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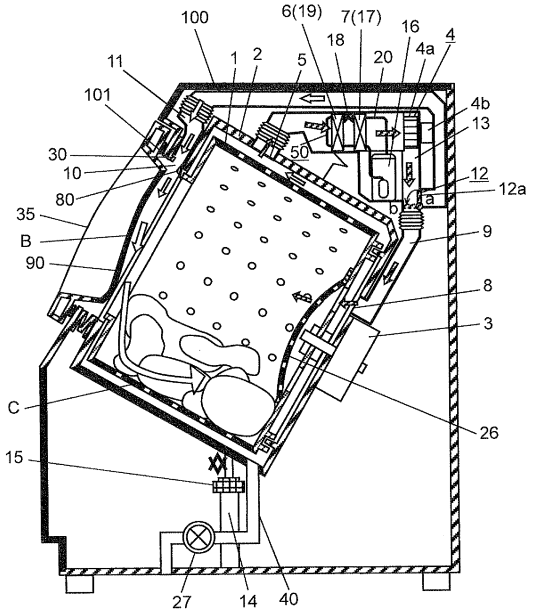
(54) CLOTHES DRYER AND WASHER/DRYER

(57) The clothes dryer according to the present invention includes a drum that is rotatably supported in a housing and agitates clothes, a window glass openably arranged in front of the drum and having a shape protruding toward a bottom part of the drum along a top-to-bottom direction, and a blower unit that sends drying air. The clothes dryer further includes a first air passage having a first air outlet opened in front of the drum for blowing drying air, and a nozzle arranged on the first air outlet outside the drum to blow the drying air toward the window glass. The window glass has a configuration that guides the drying air blown from the nozzle to a lower part of the drum. In this manner, the clothes can be efficiently evenly dried without being damaged.

FIG. 1



EP 2 602 382 A1

Description

TECHNICAL FIELD

[0001] The present invention relates a drum type clothes dryer that dries clothes and a drum type 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 and Patent Literature 2).

[0003] Conventional drum type washer-dryers described in Patent Literature 1 and Patent Literature 2 will be described below with reference to FIGS. 9 and 10.

[0004] FIG. 9 is a diagram for explaining a schematic configuration of the conventional drum type washer-dryer. FIG. 10 is an enlarged sectional view for explaining a warm air outlet unit of the conventional drum type washer-dryer.

[0005] As shown in FIGS. 9 and 10, the conventional drum type washer-dryer has a configuration in which nozzle 320 having an opening facing the inside of drum 300 is arranged and warm air blown from nozzle 320 is guided to drum 300 with drying air guide member 310 and brought into direct contact with clothes in drum 300 to dry the clothes.

[0006] However, the conventional drum type washer-dryer has a configuration in which warm air including drying air sent from nozzle 320 is brought into direct contact with the clothes in drum 300. For this reason, since the warm air concentrated on a part in drum 300 not to bring the warm air into uniform contact with the clothes in drum 300, the clothes are easily unevenly dried.

[0007] In a drying state, when the drying air and the clothes are brought into contact with each other, a rotating direction of drum 300 is constant. For this reason, the clothes are easily tangled.

Citation List

Patent Literature

[0008]

PTL 1: Unexamined Japanese Patent Publication No. 2009-50338

PTL 2: Unexamined Japanese Patent Publication No. 2010-75216

SUMMARY OF THE INVENTION

[0009] In order to solve the problems, a clothes dryer according to the present invention includes a drum that is supported in a housing and agitates clothes, a window glass arranged in front of the drum and having a shape protruding toward a bottom part of the drum along a top-to-bottom direction, and a blower unit that sends drying air. The clothes dryer further includes a first air passage having a first air outlet opened in front of the drum for blowing drying air, and a nozzle arranged on the first air outlet outside the drum to blow the drying air toward the window glass. The window glass has a configuration that guides the drying air blown from the nozzle to a lower part of the drum.

[0010] In this manner, warm air of the drying air is avoided from being concentrated on a part in the drum to make it possible to uniformly send the drying air into the drum. As a result, uneven drying or the like of the clothes can be effectively suppressed.

