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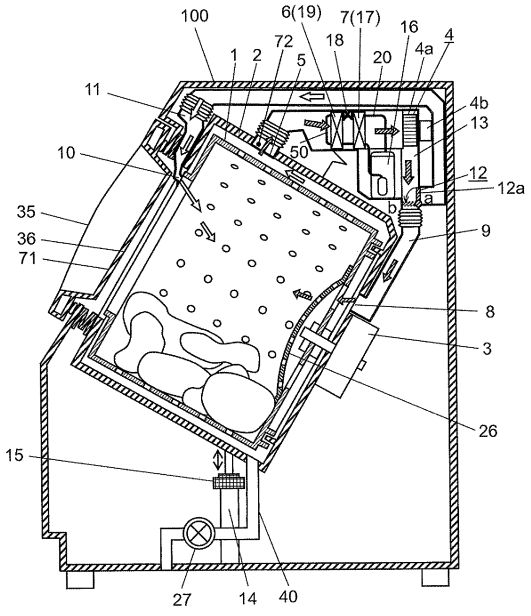
(54) CLOTHES DRYER AND WASHER/DRYER

(57) A clothes dryer according to the present invention includes a drum that agitates clothes, a window glass arranged in front of the drum, a blower unit that sends drying air, a dehumidification unit that dehumidifies the drying air, and a heating unit that heats the dehumidified drying air. Furthermore, the clothes dryer includes a first air passage having a first air outlet, a second air passage having a second air outlet, an air passage switching unit that switches the first air passage and the second air passage, a temperature detecting unit that detects a temperature of the window glass, and a control unit. The control unit performs control to switch the first air passage and the second air passage through the air passage switching unit when a detection result of the temperature detecting unit reaches a first predetermined temperature. In this manner, a clothes dryer that can pick up clothes at any time during a drying operation and suppress uneven drying with a low power consumption can be realized.

FIG. 1



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Description

TECHNICAL FIELD

[0001] The present invention relates a clothes dryer that dries clothes and a washer-dryer having a washing function and a clothes drying function.

BACKGROUND ART

[0002] In a conventional drum type clothes dryer or a conventional washer-dryer, first, drying air is caused to pass through an air passage to send the air into a drum. The drying air is brought into contact with clothes put in the drum to extract moisture from the clothes to dry the clothes. A configuration that discharges the moist drying air having a high humidity to an air passage arranged outside the drum is further arranged (see, for example, Patent Literature 1).

[0003] A conventional drum type washer-dryer described in Patent Literature 1 will be described below with reference to FIG. 7. FIG. 7 is a sectional side view showing a schematic configuration of a conventional drum type washer-dryer.

[0004] As shown in FIG. 7, the conventional drum type washer-dryer includes two air passages, i.e., first air passage 9 and second air passage 11 as air passages to feed drying air into drum 1 that stores clothes. The drum type washer-dryer includes discharge port 5 that discharges high-humidity drying air obtained such that drying air fed into drum 1 removes moisture of clothes to blower unit 4 having circular air passage 13. The drum type washer-dryer includes discharge temperature detecting unit 172 arranged at the discharge port and inflow temperature detecting unit 171 arranged on circular air passage 13 communicating with first air passage 9.

[0005] The drum type washer-dryer includes a configuration in which, on the basis of a temperature of drying air detected by discharge temperature detecting unit 172 or a temperature difference between a temperature of drying air detected by inflow temperature detecting unit 171 and the temperature detected by discharge temperature detecting unit 172, the two air passages including first air passage 9 and second air passage 11 are switched by air passage switching unit 12.

[0006] However, the conventional drum type washer-dryer has a configuration in which warm wind including drying air is brought into direct contact with the clothes in drum 1. For this reason, since the warm wind is not brought into uniform contact with the clothes in drum 1, the clothes are easily unevenly dried.

[0007] Since high-temperature and high-pressure drying air is blown from first air outlet 8 of first air passage 9 formed near window glass 36 configuring door 35 in front of drum 1 to clothes, window glass 36 has a high-temperature. For this reason, the temperature of window glass 36 must be decreased before the clothes are picked up.

[0008] Thus, in a conventional drum type washer- dryer, as will be described with reference to FIG. 8, a cooling process to cool a window glass is set.

[0009] FIG. 8 is a time chart showing an example of a relationship between a transition of a window glass temperature in a drying operation in the conventional drum type washer-dryer and timings at which the window glass is cooled.

[0010] More specifically, as shown in FIG. 8, when clothes are picked up in a drying middle stage or a drying closing stage of the drying operation, a cooling process to cool window glass 36 is required.

[0011] Thus, in the cooling process, after heating unit 7 (heat pump device 50 or heater) is cooled, window glass 36 is cooled with blowing or the like. For this reason, an increase in drying operation time of the drum type washer- dryer and an increase in power consumption occur.

[0012] A temperature of window glass 36 widely varies depending on timings at which clothes are picked up or quantities of clothes. For this reason, for example, in the case where window glass 36 is excessively cooled, in order to restart the drying operation after the clothes are picked up and put in, heating unit 7 must be warmed again. As a result, an excessive operation time and an excessive power consumption are required.

[0013] More specifically, the conventional drum type washer-dryer has a problem in which door 35 having window glass 36 cannot be opened to pickup clothes from drum 1 in the middle of a drying operation or immediately after the drying operation. Furthermore, by a cooling time of the cooling process, re-heating of the heating unit, and the like, problems are posed in terms of shortening of a drying time, a reduction in power consumption, and the like.

Citation List

Patent Literature

[0014] PTL 1: Unexamined Japanese Patent Publication No. 2011-83459

SUMMARY OF THE INVENTION

[0015] In order to solve the above problems, a clothes dryer according to the present invention includes a drum that agitates clothes, a window glass arranged in front of the drum, a blower unit that sends drying air, a dehumidification unit that dehumidifies the drying air, and a heating unit that heats the dehumidified drying air. Furthermore, the clothes dryer includes a first air passage having a first air outlet opened at a rear of the drum , a second air passage having a second air outlet opened in front of the drum and , an air passage switching unit that switches the first air passage and the second air passage, a temperature detecting unit that detects a temperature of the window glass, and a control unit. The control unit performs control to selectively switch the first air passage

and the second air passage through the air passage switching unit when a detection result of the temperature detecting unit reaches a first predetermined temperature.

[0016] In this manner, the clothes can be dried while controlling the temperature of the window glass to the first predetermined temperature or less at which a user does not feel hot when touching the window glass. As a result, in the middle of or immediately after the drying operation, a time required to cool the window glass is not required, and the clothes can be immediately picked up at any time. Furthermore, since a power consumption in a cooling process for cooling that is required in a conventional technique is made unnecessary, a power consumption can be reduced.

[0017] The washer-dryer according to the present invention includes at least the clothes dryer having the above configuration and a water tank that includes a drum and stores washing water.

[0018] In this manner, a washer-dryer that can suppress clothes from being unevenly dried with a low power consumption can be realized.

BRIEF DESCRIPTION OF DRAWINGS

[0019]

FIG. 1 is a sectional side view showing a schematic configuration of a drum type washer-dryer according to an exemplary embodiment of the present invention.

FIG. 2 is a block diagram showing a schematic configuration of the drum type washer-dryer according to the exemplary embodiment.

FIG. 3 is a time chart showing an example of timings at which an air passage switching unit switches a first air passage and a second air passage in the drum type washer-dryer according to the exemplary embodiment.

FIG. 4 is a time chart showing an example of timings at which an air passage switching unit switches a first air passage and a second air passage in another example of the drum type washer-dryer according to the exemplary embodiment.

FIG. 5 is a time chart showing an example of timings at which an air passage switching unit switches a first air passage and a second air passage in still another example of the drum type washer-dryer according to the exemplary embodiment.

FIG. 6 is a sectional side view showing a schematic configuration of another example of the drum type washer-dryer according to an exemplary embodiment of the present invention.

FIG. 7 is a sectional side view showing a schematic configuration of a conventional drum type washer-dryer.

FIG. 8 is a time chart showing an example of a relationship between a transition of a window glass temperature in a drying operation in the conventional drum type washer-dryer and timings at which the window glass is cooled.

DESCRIPTION OF EMBODIMENT

[0020] A clothes dryer and a washer-dryer according to an exemplary embodiment of the present invention will be described below with reference to the accompanying drawings. The exemplary embodiment (will be described below) is an example obtained by embodying the present invention and does not limit the technical scope of the present invention. Although a drum type washer-dryer will be described as the clothes dryer and the washer-dryer, the present invention is not limited to the drum type washer-dryer, as a matter of course.

EXEMPLARY EMBODIMENT

[0021] A drum type washer-dryer according to an exemplary embodiment of the present invention will be described below with reference to FIG. 1.

[0022] FIG. 1 is a sectional side view showing a schematic configuration of a drum type washer-dryer according to an exemplary embodiment of the present invention.

[0023] As shown in FIG. 1, in the drum type washer-dryer according to the exemplary embodiment, bottomed cylindrical drum 1 having an opening in a front surface for storing laundries and a bottom part is supported in housing 100 and included in bottomed cylindrical water tank 2 for storing washing water. On a rear surface of water tank 2, attached is drum drive motor 3 (drum drive unit) that obliquely rotates a rotating shaft of drum 1 such that a front side of the rotating shaft is kept up.

[0024] Housing 100 has door 35 facing an opening end side of drum 1 and window glass 36 arranged to face drum 1 on the internal side of door 35. A user opens door 35 to make it possible to put or pick up laundries (clothes) in/from drum 1.

[0025] On door 35, usually, a mechanism that inhibits the door from being opened during an operation for safety, for example, a door lock unit (not shown) is arranged. The door lock unit is configured not to be canceled when, in a rotation period of drum 1 or a drying operation, the temperatures of the interior of drum 1, the laundries, and window glass 36 are so high that a user may be burned when touching them.

[0026] To water tank 2, a water supply pipe (not shown) in which a feed valve is arranged and drain pipe 40 in which drain valve 27 is arranged are connected.

[0027] A circular route for drying air that dries clothes in the drum type washer-dryer according to the exemplary embodiment will be concretely described below.

[0028] As shown in FIG. 1, the drying air to dry clothes is sent into drum 1 through blower unit 4. The sent drying air removes moisture from laundries in drum 1 and becomes humid. The humid drying air is discharged out of drum 1 through discharge port 5 arranged at a position of a side-surface periphery of drum 1. The discharged

drying air is dehumidified with dehumidification unit 6. The drying air dehumidified with dehumidification unit 6 is heated with heating unit 7.

[0029] The heated drying air is switched to any one of first air passage 9 and second air passage 11 with air passage switching unit 12 through blower unit 4. The drying air switched and guided to any one of first air passage 9 and second air passage 11 is circulated to be blown into drum 1 again so that the clothes in drum 1 are dried.

[0030] As shown in FIG. 1, first air passage 9 has first air outlet 8 having an opening at a rear of drum 1, and drying air is blown from first air outlet 8 into drum 1. Second air passage 11 has second air outlet 10 having an opening in a peripheral side surface in front of drum 1, and drying air is blown from second air outlet 10 into drum 1.

