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(71) Applicant: **Panasonic Corporation**
Kadoma-shi
Osaka 571-8501 (JP)

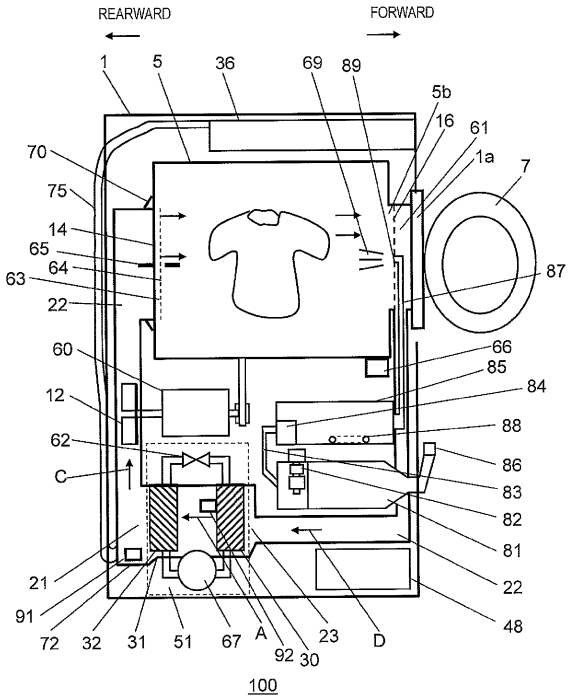
(72) Inventors:
- **Komatsu, Takashi**
  Osaka-shi
  Osaka, 540-6207 (JP)
- **Katsuki, Jungo**
  Osaka-shi
  Osaka, 540-6207 (JP)
- **Ganse, Nobuyuki**
  Osaka-shi
  Osaka, 540-6207 (JP)

(74) Representative: **Schwabe - Sandmair - Marx**
Patentanwälte
Stuntzstraße 16
81677 München (DE)

(54) Laundry dryer

(57) A laundry dryer (100) includes a rotary drum (5) that accommodates laundry; a heating unit (32) that heats circulating air supplied into the rotary drum (5); an air supplying fan (12) for supplying the circulating air into the rotary drum (5); and a motor that drives the air supplying fan (12). The laundry dryer (100) also includes a dehumidification unit (30) that condenses and separates moisture from the circulating air which is discharged from the rotary drum (5); a steam generator (85) that generates steam; and a steam supplying port (89) that supplies the steam into the rotary drum (5). A control unit (48) is configured to perform an air supplying process in which the motor is operated to supply the circulating air into the rotary drum (5) between a steaming process in which the steam generator (85) is operated to supply the steam into the rotary drum (5) and a drying process in which the heating unit (32) and the dehumidification unit (30) are operated to dry the laundry inside the rotary drum (5).

FIG. 1



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Description

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

[0001] The present invention relates to a laundry dryer for drying laundry or bedding.

BACKGROUND ART

[0002] As a laundry dryer in the related art, a drying apparatus is known which includes a heat pump unit (for example, refer to Japanese Patent Unexamined Publication No. 2005-318917).

[0003] Fig. 5 is a cross-sectional view schematically illustrating an internal configuration of laundry dryer 200 in the related art in a side view.

[0004] Laundry dryer 200 includes substantially rectangular parallelepiped housing 101. Substantially cylindrical rotary drum 105 which accommodates laundry is rotatably disposed inside housing 101. Rotary drum 105 is driven to rotate by motor 160. Rotary drum 105 is rotatably supported by rotation support shaft 165 disposed in bottom portion 163 and rotation support roller 166 disposed in a front lower portion of rotary drum 105.

[0005] On a front surface of housing 101, housing opening 101a through which the laundry is loaded and unloaded, and door 107 which opens and closes the opening are disposed. In a front surface side of rotary drum 105, opening 105b is disposed in the similar manner.

[0006] Air supplying fan 112 sucks air inside rotary drum 105 through air discharge port 116 which is disposed in front of rotary drum 105, passes the air through filter 161 which collects the lint generated from the laundry, blows the air into circulation duct 122 and introduces the air to heater case inlet 123 as indicated by arrow d. Air supplying fan 112 blows the air discharged from heater case outlet 121 in a direction of arrow c and supplies the air from air supply port 114 into rotary drum 105.

[0007] Air vent 164 is disposed in bottom portion 163 of rotary drum 105. Air vent 164 is formed to have a plurality of small holes. The air which is circulated via rotary drum 105 in this manner is referred to as circulating air. The circulating air has a function to promote drying of the laundry which is accommodated in rotary drum 105.

[0008] In the lower portion of rotary drum 105, evaporator 130 and condenser 132 which are heat exchangers configuring heat pump unit 151 are disposed. Heater case 131 is disposed so as to allow the circulating air supplied by air supplying fan 112 to flow from evaporator 130 to condenser 132 in the direction arrow a. Compressor 167 is accommodated in the vicinity of evaporator 130 or condenser 132.

[0009] The circulating air supplied by air supplying fan 112 passes through circulation duct 122, passes through evaporator 130 and condenser 132 in heater case 131, and then enters rotary drum 105 from air supply port 114. The circulating air, after passing through the laundry inside rotary drum 105, passes through air discharge port 116, returns to air supplying fan 112 again, and is circulated. Air supplying fan 112 is driven to rotate by motor 160.

[0010] In a lower portion of heater case 131, dehumidification water separated by evaporator 130 is collected. The dehumidification water is supplied to water storage tank 136 using a pump (not illustrated) and is stored in water storage tank 136. Water storage tank 136 is configured to be attachable and detachable so that a user can remove water storage tank 136 to appropriately drain the stored dehumidification water.

[0011] Heat pump unit 151 has a configuration in which compressor 167, condenser 132 radiating heat of a compressed refrigerant, an expansion mechanism (not illustrated) formed of a throttle valve or a capillary tube for reducing a pressure of the high pressure refrigerant, and evaporator 130 in which the decompressed refrigerant having a low pressure removes the heat from a surrounding section are connected to one another so as to circulate the refrigerant. Heat pump unit 151 and motor 160 are controlled by a control unit (not illustrated) disposed inside housing 101.

