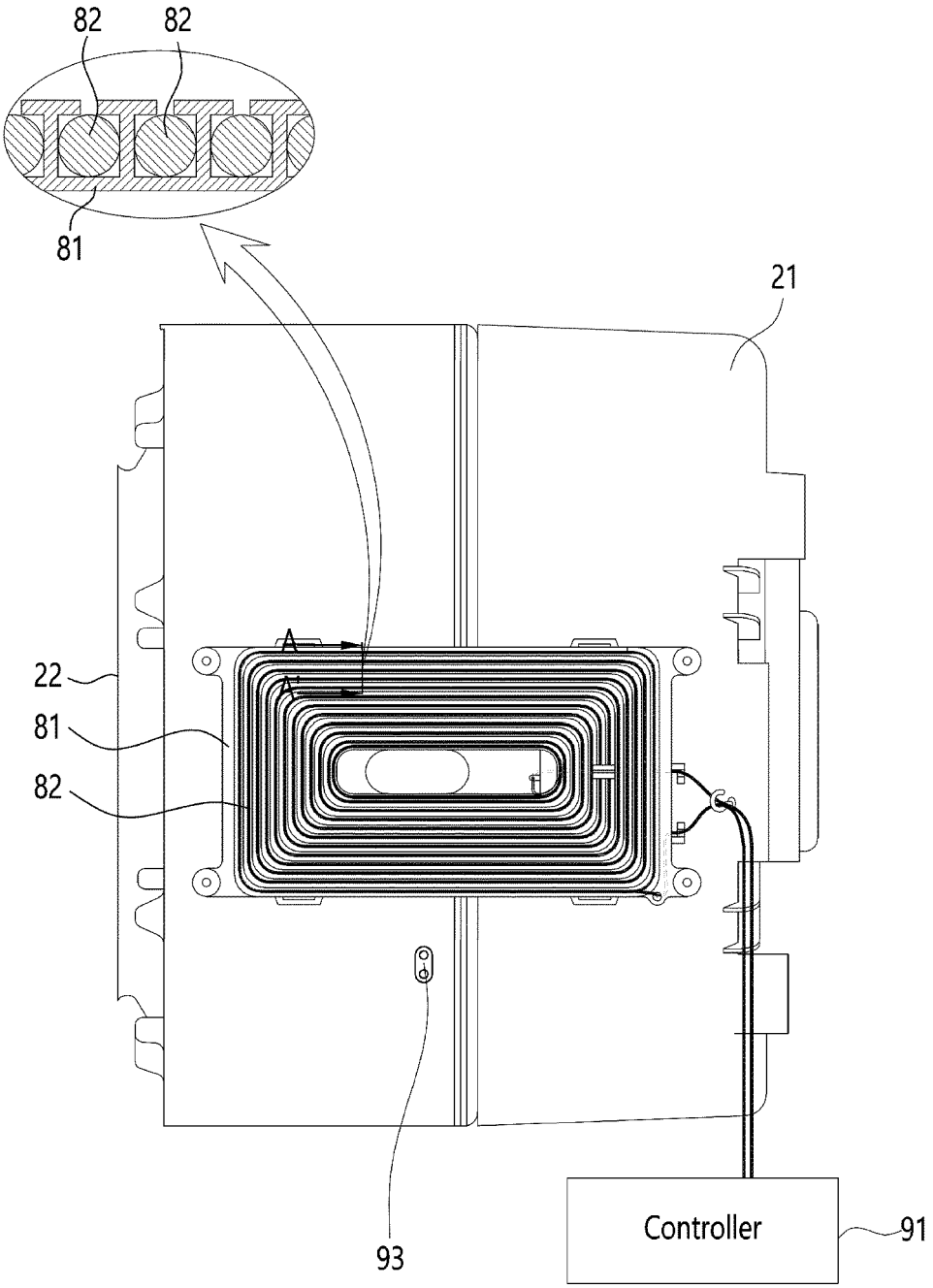
[FIG. 3]