[0031] The air-passing sectional area of first air outlet 8 of first air passage 9 is formed to be larger than the air-passing sectional area of second air outlet 10. In this manner, high-flow-rate drying air can be blown into drum 1 while keeping a pressure loss smaller than that of second air passage 11.

[0032] At this time, an air-passing sectional area of second air outlet 10 of second air passage 11 is formed to be smaller than an air-passing sectional area of first air outlet 8. For this reason, drying air of the speed of which is relatively higher than that in first air outlet 8 can be blown into drum 1.

[0033] As shown in FIG. 1, usually in a drum type washer-dryer, a clearance between the front side of rotating drum 1 and water tank 2 is minimized (narrowed) as much as possible not to catch clothes. For this reason, in the clearance, an air outlet having a wide opening and a small pressure loss is spatially difficult to be arranged. Thus, second air outlet 10 having a relatively small air-passing sectional area is arranged in the clearance between the front side of drum 1 and water tank 2.

[0034] On the other hand, a bottom part at the rear of drum 1 has a space in which first air outlet 8 having a relatively large opening can be arranged. Thus, in a bottom part at the rear of drum 1, first air outlet 8 having a relatively low pressure loss is formed. At this time, first air outlet 8 is covered with cover 26 having a large number of small-diameter vent holes through which air can be passed and a high open area ratio to make it possible to prevent the clothes (laundries) from being caught by first air outlet 8.

[0035] As in the drum type washer-dryer according to the exemplary embodiment, when clothes are agitated by rotating drum 1 having the rotating shaft obliquely arranged to keep the front side up, for example, small clothes such as socks, a handkerchief, and a brief are easily unevenly distributed at a rear part of drum 1. On the other hand, for example, large-sized clothes such as long-sleeved underwear, long-sleeved dress shirts, and long-sleeved pajamas are easily unevenly distributed at the front part of drum 1.

[0036] For this reason, in drying of a mixture of small-sized clothes and large-sized clothes, when high-flow-rate drying air is blown from first air outlet 8 arranged at a position of the rear of drum 1, the drying air is brought into contact with the small-sized clothes unevenly distributed at the rear part of drum 1 first. Hereafter, the drying air passing through the small-sized clothes while being in contact with the small-sized clothes reaches the large-sized clothes at the front part of drum 1. That is, when high-flow-rate drying air is blown from first air outlet 8, both the small-sized clothes and the large-sized clothes can be efficiently dried while being suppressed from being unevenly dried.

[0037] Thus, as shown in FIG. 1, air passage switching unit 12 is arranged at a branch part between first air passage 9 and second air passage 11 formed on the downstream side of blower unit 4, and, depending on conditions such as quantities of clothes and types of clothes, a path of drying air is switched to any one of first air passage 9 and second air passage 11.

[0038] In this case, air passage switching unit 12 includes valve 12a pivotally supported by the branch part between first air passage 9 and second air passage 11 and a drive unit (not shown) that pivotally drives valve 12a. At this time, when valve 12a is rotated on an a-side in FIG. 1 to close second air passage 11, first air passage 9 opens to cause drying air sent by blower unit 4 to pass through first air passage 9. On the other hand, when valve 12a is rotated on a b-side in FIG. 1 to close first air passage 9, second air passage 11 opens to cause drying air sent by blower unit 4 to pass through second air passage 11. That is, valve 12a configuring air passage switching unit 12 is rotated to the a-side or b-side to make it possible to switch the path of the drying air to first air passage 9 or second air passage 11.

[0039] As shown in FIG. 1, circular air passage 13 has blower unit 4 and air passage switching unit 12 that are arranged in the middle of circular air passage 13. Circular air passage 13 sends drying air from first air outlet 8 or second air outlet 10 communicating with first air passage 9 or second air passage 11 switched by air passage switching unit 12 again into drum 1 sequentially through the air passages such as drum 1, discharge port 5, dehumidification unit 6, heating unit 7, and the like. In this manner, the drying air can be circulated in the drum type washer-dryer.

[0040] Blower unit 4 includes blower fan 4a and blower fan motor 4b and is arranged between heating unit 7 and air passage switching unit 12. Blower fan motor 4b drives blower fan 4a to send drying air heated with heating unit 7 to a downstream side (air passage switching unit 12 side) of circular air passage 13.

[0041] At this time, when air passage switching unit 12 switches the air passage to first air passage 9, blower unit 4 rotates blower fan 4a such that a flow rate of drying air passing through first air passage 9 is a predetermined flow rate higher than a flow rate of drying air passing through second air passage 11. On the other hand, when

air passage switching unit 12 switches the air passage to second air passage 11, blower unit 4 rotates blower fan 4a such that a wind speed of drying air passing through second air outlet 10 of second air passage 11 is a predetermined wind speed higher than a wind speed of drying air passing through first air outlet 8. For example, when a wind speed of drying air passing through first air outlet 8 is about 10 m/s, blower fan 4a is rotated such that a wind speed of drying air passing through second air outlet 10 is about 50 m/s. The wind speeds of drying air passing through first air outlet 8 and second air outlet 10 are not limited to the above wind speeds. For example, the wind speeds can be set to arbitrary wind speeds as long as the wind speed of drying air in second air outlet 10 is higher than the wind speed of drying air in first air outlet 8.

[0042] As shown in FIG. 1, the drum type washer-dryer includes temperature detecting unit 71 such as thermistor that detects a temperature of window glass 36. Temperature detecting unit 71 is arranged on window glass 36 or near window glass 36.

[0043] In the drum type washer-dryer according to the exemplary embodiment, as will be described below in detail, on the basis of a temperature detected by temperature detecting unit 71 on window glass 36, in the middle of the drying process, air passage switching unit 12 is controlled to switch first air passage 9 and second air passage 11.

[0044] As shown in FIG. 1, discharge port 5 that discharges drying air in drum 1 is arranged at a position having a distance from first air outlet 8 that is relatively longer than a distance from second air outlet 10. More specifically, discharge port 5 is arranged at a position that is relatively close to second air outlet 10 and far from first air outlet 8. Thus, discharge port 5 is arranged to be closer to the front part of drum 1 than the rear part thereof. Discharge port 5 may be arranged near second air outlet 10 formed in the front part of drum 1 such that the distance from first air outlet 8 is maximum.

[0045] Discharge port 5 is arranged above drum 1 to effectively discharge drying air that is in contact with clothes from above. In a drum type clothes dryer that does not include a washing function, discharge port 5 may be arranged at a position except for the position above drum 1. However, since the drum type washer-dryer described above is influenced by washing water, discharge port 5 is preferably arranged above a water level of the washing water.

[0046] Second air outlet 10 is formed to have an opening in a front upper part of drum 1. At this time, even though discharge port 5 is formed near second air outlet 10, while drying air is sent from second air outlet 10, relatively high-speed drying air is blown from second air outlet 10 into drum 1. For this reason, the drying air blown at a high speed is not discharged from discharge port 5 but is sent to a position far from discharge port 5 in drum 1. In this manner, the drying air can be effectively blown to clothes agitated by a raising operation caused by rotation of drum 1 to make it possible to dry the clothes. As a result, the clothes (laundries) can be efficiently dried while being suppressed from being unevenly dried.

[0047] As shown in FIG. 1, below water tank 2, damper 14 and quantity-of-clothes detecting unit 15 arranged on damper 14 are arranged. Damper 14 supports water tank 2, and attenuates vibration of water tank 2 generated when drum 1 is rotated in an unbalanced-weight-distribution state due to uneven distribution or the like of clothes in a spin-drying operation or the like. Quantity-of- clothes detecting unit 15 detects a quantity of clothes based on amount of a displacement obtained when damper 14 vertically displaced in the axial direction by a change in weight of clothes or the like in supported water tank 2.

[0048] The drum type washer-dryer according to the exemplary embodiment includes heat pump device 50 that performs heat pump dehumidification and heating.

[0049] As shown in FIG. 1, heat pump device 50 includes compressor 16, radiator (condenser) 17, expansion unit 18, heat absorber (evaporator) 19, and pipe line 20. Compressor 16 compresses a refrigerant, and radiator (condenser) 17 radiates heat of the refrigerant that is compressed to have a high-temperature and a high pressure. Expansion unit 18 decreases a pressure of the refrigerant that is compressed to have a high pressure. Heat absorber (evaporator) 19 removes heat from an area therearound with the refrigerant that is decompressed to have a low pressure. Pipe line 20 connects four members including compressor 16, radiator (condenser) 17, expansion unit 18, and heat absorber (evaporator) 19 to each other to circulate the refrigerant. In this case, heat absorber (evaporator) 19 of heat pump device 50 corresponds dehumidification unit 6 described above, and radiator (condenser) 17 corresponds to heating unit 7.

[0050] The drum type washer-dryer according to the exemplary embodiment is not limited to a configuration in which heat pump drying of clothes is performed. For example, dehumidification unit 6 may be of a water cooled type dehumidification unit that directly sprays water on drying air, and heating unit 7 may be a heater. However, as will be described below, a configuration that uses heat pump drying for clothes is more preferable.

[0051] As shown in FIG. 1, the drum type washer-dryer according to the exemplary embodiment further includes discharge temperature detecting unit 72 including, for example, a thermistor or the like that detects a temperature of drying air that is brought into contact with clothes and then discharged from drum 1. At this time, discharge temperature detecting unit 72 is arranged at discharge port 5 or near discharge port 5. As will be described in detail below, on the basis of a temperature of drying air detected by discharge temperature detecting unit 72 at discharge port 5, air passage switching unit 12 is controlled in the middle of the drying process to switch first air passage 9 and second air passage 11.

[0052] An operation of the drum type washer-dryer according to the exemplary embodiment will be described

below with reference to FIG. 2. FIG. 2 is a block diagram showing a schematic configuration of the drum type washer-dryer according to the exemplary embodiment of the present invention.

[0053] As shown in FIG. 2, the drum type washer-dryer according to the exemplary embodiment has control unit 70 that controls an operation of the drum type washer-dryer.

[0054] More specifically, control unit 70 controls a series of driving operations including washing, rinsing, spin-drying, and drying operations (will be described below) on the basis of setting information input by a user through input setting unit 32 and information of monitoring operation states of the respective units. Control unit 70 controls door lock unit 37 of door 35 in an operation of the drum type washer-dryer.

[0055] More specifically, control unit 70 performs the following control in, for example, a drying process. Control unit 70 controls rotation of drum drive motor 3 through motor drive circuit 22. Control unit 70 controls operations of blower unit 4 and heat pump device 50. Furthermore, control unit 70, on the basis of results of detection temperatures detected by temperature detecting unit 71 arranged on window glass 36 and discharge temperature detecting unit 72 arranged at discharge port 5, controls air passage switching unit 12 to switch first air passage 9 and second air passage 11.

[0056] Control unit 70 is configured by, for example, a CPU (Central Processing Unit) (not shown), a ROM (Read Only Memory) that stores a program, a RAM (Random Access Memory) that stores a program and data in execution of various processes, an input/output interface, a bus that connects these components, and the like.