[0011] The clothes dryer according to the present invention includes a drum that is rotatably supported in a housing and agitates clothes, a window glass arranged in front of the drum and having a shape protruding toward a bottom part of the drum along a top-to-bottom direction, and a blower unit that sends drying air. The clothes dryer further includes a first air passage having a first air outlet opened in front of the drum for blowing drying air, and a nozzle arranged on the first air outlet outside the drum to blow the drying air toward the window glass. The clothes dryer includes a second air passage having a second air outlet opened at a rear of the drum for blowing drying air into the drum, an air passage switching unit that selectively switches the first air passage and the second air passage, a storage unit that stores at least a first predetermined time and a second predetermined time, and a control unit having a timer. The control unit performs control to selectively switch one air passage and the second air passage through the air passage switching unit when the timer clocks any of the first predetermined time and the second predetermined time stored in the storage unit.

[0012] In this manner, heat of the drying air is avoided from being concentrated on a part in the drum to make it possible to uniformly send the drying air into the drum. As a result, the clothes can be suppressed from being unevenly dried. Furthermore, depending on drying conditions of the clothes, on the basis of the first predetermined time and the second predetermined time, the first air outlet or the second air outlet is switched to make it possible to apply the drying air to the clothes while changing a flow rate and a wind speed of the drying air. 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.

[0013] 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.

[0014] In this manner, a washer-dryer that can suppress clothes from being unevenly dried, wrinkled, and tangled with a low power consumption can be realized.

BRIEF DESCRIPTION OF DRAWINGS

[0015]

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 an explanatory diagram showing a schematic configuration of a main part in FIG. 1.

FIG. 3 is a perspective view showing a side wall of a water tank of the drum type washer-dryer according to the exemplary embodiment of the present invention.

FIG. 4 is a perspective view of the water tank in FIG. 3 when viewed from the inside.

FIG. 5 is a block diagram showing a schematic configuration of the drum type washer-dryer according to the exemplary embodiment.

FIG. 6 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 and a rotation sequence of a drum in the drum type washer-dryer according to the exemplary embodiment.

FIG. 7 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. 8 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. 9 is a diagram for explaining a schematic configuration of a conventional drum type washer-dryer.

FIG. 10 is an enlarged sectional view for explaining a warm air outlet unit of the conventional drum type washer-dryer.

DESCRIPTION OF EMBODIMENT

[0016] 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

[0017] A drum type washer-dryer according to an exemplary embodiment of the present invention will be described below with reference to FIGS. 1 and 2.

[0018] 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 an explanatory diagram showing a schematic configuration of a main part in FIG. 1.

[0019] As shown in FIGS. 1 and 2, 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.

[0020] Housing 100 has door 35 facing an opening side of drum 1 and window glass 90 arranged at a position facing drum 1 of door 35. A user opens door 35 to make it possible to put or pick up clothes (laundries) in/from drum 1. At this time, window glass 90 has a bowl-like shape that protrudes toward a bottom part of the drum along a top-to-bottom direction to have, for example, an arc-shaped section of a cross section.

[0021] 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.

[0022] 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.

[0023] 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.

[0024] The heated drying air is switched to any one of first air passage 11 and second air passage 9 with air passage switching unit 12 through blower unit 4. The drying air switched and guided to any one of first air passage 11 and second air passage 9 is circulated to be blown into drum 1 again so that the clothes in drum 1 are dried.

[0025] In first air passage 11, nozzle 30 that blows drying air sent with blower unit 4 and drying air guide member 80 that guides the drying air from first air outlet 10 into drum 1 through window glass 90 by changing a blowing direction of the drying air are arranged. On the other hand, in second air passage 9, second air outlet 8 having an opening at the rear of drum 1 is arranged.

[0026] As shown in FIGS. 1 and 2, internal surface 80a

of drum 1 of drying air guide member 80 is formed such that internal surface 80a is inclined from the front end of internal surface 30a of nozzle 30 to a window glass 90 side. Nozzle 30 is arranged at an upper right part (i.e., an upper right part of the center of rotation of drum 1) of housing 100 when viewed from the front side (window glass 90 side) of housing 100 to face the center of rotation of drum 1. In this manner, the drying air blown from the distal end of nozzle 30 is guided from first air outlet 10 toward window glass 90 with surface 80a of drying air guide member 80, strikes on window glass 90, and then is blown into drum 1.

