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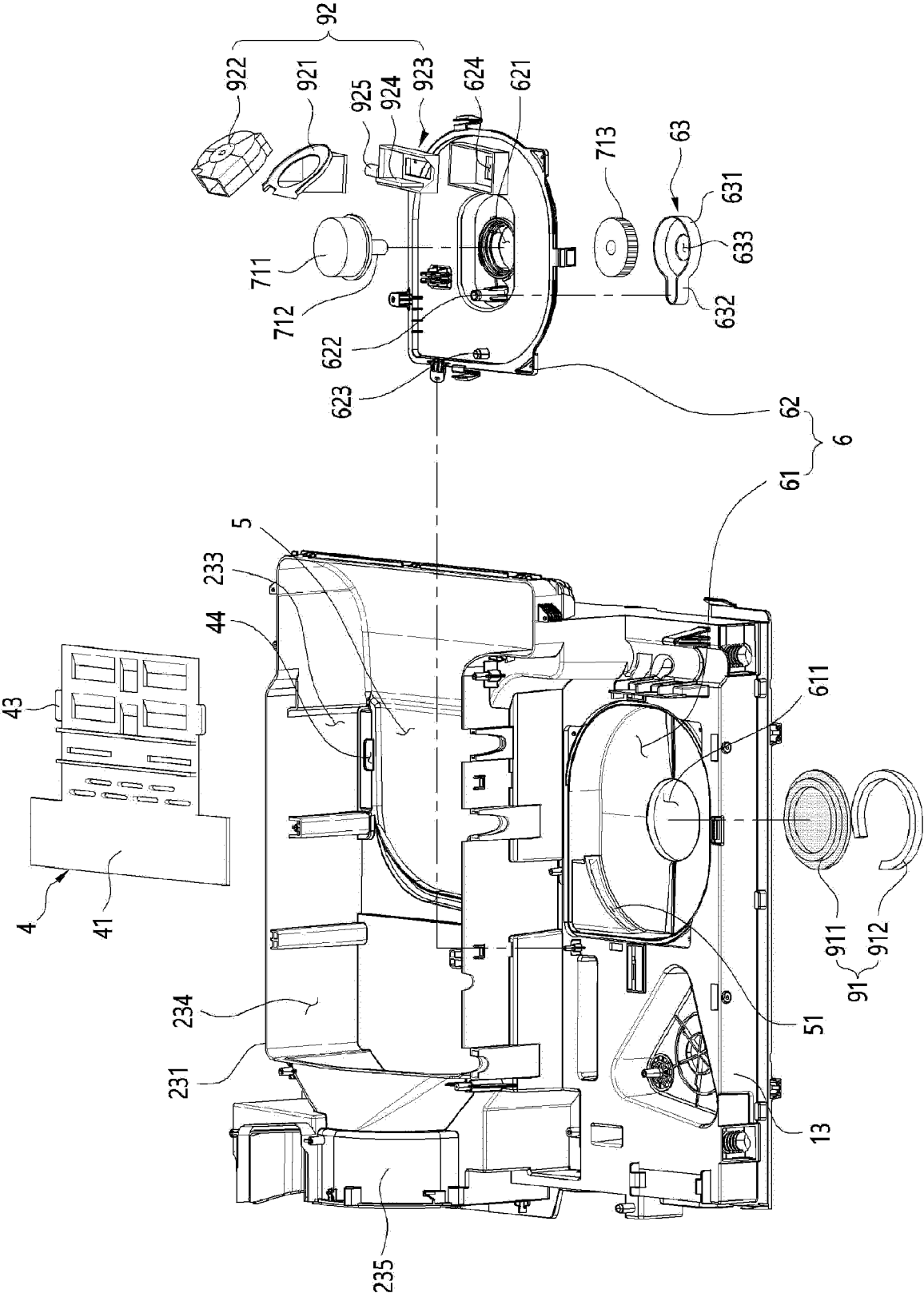
(54) **CLOTHING PROCESSING APPARATUS AND METHOD FOR CONTROLLING CLOTHING PROCESSING APPARATUS**

(57) The present application relates to a clothing processing apparatus comprising: a drum that provides a space in which an object to be dried is accommodated; a circulation flow passage through which air discharged from the drum is supplied to the drum again; a heat exchange unit that includes a circulation fan which moves air along the circulation flow passage, a first heat exchanger which dehumidifies air moving along the circula-

tion flow passage, and a second heat exchanger which heats air having passed through the first heat exchanger; a water collection unit which is connected to the circulation flow passage and in which condensate water discharged from air passing through the first heat exchanger is stored; a heating unit that heats water in the water collection unit; and an exhaust unit that discharges air out of the water collection unit.

EP 4 556 622 A1

【Fig. 5】



Description

TECHNICAL FIELD

[0001] The present disclosure relates to a laundry treatment apparatus and a control method for the same.

BACKGROUND ART

[0002] *Laundry treatment apparatus* is a generic term for apparatuses capable of performing washing of a washable article (an object to be washed), drying of a dryable article (an object to be dried), and washing and drying of the objects.

[0003] A conventional laundry treatment apparatus, which can perform drying, has a structure including a drum configured to provide a space for receiving laundry, a circulation flow passage configured to guide, to the drum, air discharged from the drum, a fan configured to move air along the circulation flow passage, and a heat exchange unit configured to sequentially execute dehumidification and heating of the air introduced into the circulation flow passage.

[0004] The heat exchange unit provided at the above-mentioned structure is configured to include a first heat exchanger configured to cool air present in the circulation flow passage, and a second heat exchanger configured to heat air emerging from the first heat exchanger. Since the air discharged from the drum is condensed while passing around the first heat exchanger, a water collection unit for collection of condensate is provided at the inside or outside of the circulation flow passage. The condensate stored in the water collection unit is discharged to the outside of the laundry treatment apparatus through a drain pump or is stored in a drain tank provided in the laundry treatment apparatus (Korean Unexamined Patent Publication No. 10-2021-0063873).

[0005] The drain pump should be configured to include a housing provided with an inlet, and an impeller provided within the housing. In this case, the inlet and a bottom surface of the water collection unit should be maintained to be spaced apart from each other. For this reason, the conventional laundry treatment apparatus has a problem in that the condensate remains within the water collection unit.

DISCLOSURE

TECHNICAL TASK

[0006] One technical task of the present disclosure devised to solve the problem lies in a laundry treatment apparatus and a control method for the same which are capable of minimizing residual condensate within a water collection unit.

[0007] Another technical task of the present disclosure devised to solve the problem lies in a laundry treatment apparatus and a control method for the same which are

capable of minimizing residual condensate within a water collection unit through evaporation of the condensate in the water collection unit.

[0008] Another technical task of the present disclosure devised to solve the problem lies in a laundry treatment apparatus and a control method for the same which are capable of achieving easy removal of condensate within a water collection unit by outwardly discharging, from the water collection unit, evaporated condensate remaining in the water collection unit.

[0009] Another technical task of the present disclosure devised to solve the problem lies in a laundry treatment apparatus and a control method for the same which are capable of solving a problem causing a decrease in dryness of an object to be dried by discharging evaporated condensate into a space other than a drum, in which laundry is stored, rather than the drum.

TECHNICAL SOLUTIONS

[0010] The present disclosure relates to a laundry treatment apparatus including a drum configured to provide a space for accommodating an object to be dried therein, a circulation flow passage configured to again supply, to the drum, air discharged from the drum, a heat exchanger configured to sequentially execute dehumidification and heating of air along the circulation flow passage, a water collection unit connected to the circulation flow passage and to store condensate released from air passing around the first heat exchanger, a heating unit configured to heat a bottom surface of the water collection unit, thereby evaporating water present in the water collection unit, and an exhaust unit configured to outwardly discharge, from the water collection unit, air present in the water collection unit.

[0011] The exhaust unit may be configured to discharge the air present in the water collection unit into a space at an outside of the drum.

[0012] In addition, the present disclosure relates to laundry treatment apparatus including a drum configured to provide a space for accommodating an object to be dried therein, a circulation flow passage configured to again supply, to the drum, air discharged from the drum, a heat exchange unit including a circulation fan configured to move air along the circulation flow passage, a first heat exchanger configured to dehumidify air moving along the circulation flow passage, and a second heat exchanger configured to heat air emerging from the first heat exchanger, a water collection unit connected to the circulation flow passage and to store condensate released from air passing around the first heat exchanger, a heating unit configured to heat water present in the water collection unit, and an exhaust unit configured to outwardly discharge, from the water collection unit, air present in the water collection unit.

[0013] The water collection unit may include a storage body configured to store the condensate released from the air passing around the first heat exchanger, a cover

configured to form an upper surface of the storage body, and a body through hole extending through a bottom surface of the storage body.

[0014] The heating unit may include a heating body constituted by a conductor to close the body through hole, and a heater configured to heat the heating body and disposed outside the water collection unit.

[0015] The heating body may be configured to form the bottom surface of the storage body.

[0016] The exhaust unit may include an exhaust duct extending through the cover to communicate with an interior of the storage body, an exhaust fan provided at the exhaust duct to discharge air present in the storage body, and a valve configured to control opening and closing of the exhaust duct.

[0017] The laundry treatment apparatus may further include an exhaust port configured to extend through the cover and configured for one end of the exhaust duct to be fixed thereto, and the valve may include a valve body rotatably mounted to the exhaust duct or the cover and configured to open and close the exhaust port, and a valve motor configured to control a rotation angle of the valve body.

[0018] The heating unit may include a film heater fixed to the bottom surface of the storage body and disposed outside the water collection unit.

[0019] The film heater may include a fixed plate fixed to the bottom surface of the storage body and disposed outside the water collection unit, and a heater embedded in the fixed plate.

[0020] The laundry treatment apparatus may further include an actuator configured to form a flow of water in the water collection unit or to vibrate condensate stored in the water collection unit.

[0021] The laundry treatment apparatus may further include a drain tank configured to be disposed at a higher level than the water collection unit and to provide a space for storing condensate therein, and a drain unit including a drain pump configured to move the condensate present in the storage body to an outside of the storage body, and a drain tube configured to guide the condensate discharged from the drain pump to the drain tank.

[0022] The present disclosure provides a control method for a laundry treatment apparatus including a drum configured to provide a space for accommodating an object to be dried therein, a circulation flow passage configured to again supply, to the drum, air discharged from the drum, a heat exchange unit including a circulation fan configured to move air along the circulation flow passage, a compressor configured to move refrigerant along a refrigerant tube, a first heat exchanger fixed to the refrigerant tube and configured to dehumidify air moving along the circulation flow passage, and a second heat exchanger fixed to the refrigerant tube and configured to heat air emerging from the first heat exchanger, a water collection unit configured to store condensate released from air passing around the first exchanger, a heating unit configured to heat water present in the water collection

unit, and an exhaust unit configured to outwardly discharge, from the water collection unit, air present in the water collection unit.

[0023] The control method may include exhausting of exhausting the air present in the water collection unit through the exhaust unit, heating of heating condensate present in the water collection unit, and sterilization of supplying heated air to the drum through operation of the compressor and the circulation fan after ending of the exhaustion and the heating.

[0024] The heating may start simultaneously with start of the exhaustion, during execution of the exhaustion or before execution of the exhaustion.

[0025] The control method may further include residual water removal of operating the circulation fan and the heating unit after ending of the sterilization.