[0012] Next, an operation of laundry dryer 200 having the above-described configuration will be described.

[0013] In a drying process, compressor 167 of heat pump unit 151 is operated to compress the refrigerant, and this pressure enables the refrigerant to circulate condenser 132, the expansion mechanism and evaporator 130. In condenser 132, heat is radiated by compressing the refrigerant. In evaporator 130, the heat is absorbed by the refrigerant which is decompressed by the expansion mechanism and has a low pressure.

[0014] At this time, operating air supplying fan 112 causes the circulating air heated by radiation of condenser 132 to pass through circulation duct 122, to pass from air supply port 114 through air vent 164 and to be supplied into rotary drum 105. Rotary drum 105 is driven to rotate by motor 160, and the laundry is agitated inside rotary drum 105.

[0015] The circulating air supplied into rotary drum 105 removes moisture from the laundry when passing through a gap in the laundry. The circulating air passes through circulation duct 122 via air discharge port 116 in a humid state and reaches heater case 131. The humid circulating air, when passing through evaporator 130, is dehumidified by removing sensible heat and latent heat so as to be divided into dried circulating air and dehumidification water, respectively. The dried circulating air is re-heated in condenser 132 to become the circulating air.

[0016] The dehumidification water which is condensed in evaporator 130 is supplied by a pump and stored in water storage tank 136. Drying of the laundry proceeds by repeating the above-described operation.

[0017] In such laundry dryer 200, a laundry dryer has

been proposed which includes steam generation device 168 and ejects steam 169 onto the laundry inside rotary drum 105 so as to reduce wrinkles of the laundry (for example, refer to Japanese Patent Unexamined Publication No. 2009-039436).

[0018] In this configuration, steam 169 ejected from steam generation device 168 onto the laundry (not illustrated) inside rotary drum 105 is also discharged and circulated from air discharge port 116 along a flow of the circulating air. However, in an operating process of heat pump unit 151, steam 169 is dehumidified in evaporator 130. Accordingly, when the circulating air subsequently returns from air supply port 114 into rotary drum 105, there is no steam 169 remaining in the circulating air, thereby causing a problem that an effect of steam 169 does not last long.

SUMMARY OF THE INVENTION

[0019] The present invention is made in view of such a disadvantage in the related art and aims to provide a laundry dryer in which steam ejected in a rotary drum is maintained without being dehumidified and which can sufficiently exhibit an effect of steam on reducing wrinkles of laundry.

[0020] According to an aspect of the invention, there is provided a laundry dryer including a rotary drum that accommodates laundry; a heating unit that heats circulating air supplied into the rotary drum; an air supplying fan for supplying the circulating air into the rotary drum; a motor that drives the air supplying fan; and a dehumidification unit that condenses and separates moisture from the circulating air which is discharged from the rotary drum. The laundry dryer also includes a steam generator that generates steam; a steam supplying port that supplies the steam into the rotary drum; and a control unit that controls operations of the motor, the heating unit, the dehumidification unit and the steam generator. The control unit is configured to perform an air supplying process in which the motor is operated to supply the circulating air into the rotary drum between a steaming process in which the steam generator is operated to supply the steam into the rotary drum and a drying process in which the heating unit and the dehumidification unit are operated to dry the laundry inside the rotary drum.

[0021] According to this configuration, since the ejected steam is not dissipated in a circulation duct, the steam is sufficiently supplied into the rotary drum, and thus, it is possible to provide the laundry dryer that can sufficiently exhibit the effect of steam such as reduced wrinkles of the laundry.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022]

Fig. 1 is a view schematically illustrating a cross-sectional configuration of a laundry dryer according to an embodiment of the present invention in a side view.

Fig. 2 is a time chart illustrating an operation of a laundry dryer according to a comparative example.

Fig. 3 is a time chart illustrating an operation of a laundry dryer according to an embodiment of the present invention.

Fig. 4 is a time chart illustrating an example of an operation of a laundry dryer according to an embodiment of the present invention.

Fig. 5 is a cross-sectional view schematically illustrating an internal configuration of a laundry dryer in the related art in a side view.

DETAILED DESCRIPTION OF THE INVENTION

[0023] Hereinafter, an embodiment of the present invention will be described with reference to the drawings. The present invention is not limited to the embodiment.

[0024] Fig. 1 is a view schematically illustrating a cross-sectional configuration of laundry dryer 100 according to an embodiment of the invention in a side view. Fig. 2 is a time chart illustrating an operation of laundry dryer 100 according to a comparative example. Fig. 3 is a time chart illustrating the operation of laundry dryer 100 according to the embodiment of the present invention.

[0025] As illustrated in Fig. 1, laundry dryer 100 includes substantially rectangular parallelepiped housing 1. Substantially cylindrical rotary drum 5 which accommodates laundry is rotatably disposed inside housing 1. Rotary drum 5 is driven to rotate by motor 60. Rotary drum 5 is rotatably supported by rotation support shaft 65 disposed in bottom portion 63 and rotation support roller 66 disposed in a front lower portion of rotary drum 5.

[0026] On a front surface of housing 1, housing opening 1a through which the laundry is loaded and unloaded, and door 7 which opens and closes the opening are disposed. In a front surface side of rotary drum 5, opening 5b is disposed in the similar manner.

[0027] Air supplying fan 12 sucks air inside rotary drum 5 from air discharge port 16 which is disposed in front of rotary drum 5 and passes the air through filter 61 which collects lint generated from the laundry. Air supplying fan 12 supplies the air which has passed through filter 61 into circulation duct 22 and introduces the air to heater case inlet 23 as indicated by arrow D. Air supplying fan 12 supplies the air discharged from heater case outlet 21 in a direction of arrow C and supplies the air from air supply port 14 into rotary drum 5.

[0028] Air vent 64 is disposed in bottom portion 63 of rotary drum 5. Air vent 64 is formed to have a plurality of small holes. The air which is circulated via rotary drum 5 in this manner is referred to as circulating air. The circulating air has a function to promote drying of the laundry which is accommodated in rotary drum 5.