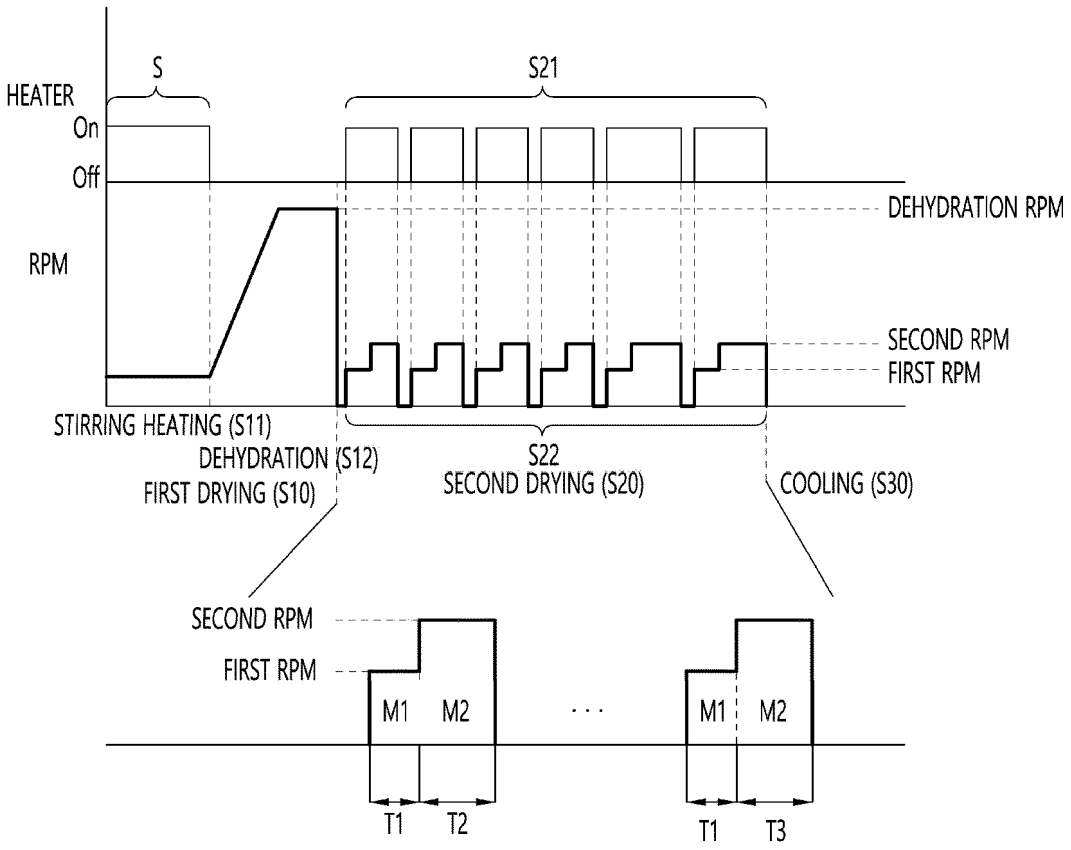
[FIG. 4]



[FIG. 5]