[0026] The heating unit may operate continuously for a predetermined first reference time in the heating, and the heating unit may repeat operation and stop thereof for a predetermined second reference time in the residual water removal.

[0027] The present disclosure provides a control method for a laundry treatment apparatus including a drum configured to provide a space for accommodating an object to be dried therein, a circulation flow passage configured to again supply, to the drum, air discharged from the drum, a heat exchange unit including a circulation fan configured to move air along the circulation flow passage, a compressor configured to move refrigerant along a refrigerant tube, a first heat exchanger fixed to the refrigerant tube and configured to dehumidify air moving along the circulation flow passage, and a second heat exchanger fixed to the refrigerant tube and configured to heat air emerging from the first heat exchanger, a water collection unit configured to store condensate released from air passing around the first exchanger, a heating unit configured to heat water present in the water collection unit, and an exhaust unit configured to outwardly discharge, from the water collection unit, air present in the water collection unit.

[0028] The control method may include drying of supplying air to an interior of the drum through operation of the compressor and the circulation fan, and residual water removal of evaporating condensate present in the water collection unit through operation of the exhaust unit and the heating unit after ending of the drying.

[0029] The residual water removal may include a first period in which the heating unit operates continuously, and a second period in which the heating unit repeats operation and stop thereof after ending of the first period.

ADVANTAGEOUS EFFECTS

[0030] The present disclosure provides a laundry treatment apparatus and a control method for the same which are capable of minimizing residual condensate in the water collection unit.

[0031] In addition, the present disclosure provides a

laundry treatment apparatus and a control method for the same which are capable of minimizing residual condensate within a water collection unit through evaporation of the condensate in the water collection unit.

[0032] In addition, the present disclosure provides a laundry treatment apparatus and a control method for the same which are capable of achieving easy removal of condensate within a water collection unit by outwardly discharging, from the water collection unit, evaporated condensate remaining in the water collection unit.

[0033] In addition, the present disclosure provides a laundry treatment apparatus and a control method for the same which are capable of solving a problem causing a decrease in dryness of an object to be dried by discharging evaporated condensate into a space other than a drum, in which laundry is stored, rather than the drum.

DESCRIPTION OF DRAWINGS

[0034]

FIG. 1, FIG. 2, and FIG. 3 show an example of a laundry treatment apparatus.

FIG. 4 shows examples of a circulation flow passage and a heat exchange unit.

FIG. 5, FIG. 6, and FIG. 7 show examples of a support unit, a drain unit, and a condensate removal unit.

FIG. 8 shows another embodiment of the condensate removal unit.

FIG. 9 shows an example of a control method for the laundry treatment apparatus.

FIG. 10 shows another embodiment of a control method for the laundry treatment apparatus.

FIG. 11 shows other embodiments of the circulation flow passage and the heat exchange unit.

FIG. 12 and FIG. 13 show a control method for a laundry treatment apparatus of FIG. 11.

BEST MODE FOR DISCLOSURE

[0035] Hereinafter, preferred embodiments of a laundry treatment apparatus and a control method for the same will be described in detail with reference to the accompanying drawings.

[0036] As shown in FIG. 1, a laundry treatment apparatus 100 may be configured to include a cabinet 1. Within the cabinet, an accommodation unit provided within the cabinet 1 to accommodate an object to be dried (referred to as laundry hereinafter), and a circulation flow passage and a heat exchange unit, which are configured to remove moisture from the laundry in the accommodation unit, may be provided.

[0037] The cabinet 1 may be configured to include a front surface 11 disposed at a front side of the laundry treatment apparatus, a rear surface disposed at a rear side of the laundry treatment apparatus, and a base 13 configured to form a bottom surface of the laundry treat-

ment apparatus.

[0038] A control panel may be provided at the front surface 11. The control panel may be configured to include a display 114 configured to display a control command selectable by the user, and an input unit 113 configured to enable the user to select the control command displayed on the display 114.

[0039] As shown in FIG. 2, a cabinet access port 111 for loading and unloading of laundry is provided at the front surface 11. The cabinet access port 111 may be configured to be closed by a door 115 pivotably mounted to the front surface 11.

[0040] As shown in FIG. 3, the accommodation unit may be constituted by a drum 17 rotatably provided within the cabinet 1. The drum 17 may be configured to include a cylindrical drum body 171 opened at a front surface and a rear surface thereof.

[0041] In order to rotatably support the drum body 171, the cabinet 1 may be configured to include a front panel 14 configured to rotatably support the front surface of the drum body 171 and a rear panel 15 configured to rotatably support the rear surface of the drum body 171.

[0042] The front panel 14 may be configured to include a front panel body 141 fixed to the front surface 11 or the cabinet 1, a drum access port 142 configured to extend through the front panel body 141, and a drum exhaust hole 143 configured to discharge air in the drum body 171 into the circulation flow passage 2.

[0043] The drum access port 142 may be configured to be connected to the cabinet access port 111. Accordingly, when the door 115 opens the cabinet access port 111, the user may load laundry in the drum body 171 or may unload laundry from the drum body 171 through the cabinet access port 111 and the drum access port 142.

[0044] For filtration of air discharged from the drum body 171, a filter attachable to or detachable from the front panel body 141 may be provided at the drum exhaust hole 143.

[0045] The rear panel 15 may be configured to include a rear panel body 151 fixed to the rear surface 12 or the cabinet 1, and a drum supply hole 152 configured to extend through the rear panel body 151.

[0046] The drum body 171 is rotatable by a driver 18 provided within the cabinet 1. The driver 18 may be configured through inclusion of a drum motor 181 fixed to the base 13, and a belt 182 configured to interconnect a rotation shaft of the drum motor 181 and a circumferential surface of the drum body 171.

[0047] In order to agitate laundry in the drum body 171, a lifter 172 may be further provided within the drum body 171. The lifter 172 may be constituted by a board protruding from the circumferential surface of the drum body 171 toward a rotation center of the drum body 171.

[0048] The circulation flow passage 2 may be configured to include a first duct 21 connected to the drum exhaust hole 143, a second duct 22 connected to the drum supply hole 152, and a third duct 23 (a connection duct) configured to interconnect the first duct 21 and the

second duct 22. The connection duct 23 may be configured to be fixed to the base 13.

[0049] As shown in FIG. 4, the heat exchange unit 3 may be configured to include a circulation fan 36 configured to move air along the circulation flow passage 2, and a heat pump 31-32-33-34-35 configured to sequentially execute dehumidification and heating of air moving along the circulation flow passage 2.

[0050] The circulation fan 36 may be configured to include a fan impeller 361 disposed at the inside of the circulation flow passage 2, and a fan motor 362 disposed at the outside of the circulation flow passage 2 to rotate the fan impeller 361.

[0051] The heat pump may be configured to include a refrigerant tube 33 configured to form a flow path through which refrigerant circulates, a compressor 34 configured to force the refrigerant to move along the refrigerant tube 33, a first heat exchanger 31 fixed to the refrigerant tube 33 to transfer heat of air introduced into the connection duct 23 to the refrigerant, a second heat exchanger 32 fixed to the refrigerant tube 33 to transfer heat of the refrigerant to air emerging from the first heat exchanger 31, and a control valve 35 configured to adjust the pressure of the refrigerant.

[0052] The connection duct 23 may be configured to include a duct body 231 fixed to the base 13, and a duct cover 232 configured to form an upper surface of the duct body 231. As shown in FIG. 5, the duct body 231 may be configured to include a first mounting portion 233, to which the first heat exchanger 31 is mounted, a second mounting portion 234, to which the second heat exchanger 32 is mounted, and a third mounting portion 235 (a fan mounting portion), in which the fan impeller 361 is rotatably received.

[0053] Air introduced into the connection duct 23 is condensed while passing around the first heat exchanger 31, is heated while passing around the second heat exchanger 32, and is then moved to the drum body 171 through the second duct 22 and the drum supply hole 152.

[0054] A support unit 4 configured to support a bottom surface of the first heat exchanger 31 may be provided at the circulation flow passage 2. The support unit 4 divides an interior of the connection duct 23 into a mounting space 233a, in which the first heat exchanger 31 is disposed, and a drain space 233b configured to guide condensate to the outside of the circulation flow passage 2 (see FIG. 4). The drain space 233b is disposed under the mounting space 233a, and a drain flow passage 5 is provided at the drain space 233b.

[0055] As shown in FIG. 6, the support unit 4 may be configured to include a support body 41 configured to support the bottom surface of the first heat exchanger 31, an extension body 42 configured to extend from the support body 41 toward the second heat exchanger 32, and a fastener 43-44 configured to fasten the support body 41 and the extension body 42 to the connection duct 23.

[0056] FIG. 6 shows, as an example, the case in which the fastener is configured through inclusion of fastening protrusions 43 protruding from opposite lateral surfaces of the support body 41, and fastening grooves 44 provided at the connection duct 23 to receive the fastening protrusion 43.

[0057] A support body through hole 411 is provided at the support body 41, and an extension body through hole 421 is provided at the extension body 42. Accordingly, an inner space of the connection duct 23 (a space in which the first mounting portion is disposed) is divided into the mounting space 233a and the drain space 233b by the support body 41 and the extension body 42. However, the condensate present in the mounting space 233a may move to the drain space 233b through the support body through hole 411 and the extension body through hole 421.

[0058] The support body through hole 411 may be configured to be disposed under the first exchanger 31, and the extension body through hole 421 may be configured to be disposed between the first heat exchanger 31 and the second heat exchanger 32. These configurations are intended to prevent the condensate, which could not move to the drain space 233b through the support body through hole 411, from moving to the second heat exchanger 32 along a flow of air in the connection duct 23.

[0059] A water collection unit 6 configured to store condensate produced during condensation of air passing around the first heat exchanger 31 may be provided at the base 13.

[0060] As shown in FIG. 5, the water collection unit 6 may be disposed at the outside of the circulation flow passage 2. In this case, the water collection unit 6 may be connected to the drain space 233b through a drain port 51 configured to extend through the connection duct 23. It is preferred that the drain flow passage 5 be provided at a bottom surface of the connection duct 23 and be configured to guide condensate to the drain port 51.

[0061] For natural drainage of the condensate (in order to enable the condensate in the drain flow passage to move to the water collection unit by gravity), a bottom surface of the water collection unit 6 may be disposed at a lower level than the drain port 51, and the drain flow passage 5 may be configured to have an inclined surface downwardly inclined toward the drain port 51.

[0062] As shown in FIG. 3, the condensate stored in the water collection unit 6 may be discharged into a drain tank 8 through the drain unit 7. The drain tank 8 may be configured to be disposed at a higher level than the water collection unit 6.

[0063] The drain tank 8 may be configured to include a drawer 81 configured to be withdrawable from the cabinet 1 and to provide a space in which condensate is stored, and a drawer through hole 82 configured to extend through an upper surface of the drawer 81.

[0064] An access port 112 for withdrawal of the drawer 81 may be provided at the front surface 11, and a tank

housing 16 configured to provide a space in which the drawer 81 is accommodated may be provided within the cabinet 1.

[0065] The condensate discharged from the water collection unit 6 through the drain unit 7 may move to the tank housing 16 through a supply tube 72, and the condensate discharged from the supply tube 72 may move to an interior of the drawer 81 through the drawer through hole 82.