[0027] At this time, an air-passing sectional area of first air outlet 10 of first air passage 11 is formed to be smaller than an air-passing sectional area of second air outlet 8 of second air passage 9. In this manner, the drying air can be blown toward window glass 90 at a pressure and a speed that are higher than that of second air outlet 8, and after the drying air strikes on window glass 90, the drying air can be blown into drum 1.

[0028] The air-passing sectional area of second air outlet 8 of second air passage 9 is formed to be larger than the air-passing sectional area of first air outlet 10. For this reason, high-flow-rate drying air can be blown into drum 1 while keeping a pressure loss smaller than that of first air passage 11.

[0029] 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 get stuck in 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, first 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.

[0030] On the other hand, a bottom part at the rear of drum 1 has a space in which second air outlet 8 having a relatively large opening can be arranged. Thus, second air outlet 8 having a relatively small pressure loss is arranged in the bottom part at the rear of drum 1. At this time, second 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 prevent the clothes from being caught by second air outlet 8.

[0031] 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.

[0032] For this reason, in drying of a mixture of small-sized clothes and large-sized clothes, when drying air is blown from first air outlet 10 arranged at a front position of drum 1, the clothes are unevenly distributed at the front part of drum 1, and the large-sized clothes the sleeves of which are easily twisted by agitation during drying are dried at a high speed. Furthermore, when drying air blown from first air outlet 10 and diffused is applied to large-sized clothes, the large-sized clothes are easily moved (agitated) by the drying air. For this reason, heat of the drying air is extensively transmitted. As a result, an effect of suppressing uneven drying of clothes and an effect of reducing occurrence of wrinkles of the clothes are improved.

[0033] On the other hand, in drying of a mixture of small-sized clothes and large-sized clothes, when high-flow-rate drying air is blown from second 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. Thereafter, 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 10, both the small-sized clothes and the large-sized clothes can be efficiently dried while being suppressed from being unevenly dried. At this time, in particular, the small-sized clothes can be especially dried with a relatively small number of wrinkles.

[0034] Thus, as shown in FIG. 1, air passage switching unit 12 is arranged at a branch part between first air passage 11 and second air passage 9 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 11 and second air passage 9.

[0035] In this case, air passage switching unit 12 includes valve 12a pivotally supported by the branch part between first air passage 11 and second air passage 9 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 first air passage 11, second air passage 9 opens to cause drying air sent by blower unit 4 to pass through second air passage 9. On the other hand, when valve 12a is rotated on a b-side in FIG. 1 to close twelve air passage 9, first air passage 11 opens to cause drying air sent by blower unit 4 to pass through first 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 11 or second air passage 9.

[0036] 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 10 or second air outlet 8 communicating with first air passage 11 or second air passage 9 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.

[0037] 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.

[0038] At this time, when air passage switching unit 12 switches the air passage to first air passage 11, blower unit 4 rotates blower fan 4a such that a wind speed of drying air passing through first air passage 11 is a predetermined wind speed higher than a wind speed of second air passage 9. For example, when a wind speed of drying air passing through second air outlet 8 is about 10 m/s, blower fan 4a is rotated such that a wind speed of drying air passing through first air outlet 10 is about 50 m/s. The wind speeds of drying air passing through first air outlet 10 and second air outlet 8 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 first air outlet 10 is higher than the wind speed of drying air in second air outlet 8.

[0039] On the other hand, when air passage switching unit 12 switches the air passage to second air passage 9, blower unit 4 rotates blower fan 4a such that a flow rate of drying air passing through second air outlet 8 of second air passage 9 is a predetermined flow rate higher than a flow rate of drying air passing through first air outlet 10.