[0029] In a lower portion of rotary drum 5, evaporator 30 and condenser 32 which are heat exchangers configuring heat pump unit 51 are disposed. Heater case 31 is

disposed to allow the circulating air supplied by air supplying fan 12 to flow from evaporator 30 to condenser 32 in a direction of arrow A. Compressor 67 is accommodated in the vicinity of evaporator 30 or condenser 32. Evaporator 30 functions as a dehumidification unit, and condenser 32 functions as a heating unit respectively.

[0030] The circulating air supplied by air supplying fan 12 passes through circulation duct 22 and enters rotary drum 5 through air supply port 14. The circulating air, after passing through the laundry inside rotary drum 5, passes through air discharge port 16 and then, after passing through evaporator 30 and condenser 32 inside heater case 31, returns to air supplying fan 12 again and is circulated. Air supplying fan 12 is driven to rotate by motor 60. Air supplying fan 12 may be configured to be driven to rotate by another motor which is disposed separately from motor 60 which drives rotary drum 5.

[0031] In a lower portion of heater case 31, the dehumidification water from evaporator 30 is collected. The dehumidification water is collected in dehumidification tank 72 disposed in a lower portion of housing 1. The water stored in dehumidification tank 72 is supplied to water storage tank 36 disposed on an upper portion of housing 1 via water supplying channel 75 by a water supplying pump (not illustrated) arranged on an upper portion of dehumidification tank 72.

[0032] Water storage tank 36 is configured to be attachable to and detachable from housing 1 so that a user can remove water storage tank 36 to appropriately drain the stored dehumidification water. Water storage tank 36 is disposed in an upper front corner portion of housing 1 so that a user can attach and detach water storage tank 36 by drawing water storage tank 36 out forward from housing 1. According to this configuration, it is possible to easily perform attachment and detachment operations of water storage tank 36.

[0033] In heat pump unit 51, compressor 67, condenser 32 radiating heat of a compressed refrigerant, expansion mechanism 62 formed of a throttle valve or a capillary tube for reducing a pressure of refrigerant having the high pressure, and evaporator 30 in which the decompressed refrigerant having a low pressure removes the heat from a surrounding section are connected to one another so as to circulate the refrigerant. Heat pump unit 51 and motor 60 are controlled by control unit 48 disposed inside housing 1 as a control unit. In this manner, condenser 32 functions as a heating unit for heating the circulating air, and evaporator 30 functions as a dehumidification unit for dehumidifying the circulating air respectively.

[0034] Air vent 64 formed to have a plurality of holes is disposed in bottom portion 63 of rotary drum 5. An outer peripheral end portion of air vent 64 in bottom portion 63 is in contact with an inner peripheral surface of annular seal member 70 which is disposed on an outer periphery of air supply port 14. According to this configuration, even if rotary drum 5 is rotated, the circulating air supplied from air supply port 14 is supplied into rotary drum 5 passing through air vent port 64 without leaking outward from rotary drum 5.

[0035] In a drying process, compressor 67 of heat pump unit 51 is operated to compress the refrigerant and the refrigerant is circulated in condenser 32, expansion mechanism 62 and evaporator 30 by this pressure. In condenser 32, the heat is radiated by compressing the refrigerant. In evaporator 30, the heat is absorbed by the decompressed refrigerant having the low pressure in expansion mechanism 62.

[0036] At this time, air supplying fan 12 is operated so that the circulating air which is heated by radiation of condenser 32 passes circulation duct 22, passes through air vent 64 from air supply port 14, and is supplied into rotary drum 5. Rotary drum 5 is driven to rotate by motor 60 and the laundry is vertically agitated inside rotary drum 5.

[0037] The circulating air supplied into rotary drum 5 removes moisture from the laundry when passing a gap in the laundry. The circulating air passes through circulation duct 22 via air discharge port 16 in a humid state and reaches heater case 31. The humid circulating air, when passing through evaporator 30, is dehumidified by removing sensible heat and latent heat so as to be divided into dried circulating air and the dehumidification water. The dried circulating air is re-heated in condenser 32.

[0038] The dehumidification water which is condensed in evaporator 30 is collected in dehumidification tank 72. A water level of the dehumidification water stored in dehumidification tank 72 is detected by water level detection unit 91. Control unit 48, when detecting that the water level of the dehumidification water inside dehumidification tank 72 reaches a predetermined water level by using water level detection unit 91, drives the water supplying pump for a predetermined period so as to supply the dehumidification water to water storage tank 36. A process in which the heating unit and the dehumidification unit are operated to dry the laundry inside rotary drum 5 in this manner is referred to as a drying process.

[0039] Steam water tank 81 that stores water for steaming is disposed inside housing 1. Steam water tank 81 is configured to enable a user to supply water from water supply port 86. A water level inside steam water tank 81 is detected by water level switch 82. Steam pump 84 supplies the water stored inside steam water tank 81 from a rear portion of steam water tank 81 to steam generator 85 through water guide pipe 83.

[0040] Heater 88 is embedded inside steam generator 85. The water supplied by steam pump 84 is heated by heater 88 and evaporates to become steam 69. Steam 69 is ejected into rotary drum 5 from steam supplying port 89 disposed inside rotary drum 5 via discharge hose 87. Similar to motor 60 and compressor 67, steam pump 84 and motor 88 which are disposed inside steam generator 85 are also controlled by control unit 48. A process in which steam generator 85 is operated to supply steam 69 into rotary drum 5 in this manner is referred to as a steaming process.

[0041] Next, an operation of laundry dryer 100 which is controlled by control unit 48 will be described with reference to Figs. 2 and 3.

[0042] If heat pump unit 51 is operated, evaporator 30 functions as the dehumidification unit. Thus, when steam 69 is circulated through circulation duct 22, steam 69 is subjected to dehumidification in evaporator 30 together with the moisture removed from the laundry and is immediately dissipated.