[0057] The exemplary embodiment explains an example in which only one first air outlet 8 of first air passage 9 is formed. However, the present invention is not limited to the configuration, and, for example, plurality of first air outlets 8 may be formed. Similarly, an example in which only one second air outlet 10 of second air passage 11 is formed is explained. However, the present invention is not limited to the configuration, and, for example, plurality of second air outlets 10 may be formed. In this manner, the drying air is uniformly applied to the clothes to make it possible to suppress the clothes from being unevenly dried.

[0058] The control operation of the drum type washer-dryer according to the exemplary embodiment, in particular, a control operation in the drying process will be described below in detail with reference to FIG. 3. The drying process generally includes three sections, i.e., a drying opening stage, a drying middle stage, and a drying closing stage.

[0059] FIG. 3 is a time chart showing an example of timings at which an air passage switching unit switches a first air passage and a second air passage in the drum type washer-dryer according to the exemplary embodiment of the present invention.

[0060] As shown in FIG. 3, in the exemplary embodiment, in the sections of the drying opening stage to the drying middle stage in the drying process, drum 1 is rotated to efficiently move clothes. At this time, control unit 70 causes air passage switching unit 12 to switch the air passage to second air passage 11 and blows low-flow-rate drying air from second air outlet 10 of second air passage 11 at a relatively high speed to bring the drying air in contact with clothes. In this manner, the clothes are suppressed from being unevenly dried.

[0061] In the section of the drying closing stage of the drying process, control unit 70 controls air passage switching unit 12 to switch the air passage to first air passage 9, and injects high-flow-rate drying air from first air outlet 8 of first air passage 9 at a low speed to apply the drying air to the clothes.

[0062] More specifically, in the sections of the drying process, first air passage 9 and second air passage 11 are switched to apply drying air to the clothes, and the clothes are efficiently dried to make it possible to suppress the clothes from being unevenly dried. Furthermore, the clothes can be suppressed from being wrinkled.

[0063] In the drum type washer-dryer according to the exemplary embodiment, in the drying process, on the basis of a temperature of window glass 36 detected by temperature detecting unit 71 arranged on window glass 36, first air passage 9 and second air passage 11 are selectively switched.

[0064] More specifically, when temperature detecting unit 71 detects first predetermined temperature A in the middle of the drying process, in the drying opening stage to the drying middle stage in the drying process, control unit 70 controls air passage switching unit 12 to switch second air passage 11 that has blown drying air to first air passage 9.

[0065] More specifically, at the timings of the drying opening stage and the drying middle stage in the drying process in which the temperature of window glass 36 is low, by using second air passage 11, high-speed and low flow-rate drying air is applied to clothes. In this manner, the drying air blown from second air outlet 10 of second air passage 11 effectively dries the clothes. As a result, the clothes are suppressed from being unevenly dried.

[0066] However, in the period of the drying closing stage in the drying process, since a moisture content of the clothes is small, high- temperature drying air blown from second air outlet 10 increases the temperature of window glass 36 near second air outlet 10. Thus, when temperature detecting unit 71 arranged on window glass 36 detects first predetermined temperature A set in advance, control unit 70 controls air passage switching unit 12 to switch the air passage to first air passage 9. In this manner, the temperature of window glass 36 is suppressed from being increased by the high- temperature drying air blown from second air outlet 10. First predetermined temperature A is preferably set to, for example, 60 deg C or less at which a user is not burned when

touching window glass 36.

[0067] The high-temperature drying air sent from first air outlet 8 formed at the rear of drum 1 by switching the air passage to first air passage 9 passes across the front part of drum 1 having window glass 36 in the middle of discharging from discharge port 5 after the drying air is in contact with the clothes to have a reduced temperature. For this reason, the drying air having the reduced temperature can reduce the temperature of window glass 36. In this manner, without increasing the temperature of window glass 36 to first predetermined temperature A or more, the clothes can be further dried by low-speed, high-flow-rate drying air sent from first air outlet 8.

[0068] More specifically, according to the exemplary embodiment, on the basis of the temperature of window glass 36, air passage switching unit 12 is controlled to switch first air passage 9 and second air passage 11 to make it possible to control the temperature of window glass 36 to first predetermined temperature A or less. For this reason, in the middle of or immediately after the drying operation, a time required to cool window glass 36 to open/close door 35 is not necessary. As a result, the door lock unit is canceled without a cooling process for cooling window glass 36 by temporarily stopping the drying operation in the middle of the drying operation, making it possible to immediately pick up clothes from drum 1 at any time.

[0069] In a conventional technique, in the cooling process, a power consumption can be reduced because a power consumption required to cool window glass 36 is not needed.

[0070] Furthermore, window glass 36 need not be cooled, clothes that have a high ratio of synthetic fiber and are easily dried can be easily picked up even in the middle of the drying operation. As a result, the clothes that can be easily dried can be prevented from being over dried.

[0071] In the exemplary embodiment, a reason why the air passage is switched to first air passage 9 in the period of the drying closing stage in the drying process will be described below.

[0072] In general, in the period of the drying closing stage in which the temperature of window glass 36 increases, since a moisture content of the clothes is low, a long time is required to vapor the moisture by bring the moisture into contact with the drying air. Thus, in the period of the drying closing stage, low-speed, high-flow-rate drying air is sent from first air outlet 8 of first air passage 9 into drum 1 to increase the opportunity to bring the moisture into contact with the drying air. At this time, since an air-passing sectional area of first air outlet 8 of first air passage 9 is smaller than an air-passing sectional area of second air outlet 10 of second air passage 11, a pressure loss of first air passage 9 is smaller than that of second air passage 11. For this reason, even though blower unit 4 is driven with a small power consumption, high-flow-rate drying air can be obtained. As a result, a drying time in the period of the drying closing stage of the drying process can be shortened, and a power consumption in the period can be reduced.

[0073] Unlike in a conventional drum type washer-dryer, the temperature of window glass 36 does not become high, a cooling process of cooling window glass 36 performed before the clothes are picked up from drum 1 is not required. In this manner, during the drying operation, the clothes can be picked up from drum 1 at any time. As a result, a preferable finishing state of dried clothes can be realized with a low power consumption within a short total drying period while being suppressed from being unevenly dried.

[0074] Another example of the control operation in the drying process of the drum type washer-dryer according to the exemplary embodiment will be described below by using FIG. 4 with reference to FIG. 1.

[0075] FIG. 4 is a time chart showing an example of timings at which an air passage switching unit switches a first air passage and a second air passage in another example of the drum type washer-dryer according to the exemplary embodiment.

[0076] As described above, the drum type washer-dryer shown in FIG. 1 includes discharge temperature detecting unit 72 such as a thermistor that detects a temperature of drying air that is in contact with clothes and discharged from drum 1 on discharge port 5 or near discharge port 5.

[0077] In the exemplary embodiment, as will be described below in detail, timings of a drying opening stage, a drying middle stage, and a drying closing stage in a drying process are determined on the basis of a temperature of drying air in discharge port 5 detected by discharge temperature detecting unit 72 to control an air passage switching unit.

[0078] A pre-heating period, a constant drying period, and a decreasing drying period in the drying process shown in FIG. 4 will be described below.

[0079] In general, when sufficiently moist clothes are in a constant dry condition (for example, are in drying air having a constant temperature, a constant humidity, and a wind speed), a dryness factor in the drying process and a temperature of the drying air change as shown in FIG. 4, and drying periods are discriminated from each other as three drying periods, i.e., pre-heating period A, constant drying period B, and decreasing drying period C.

[0080] More specifically, pre-heating period A is a period in which clothes are warmed by heat of the drying air. Constant drying period B is a period in which moisture is present on a surface of clothes and the moisture is vaporized from the surface of the clothes to reduce a weight of the moist clothes at a constant rate. Decreasing drying period C is a period in which moisture on the surface of clothes are eliminated, and a speed of evaporation from the surface of the clothes is higher than a speed of movement of moisture from the inside of the clothes to the surface thereof to increase a surface temperature of the clothes and to gradually decrease a dryness factor (drying speed).

[0081] As shown in FIG. 4, in the drying process, a temperature of drying air that is in contact with the clothes gradually increases in pre-heating period A, the temperature is constant in constant drying period B, and the temperature increases again in decreasing drying period C.

[0082] In general, even in constant drying period B, drying of the clothes progresses, and a dryness factor (weight ratio of a weight of wet clothes in the middle of drying to a weight of clothes serving as a reference of a dry state) increases. However, in constant drying period B, a change in temperature of drying air that is in contact with the clothes is small. For this reason, even though the temperature change is measured, a change in dryness factor in constant drying period B after the temperature changes cannot be easily captured.

[0083] On the other hand, a washer-dryer in recent years, due to improvement of spin-drying capability, a moisture content of clothes at the start of a drying process after washing and spin-drying is considerably small, and the clothes are dried to have a dryness factor of 85% to 86%.

[0084] Thus, in the state in which the clothes are dried to have a dryness factor of 85% to 86%, as in the exemplary embodiment, when drying air (high-flow-rate drying air having a low humidity) having a drying capability higher than that in a conventional technique is applied to clothes, a dryness factor in the drying process and a temperature of the drying air change as shown in FIG. 4. More specifically, even in pre-heating period A, moisture on the surface of the clothes is vaporized to some extent.

[0085] For this reason, constant drying period B after pre-heating period A is almost eliminated, the surface of the clothes is dried to some extent, and a drying speed from the surface is higher than a speed of movement of moisture from the inside of clothes. That is, decreasing drying period C is started little time after the start of the drying process.

[0086] In decreasing drying period C, a temperature of the drying air that is in contact with the clothes gradually increases. For this reason, by the change in temperature of the drying air, a progressing state of drying of the clothes, i.e., a dryness factor of the clothes can be estimated.

[0087] However, in conventional heater drying, when air that is merely dehumidified by water cooling with tap water or air cooling with room air is heated by a heater to obtain drying air. For this reason, as in the exemplary embodiment, a drying process almost occupied with decreasing drying period C shown in FIG. 4 cannot be easily realized.

[0088] More specifically, as in the exemplary embodiment, by using high-flow-rate drying air obtained by a heat pump scheme that can dehumidify a large amount of air with a refrigerant having a sufficiently low temperature, a drying process that is almost occupied with decreasing drying period C and rarely includes constant drying period B as shown in FIG. 4 can be realized. For this reason, in the exemplary embodiment, a configuration in which clothes are dried with a heat pump scheme using heat pump device 50 is preferable.

[0089] Thus, in the exemplary embodiment, in the drying process almost occupied with decreasing drying period C, control unit 70 estimates a temperature of window glass 36 on the basis of a temperature of drying air detected by discharge temperature detecting unit 72 of discharge port 5. More specifically, in order to control the temperature of window glass 36 to first predetermined temperature A or less, for example, 60 deg C, when the temperature of drying air detected by discharge temperature detecting unit 72 reaches second predetermined temperature B, control unit 70 controls air passage switching unit 12 to switch second air passage 11 to first air passage 9.