[0040] That is, in the drum type washer-dryer according to the exemplary embodiment, as needed, air passage switching unit 12 is controlled in the middle of a drying process to switch first air passage 11 and second air passage 9 such that the wind speed of drying air passing through first air outlet 10 of first air passage 11 is higher than the wind speed of drying air passing through second air outlet 8 or the flow rate of drying air passing through second air passage 9 is higher than the flow rate of drying air passing through first air passage 11.

[0041] 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 10 that is relatively shorter than a distance from second 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 first air outlet 10 formed in the front part of drum 1 such that the distance from second air outlet 8 is maximum.

[0042] 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.

[0043] 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.

[0044] The drum type washer-dryer according to the exemplary embodiment includes heat pump device 50 that performs heat pump dehumidification and heating.

[0045] 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.

[0046] 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.

[0047] Configurations and arrangements of nozzle 30 and drying air guide member 80 arranged on the water tank of the drum type washer-dryer according to the exemplary embodiment will be concretely described below with reference to FIG. 1 by using FIGS. 3 and 4.

[0048] FIG. 3 is a perspective view showing a side wall of the water tank of the drum type washer-dryer according to the exemplary embodiment of the present invention. FIG. 4 is a perspective view of the water tank in FIG. 3 when viewed from the inside. FIG. 4 is a perspective view showing water tank 2 cut in a circumferential direction when the inside of water tank 2 is viewed from the rear side of housing 100 to window glass 90.

[0049] As shown in FIG. 3, nozzle 30 communicating with first air passage 11 (not shown) is formed on a side wall of water tank 2 such that nozzle 30 is integrated with water tank 2.

[0050] As shown in FIGS. 1 and 4, drying air guide member 80 is formed to be arc-shaped along an edge of circular opening 101 formed in housing 100 to correspond to the front opening of water tank 2. Drying air

guide member 80 is fitted to be supported with support member 80b along the edge of circular opening 101 formed in housing 100 to put or pick up clothes in/from drum 1.

[0051] At this time, window glass 90 is fitted to have a lower part inclined to the interior of drum 1. For this reason, as shown in FIG. 4, drying air blown from first air outlet 10 with drying air guide member 80 arranged to be arc-shaped, as indicated by outline arrow W in the drawing, is blown to be converged toward, for example, the central part of window glass 90. Drying air brought into contact with window glass 90 is blown to be dispersed toward the interior of drum 1 along the shape of window glass 90 as indicated by an outline arrow Y in the drawing.

[0052] As described above, according to the drum type washer-dryer of the exemplary embodiment, nozzle 30 that blows drying air sent by blower unit 4 is arranged outside drum 1. Drying air guide member 80 that changes a direction of drying air to a position where the drying air blown from nozzle 30 is directly applied and guides the drying air to window glass 90 while converging the drying air is arranged. Furthermore, window glass 90 having a shape that guides drying air into the interior of drum 1 such that the drying air is curled up from the lower part of drum 1 while being diffused.

[0053] That is, a direction in which drying air is applied to drying air guide member 80 as in a conventional drum type washer-dryer is not changed to the interior of drum 1, and the drying air is applied to window glass 90 once.

[0054] In this manner, uneven drying caused by concentrating high-temperature drying air on a part in drum 1 can be suppressed. As a result, clothes can be uniformly dried while suppressing uneven drying of the clothes.

[0055] According to the drum type washer-dryer of the exemplary embodiment includes drying air guide member 80 that guides drying air into drum 1 after a wind direction of drying air is changed to apply drying air to window glass 90. For this reason, nozzle 30 can be arranged outside drum 1. In this manner, the distal end of nozzle 30 need not be protruded into drum 1 (into a storage space for clothes to be dried). As a result, in a drying operation, the clothes can be prevented from being damaged by striking on the distal end of nozzle 30.

[0056] According to the drum type washer-dryer of the exemplary embodiment, drying air guide member 80 is formed in an arc shape along the edge of circular opening 101 formed in housing 100. For this reason, as in a conventional technique, in comparison with a configuration in which drying air is guided from a linear, flat, long-narrow nozzle into drum 1, the drying air can be made difficult to be spread. In this manner, the drying air can be converged and guided to a predetermined position of window glass 90, and the drying air can be guided into drum 1 while being diffused with window glass 90.