[0043] In order to avoid this case, as in Fig. 2 which is illustrated as a comparative example, it is considered that processes are separately controlled by dividing the processes into a drying process of operating compressor 67 (driving source of heat pump unit 51) a steaming process of operating steam generator 85. More specifically, control unit 48 controls the drying process to be performed from time t0 to time t1 and the steaming process to be performed from time t1. In this manner, the drying process and the steaming process are not overlapped with each other. Here, an example is described in which steam generator 85 is intermittently operated.

[0044] Evaporator 30 as the dehumidification unit is in a low temperature state while compressor 67 is operated. Then, if compressor 67 is stopped, a temperature of evaporator 30 gradually restores a temperature of the circulating air before heat pump unit 51 is operated. However, while the temperature of evaporator 30 is lower than the temperature of the circulating air before heat pump unit 51 is operated, evaporator 30 still has a dehumidification capacity. Therefore, if steam 69 is ejected immediately after control unit 48 stops compressor 67, ejected steam 69 is subjected to dehumidification and is dissipated while evaporator 30 has a low temperature.

[0045] Fig. 2 illustrates whether or not steam 69 is effectively present as a "circulation amount of steam". When the steaming process is performed immediately after the drying process, the circulation amount of steam 69 is increased immediately after steam generator 85 starts to be driven. Then, the circulation amount of steam 69 is gradually decreased and is dissipated. Thereafter, the circulation amount of steam 69 is increased again immediately after steam generator 85 subsequently starts to be driven. Then, the circulation amount of steam 69 is immediately decreased again and is dissipated. These steps are repeated.

[0046] Therefore, as illustrated in Fig. 2, when control unit 48 completes the drying process and simultaneously stops the operation of compressor 67 to immediately operate steam generator 85, generated steam 69 is dissipated. Thus, it is difficult to obtain a sufficient amount of steam 69.

[0047] For this reason, in the present embodiment, as illustrated in Fig. 3, control unit 48 starts the drying process from time t0, completes the drying process at time t1 and simultaneously stops the operation of compressor 67 to stop heat pump unit 51. Subsequently, control unit 48 operates motor 60 and drives air supplying fan 12 to circulate the circulating air during a period from time t1 to time t2. Then, control unit 48 operates steam generator 85 from time t2.

[0048] Fig. 3 also illustrates whether or not steam 69 is effectively present as the "circulation amount of steam". When control unit 48 performs the steaming process after completing the drying process and the subsequent air supplying process, the circulation amount of steam 69 which is increased immediately after steam generator 85 starts to be driven is gently decreased, but is not dissipated. A state is repeated where the circulation amount of steam 69 is increased again immediately after steam generator 85 starts to be subsequently driven. Accordingly, in the example of Fig. 3, during a period of the steaming process, it is possible to maintain the circulation amount of steam 69 to be an appropriate amount.

[0049] In this manner, after stopping heat pump unit 51 including the heating unit and the dehumidification unit, while maintaining a state where heat pump unit 51 is stopped, control unit 48 performs the air supplying process in which air supplying fan 12 is driven to supply the air into rotary drum 5 for a predetermined period of time. Thereafter, control unit 48 operates steam generator 85 and thus, it is possible to ensure the time for allowing the temperature of evaporator 30 to be equal to the temperature of the circulating air before heat pump unit 51 is operated. In this manner, even when steam generator 85 is operated, steam 69 is not dissipated. During the period of steaming process, it is possible to maintain steam 69 to have the appropriate amount and it is possible to sufficiently supply steam 69 into rotary drum 5.

[0050] In a state where control unit 48 stops heat pump unit 51 including the heating unit and the dehumidification unit, control unit 48 is configured to perform the air supplying process of supplying the air into rotary drum 5 by operating motor 60. In this manner, while the circulating air passing through rotary drum 5 is dehumidified, the temperature of evaporator 30 can be forcibly adapted to have a temperature close to the temperature of the circulating air before heat pump unit 51 is operated. Therefore, it is possible to perform an effective process without prolonging the entire required period of time unnecessarily.

[0051] As described above, in the present embodiment, generated steam 69 is not dehumidified to be dissipated by performing the steaming process after the air supplying process. Accordingly, steam 69 returns into rotary drum 5 again while being circulated together with the circulating air, and thus, it is possible to achieve a long-lasting effect such as wrinkle removing from the laundry inside rotary drum 5.

[0052] Fig. 4 is a time chart illustrating an example of another operation of laundry dryer 100 according to an embodiment of the present invention.

[0053] In the operation example illustrated in Fig. 4, control unit 48 controls the time for air supplying process while the temperature of evaporator 30 is detected by temperature detection unit 92 disposed inside heater case 31. The "temperature" in Fig. 4 represents the tem-

perature of evaporator 30.

[0054] Control unit 48 starts the drying process from time t0, completes the drying process at time t1 and simultaneously stops the operation of compressor 67 to stop heat pump unit 51. Subsequently, control unit 48 operates motor 60 from time t1 and drives air supplying fan 12 to circulate the circulating air. Thereafter, control unit 48 completes the air supplying process when based on an output from temperature detection unit 92, the temperature of evaporator 30 reaches threshold value Th close to the temperature of the circulating air before heat pump unit 51 is operated. Thereafter, control unit 48 operates steam generator 85 so that the process proceeds to the steaming process.

[0055] The temperature of evaporator 30 is lowered in the drying process. Thereafter, the temperature of evaporator 30 is changed to be close to the temperature of the circulating air before heat pump unit 51 is operated, by control unit 48 stopping heat pump unit 51, and for the predetermined period of time, performing the air supplying process of supplying the air into rotary drum 5 by driving air supplying fan 12 while maintaining a state thereof.

[0056] Control unit 48 completes the air supplying process when the temperature of evaporator 30 which is a low temperature in an initial stage of the air supplying process reaches threshold value Th which is close to the temperature of the circulating air, and operates steam generator 85 so that the process proceeds to the steaming process. This effectively prevents steam 69 from being dehumidified to be dissipated and thus, it is possible to achieve the more enhanced and long-lasting effect such as wrinkle removing from the laundry inside rotary drum 5.

[0057] As described above, in laundry dryer 100 of the present embodiment, control unit 48 is configured to perform the air supplying process in which motor 60 is operated to supply the air into rotary drum 5 between the steaming process in which steam generator 85 is operated to supply steam 69 into rotary drum 5 and the drying process in which the heating unit and the dehumidification unit are operated to dry the laundry inside rotary drum 5.