[FIG. 6]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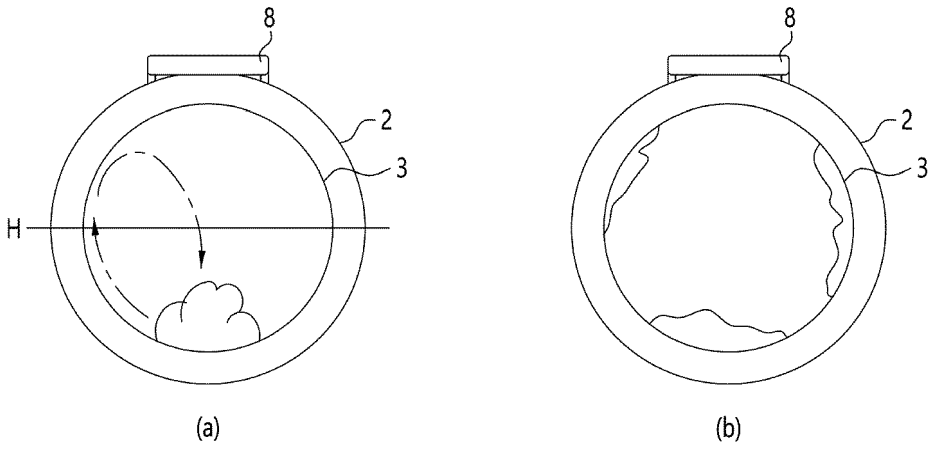
RPM
DEHYDRATION RPM
SECOND RPM
FIRST RPM
STIRRING HEATING (S11)
DEHYDRATION (S12)
FIRST DRYING (S10)
S22
SECOND DRYING (S20)
COOLING (S30)
SECOND RPM
FIRST RPM
M1
M2
M1
M2
T1
T2
T1
T3

[FIG. 7]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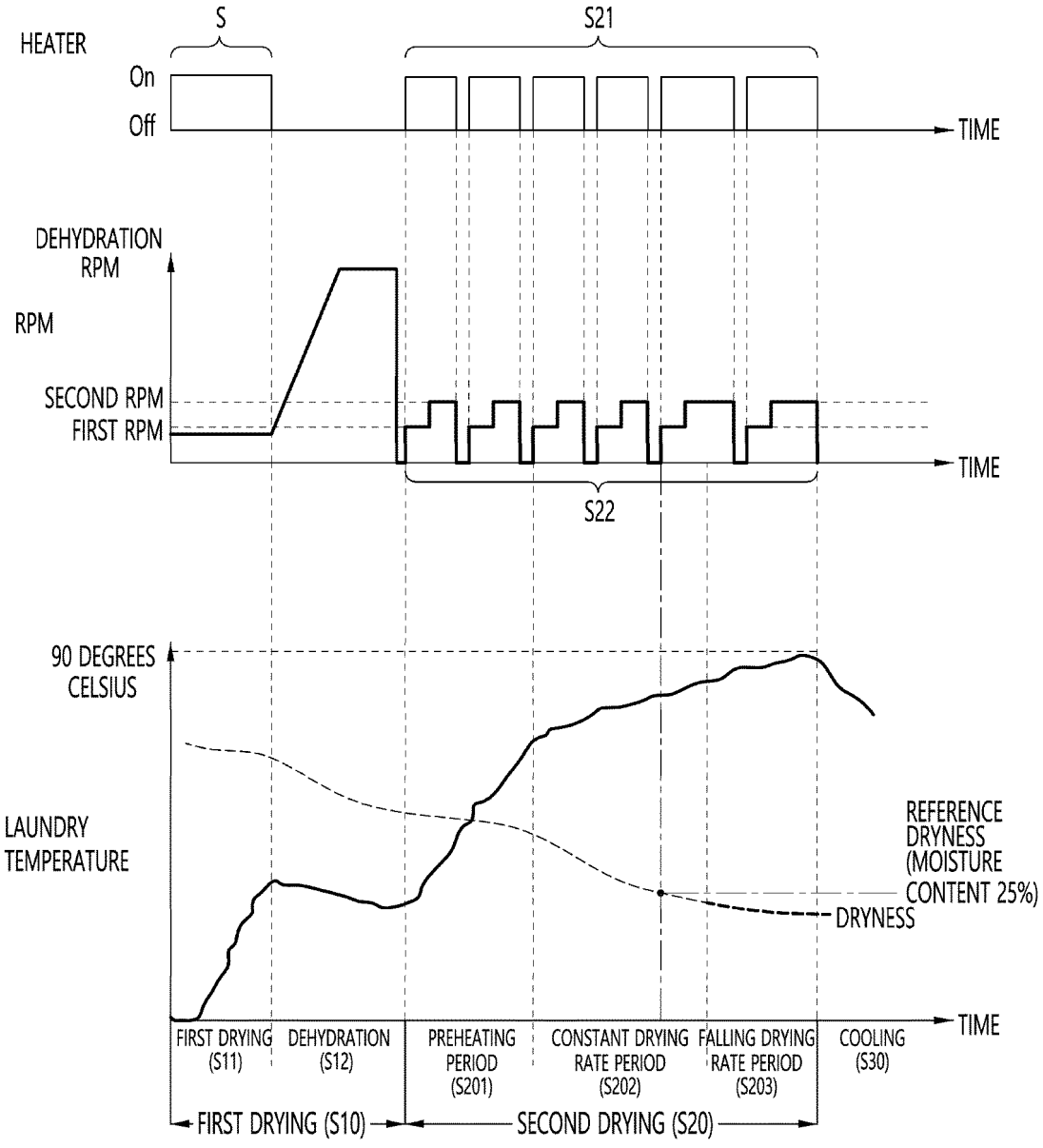
(a)
8
2
3
(b)