[0066] Meanwhile, when the condensate is supplied in an excessive amount to the drawer 81, the condensate present in the drawer 81 may be discharged into the tank housing 16 through the drawer through hole 82. To this end, a recovery tube 72 may be further provided at the drain unit 7. The recovery tube 72 is configured to interconnect a bottom surface of the tank housing 16 and the water collection unit 6 and, as such, to guide the condensate discharged from the drawer 81 to the water collection unit 6.

[0067] As shown in FIG. 5, the water collection unit 6 may be configured to include a storage body 61 provided at the base 13 and configured to store condensate therein, and a cover 62 configured to close an opened upper surface of the storage body 61. The drain port 51 is provided at a circumferential surface of the storage body 61 and, as such, communicates with an interior of the circulation flow passage 2 through the drain port 51.

[0068] A supply port 622 and a recovery port 623 are provided at the cover 62. The supply tube 72 is connected to the supply port 622, and the recovery tube 623 is connected to the recovery port 623.

[0069] In addition, a cover through hole 621 and a chamber 63, in which a drain pump 71 of the drain unit 7 is mounted, are provided at the cover 62. The chamber 63 is fixed to the cover 62 such that the chamber 63 is disposed within the storage body 61. As shown in the drawing, the chamber 63 may be configured to include a chamber body 631 configured to have a cylindrical shape surrounding the cover through hole 621, and a supply body 632 configured to connect an inner space of the chamber body 631 to the supply port 622.

[0070] In this case, the drain pump 71 may be configured to include a drain motor 711 fixed to the cover 62, and an impeller 713 fixed to a rotation shaft 712 of the drain motor 711 and disposed within the chamber body 631.

[0071] A chamber inlet 633 is provided at a bottom surface of the chamber body 631 and, as such, condensate present in the storage body 61 is introduced into the chamber body 631 and is then moved to the supply port 622 through the supply body 632 during rotation of the impeller 713. The condensate moving to the supply port 622 may then move to the drain tank 8 through the supply tube 72.

[0072] The recovery port 623 extends through the cover 62 to communicate with the storage body 61 and, as such, the condensate discharged from the drain tank 8 may move to the storage body 61 through the

recovery tube 73 and the recovery port 623.

[0073] The laundry treatment apparatus having the above-described structure inevitably encounters a phenomenon in which condensate remains within the storage body 61 because a space should be maintained between the chamber inlet 633 and a bottom surface of the storage body 61. The phenomenon in which condensate remains within the storage body 61 may become a factor making it difficult to hygienically manage the storage body 61, the heat exchange unit 3, and the drum 17.

[0074] In order to minimize problems caused by residual condensate in the water collection unit 6, the laundry treatment apparatus 100 may further include a condensate removal unit 9.

[0075] It is preferred that the condensate removal unit 9 be configured to include at least one of a heating unit 91 configured to heat water present in the water collection unit 6 or an exhaust unit 92 configured to exhaust air present in the water collection unit 6 to the outside of the water collection unit 6. FIG. 5 shows, as an example, the case in which both the heating unit 91 and the exhaust unit 92 are provided.

[0076] The storage body 61 is provided with a body through hole 611 extending through a bottom surface of the storage body 61. The heating unit 91 may be configured to include a heating body 911 constituted by a conductor to close the body through hole 611, and a heater 912 configured to heat the heating body 911 and disposed outside the water collection unit 6.

[0077] The heating body 911 is configured to form the bottom surface of the storage body 61 and, as such, may completely evaporate condensate present in the storage body 61 during operation of the heater 912.

[0078] The exhaust unit 92 may be configured to discharge vapors present in the water collection unit 6 into the inside of the cabinet 1 or the outside of the cabinet 1. The drawing shows, as an example, the exhaust unit 92 configured to discharge vapors into the inside of the cabinet 1.

[0079] The exhaust unit 92 may be configured to include an exhaust duct 912 having an inlet fixed to an exhaust port 624 of the cover (a hole configured to extend through the cover) and an outlet disposed within the cabinet 1, and an exhaust fan 922 configured to move air present in the storage body 61 to the exhaust duct 921.

[0080] Under the condition that the exhaust duct 912 is always maintained in an opened state, a part of air emerging from the first heat exchanger 31 may be discharged through the water collection unit 6 and the exhaust duct 921 when the heat exchange unit 3 operates to dry laundry loaded in the drum 17. To this end, a valve 923 configured to control opening and closing of the exhaust duct 921 may be further provided at the exhaust unit 92.

[0081] The valve 923 may be configured to include a valve body 924 having a shape capable of opening and closing the exhaust duct 921 or the exhaust port 624, and a valve motor 925 configured to control a rotation angle of the valve body 924.

[0082] The valve body 924 may be rotatably mounted to the exhaust duct 921 or may be rotatably mounted to the cover 62. FIG. 7 shows, as an example, a state in which the valve body 924 provided at the exhaust duct 921 opens the exhaust duct 921.

[0083] When a drying procedure for drying of laundry or a sterilization procedure for sterilization of the drum or the heat exchangers is executed, condensate is stored in the storage body 61. The condensate in the storage body 61 is discharged into the drain tank 8 through the supply port 622 during rotation of the impeller 713. The condensate remaining in the storage body 61 after rotation of the impeller 713 is stopped may be removed through operation of the heater 912 and the exhaust fan 922 in an opened state of the exhaust duct 921.

[0084] FIG. 8 shows another embodiment of the heating unit 91. The heating unit 91 according to this embodiment is characterized by including a film heater 914 (or a plate heater) configured to heat the bottom surface of the storage body 61.

[0085] The film heater 914 may be configured to include a fixed plate 915 fixed to the bottom surface of the storage body 61 and disposed outside the water collection unit 6, and a heater 916 embedded in the fixed plate 915. In the embodiment of FIG. 8, there is no problem even when the body through hole 611 is not provided at the bottom surface of the storage body 61.

[0086] In order to reduce the time taken to remove the condensate in the water collection unit 6, an actuator 93 may be further provided within the water collection unit 6. The actuator 93 may be constituted by an impeller (a water collection unit impeller) provided at the bottom surface of the storage body 61 and configured to be rotated by a motor (disposed outside the water collection unit), an ultrasonic generator provided within the storage body 61, or the like.

[0087] FIG. 9 and FIG. 10 show examples of control methods for the laundry treatment apparatus 100 as described above.

[0088] In the laundry treatment apparatus 100 as described above, the drain port 51 is disposed between the first heat exchanger 31 and the second heat exchanger 32, and the circulation fan 36 is disposed at the rear side of the second heat exchanger 32 (between the second heat exchanger and the second duct). Accordingly, FIG. 9 and FIG. 10 relate to control methods for preventing an operation time of the circulation fan 36 and an operation time of the exhaust fan 922 from overlapping each other, because a negative pressure (a minus pressure) may be generated in the water collection unit 6 when the circulation fan 36 operates.

[0089] The control method of FIG. 9 relates to sterilization of sterilizing the drum by supplying heated air to the drum and is characterized in that a procedure for removing condensate present in the water collection unit 6 (first residual water removal) is executed before start of the sterilization.

[0090] The first residual water removal may be config-

ured to include exhaustion of exhausting air present in the water collection unit 6 through the exhaust unit 92, and heating of heating condensate present in the water collection unit 6 by the heater 91.

5 **[0091]** The exhaustion may include opening the exhaust duct 921 by the valve 923, and exhausting air present in the water collection unit 6 through operation of the exhaust fan 922.

10 **[0092]** The heating is a procedure for supplying heat energy to the water collection unit 6 by the heating unit 91. The heating may start simultaneously with start of the exhaustion or may start during execution of the exhaustion or before execution of the exhaustion. It is preferred that, in the heating, the heating unit 91 continuously
15 operate for a predetermined first reference time (reduction in the execution time of the first residual water removal).

[0093] When the first residual water removal ends, the control method executes the sterilization. The sterilization
20 may be configured to include supplying high-temperature dry air to the drum 17 for a predetermined time through operation of the heat exchange unit 3.

[0094] After the sterilization ends, the control method may execute second residual water removal of removing
25 condensate produced in the sterilization. The second residual water removal may be configured to include operating the circulation fan 36 of the heat exchange unit 3 and the heating unit 91 of the condensate removal unit 9 in a closed state of the exhaust duct 921.

30 **[0095]** The second residual water removal is characterized by operating the circulation fan 36, rather than the exhaust fan 922. When the circulation fan 36 operates, without operation of the compressor 34, it may be possible to not only cool the drum 17, but also to move air of
35 the water collection unit 6 to the circulation flow passage 2. Accordingly, when the heating unit 91 operates during operation of the circulation fan 36, it may be possible to remove the condensate of the water collection unit 6. The heating unit 91 may be configured to repeat operation and stop thereof for a predetermined second reference
40 time in the second residual water removal.

[0096] The control method of FIG. 9 may prevent or minimize residual condensate in the water collection unit because the control method is executed before the sterilization starts or after the sterilization ends.
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[0097] The control method of FIG. 10 is characterized in that the control method is constituted by drying and residual water removal (third residual water removal).

50 **[0098]** The drying is a procedure for supplying air to the interior of the drum 17 through operation of the compressor 34 and the circulation fan 36, and the third residual water removal is a procedure for evaporating condensate present in the water collection unit 6 through operation of the exhaust unit 92 and the heating unit 91.

55 **[0099]** The third residual water removal may be configured to include opening the exhaust duct 921 by the valve 923 after the drying ends, exhausting air of the water collection unit 6 through operation of the exhaust

fan 922, and supplying heat energy to the interior of the water collection unit 6 through operation of the heating unit 91.

[0100] The third residual water removal may be divided into a first period in which the heating unit 91 operates continuously, and a second period in which the heating unit 91 repeats operation and stop thereof after the first period ends. In this case, the first period is configured to start when the exhaust unit 92 operates (when the valve and the exhaust fan operate), and the second period is configured to end when operation of the exhaust unit ends (when operation of the valve and the exhaust fan ends).

[0101] Since the residual water removal of FIG. 10 is executed for a predetermined time after the drying ends, it may be possible to prevent or minimize residual condensate in the water collection unit.

[0102] FIG. 11 shows another embodiment of the laundry treatment apparatus. In the laundry treatment apparatus according to this embodiment, the circulation fan 36 is disposed between the inlet of the first duct 21 (the drum exhaust hole 143) and the first heat exchanger 31.

[0103] In this embodiment, the drain port 51, which supplies condensate to the water collection unit 6, is disposed between the first heat exchanger 31 and the second heat exchanger 32, and the circulation fan 36 is disposed upstream of the first heat exchanger 31. Accordingly, when the circulation fan 36 operates, the internal pressure of the water collection unit 6 may rise. FIG. 12 and FIG. 13 relate to control methods for the laundry treatment apparatus of FIG. 11. The control methods of FIG. 12 and FIG. 13 are characterized in that the operation time of the circulation fan 36 and the operation time of the exhaust fan 922 overlap each other.

[0104] The control method of FIG. 12 is characterized in that sterilization and residual water removal are simultaneously executed.

[0105] The sterilization of FIG. 12 is a procedure for sterilizing the drum by supplying, to the drum, high-temperature dry air (air having a higher temperature than room temperature while having a lower humidity than the humidity of a space in which the laundry treatment apparatus is installed) through operation of the heat exchange unit 3. The sterilization is executed through operation of the heat exchange unit 3. In this case, the sterilization may be configured to include a procedure for operating only the compressor 34 and the circulation fan 36 or may be configured to include a procedure for operating the compressor 34, the circulation fan 36, and the control valve 35.