[0058] This enables the steaming process to be started and steam 69 to be ejected after the temperature of evaporator 30 which has the low temperature and the dehumidification function during the drying process becomes substantially equal to the temperature of the circulating air before heat pump unit 51 is operated. Accordingly, it is possible to prevent ejected steam 69 from being dehumidified by evaporator 30 and it is possible to circulate steam 69 together with the circulating air. Therefore, it is possible to show the more enhanced effect of steam 69 such as reduced wrinkles of the laundry.

[0059] The heating unit and the dehumidification unit are configured to include heat pump unit 51 having compressor 67 which compresses the refrigerant, condenser 32 for heating the air, and evaporator 30 for removing the moisture. In addition, control unit 48 is configured to perform the steaming process after heat pump unit 51 is stopped and the air supplying process is performed. In this manner, it is possible to reduce influence of the dehumidification caused by evaporator 30 after heat pump unit 51 is stopped. Therefore, since steam 69 is sufficiently supplied into rotary drum 5, it is possible to show the more enhanced effect of steam 69.

[0060] As described above, laundry dryer 100 of the present embodiment includes rotary drum 5 that accommodates the laundry; condenser 32 that is the heating unit which heats the circulating air supplied into rotary drum 5; air supplying fan 12 for supplying the circulating air into rotary drum 5; and motor 60 that drives air supplying fan 12. In addition, laundry dryer 100 includes evaporator 30 that is the dehumidification unit which condenses and separates moisture from the circulating air which is discharged from rotary drum 5; steam generator 85 that generates steam 69; and steam supplying port 89 which supplies steam 69 into rotary drum 5. Laundry dryer 100 further includes control unit 48 that is a controller which controls operations of motor 60, the heating unit, the dehumidification unit and steam generator 85. Control unit 48 is configured to perform the air supplying process in which motor 60 is operated to supply the circulating air into rotary drum 5 between the steaming process in which steam generator 85 is operated to supply steam 69 into rotary drum 5 and the drying process in which the heating unit and the dehumidification unit are operated to dry the laundry inside rotary drum 5.

[0061] According to this configuration, steam 69 ejected into rotary drum 5 is continuously maintained without being dehumidified. Therefore, it is possible to show the enhanced effect of steam 69 such as reduced wrinkles of the laundry.

[0062] Laundry dryer 100 is configured to include heat pump unit 51 having compressor 67 that compresses the refrigerant; condenser 32 for heating the air as the heating unit; and evaporator 30 for removing the moisture as the dehumidification unit.

[0063] In this manner, it is possible to sufficiently achieve an advantageous effect of reducing power consumption in the drying process and the advantageous effect of steam 69 such as the reduced wrinkles of the laundry, since steam 69 ejected into rotary drum 5 is continuously maintained without being dehumidified.

[0064] Laundry dryer 100 further includes temperature detection unit 92 that is disposed heat pump unit 51. Control unit 48 is configured to control a time for the air supplying process based on an output from temperature detection unit 92.

[0065] This enables the process of laundry dryer 100 to efficiently proceed to the steaming process after evaporator 30 certainly restores the temperature of before heat pump unit 51 is operated. Accordingly, steam 69 ejected into rotary drum 5 is continuously maintained without being dehumidified. Therefore, it is possible to more certainly show the enhanced effect of steam 69

such as the reduced wrinkles of the laundry.

[0066] As described above, according to the present invention, since the ejected steam is not dissipated in the circulation duct, the steam is sufficiently supplied into the rotary drum. Therefore, particularly advantageous effects can be achieved in that it is possible to show the enhanced effect of steam such as the reduced wrinkles of the laundry. Accordingly, the present invention is not limited to the laundry dryer, and can be usefully applied to use in laundry dryers for both household purpose and business purpose which have a function of supplying the steam.

Claims

1. A laundry dryer comprising:

a rotary drum that accommodates laundry;
a heating unit that heats circulating air supplied into the rotary drum;
an air supplying fan for supplying the circulating air into the rotary drum;
a motor that drives the air supplying fan;
a dehumidification unit that condenses and separates moisture from the circulating air which is discharged from the rotary drum;
a steam generator that generates steam;
a steam supplying port that supplies the steam into the rotary drum; and
a control unit that controls operations of the motor, the heating unit, the dehumidification unit and the steam generator,
wherein the control unit is configured to perform an air supplying process in which the motor is operated to supply the circulating air into the rotary drum between a steaming process in which the steam generator is operated to supply the steam into the rotary drum and a drying process in which the heating unit and the dehumidification unit are operated to dry the laundry inside the rotary drum.