[0090] More specifically, when second air passage 11 is switched to first air passage 9 when the temperature reaches second predetermined temperature B, drying air sent from first air outlet 8 communicating with first air passage 9 formed at the rear of drum 1 is brought into contact with the clothes and then discharged from discharge port 5 across the front part of drum 1 having window glass 36. As a result, window glass 36 is brought into contact with the drying air of the temperature which decreases after drying air is in contact with the clothes to make it possible to reduce the temperature of window glass 36.

[0091] Even though the temperature of the drying air detected by discharge temperature detecting unit 72 is second predetermined temperature B or less, timings of the drying opening stage, the drying middle stage, and the drying closing stage in the drying process can be determined as described below.

[0092] In this case, control unit 70, depending on the determined timings of the drying opening stage, the drying middle stage, and the drying closing stage in the drying process, controls air passage switching unit 12 to timely switch first air passage 9 and second air passage 11. More specifically, control unit 70, after the start of the drying process, determines a period until the temperature reaches a specific temperature as the drying opening stage on the basis of the temperature of drying air detected by discharge temperature detecting unit 72. Control unit 70, after the period is determined as the drying opening stage, determines a period until the temperature of drying air detected by discharge temperature detecting unit 72 reaches a specific higher temperature as the drying middle stage. Control unit 70, after the period is determined as drying middle stage, determines a period until the drying process ends as the drying closing stage. In this manner, the timings of the drying opening stage, the drying middle stage, and the drying closing stage in the drying process can be determined.

[0093] A temperature (more specifically, a temperature of drying air flowing into drum 1) of drying air heated by heating unit 7 is almost constant (including constant). For this reason, on the basis of only the temperature of drying

air detected by discharge temperature detecting unit 72, the timings of the drying opening stage, the drying middle stage, and the drying closing stage in the drying process can also be determined.

[0094] According to another example of the exemplary embodiment, on the basis of a detection result of a temperature of drying air detected by discharge temperature detecting unit 72, a temperature of window glass 36 is estimated to set second predetermined temperature B. In the middle of the drying process, when discharge temperature detecting unit 72 detects second predetermined temperature B, first air passage 9 and second air passage 11 are timely switched through air passage switching unit 12. In this manner, the temperature of window glass 36 can be controlled to first predetermined temperature A or less.

[0095] According to another example of the exemplary embodiment, in the middle of the drying process, a section in which high-flow-rate drying air is blown from first air outlet 8 to dry clothes is set. For this reason, unlike in the conventional technique, the window glass need not be cooled by setting a cooling process and using high-pressure, high-speed drying air. Thus, a total power consumption can be reduced. In this manner, with a low power consumption, clothes are suppressed from being unevenly dried, and a preferable finishing state of dried clothes can be realized.

[0096] Another example of the control operation in the drying process of the drum type washer-dryer according to the exemplary embodiment will be described below by using FIG. 5 with reference to FIGS. 1, 2, and 4.

[0097] FIG. 5 is a time chart showing an example of timings at which an air passage switching unit switches a first air passage and a second air passage in another example of the drum type washer-dryer according to the exemplary embodiment. FIG. 5 shows a time chart obtained when a quantity of clothes is small, and FIG. 4 shows a time chart obtained when a quantity of clothes is large.

[0098] The exemplary embodiment is different from the above exemplary embodiment in that, by using quantity-of-clothes detecting unit 15 shown in FIG. 2, depending on a quantity of clothes put in drum 1, air passage switching unit 12 is controlled to switch first air passage 9 and second air passage 11.

[0099] More specifically, in the exemplary embodiment described by using FIG. 3 or 4, control unit 70, on the basis of a temperature of window glass 36 and a temperature of drying air of discharge port 5 that are detected by temperature detecting unit 71 and discharge temperature detecting unit 72, determines timings of periods of the drying opening stage, the drying middle stage, and the drying closing stage in the drying process.

[0100] However, in general, depending on a quantity of clothes to be dried, a relationship between a temperature of drying air detected by discharge temperature detecting unit 72 and a temperature of window glass 36 detected by temperature detecting unit 71 changes for the following reason.

[0101] This is because, since a surface area of clothes that are in contact with drying air increases when a quantity of clothes to be dried is large, an amount of evaporation of moisture from the surface of clothes also increases. When the amount of evaporation of moisture increases, a large amount of heat of drying air is consumed. For this reason, a temperature of drying air detected by discharge temperature detecting unit 72 after the drying air is in contact with the clothes becomes low when a quantity of clothes to be dried increases.

[0102] When the quantity of clothes is large, the opportunity to bring the clothes into contact with window glass 36 increases. For this reason, the temperature of window glass 36 tends to have a rising rate lower than a rate of increase in temperature of discharge temperature detecting unit 72. On the other hand, when the quantity of clothes is small, the temperature of window glass 36 tends to have a rising rate higher than a rate of increase in temperature of discharge temperature detecting unit 72. More specifically, in comparison with second predetermined temperature B set by the temperature of drying air after the drying air is in contact with the clothes, the temperature of window glass 36 varies depending on a quantity of clothes to be dried and decreases when the quantity of clothes increases.

[0103] More specifically, depending on a quantity of clothes, a temperature detected by discharge temperature detecting unit 72 and a temperature detected by temperature detecting unit 71 may be different from each other.

[0104] Thus, in the exemplary embodiment, quantity-of- clothes detecting unit 15 detects a quantity of clothes to be dried, and changes second predetermined time B serving as a criterion of judgment (estimation) of the temperature of window glass 36 by the following method on the basis of the detection result of the quantity of clothes.

[0105] First, in control unit 70, quantity- of- clothes detecting unit 15 shown in FIGS. 1 and 2 detects a quantity (weight) of clothes put in drum 1 before washing is started. More specifically, first, quantity- of- clothes detecting unit 15 detects a displacement of damper 14 of the axial direction in an empty state of water tank 2 (state in which no water is present in water tank 2 and no clothes are put in drum 1) . Before the washing is started, before water is injected into water tank 2 (state in which no water is present and clothes are present in drum 1) , the displacement of damper 14 in the axial direction is detected. On the basis of a difference between the displacements of damper 14 in the axial direction, for example, a vertical direction detected by quantity- of- clothes detecting unit 15, control unit 70 detects a quantity of clothes put in drum 1.

[0106] Control unit 70, on the basis of the quantity of clothes detected by quantity-of-clothes detecting unit 15, sets second predetermined temperature B. More specifically, when a quantity of clothes shown in FIG. 5 is small, control unit 70 sets second predetermined temperature

B to B2. On the other hand, when a quantity of clothes shown in FIG. 4 is large, control unit 70 sets second predetermined temperature B to B1.

[0107] That is, as shown in FIG. 5, when a quantity of clothes is small, a period until the dryness factor reaches 90% or 100% is short. Since the quantity of clothes is small, the temperature of window glass 36 tends to be higher than the temperature of drying air detected by discharge temperature detecting unit 72. This is caused by a relationship between a heat capacity of the drying air and a heat capacity of the clothes. That is, clothes are quickly dried when a quantity of clothes is small, and, since the temperature of the drying air does not decrease after the clothes are dried, window glass 36 is further heated to have a high-temperature.

[0108] Thus, control unit 70 sets second predetermined temperature B of discharge temperature detecting unit 72 to satisfy B2 < B1 to set the temperature of window glass 36 to first predetermined temperature A or less. More specifically, when a quantity of clothes to be dried is small, control unit 70 sets second predetermined temperature B set on the basis of a detected temperature of discharge temperature detecting unit 72 to a lower temperature.

[0109] According to another example of the exemplary embodiment, on the basis of a quantity of clothes to be dried, second predetermined temperature B serving as a criterion of judgment of the temperature of window glass 36 can be optimized. At this time, as shown in FIG. 4, when a quantity of clothes is large, second predetermined temperature B is set to be high, i.e., B1. In this manner, in the drying process, in the period of the drying middle stage in which clothes are easily wrinkled, the temperature is suppressed from reaching second predetermined temperature B, and drying air is efficiently blown to the clothes to make it possible to suppress the clothes from being unevenly dried. Relatively high-speed drying air that suppresses the clothes from being wrinkled can be blown from second air outlet 10 of second air passage 11 to continuously apply the drying air to the clothes for a long period of time.

[0110] On the other hand, as shown in FIG. 5, when a quantity of clothes is small, second predetermined temperature B is set to be low, i.e., B2. In this manner, while the temperature of window glass 36 is kept at first predetermined temperature A or less, in the period of the drying closing stage of the drying process, a high-flow-rate drying air can be injected from first air outlet 8 of first air passage 9.

[0111] More specifically, in the drying process, on the basis of second predetermined temperature B set depending on a quantity of clothes, air passage switching unit 12 is controlled to switch first air passage 9 and second air passage 11 to make it possible to suppress the clothes from being unevenly dried and wrinkled and to realize a low power consumption.

[0112] In comparison with a case in which second predetermined temperature B is set to be constant regardless of a quantity of clothes, for example, depending on a maximum quantity of clothes, first air passage 9 and second air passage 11 can be switched in an optimum drying period depending on a quantity of clothes. As a result, a total power consumption can be suppressed, and the clothes can be prevented from being unevenly dried. The clothes are also suppressed from being wrinkled, and a preferable finishing state of dried clothes can be realized.

[0113] Another example of the drum type washer-dryer according to the exemplary embodiment of the present invention will be described below with reference to FIG. 6.

[0114] FIG. 6 is a sectional side view showing a schematic configuration of another example of the drum type washer-dryer according to the exemplary embodiment of the present invention.

[0115] More specifically, as shown in FIG. 6, the drum type washer-dryer according to the exemplary embodiment has a shape of window glass 36 and a blowing direction of drying air blown from second air outlet that are different from those in the drum type washer-dryer shown in FIG. 1. Since the other configurations and operations are basically the same as those of drum type washer-dryer shown in FIG. 1, a description thereof will be omitted.

[0116] More specifically, as shown in FIG. 6, in the drum type washer-dryer according to the exemplary embodiment, second air outlet 10 communicating with second air passage 11 is arranged to make for window glass 36. At this time, window glass 36 has a bowl-like shape such that, for example, an arc-shaped section of a cross section protrudes toward a bottom part of drum 1 along a top-to-bottom direction to guide drying air blown from second air outlet 10 to the lower part of drum 1. In this manner, as indicated by an outline arrow in the drawing, drying air can be blown from the lower part of drum 1 into drum 1 along window glass 36 and guided into drum 1 while causing clothes to curl up from the lower part of drum 1. As a result, the drying air is efficiently applied to the clothes to make it possible to prevent the clothes from being unevenly dried.

[0117] Second air outlet 10 is preferably formed to blow the drying air toward substantially a center (including the center) of window glass 36. In this manner, the drying air can be uniformly diffused into drum 1 along the shape of window glass 36. As a result, the clothes are more suppressed from being unevenly dried.

[0118] According to the exemplary embodiment, drying air sent from second air outlet 10 is applied to window glass 36, guided by window glass 36, and headed to the lower part of drum 1. When the drying air curls up in drum 1, the drying air is brought into contact with clothes and dries the clothes while blowing up the clothes. In this manner, the clothes can be dried while being efficiently moved.