[0106] In the control method of FIG. 12, the residual water removal is executed during execution of the sterilization. The residual water removal may be configured to include operating the exhaust unit 92 and operating the heating unit 91.

[0107] The operating the exhaust unit 92 may be configured to include opening the exhaust duct 921 by the valve 923, and operating the exhaust fan 922. The oper-

ating the heating unit 91 may be configured to include a first period in which the heating unit 91 operates continuously, a second period in which the heating unit 91 repeats operation and stop thereof, and a third period in which the heating unit 91 repeats operation and stop thereof (the third period having a shorter repetition interval than the repetition interval set in the second period).

[0108] In the sterilization, operation of the compressor 34 ends before operation of the circulation fan 36 ends. The second period may be configured to end at a time when operation of the compressor 34 ends, and the third period may be configured to end at a time when operation of the circulation fan 36 ends. Meanwhile, the operating the exhaust unit 92 in the residual water removal (operating the valve 923 and the exhaust fan 922) may be configured to end at the time when operation of the circulation fan 36 ends.

[0109] Since the residual water removal of FIG. 12 is executed for a predetermined time after operation of the compressor 34 ends, it may be possible to prevent or minimize residual condensate in the water collection unit.

[0110] The control method of FIG. 13 is characterized in that residual water removal is executed during execution of drying.

[0111] The drying of FIG. 13 is a procedure for removing moisture from laundry in the drum by supplying high-temperature dry air to the drum through operation of the heat exchange unit 3.

[0112] The residual water removal of FIG. 13 is configured to include operating the exhaust unit 92, and operating the heating unit 91, and starts during execution of the drying. The operating the exhaust unit 92 may be configured to include opening the exhaust duct 921 by the valve 923, and exhausting air from the water collection unit 6 by the exhaust fan 922. The operating the heating unit 91 may be configured to include a first period in which the heating unit 91 operates continuously, and a second period in which the heating unit 92 repeats operation and stop thereof (on-off control of the heating unit).

[0113] Since the residual water removal of FIG. 13 is configured to be executed for a predetermined time after the drying ends, the control method of FIG. 13 may prevent or minimize residual condensate in the water collection unit after ending of the drying.

[0114] The structure and the control method of the laundry treatment apparatus as described above have been described as an example of the present disclosure. Accordingly, the scope of the present disclosure is not limited to the above-described structure and control method.

Claims

1. A laundry treatment apparatus comprising:

a drum configured to provide a space for accommodating an object to be dried therein;

a circulation flow passage configured to again supply, to the drum, air discharged from the drum;
 a heat exchange unit comprising a circulation fan configured to move air along the circulation flow passage, a first heat exchanger configured to dehumidify air moving along the circulation flow passage, and a second heat exchanger configured to heat air emerging from the first heat exchanger;
 a water collection unit connected to the circulation flow passage and to store condensate released from air passing around the first heat exchanger;
 a heating unit configured to heat water present in the water collection unit; and
 an exhaust unit configured to outwardly discharge, from the water collection unit, air present in the water collection unit.

2. The laundry treatment apparatus according to claim 1, wherein:

the water collection unit comprises a storage body configured to store the condensate released from the air passing around the first heat exchanger, a cover configured to form an upper surface of the storage body, and a body through hole extending through a bottom surface of the storage body; and
 the heating unit comprises a heating body constituted by a conductor to close the body through hole, and a heater configured to heat the heating body and disposed outside the water collection unit.

3. The laundry treatment apparatus according to claim 2, wherein the heating body is configured to form the bottom surface of the storage body.

4. The laundry treatment apparatus according to claim 2, wherein the exhaust unit comprises an exhaust duct extending through the cover to communicate with an interior of the storage body, an exhaust fan provided at the exhaust duct to discharge air present in the storage body, and a valve configured to control opening and closing of the exhaust duct.

5. The laundry treatment apparatus according to claim 4, further comprising:

an exhaust port configured to extend through the cover and configured for one end of the exhaust duct to be fixed thereto,
 wherein the valve comprises a valve body rotatably mounted to the exhaust duct or the cover and configured to open and close the exhaust port, and a valve motor configured to control a

rotation angle of the valve body.

6. The laundry treatment apparatus according to claim 2, wherein the heating unit comprises a film heater fixed to the bottom surface of the storage body and disposed outside the water collection unit.

7. The laundry treatment apparatus according to claim 6, wherein the film heater comprises a fixed plate fixed to the bottom surface of the storage body and disposed outside the water collection unit, and a heater embedded in the fixed plate.

8. The laundry treatment apparatus according to claim 1, further comprising:
 an actuator configured to form a flow of water in the water collection unit or to vibrate condensate stored in the water collection unit.

9. The laundry treatment apparatus according to any one of claims 1 to 8, further comprising:

a drain tank configured to be disposed at a higher level than the water collection unit and to provide a space for storing condensate therein; and

a drain unit comprising a drain pump configured to move the condensate present in the storage body to an outside of the storage body, and a drain tube configured to guide the condensate discharged from the drain pump to the drain tank.

10. A control method for a laundry treatment apparatus comprising a drum configured to provide a space for accommodating an object to be dried therein, a circulation flow passage configured to again supply, to the drum, air discharged from the drum, a heat exchange unit comprising a circulation fan configured to move air along the circulation flow passage, a compressor configured to move refrigerant along a refrigerant tube, a first heat exchanger fixed to the refrigerant tube and configured to dehumidify air moving along the circulation flow passage, and a second heat exchanger fixed to the refrigerant tube and configured to heat air emerging from the first heat exchanger, a water collection unit configured to store condensate released from air passing around the first exchanger, a heating unit configured to heat water present in the water collection unit, and an exhaust unit configured to outwardly discharge, from the water collection unit, air present in the water collection unit, the control method comprising:

exhaustion of exhausting the air present in the water collection unit through the exhaust unit;
 heating of heating condensate present in the water collection unit; and

sterilization of supplying heated air to the drum through operation of the compressor and the circulation fan after ending of the exhaustion and the heating.

operation and stop thereof after ending of the first period.

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11. The control method according to claim 10, wherein the heating starts simultaneously with start of the exhaustion, during execution of the exhaustion or before execution of the exhaustion.

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12. The control method according to claim 10, further comprising:
residual water removal of operating the circulation fan and the heating unit after ending of the sterilization.

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13. The control method according to claim 12 wherein:

the heating unit operates continuously for a predetermined first reference time in the heating; and
the heating unit repeats operation and stop thereof for a predetermined second reference time in the residual water removal.

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14. A control method for a laundry treatment apparatus comprising a drum configured to provide a space for accommodating an object to be dried therein, a circulation flow passage configured to again supply, to the drum, air discharged from the drum, a heat exchange unit comprising a circulation fan configured to move air along the circulation flow passage, a compressor configured to move refrigerant along a refrigerant tube, a first heat exchanger fixed to the refrigerant tube and configured to dehumidify air moving along the circulation flow passage, and a second heat exchanger fixed to the refrigerant tube and configured to heat air emerging from the first heat exchanger, a water collection unit configured to store condensate released from air passing around the first exchanger, a heating unit configured to heat water present in the water collection unit, and an exhaust unit configured to outwardly discharge, from the water collection unit, air present in the water collection unit, the control method comprising:

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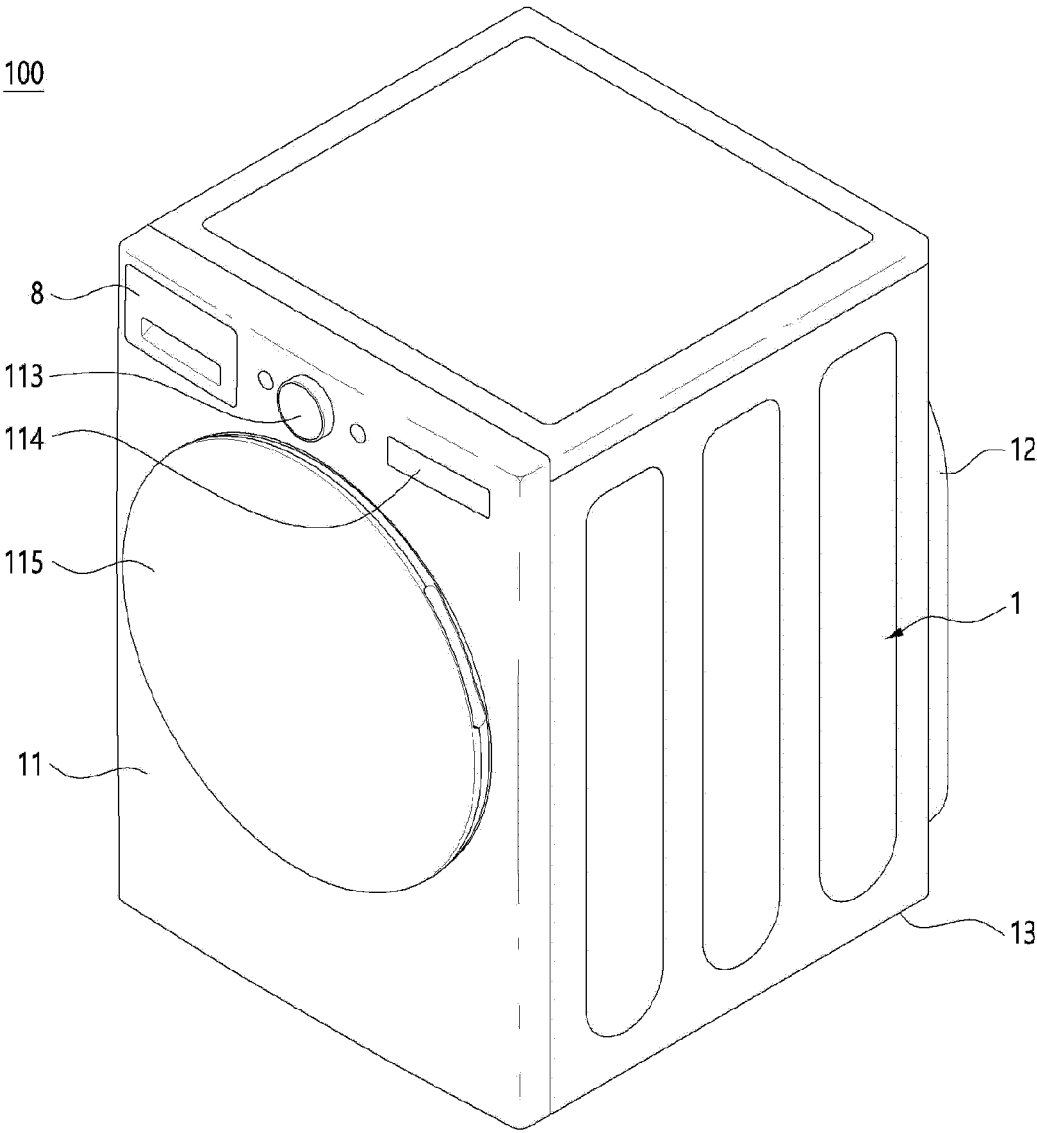
drying of supplying air to an interior of the drum through operation of the compressor and the circulation fan; and
residual water removal of evaporating condensate present in the water collection unit through operation of the exhaust unit and the heating unit after ending of the drying.