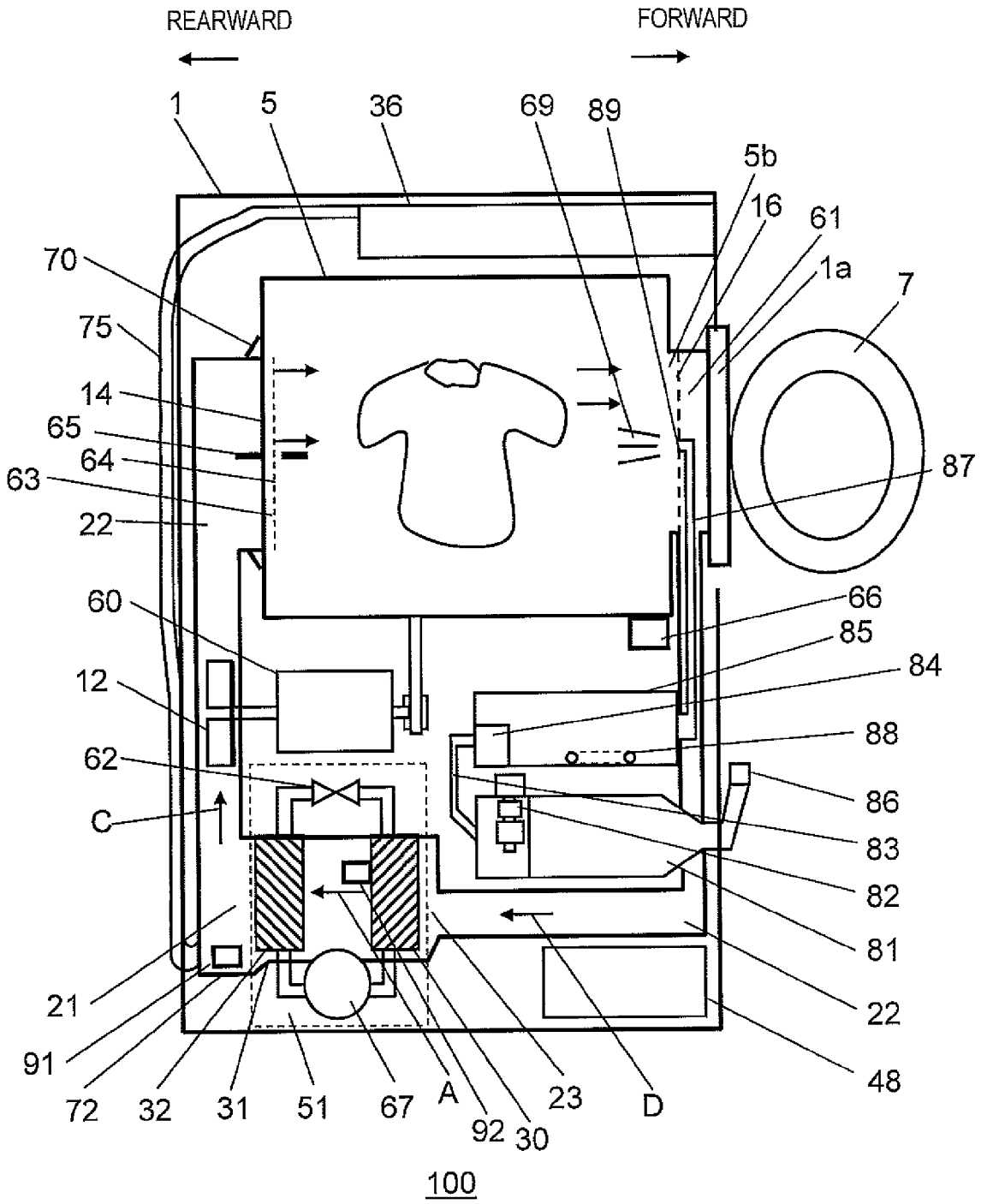
2. The laundry dryer of Claim 1, further comprising:

a heat pump unit that has a compressor which compresses a refrigerant, a condenser as the heating unit for heating the circulating air, and an evaporator as the humidification unit for removing the moisture.

3. The laundry dryer of Claim 2, further comprising:

a temperature detection unit that is disposed in the heat pump unit,
wherein the control unit is configured to control a time for the air supplying process based on an output from the temperature detection unit.

FIG. 1


REARWARD
FORWARD
1
5
36
69
89
5b
16
61
1a
7
70
75
14
65
64
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22
87
60
66
85
84
12
88
62
86
C
83
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51
67
A
92
30
23
D
100

FIG. 2

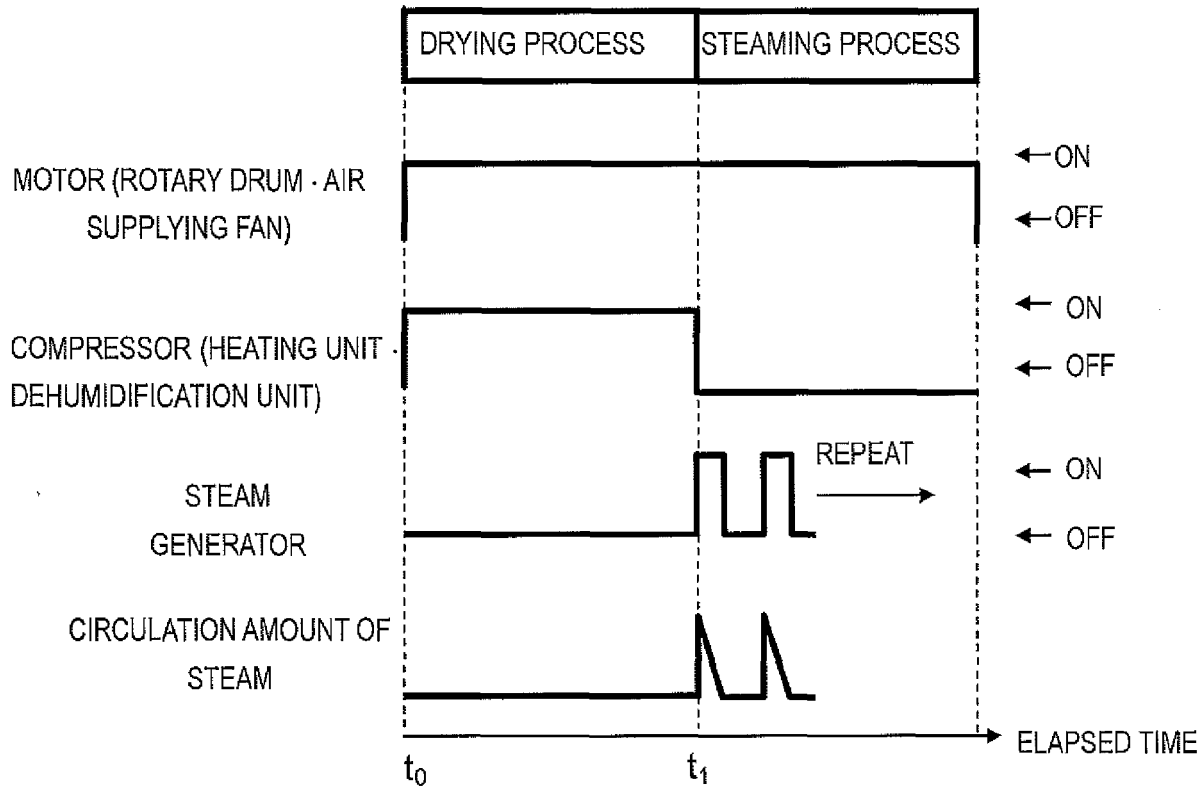

DRYING PROCESS
STEAMING PROCESS
MOTOR (ROTARY DRUM · AIR SUPPLYING FAN)
ON
OFF
COMPRESSOR (HEATING UNIT · DEHUMIDIFICATION UNIT)
ON
OFF
REPEAT
STEAM GENERATOR
ON
OFF
CIRCULATION AMOUNT OF STEAM
ELAPSED TIME
t_0
t_1