[FIG. 8]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S21
On
Off
TIME
DEHYDRATION RPM
RPM
SECOND RPM
FIRST RPM
TIME
S22
90 DEGREES CELSIUS
LAUNDRY TEMPERATURE
REFERENCE DRYNESS (MOISTURE CONTENT 25%)
DRYNESS
TIME
FIRST DRYING (S11)
DEHYDRATION (S12)
PREHEATING PERIOD (S201)
CONSTANT DRYING RATE PERIOD (S202)
FALLING DRYING RATE PERIOD (S203)
COOLING (S30)
FIRST DRYING (S10)
SECOND DRYING (S20)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2023/019530

A. CLASSIFICATION OF SUBJECT MATTER

D06F 58/40(2020.01)i; **D06F 58/26**(2006.01)i; **D06F 34/26**(2020.01)i; **D06F 58/46**(2020.01)i; **D06F 105/12**(2020.01)i; **D06F 105/20**(2020.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

D06F 58/40(2020.01); D06F 25/00(2006.01); D06F 33/70(2020.01); D06F 39/04(2006.01); D06F 58/02(2006.01); D06F 58/04(2006.01); D06F 58/20(2006.01); D06F 58/28(2006.01); D06F 58/30(2020.01); D06F 58/46(2020.01)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models: IPC as above
Japanese utility models and applications for utility models: IPC as above

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

eKOMPASS (KIPO internal) & keywords: 의류처리장치(clothing treatment apparatus), 건조(drying), 회전(rotation), 가열(heating), 시간(time), 제어(control)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	KR 10-2022-0031304 A (LG ELECTRONICS INC.) 11 March 2022 (2022-03-11) See paragraphs [0017]-[0051] and [0165]-[0219] and claims 1-2.	1-15
Y	KR 10-2019-0103879 A (LG ELECTRONICS INC.) 05 September 2019 (2019-09-05) See paragraphs [0024] and [0154]-[0187].	1-15
Y	JP 2005-323697 A (SANYO ELECTRIC CO., LTD.) 24 November 2005 (2005-11-24) See paragraphs [0035], [0067] and [0075]-[0083].	9-15
A	JP 2006-158489 A (MATSUSHITA ELECTRIC IND. CO., LTD.) 22 June 2006 (2006-06-22) See paragraphs [0030]-[0068] and claims 1-15.	1-15
A	KR 10-2019-0065151 A (LG ELECTRONICS INC.) 11 June 2019 (2019-06-11) See paragraphs [0042]-[0267] and figures 1-19.	1-15

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

* Special categories of cited documents:
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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
18 March 2024	**18 March 2024**
Name and mailing address of the ISA/KR **Korean Intellectual Property Office** **Government Complex-Daejeon Building 4, 189 Cheongsa-ro, Seo-gu, Daejeon 35208** Facsimile No. **+82-42-481-8578**	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/KR2023/019530

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		EP 3971340 A1	23 March 2022
		JP 2023-540986 A	27 September 2023
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