[0057] A rotating operation of drum 1 performed when drying air is blown from nozzle 30 in the drum type washer-dryer according to the exemplary embodiment will be concretely described below.

[0058] When drying air is blown from nozzle 30, first, drum 1 is rotated sequentially through, for example, an inner wall of water tank 2 almost in a vertically downward direction of the center of rotation of drum 1, an inner wall of water tank 2 almost in a vertically upward direction of the center of rotation of drum 1, and an inner wall of water tank 2 at an upper right part of the center of rotation of drum 1. Thereafter, for example, drum 1 is rotated sequentially through the inner wall of water tank 2 at the upper right part of the center of rotation of drum 1, the inner wall of water tank 2 almost in the vertically upward direction of the center of rotation of drum 1, and the inner wall of water tank 2 almost in the vertically downward direction of the center of rotation of drum 1. In this manner, drum 1 rotates to alternately move between an inner wall of water tank 2 at a left part of the center of rotation of drum 1 and an inner wall of water tank 2 at a right part of the center of rotation of drum 1. More specifically, drum 1, repeats clockwise and counterclockwise half-turn operations including a clockwise turn and a counterclockwise turn when viewed from a front side (door 35 side) of housing 100. In this manner, a motion in which clothes is raised up to a predetermined level and fall down with rotation of drum 1 and a motion in which the clothes curl up are repeated.

[0059] At this time, drying air blown from nozzle 30 is blown from nozzle 30, strikes on window glass 90, and then is sent to the clothes in drum 1 while being diffused. For this reason, raising action of the clothes in drum 1 is accelerated by the drying air that is diffused and sent.

[0060] More specifically, as indicated by an arrow in FIG. 2, drying air blown from nozzle 30 is blown toward window glass 90 being in contact with middle inner wall B of door 35 by drying air guide member 80. Thereafter, the drying air guided toward the bottom part of drum 1 along window glass 90 having a shape protruding in, for example, the form of arc is guided into drum 1 by window glass 90 such that the drying air is blown to lower inner wall C of drum 1 and curls up while being diffused.

[0061] That is, the drying air guided by drying air guide member 80 strikes on window glass 90 of door 35 once, beaten against lower inner wall C of drum 1 while being diffused, and brought into contact with the clothes while curling up. In this manner, the clothes can be dried while being efficiently moved.

[0062] More specifically, clothes stored in drum 1 are agitated while being raised with rotation of drum 1, and, when the raised clothes fall down, the clothes are in contact with drying air that is blown to lower inner wall C of drum 1 and curls up. At this time, by a fall speed of the raised clothes and a speed of drying air curling from lower inner wall C of drum 1, a relative speed between the clothes and the drying air that are brought into contact with each other increases. In this manner, the clothes can be dried while being effectively moved.

[0063] Since the drying air spreads in the entire area of drum 1 while being diffused, the drying air is brought

into contact with all the clothes. As a result, the clothes can be effectively dried while being suppressed from being unevenly dried. Furthermore, since the clothes can be dried while being tense, the number of wrinkles of the clothes can also be reduced.

[0064] Furthermore, since clockwise and counterclockwise half-turns of drum 1 are repeated within a short period of time to make it possible to frequently blow up the clothes, the clothes can be dried while being suppressed from being unevenly dried and tangled.

[0065] Nozzle 30 is arranged at an upper left part of housing 100 when viewed from the front side of housing 100, counterclockwise turn, clockwise turn, and counterclockwise and clockwise half-turn operations of drum 1 may be repeated when viewed from the front side of housing 100, and the same effect as described above can be obtained.

[0066] An operation of the drum type washer-dryer according to the exemplary embodiment will be described below with reference to FIG. 5. FIG. 5 is a block diagram showing a schematic configuration of the drum type washer-dryer according to the exemplary embodiment.

[0067] As shown in FIG. 5, the drum type washer-dryer according to the exemplary embodiment has control unit 70 that controls an operation of the drum type washer-dryer.

[0068] 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.

[0069] 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 controls air passage switching unit 12 to switch first air passage 11 and second air passage 9 on the basis of the first predetermined time and the second predetermined time measured by, for example, timer 71. The first predetermined time and the second predetermined time will be described below in detail.