[0119] According to the exemplary embodiment, the clothes stored in drum 1 are agitated while being raised with rotation of drum 1, and the blown-up clothes are in

contact with drying air curling from the lower part of drum 1. Since the drying air spreads in the entire area of drum 1 and is brought into contact with all the clothes. As a result, the clothes can be effectively dried while being suppressed from being unevenly dried.

[0120] According to the exemplary embodiment, since drying air having substantially a constant (including constant) temperature heated by heating unit 7 is blown along window glass 36, the temperature of window glass 36 becomes stable. For this reason, as described above, second set temperature B can be more accurately estimated on the basis of the temperature of drying air detected by discharge temperature detecting unit 72. On the basis of second set temperature B, the temperature of window glass 36 can be easily controlled to first predetermined temperature A or less. In this manner, in the middle of or immediately after the drying operation, since a cooling process to cool window glass 36 can be made unnecessary, clothes can be picked up at any time during the drying operation. As a result, the drying operation time can be shortened and the power consumption can be reduced.

[0121] The clothes dryer and the washer-dryer according to the present invention are not limited to the exemplary embodiments described above, and various changes and modifications can be effected without departing from the scope of the invention, as a matter of course.

[0122] In each of the exemplary embodiments, as quantity-of-clothes detecting unit 15, a scheme that detects a vertical displacement magnitude of the axis of damper 14 is exemplified. However, quantity-of-clothes detecting unit 15 is not limited to the scheme. For example, a scheme that detects variables such as a rotating speed, a drive current, and a torque of drum drive motor 3 that rotates drum 1 to detect a quantity of clothes in drum 1 on the basis of a variation in load of drum drive motor 3 may be applied as a quantity-of-clothes detecting unit.

[0123] The exemplary embodiment describes the example in which, on the basis of a detection result of quantity-of-clothes detecting unit 15, control unit 70 automatically changes a setting of second predetermined temperature B. However, another configuration may be used. For example, even though quantity-of-clothes detecting unit 15 is not present, on the basis of a quantity of clothes input by a user through input setting unit 32, control unit 70 may change a setting of second predetermined temperature B.

[0124] Each of the exemplary embodiments describes the drum type washer-dryer including both a washing function and a cloths drying function as an example. However, another washer-dryer may be used. For example, the present invention may be applied to a clothes dryer that does not include a washing function. More specifically, a clothes dryer may be configured by removing a washing function from the drum type washer-dryer shown in FIG. 1. More specifically, as the clothes dryer that does not include a washing function, a water supply pipe and drain pipe 40 are not connected to water tank 2 shown in FIG. 1, and water tank 2 is configured as only an outer tank of drum 1, so that the other basic configurations may be configured as in the drum type washer-dryer shown in FIG. 1.

[0125] In the exemplary embodiments described above, the drum type washer-dryer is exemplified. However, not only the drum type washer-dryer but also a dryer or a washer-dryer that is not of a drum type may be used. Furthermore, drying by hanging or a pulsator (agitator) vertical washer-dryer may be used.

[0126] As described above, a clothes dryer according to the present invention includes a drum that agitates clothes, a window glass arranged in front of the drum, a blower unit that sends drying air, a dehumidification unit that dehumidifies the drying air, and a heating unit that heats the dehumidified drying air. Furthermore, the clothes dryer includes a first air passage having a first air outlet opened at the rear of the drum, a second air passage having a second air outlet opened in front of the drum, an air passage switching unit that switches the first air passage and the second air passage, a temperature detecting unit that detects a temperature of the window glass, and a control unit. The control unit performs control to selectively switch the first air passage and the second air passage through the air passage switching unit when a detection result of the temperature detecting unit reaches a first predetermined temperature.

[0127] With the configuration, the clothes can be dried while controlling the temperature of the window glass to the first predetermined temperature or less at which a user does not feel hot when touching the window glass. For this reason, in the middle of or immediately after the drying operation, a time required to cool the window glass is not required, and the clothes can be immediately picked up at any time. Since a power consumption in a cooling process for cooling that is required in a conventional technique is made unnecessary, a power consumption can be reduced.

[0128] The clothes dryer according to the present invention further includes a discharge temperature detecting unit that detects a temperature of drying air discharged from the drum, and the control unit performs control to selectively switch the first air passage and the second air passage through the air passage switching unit when a detection result of the discharge temperature detecting unit reaches a second predetermined temperature.

[0129] With the configuration, a temperature of the window glass is estimated on the basis of a temperature of drying air discharged from the drum to make it possible to control the temperature of the window glass to the first predetermined temperature or less. For this reason, a temperature detecting unit that detects a temperature of the window glass can be made unnecessary.

[0130] The clothes dryer according to the present invention has a configuration in which drying air is blown from the second air outlet toward the window glass. The

clothes dryer has a configuration in which drying air is blown toward substantially the center of the window glass.

[0131] With the configuration, since the drying air is directly applied to the window glass, the temperature of the window glass is stable, and a correlation between the temperature detecting unit and the discharge temperature detecting unit can be more increased. As a result, even though any one of the detection results of the temperature detecting unit and the discharge temperature detecting unit is used, the temperature of the window glass can be accurately controlled to the first predetermined temperature or less.

[0132] The clothes dryer according to the present invention further includes a quantity-of-clothes detecting unit that detects a quantity of clothes in the drum, and a control unit sets a second predetermined temperature depending on a quantity of clothes detected by the quantity-of-clothes detecting unit.

[0133] With the configuration, the second predetermined temperature can be set depending on a quantity of clothes. For this reason, regardless of a quantity of clothes to be dried, a temperature of a window glass can be accurately controlled to the first predetermined temperature or less.

[0134] In the clothes dryer according to the present invention, a dehumidification unit and a heating unit are configured as a heat pump device.

[0135] With the configuration, in comparison with a heater type, a rise in temperature of the clothes themselves can be suppressed to a considerably low temperature. As a result, a clothes dryer that can prevent clothes from being thermally deteriorated, maintain durability of the clothes, and hold textures of the clothes for a long period of time can be realized.

[0136] The clothes dryer according to the present invention has a configuration in which the air-passing sectional area of the second air outlet is smaller than the air-passing sectional area of the first air outlet.

[0137] With the configuration, the drying air can be applied to the clothes while changing a flow rate or a wind speed of drying air by switching the first air outlet or the second air outlet depending on drying conditions of clothes. As a result, the clothes can be prevented from being wrinkled, and shortening of a drying time and a low power consumption can be realized.

[0138] The washer-dryer according to the present invention includes at least the clothes dryer having the above configuration and a water tank that includes a drum and stores washing water.

[0139] With the configuration, when the clothes dryer is applied, a washer-dryer that can suppress clothes from being unevenly dried with a low power consumption can be realized.

INDUSTRIAL APPLICABILITY

[0140] According to the exemplary embodiment, a drying time is shortened, and drying can be performed with a low power consumption while suppressing uneven drying. For this reason, the present invention is useful for the technical field of various clothes dryers and washer-dryers of a drum type, a hanging- dry- type, a pulsator (agitator) type, and the like.

REFERENCE MARKS IN THE DRAWINGS

[0141]

1	Drum
2	Water tank
3	Drum drive motor
4	Blower unit
4a	Blower fan
4b	Blower fan motor
5	Discharge port
6	Dehumidification unit
7	Heating unit
8	First air outlet
9	First air passage
10	Second air outlet
11	Second air passage
12	Air passage switching unit
12a	Valve
13	Circular air passage
14	Damper
15	Quantity-of-clothes detecting unit
16	Compressor
17	Radiator (Condenser)
18	Expansion unit
19	Heat absorber (Evaporator)
20	Pipe line
22	Motor drive circuit
26	Cover
27	Drain valve
32	Input setting unit
35	Door
36	Window glass
37	Door lock unit
40	Drain pipe
50	Heat pump device
70	Control unit
71	Temperature detecting unit
72, 172	Discharge temperature detecting unit
100	Housing
171	Inflow temperature detecting unit

Claims

1. A clothes dryer comprising:

a drum that agitates clothes;
a window glass openably arranged in front of the drum;
a blower unit that sends drying air;

a dehumidification unit that dehumidifies the drying air discharged from the drum;
a heating unit that heats the drying air dehumidified by the dehumidification unit;
a first air passage having a first air outlet opened at a rear of the drum for blowing the drying air into the drum;
a second air passage having a second air outlet opened in front of the drum for blowing the drying air into the drum;
an air passage switching unit that selectively switches the first air passage and the second air passage;
a temperature detecting unit that detects a temperature of the window glass; and
a control unit,
wherein the control unit performs control to selectively switch the first air passage and the second air passage through the air passage switching unit when a detection result of the temperature detecting unit reaches a first predetermined temperature.

2. The clothes dryer according to claim 1, further comprising
a discharge temperature detecting unit that detects a temperature of the drying air discharged from the drum,
wherein the control unit performs control to selectively switch the first air passage and the second air passage through the air passage switching unit when a detection result of the discharge temperature detecting unit reaches a second predetermined temperature.

3. The clothes dryer according to claim 1, wherein the drying air is blown from the second air outlet toward the window glass.

4. The clothes dryer according to claim 3, wherein the drying air is blown toward substantially the center of the window glass.

5. The clothes dryer according to claim 2, further comprising
a quantity-of-clothes detecting unit that detects a quantity of the clothes in the drum,
wherein the control unit sets the second predetermined temperature depending on the quantity of the clothes detected by the quantity-of-clothes detecting unit.