FIG. 3

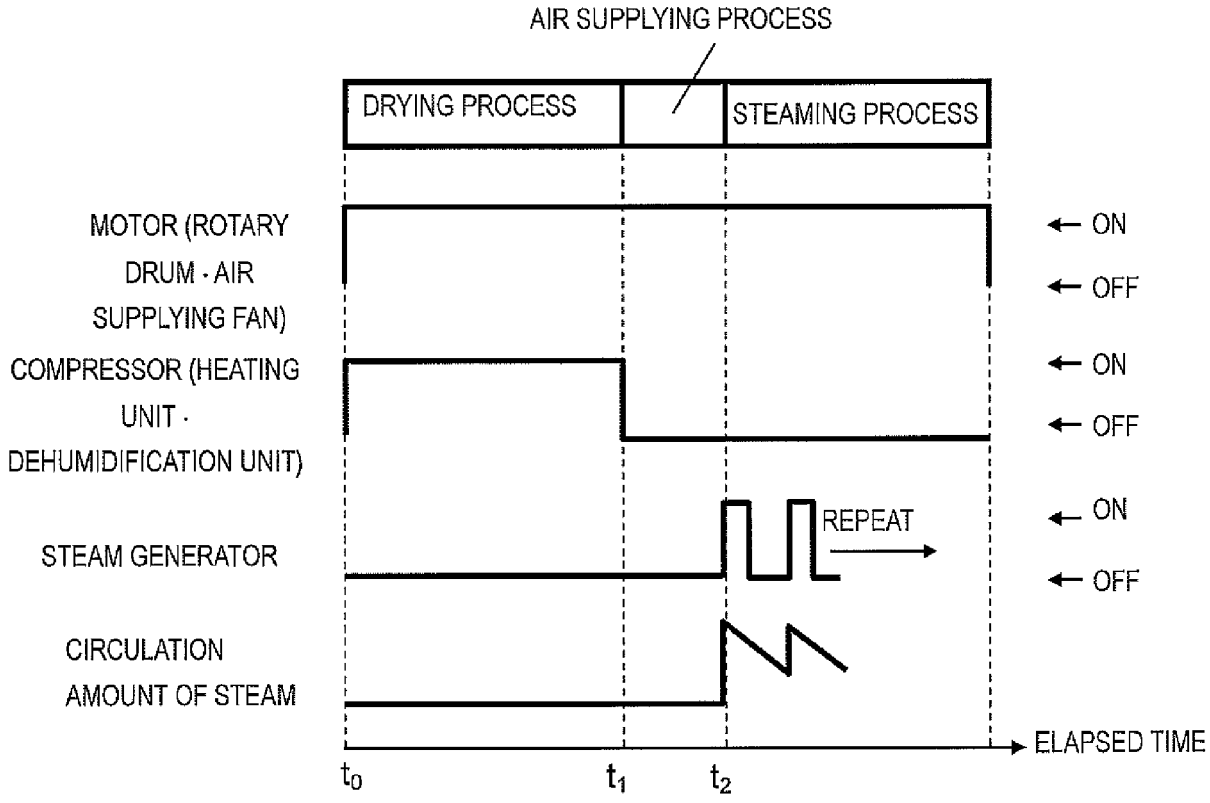

AIR SUPPLYING PROCESS
DRYING PROCESS
STEAMING PROCESS
MOTOR (ROTARY DRUM · AIR SUPPLYING FAN)
COMPRESSOR (HEATING UNIT · DEHUMIDIFICATION UNIT)
STEAM GENERATOR
CIRCULATION AMOUNT OF STEAM
ON
OFF
ON
OFF
REPEAT
ON
OFF
ELAPSED TIME
t_0
t_1
t_2