[0070] 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.

[0071] Control unit 70 has timer 71 that measures the first predetermined time and the second predetermined time described above. As timer 71, an internal timer built as an internal function on an operation of control unit 70 or a timer device independent of control unit 70 can be used. At this time, the first predetermined time and the second predetermined time are stored in a storage unit (not shown) of, for example, control unit 70 as a standard time in advance or stored by changing settings by an input by input setting unit 32 or a quantity of clothes (will be described later).

[0072] The exemplary embodiment explains an example in which only one second air outlet 8 of second air passage 9 is formed. However, the present invention is not limited to the configuration, and, for example, plurality of second air outlets 8 may be formed. Similarly, an example in which only one first air outlet 10 of first air passage 11 is formed is explained. However, the present invention is not limited to the configuration, and, for example, plurality of first 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.

[0073] According to the exemplary embodiment, discharge port 5 is arranged a position that is close to first air outlet 10 in front of drum 1 and far from second air outlet 8. For this reason, since the distance between second air outlet 8 and discharge port 5 becomes long, the drying air can be widely circulated around the interior of drum 1 while the drying air is sent from second air outlet 8 at the rear of drum 1. As a result, in drum 1, the clothes and the drying air are efficiently brought into contact with each other to make it possible to dry the clothes with a low power consumption.

[0074] A control operation of the drum type washer-dryer according to the exemplary embodiment, in particular, a control operation in a drying process and a rotation sequence of the drum will be described below with reference to FIG. 6.

[0075] The drying process generally includes three periods, i.e., a drying opening stage, a drying middle stage, and a drying closing stage.

[0076] Timings of the drying opening stage, the drying middle stage, and the drying closing stage in the drying process are set by times started from the start of the drying process.

[0077] Thus, in the exemplary embodiment, on the basis of the times from the start of the drying process measured by timer 71 of control unit 70, the timings of the drying opening stage, the drying middle stage, and the drying closing stage in the drying process are determined. More specifically, a period from the start of the drying process to the elapse of the first predetermined time is defined as the drying opening stage. The period until the second predetermined time having the time from the start of the drying process longer than that of the first predetermined time has elapsed after the first predetermined time has elapsed is defined as the drying middle stage. Furthermore, a period until the drying process is ended after the second predetermined time has elapsed is defined as the drying closing stage.

[0078] Control unit 70 controls air passage switching unit 12 to timely switch first air passage 11 and second air passage 9 on the basis of the first predetermined time and the second predetermined time measured by timer 71, and executes the following drying process shown in FIG. 6.

[0079] FIG. 6 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 and a rotation sequence of a drum in the drum type washer-dryer according to the exemplary embodiment of the present invention.

[0080] As shown in FIG. 6, in the periods of the drying opening stage and the drying middle stage until the first predetermined time and the second predetermined time have elapsed after the start of the drying operation, control unit 70 controls air passage switching unit 12 to switch the air passage to first air passage 11.

[0081] In this manner, from first air outlet 10 communicating with first air passage 11 having an air-passing sectional area near the air outlet smaller than that of second air outlet 8, a high-speed and low-flow-rate drying air obtained by high-speed rotation of blower fan motor 4b of blower unit 4 is applied to window glass 90 to start a drying operation.

[0082] Control unit 70 simultaneously starts the drying operation and time measurement by timer 71, and continues an open state of first air passage 11 until the second predetermined time has elapsed.

[0083] At this time, as shown in a drum rotation sequence in FIG. 6, drum 1 is rotated on the clockwise at a speed of 51 r/min (rpm) for 57 seconds. Next, after the rotation of the drum is stopped for 3 seconds, drum 1 is rotated on the counterclockwise at a speed of 51 r/min for 57 seconds. Drum 1 is stopped for 3 seconds. More specifically, the clockwise/counterclockwise rotations of drum 1 are repeated for 123 seconds. That is, a so-called tumbling clockwise/counterclockwise rotating operation is performed.