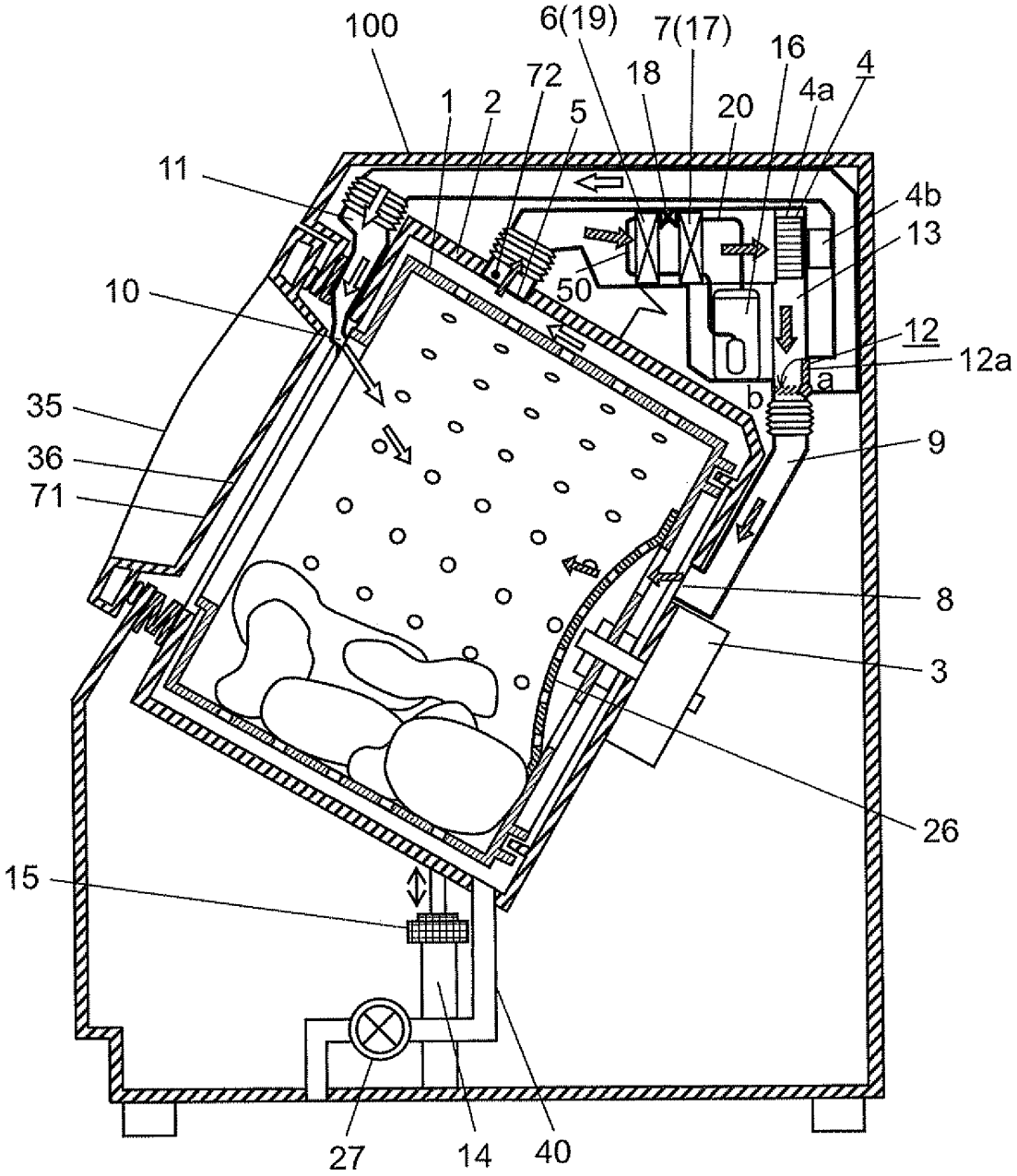
6. The clothes dryer according to claim 1, wherein the dehumidification unit and the heating unit are configured as a heat pump device.

7. The clothes dryer according to claim 1, wherein an air-passing sectional area of the second air outlet is smaller than an air-passing sectional area of the first air outlet.

8. A washer-dryer comprising:

at least the clothes dryer according to claim 1; and
a water tank that includes the drum and stores washing water.

FIG. 1


100
6(19)
7(17)
16
4
72
18
4a
1
2
5
20
11
4b
13
10
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12a
a
b
35
9
36
71
8
3
26
15
27
14
40

FIG. 2

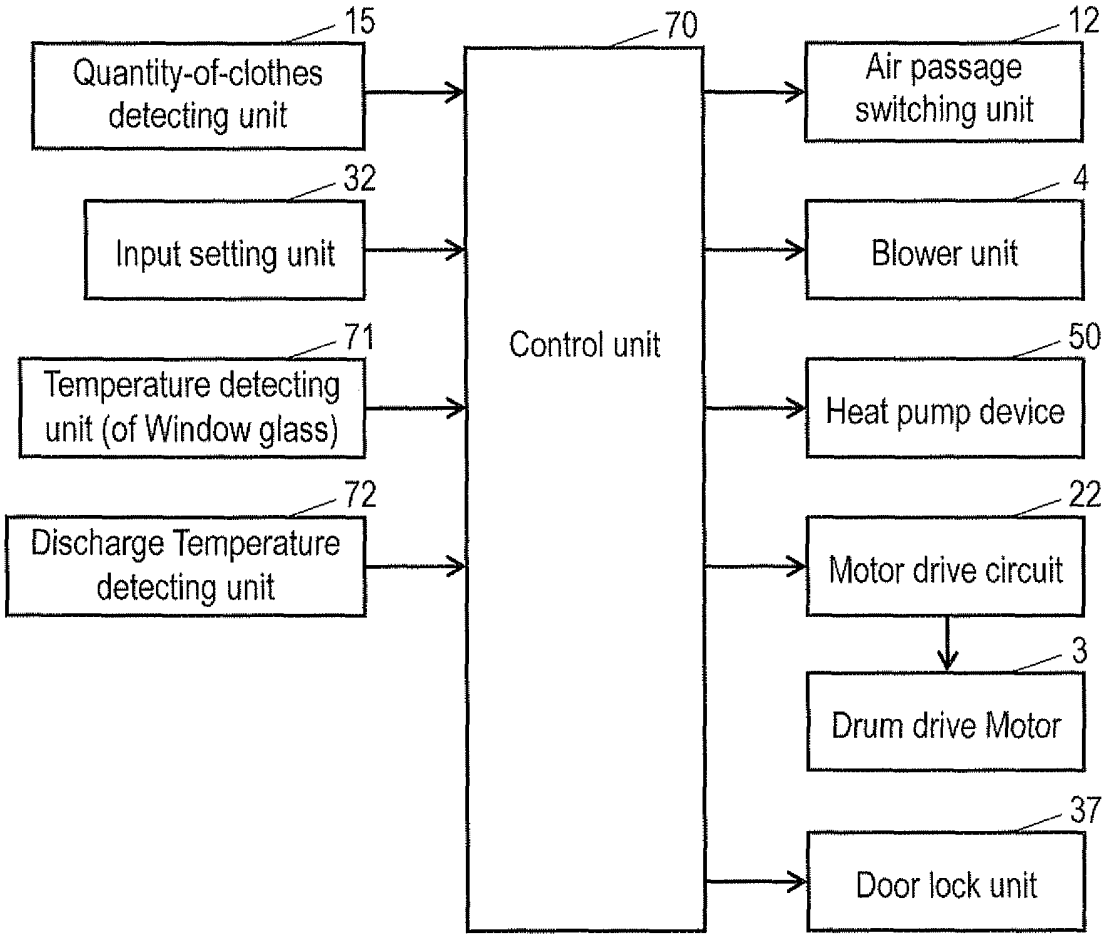

15
Quantity-of-clothes detecting unit
32
Input setting unit
71
Temperature detecting unit (of Window glass)
72
Discharge Temperature detecting unit
70
Control unit
12
Air passage switching unit
4
Blower unit
50
Heat pump device
22
Motor drive circuit
3
Drum drive Motor
37
Door lock unit

FIG. 3

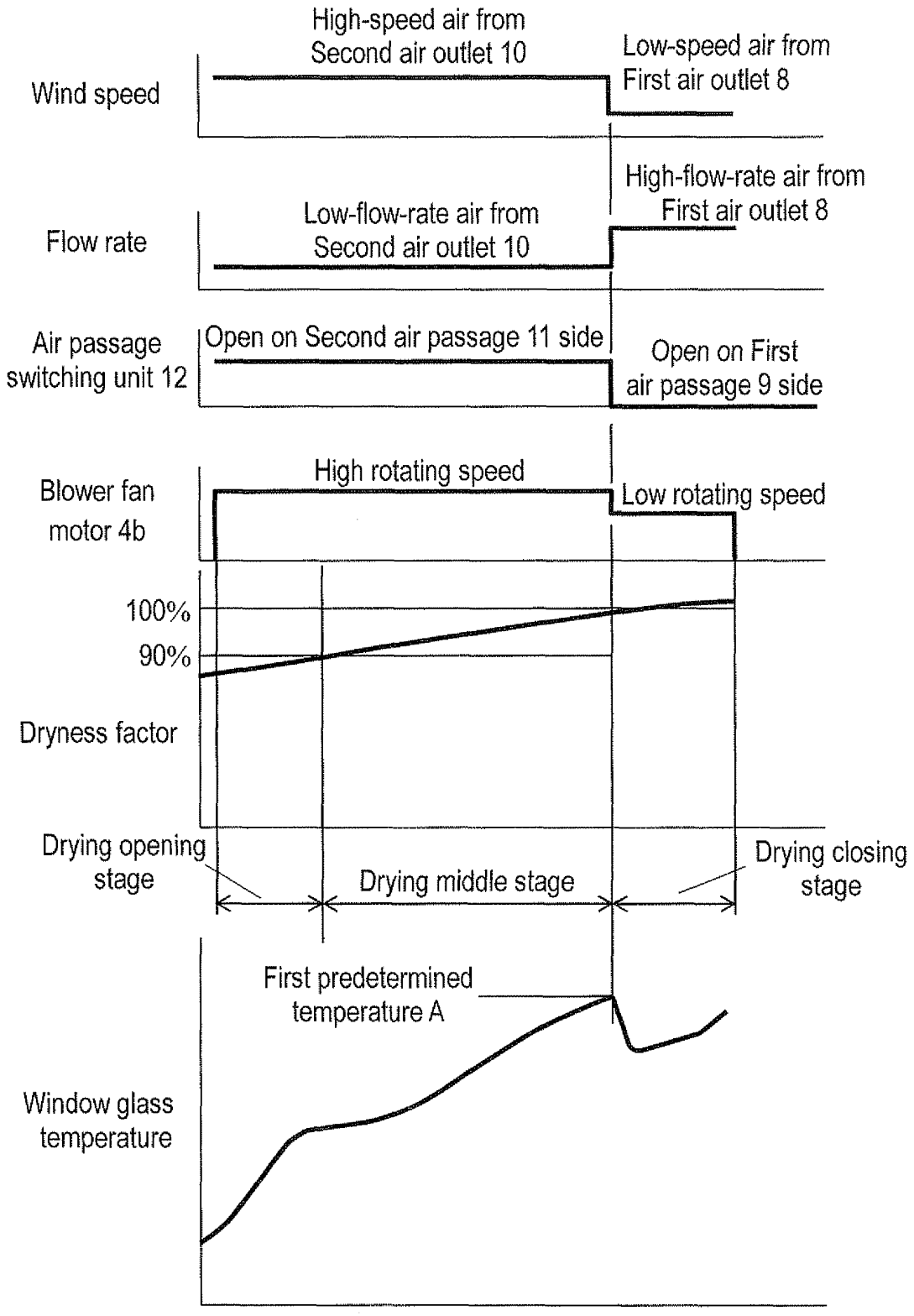

High-speed air from Second air outlet 10
Low-speed air from First air outlet 8
Wind speed
High-flow-rate air from First air outlet 8
Low-flow-rate air from Second air outlet 10
Flow rate
Air passage switching unit 12
Open on Second air passage 11 side
Open on First air passage 9 side
High rotating speed
Low rotating speed
Blower fan motor 4b
100%
90%
Dryness factor
Drying opening stage
Drying middle stage
Drying closing stage
First predetermined temperature A
Window glass temperature