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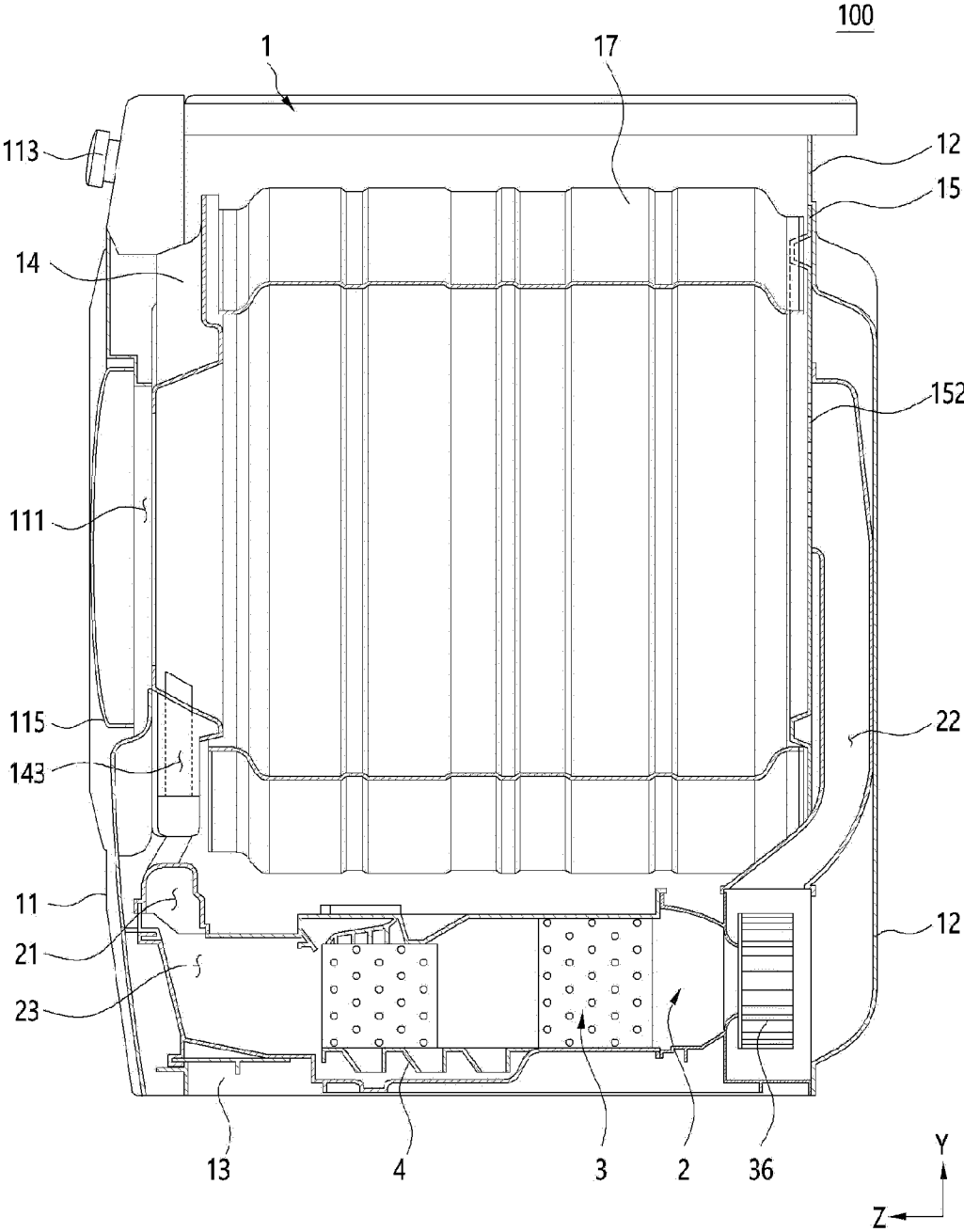
15. The control method according to claim 14, wherein the residual water removal comprises a first period in which the heating unit operates continuously, and a second period in which the heating unit repeats

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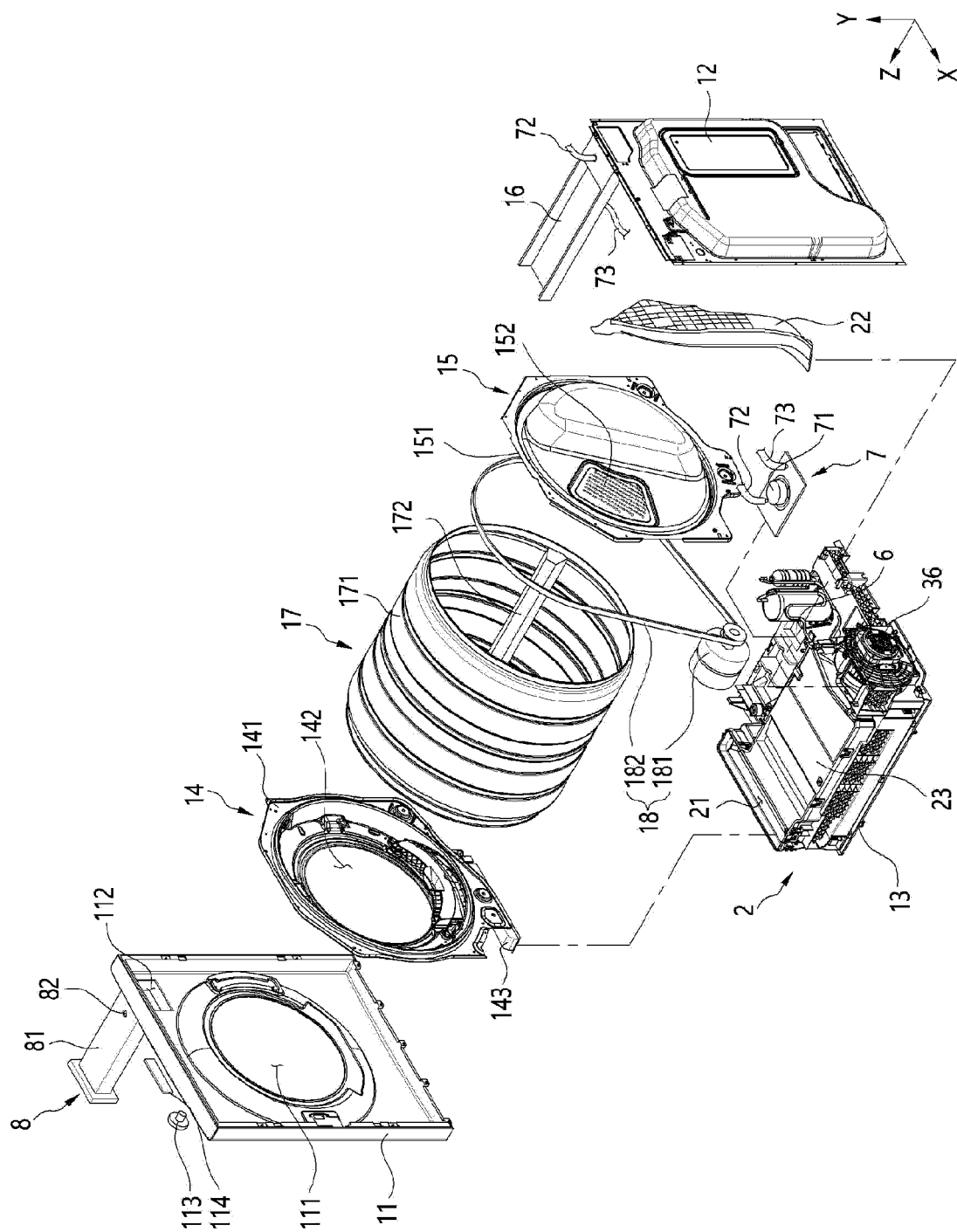
【Fig. 1】