FIG. 4

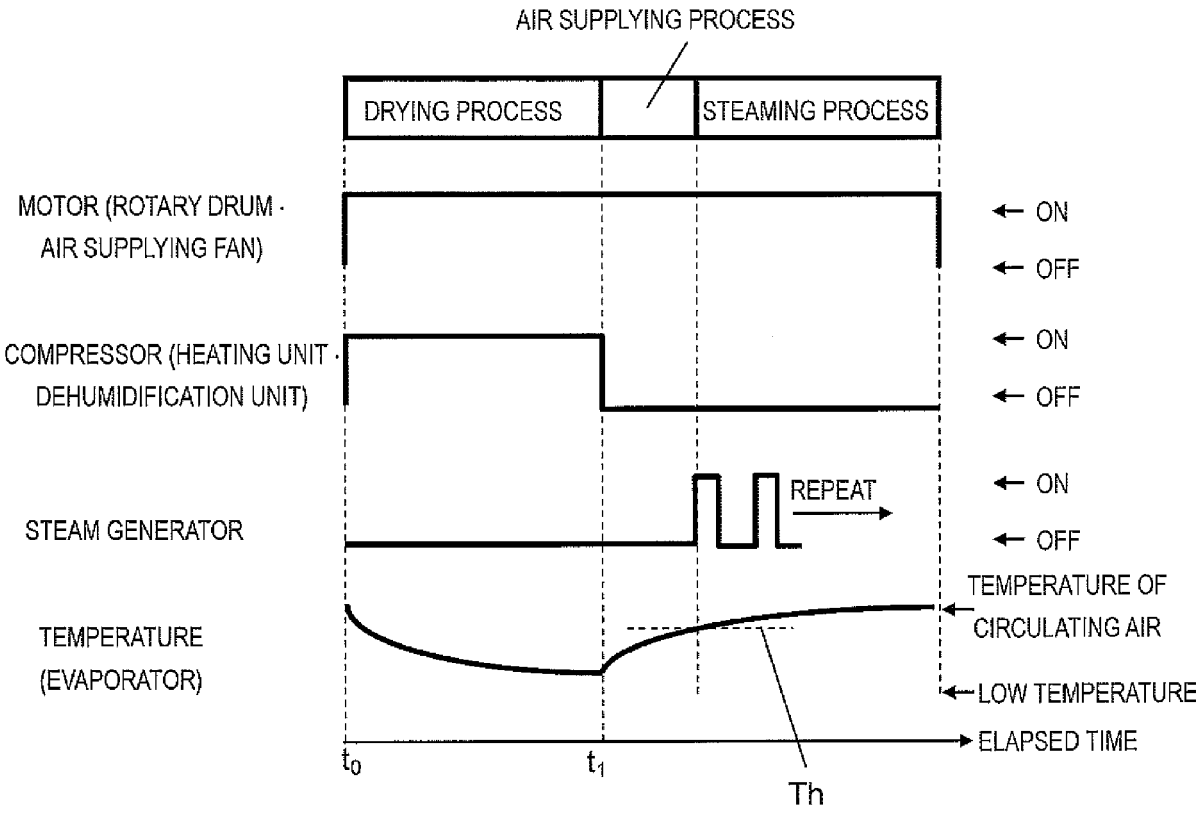
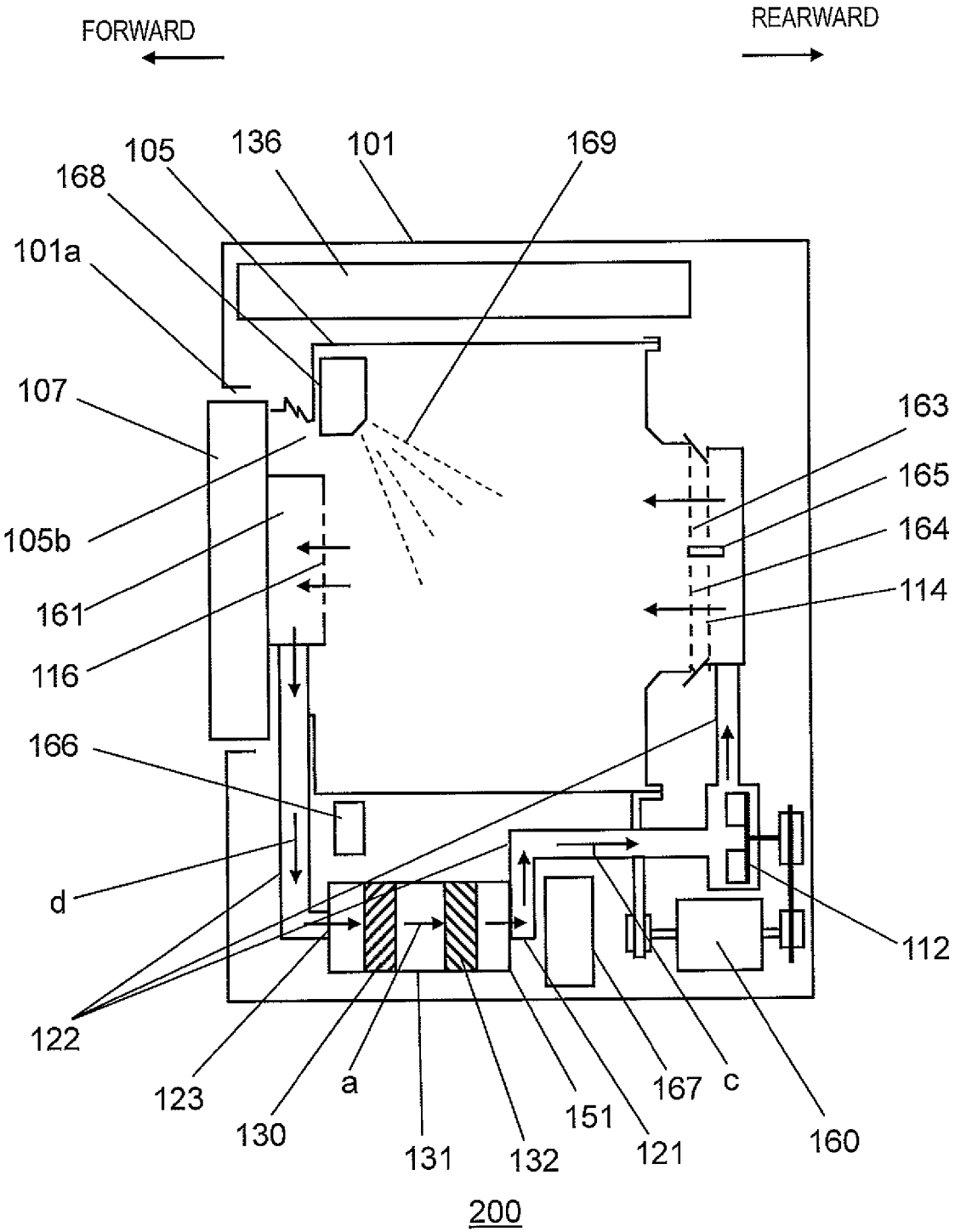

AIR SUPPLYING PROCESS
DRYING PROCESS
STEAMING PROCESS
MOTOR (ROTARY DRUM · AIR SUPPLYING FAN)
ON
OFF
COMPRESSOR (HEATING UNIT · DEHUMIDIFICATION UNIT)
ON
OFF
STEAM GENERATOR
REPEAT
ON
OFF
TEMPERATURE (EVAPORATOR)
TEMPERATURE OF CIRCULATING AIR
LOW TEMPERATURE
ELAPSED TIME
t_0
t_1
Th

FIG. 5


FORWARD
REARWARD
105
136
101
169
168
101a
107
163
165
105b
164
161
114
116
166
d
112
122
123
a
167
c
130
151
131
132
121
160
200

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EUROPEAN SEARCH REPORT

Application Number
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