FIG. 4

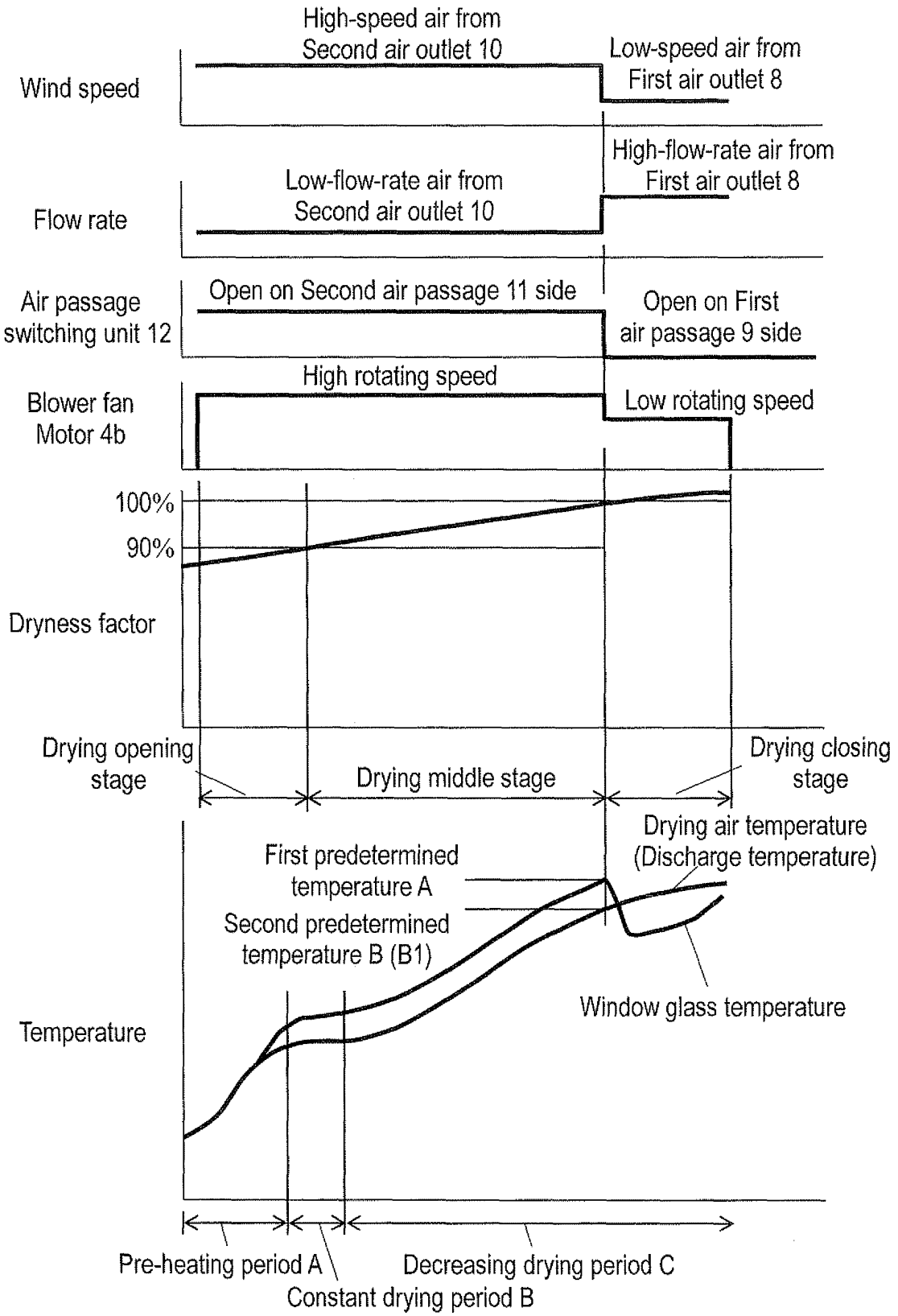

High-speed air from Second air outlet 10
Low-speed air from First air outlet 8
Wind speed
High-flow-rate air from First air outlet 8
Low-flow-rate air from Second air outlet 10
Flow rate
Open on Second air passage 11 side
Open on First air passage 9 side
Air passage switching unit 12
High rotating speed
Low rotating speed
Blower fan Motor 4b
100%
90%
Dryness factor
Drying opening stage
Drying middle stage
Drying closing stage
Drying air temperature (Discharge temperature)
First predetermined temperature A
Second predetermined temperature B (B1)
Window glass temperature
Temperature
Pre-heating period A
Constant drying period B
Decreasing drying period C

FIG. 5

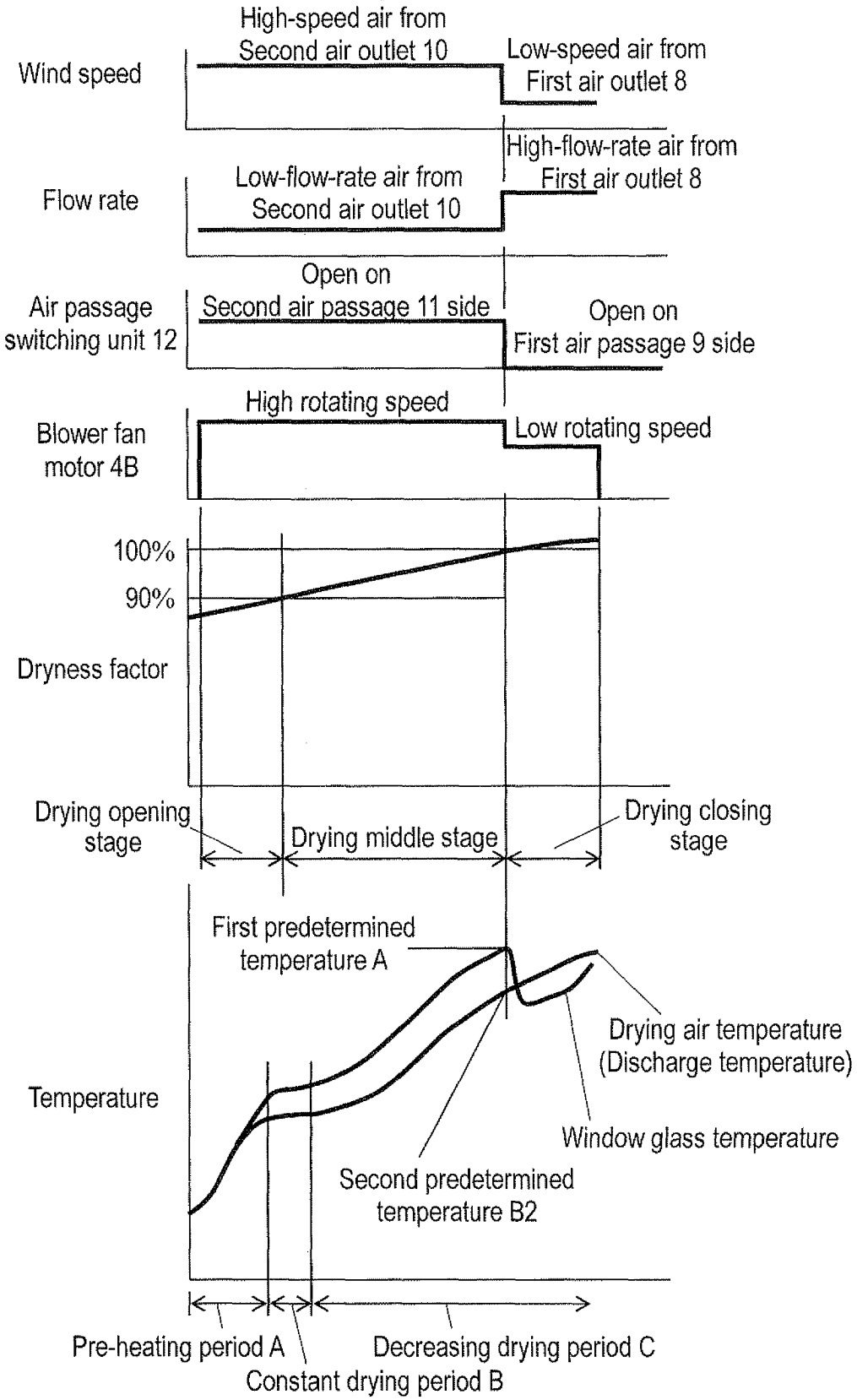

High-speed air from Second air outlet 10
Low-speed air from First air outlet 8
Wind speed
High-flow-rate air from First air outlet 8
Low-flow-rate air from Second air outlet 10
Flow rate
Open on Second air passage 11 side
Open on First air passage 9 side
Air passage switching unit 12
High rotating speed
Low rotating speed
Blower fan motor 4B
100%
90%
Dryness factor
Drying opening stage
Drying middle stage
Drying closing stage
First predetermined temperature A
Drying air temperature (Discharge temperature)
Temperature
Window glass temperature
Second predetermined temperature B2
Pre-heating period A
Constant drying period B
Decreasing drying period C