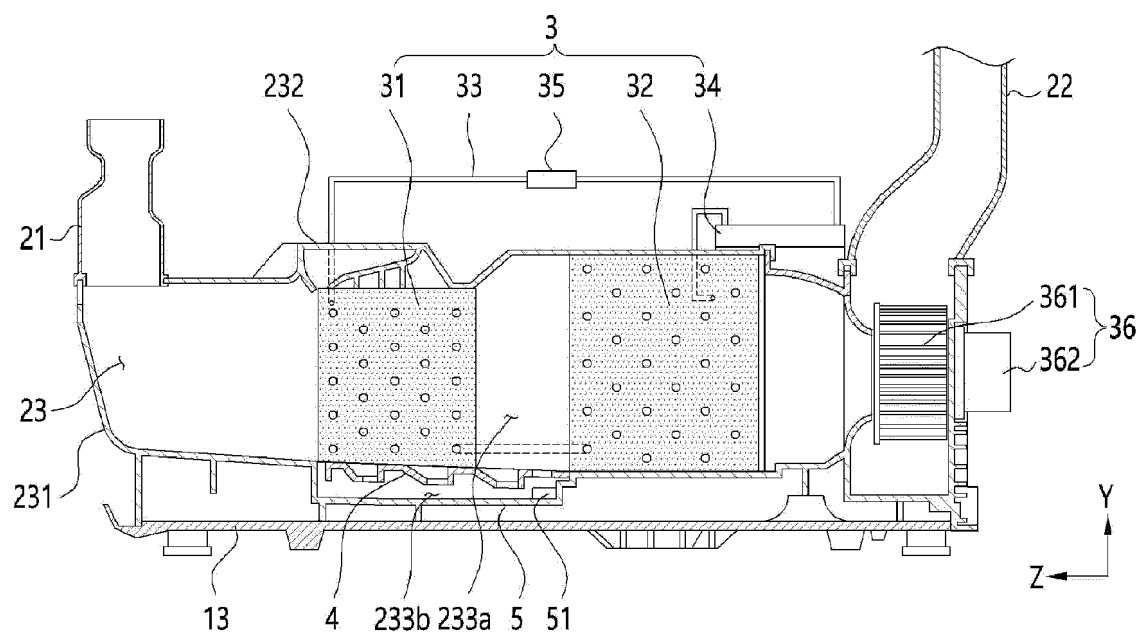
【Fig. 2】



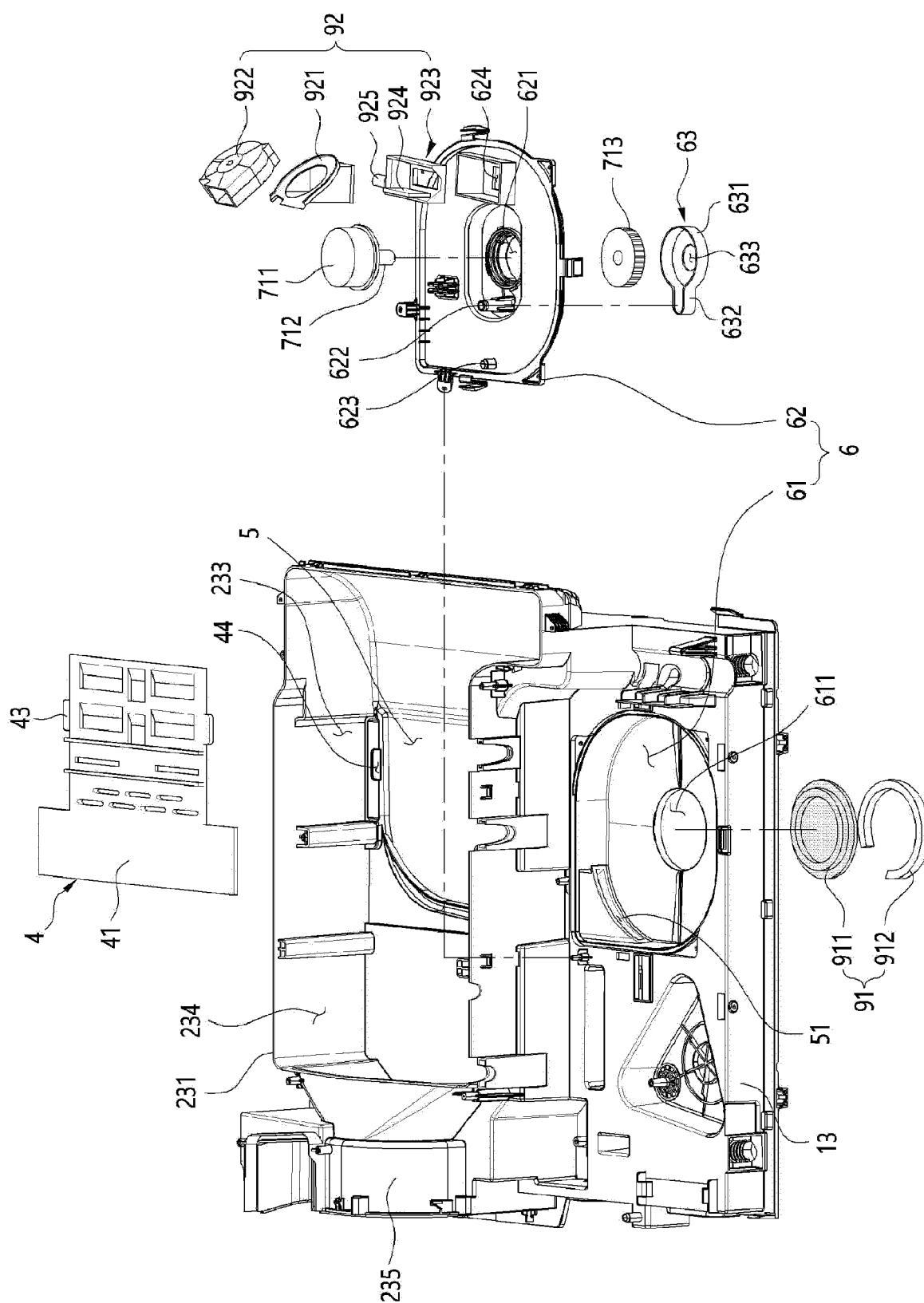
【Fig. 3】



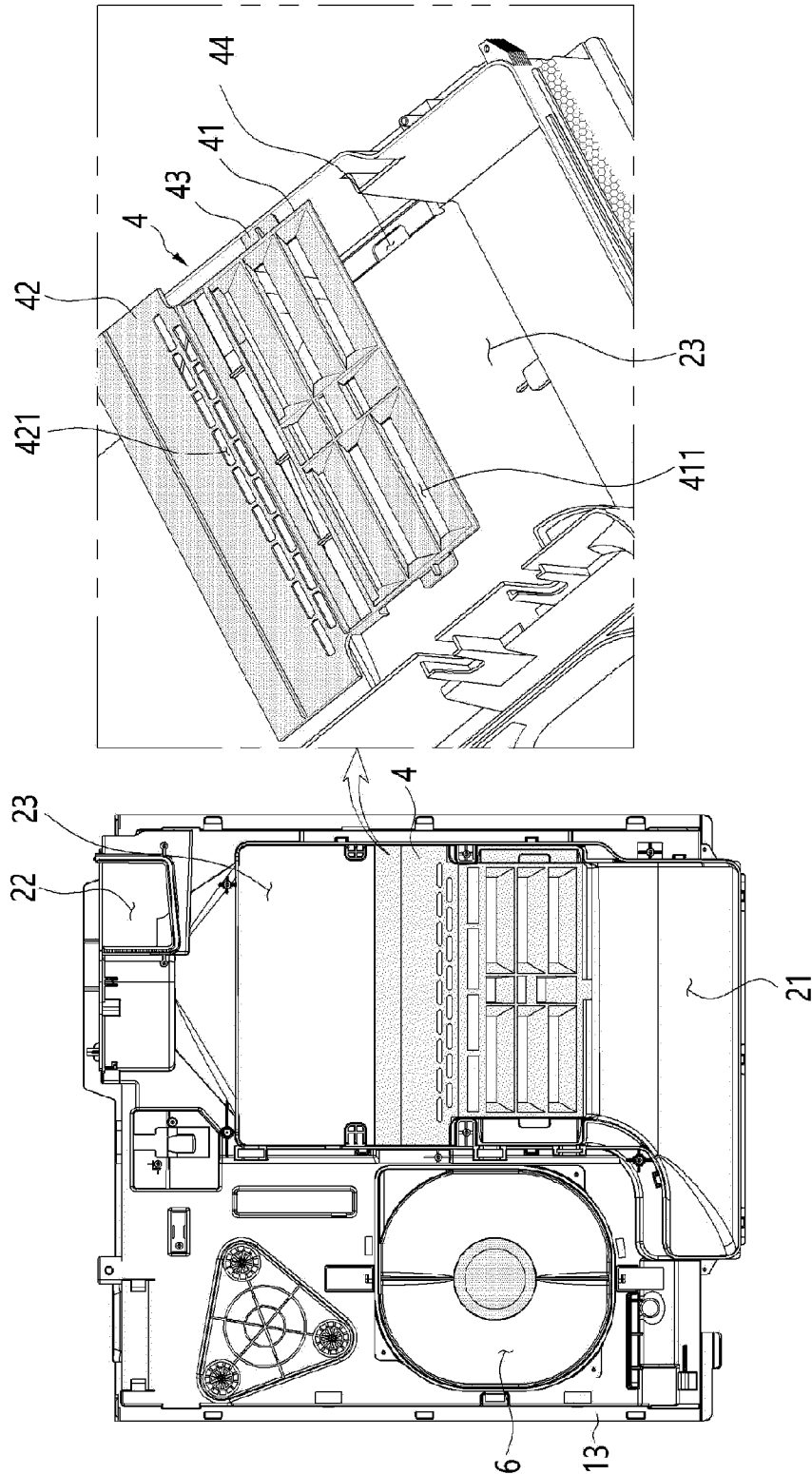
【Fig. 4】



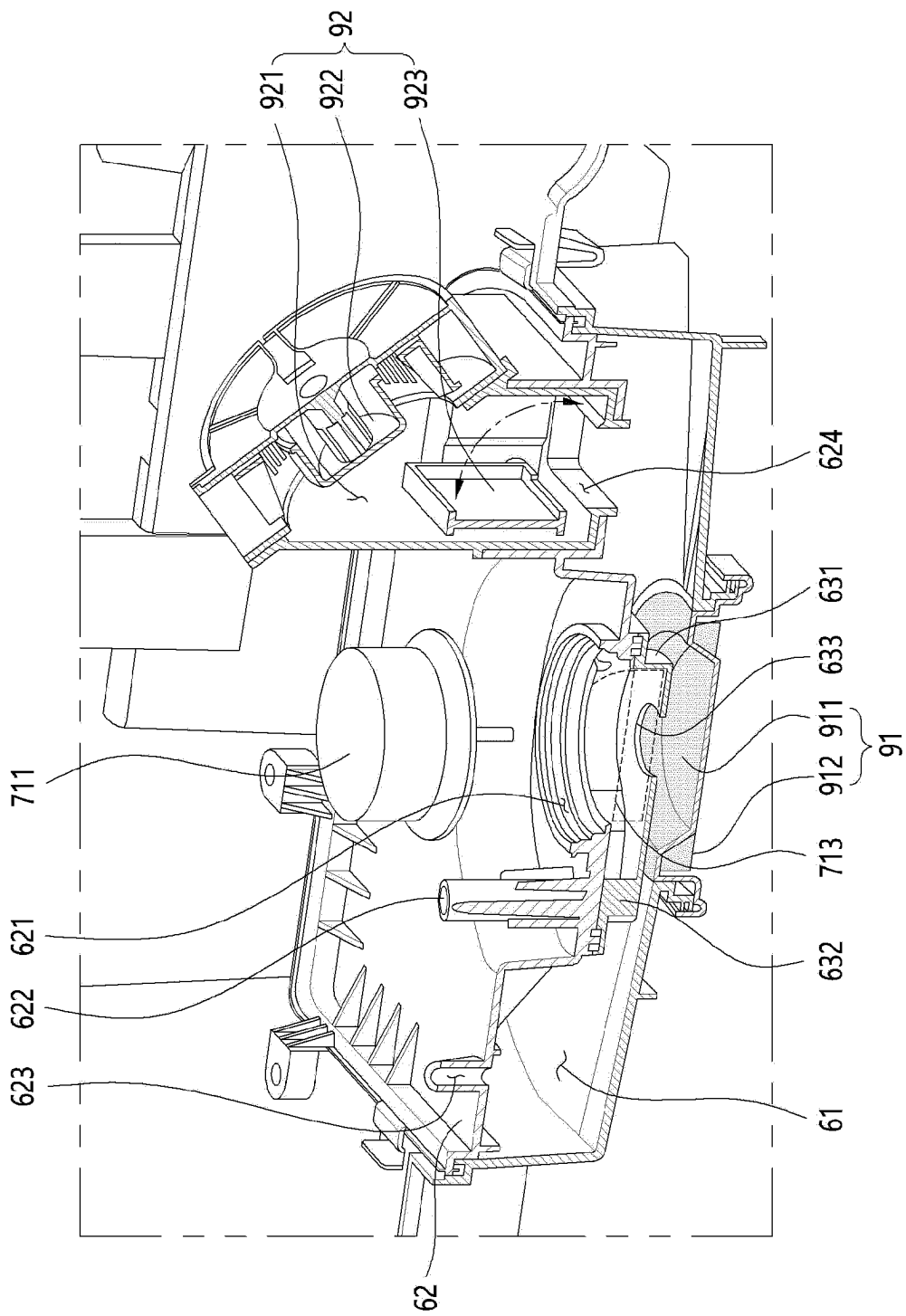
【Fig. 5】



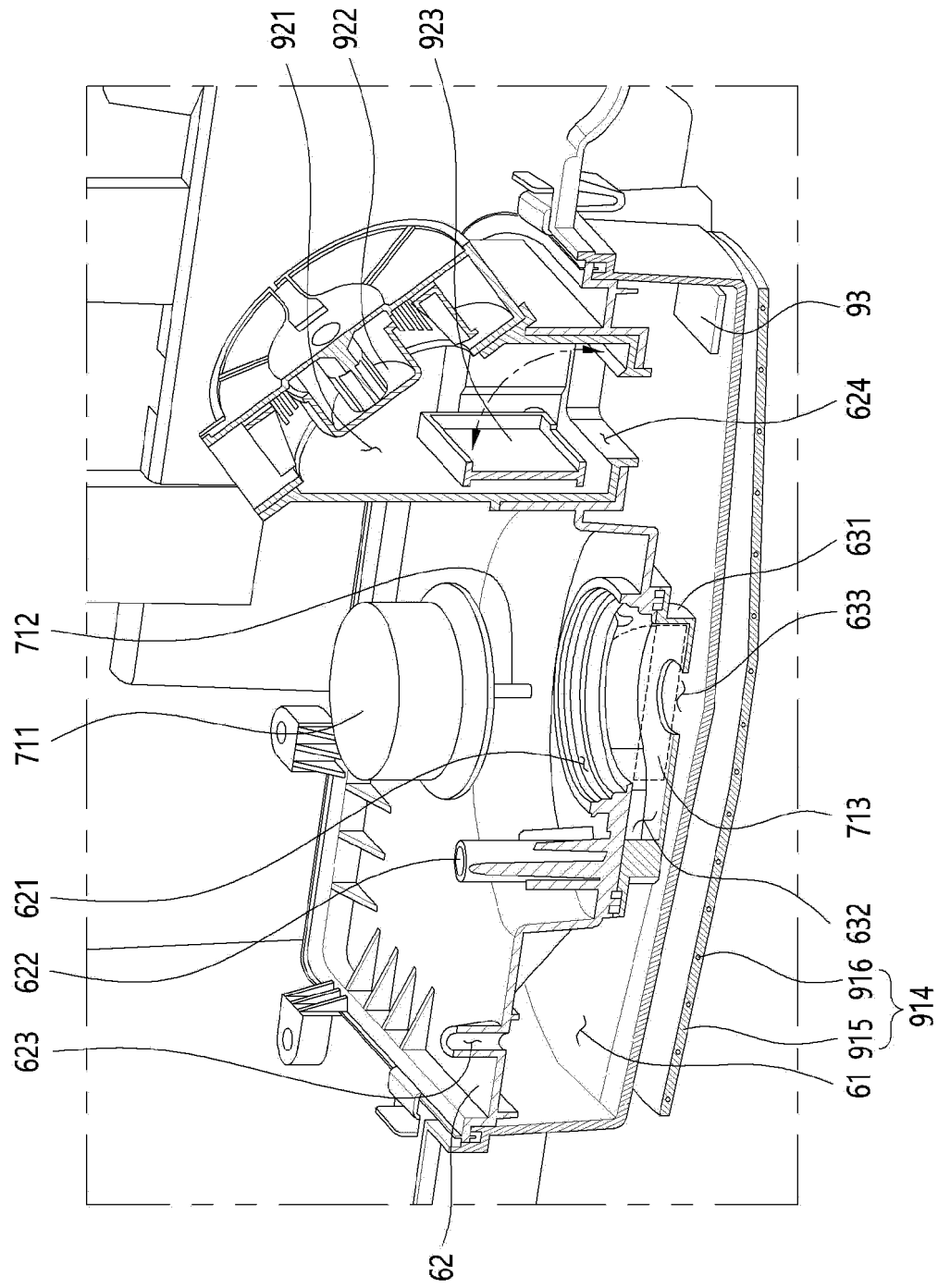
【Fig. 6】



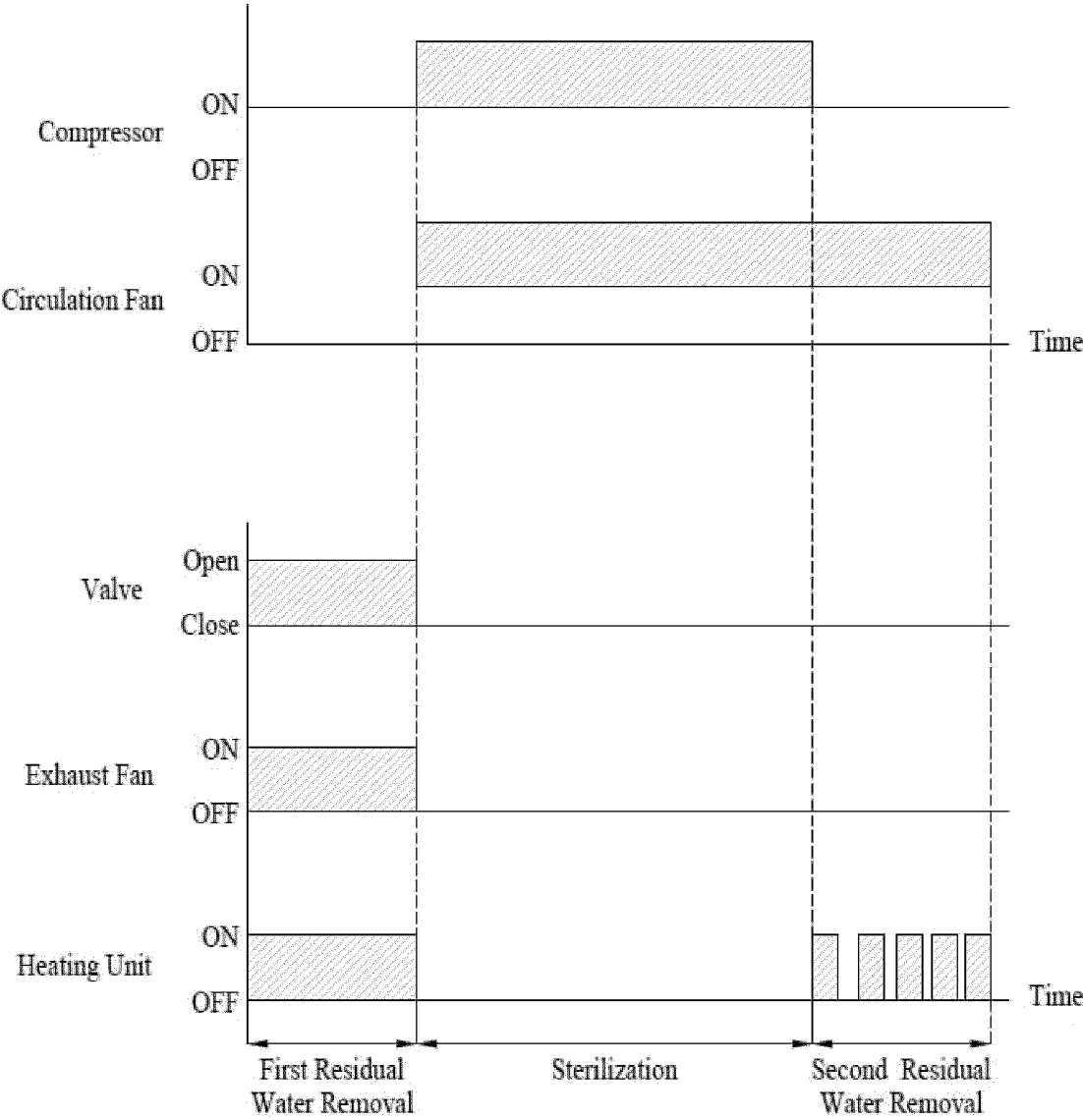
【Fig. 7】



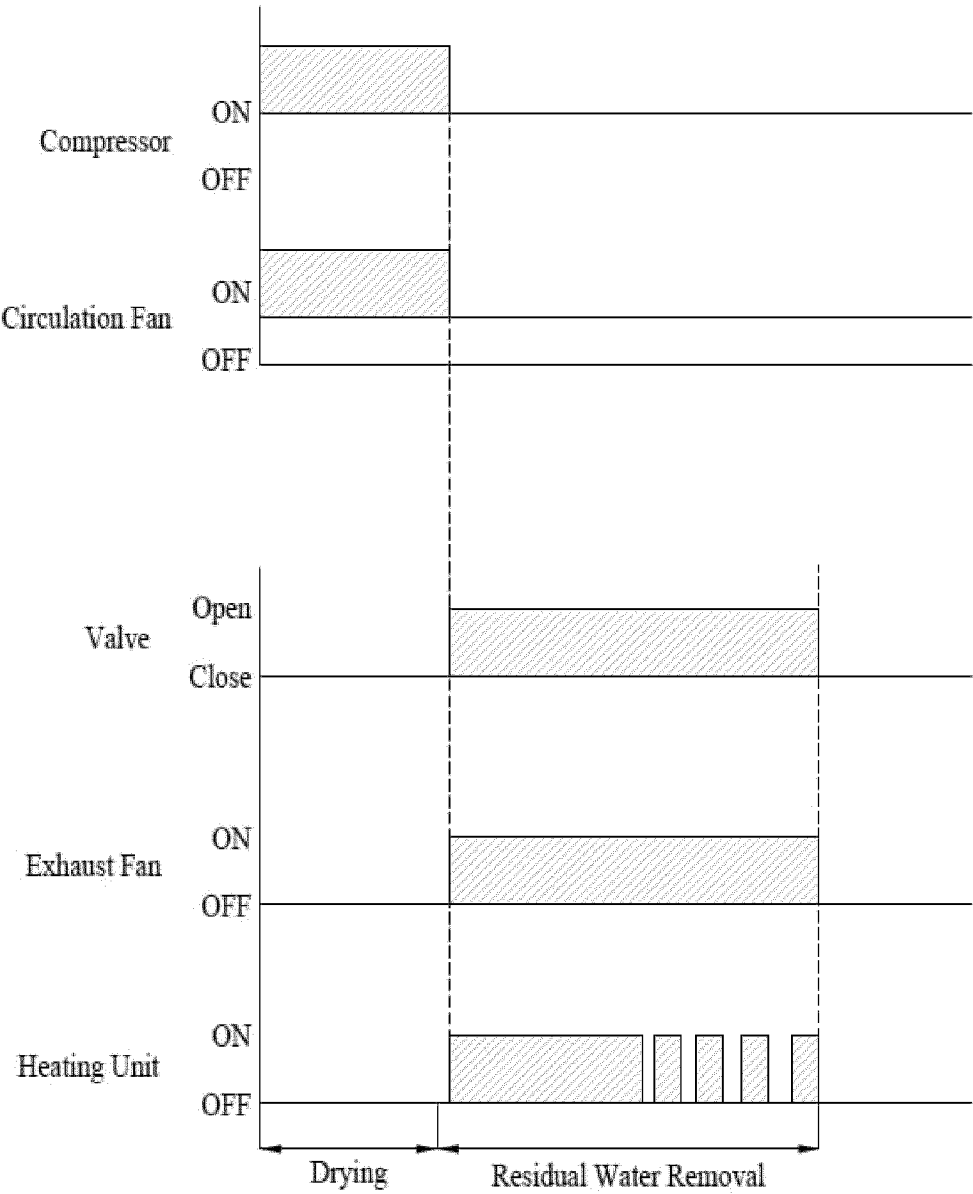
【Fig. 8】



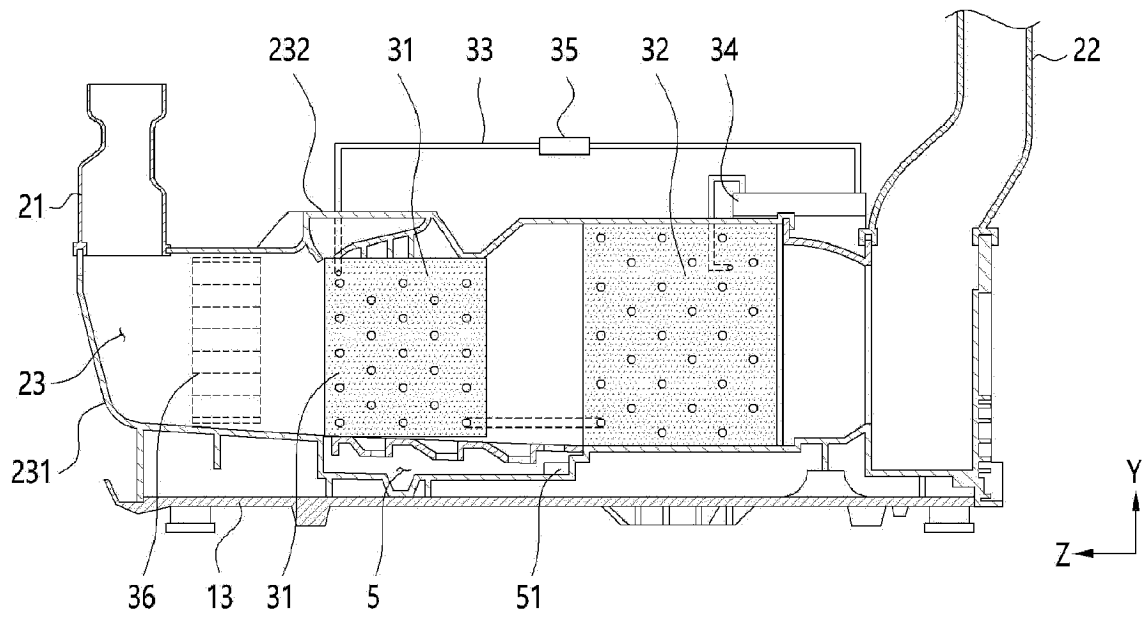
【Fig. 9】



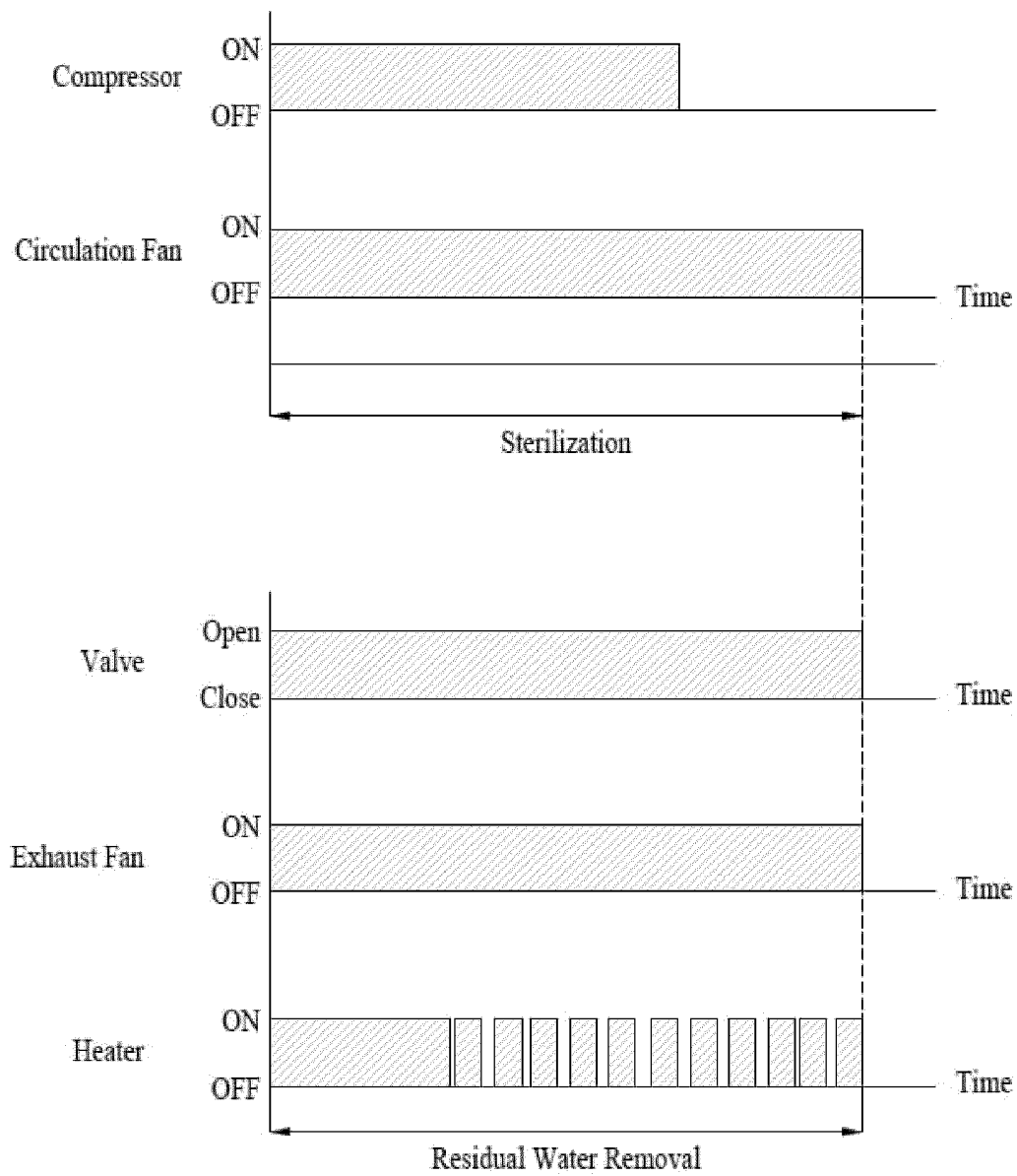
【Fig. 10】



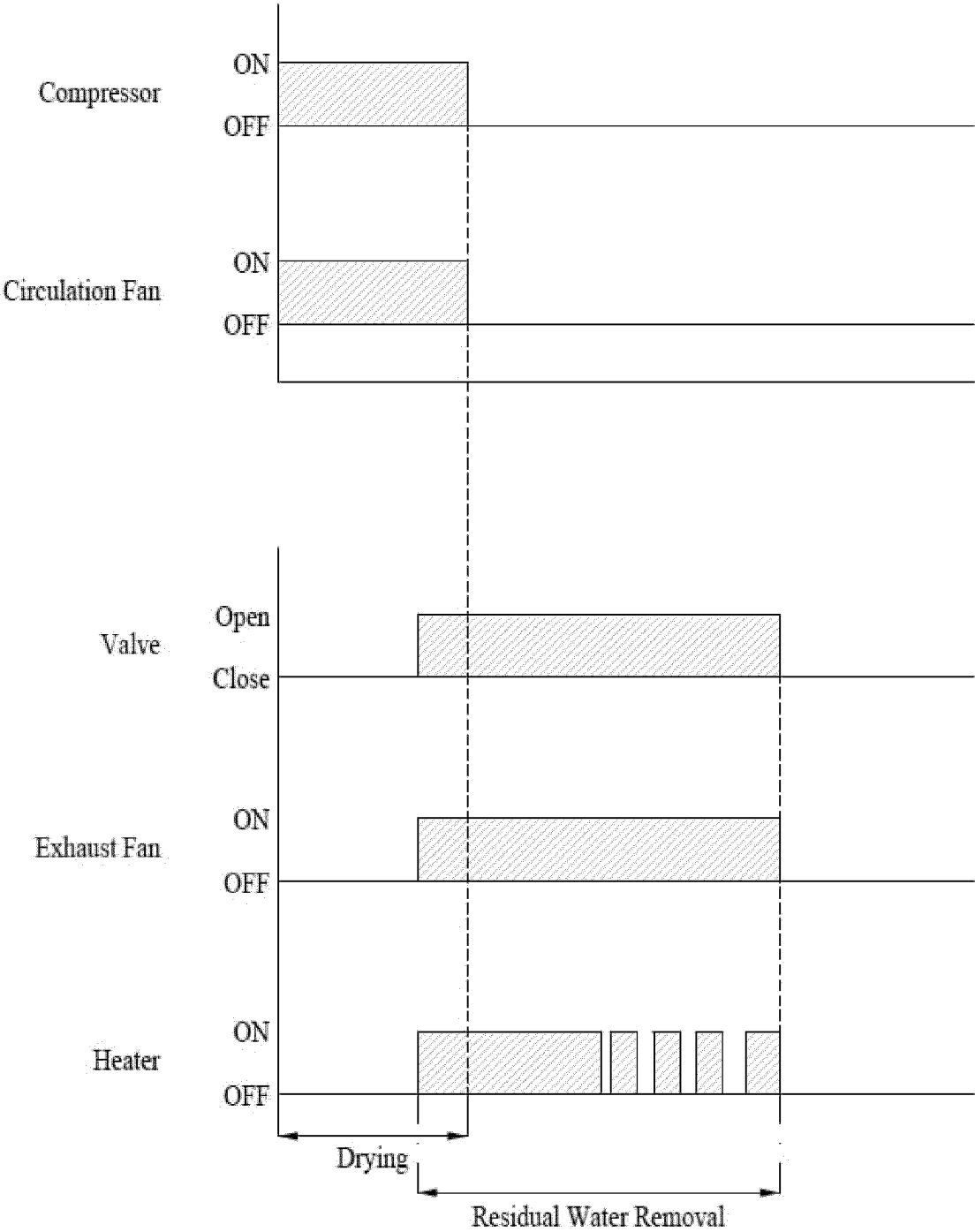
【Fig. 11】



【Fig. 12】



【Fig. 13】



INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR2023/010813

A. CLASSIFICATION OF SUBJECT MATTER

D06F 58/26(2006.01)i; D06F 58/20(2006.01)i; D06F 58/24(2006.01)i; D06F 58/38(2020.01)i; D06F 58/45(2020.01)i;