FIG. 6

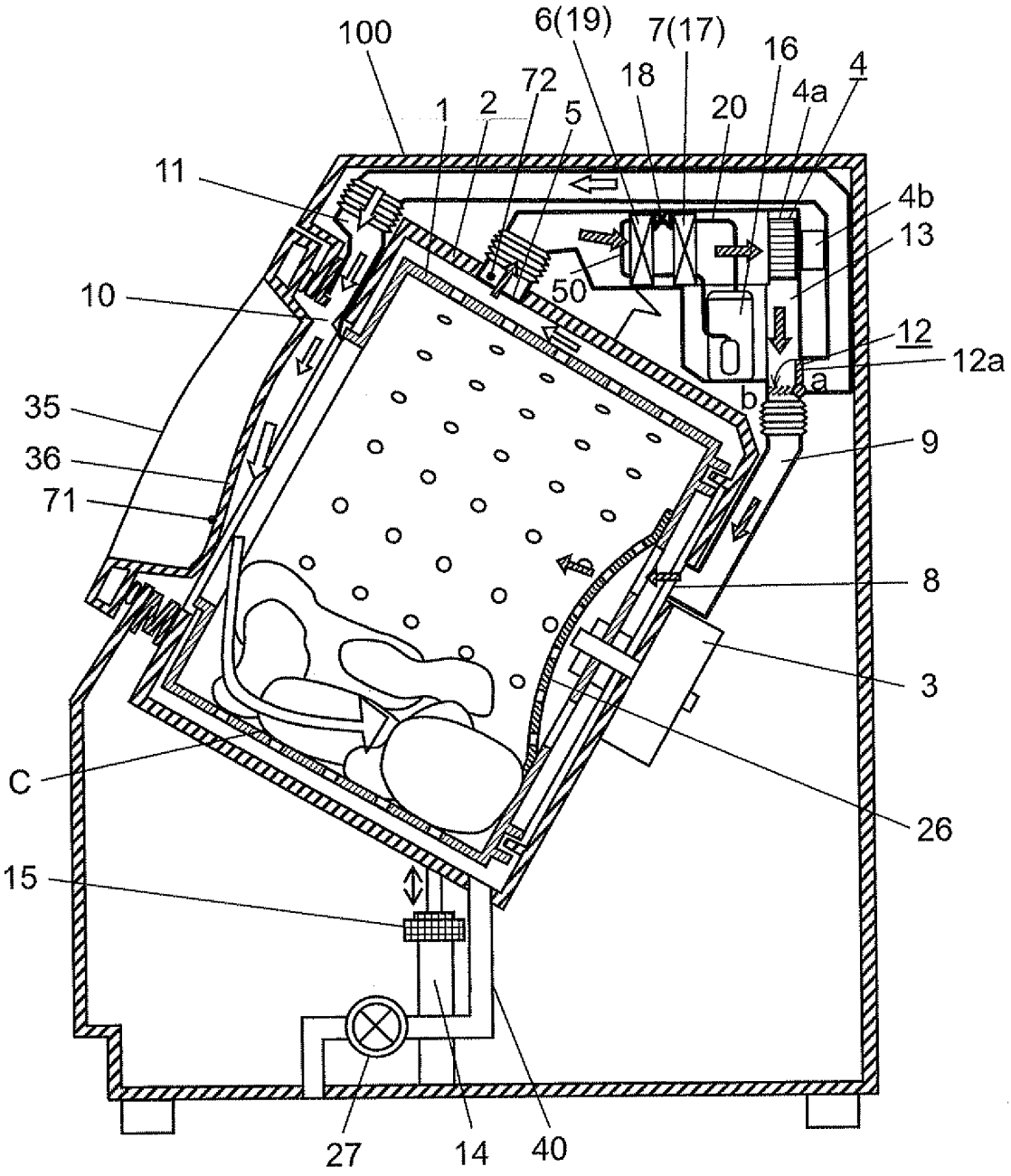

100
6(19)
7(17)
16
4
72
18
4a
1
2
5
20
11
4b
13
50
10
12
12a
a
b
35
9
36
71
8
3
C
26
15
27
14
40

FIG. 7

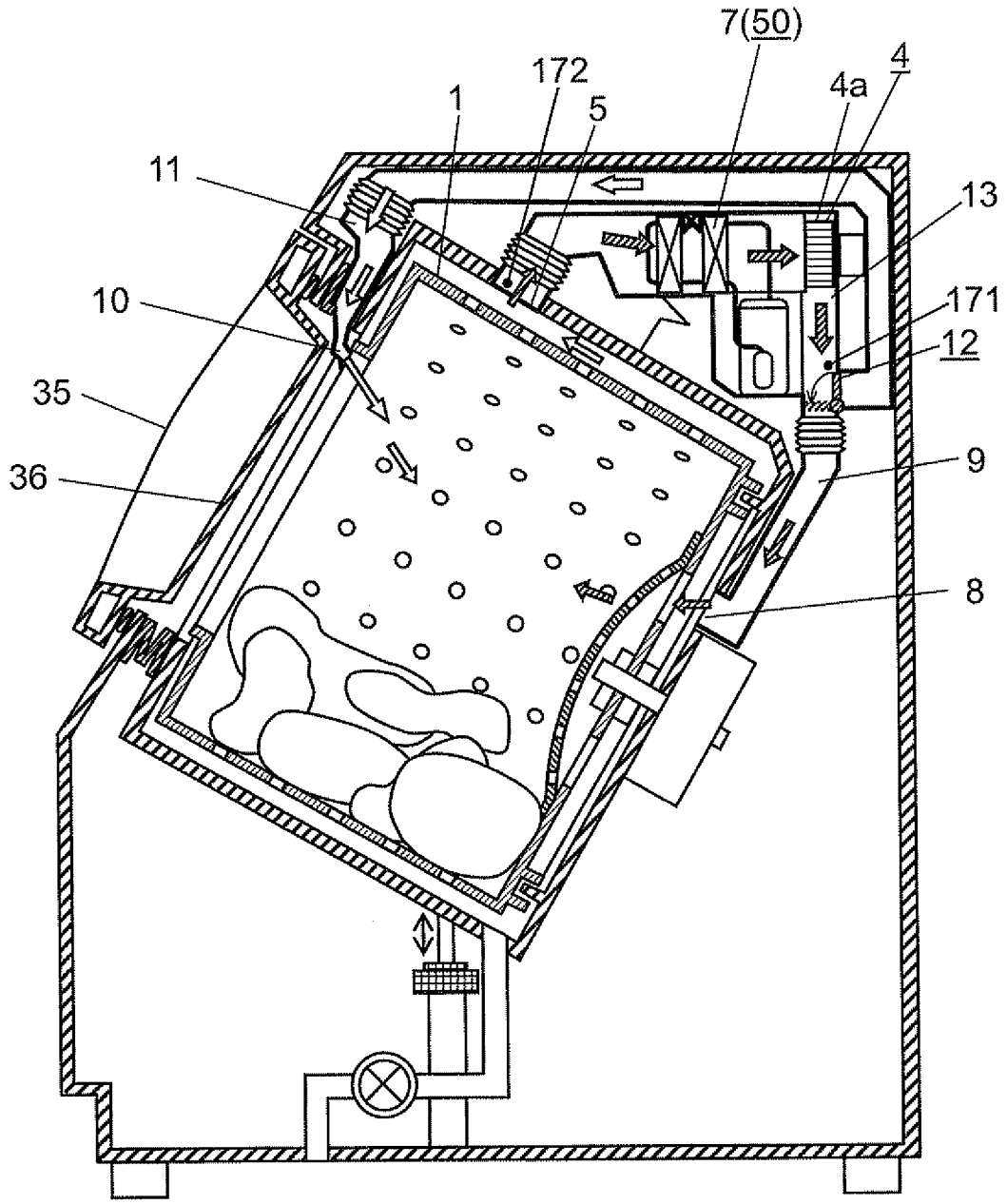
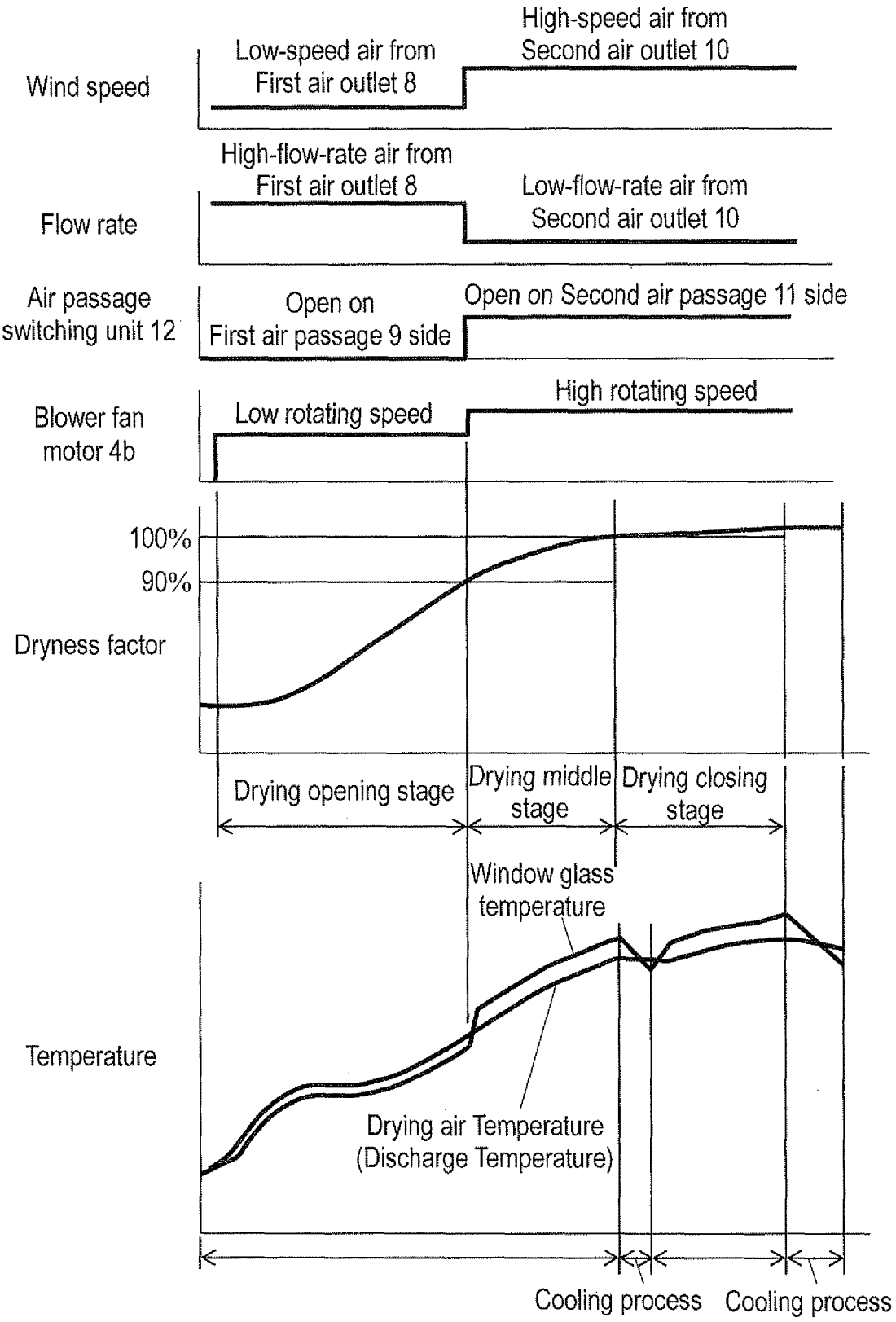


FIG. 8


Wind speed
Low-speed air from First air outlet 8
High-speed air from Second air outlet 10
Flow rate
High-flow-rate air from First air outlet 8
Low-flow-rate air from Second air outlet 10
Air passage switching unit 12
Open on First air passage 9 side
Open on Second air passage 11 side
Blower fan motor 4b
Low rotating speed
High rotating speed
100%
90%
Dryness factor
Drying opening stage
Drying middle stage
Drying closing stage
Window glass temperature
Temperature
Drying air Temperature (Discharge Temperature)
Cooling process
Cooling process

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2012/005401

A. CLASSIFICATION OF SUBJECT MATTER
D06F58/28(2006.01)i, *D06F25/00*(2006.01)i, *D06F33/02*(2006.01)i, *D06F58/02*(2006.01)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)
D06F58/28, D06F25/00, D06F33/02, D06F58/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2012
Kokai Jitsuyo Shinan Koho 1971-2012 Toroku Jitsuyo Shinan Koho 1994-2012

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2011-83459 A (Panasonic Corp.), 28 April 2011 (28.04.2011), paragraphs [0045] to [0048], [0088]; fig. 1 & WO 2011/045915 A1 & TW 201124588 A & CN 102482840 A	1-8
A	JP 2-305599 A (Sanyo Electric Co., Ltd.), 19 December 1990 (19.12.1990), page 2, lower left column, line 18 to lower right column, line 15; page 3, upper left column, lines 12 to 18; page 3, lower right column, lines 1 to 4; fig. 2 (Family: none)	1-8

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

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
26 September, 2012 (26.09.12)	09 October, 2012 (09.10.12)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (July 2009)

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Patent documents cited in the description

- JP 2011083459 A **[0014]**