D06F 33/69(2020.01)i; D06F 105/28(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 58/26(2006.01); A47L 15/42(2006.01); A47L 15/44(2006.01); D06F 33/69(2020.01); D06F 58/10(2006.01);
D06F 58/24(2006.01); D06F 58/45(2020.01); F24F 1/00(2011.01); F24F 13/22(2006.01); F26B 25/04(2006.01);
F26B 9/08(2006.01)

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 device), 응축수(condensed water), 공기(air), 밸브
(valve), 가열(heating), 살균(sterilization)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	KR 10-2009-0013983 A (LG ELECTRONICS INC.) 06 February 2009 (2009-02-06) See paragraphs [0006]-[0039], claims 1-13 and figures 1-5.	1-15
Y	KR 20-0442556 Y1 (WEL TEM CO., LTD.) 19 November 2008 (2008-11-19) See paragraphs [0009]-[0041], claims 1-5 and figures 1-3.	1-15
Y	KR 10-2021-0112168 A (LG ELECTRONICS INC.) 14 September 2021 (2021-09-14) See paragraphs [0011]-[0247], claims 1-20 and figures 1-4.	1-15
Y	KR 10-2022-0102479 A (LG ELECTRONICS INC.) 20 July 2022 (2022-07-20) See paragraphs [0010]-[0094], claims 1-11 and figures 1-5.	8
A	KR 10-2010-0096736 A (JANG, Dong Yeon) 02 September 2010 (2010-09-02) See paragraphs [0005]-[0043], claims 1-5 and figures 1-5.	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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“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

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Date of the actual completion of the international search

13 November 2023

Date of mailing of the international search report

13 November 2023

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/KR2023/010813

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