[0084] Thereafter, after drum 1 is rotated on the clockwise at a speed of 60 r/min for 0.5 seconds, drum 1 is stopped for 0.4 seconds. After drum 1 is rotated on the counterclockwise at a speed of 60 r/min for 0.5 seconds, drum 1 is stopped for 0.4 seconds. More specifically, the clockwise/counterclockwise rotations of drum 1 are repeated for 8 seconds. That is, a so-called quick clockwise/counterclockwise rotating operation is performed. The rotation speed, the rotation time, and the stop time of the drum are not limited to the above values, and an arbitrary rotation and an arbitrary time can be set.

[0085] In the drying opening stage period and the drying middle stage period until the first predetermined time and the second predetermined time have elapsed, drum 1 repeats the tumbling clockwise/counterclockwise rotating operation and the quick clockwise/counterclockwise rotating operation to execute a rotating operation.

[0086] At this time, by drying air blown from first air outlet 10 through window glass 90 while being diffused in drum 1, a raising operation of clothes in drum 1 executed by rotation of drum 1 is accelerated. In this manner, the clothes can be suppressed from being unevenly dried, and the clothes can be suppressed from being wrinkled. As a result, a preferable finishing state of the dried clothes can be realized.

[0087] Thereafter, in the period of the drying closing stage after the second predetermined time has elapsed, control unit 70 controls air passage switching unit 12 to switch the air passage to second air passage 9. This is because, in the drying closing stage, since a moisture content of the clothes is low, a long time is required to vaporize a small amount of moisture by bring the moisture into contact with the drying air. In this case, high-flow-rate drying air must be sent into drum 1 to increase the opportunity to bring the moisture into contact with the drying air.

[0088] Thus, control unit 70 switches the air passage to second air passage 9 having a large air-passing sectional area and a small pressure loss, and a high-flow-rate and low-speed drying air is blown from second air outlet 8 at the rear of drum 1 and applied to the clothes. More specifically, control unit 70, when timer 71 measures the elapse of the second predetermined time, controls air passage switching unit 12 to open second air passage 9 and controls blower unit 4 to decrease the rotating speed of blower fan motor 4b.

[0089] Control unit 70 continues an open state of second air passage 9 until the drying process is ended.

[0090] At this time, as shown in a drum rotation sequence in FIG. 6, as in the periods of the drying opening stage and the drying middle stage, the drum is rotated on the clockwise at a speed of 51 r/min for 57 seconds. Next, after the rotation of the drum is stopped for 3 seconds, drum 1 is rotated on the counterclockwise at a speed of 51 r/min for 57 seconds. Drum 1 is stopped for 3 seconds. More specifically, the clockwise/counterclockwise rotations of drum 1 are repeated for 123 seconds. That is, a so-called tumbling clockwise/counterclockwise rotating operation is performed.

[0091] Thereafter, after drum 1 is rotated on the clockwise at a speed of 60 r/min for 0.5 seconds, drum 1 is stopped for 0.4 seconds. After drum 1 is rotated on the counterclockwise at a speed of 60 r/min for 0.5 seconds, drum 1 is stopped for 0.4 seconds. More specifically, the clockwise/counterclockwise rotations of drum 1 are repeated for 8 seconds. That is, a so-called quick clockwise/counterclockwise rotating operation is performed. The rotation speed, the rotation time, and the stop time of the drum are not limited to the above values, and an arbitrary rotation and an arbitrary time can be set.

[0092] In the period of the drying closing stage after the second predetermined time has elapsed, drum 1 repeats the tumbling clockwise/counterclockwise rotating operation and the quick clockwise/counterclockwise rotating operation to execute a rotating operation.

[0093] At this time, since the pressure loss of second air passage 9 is small, a rotating speed of blower fan motor 4b is made relatively low to drive blower unit 4 with a low power consumption to make it possible to obtain high-flow-rate drying air. High-flow-rate drying air is sent into drum 1 to increase the opportunity to bring the moisture in the clothes into contact with the drying air so as to make it possible to shorten a drying time for clothes.

In this manner, in the drying closing stage of the drying process, shortening of the drying time and a reduction in power consumption can be achieved.

[0094] More specifically, unlike in a conventional drum type washer-dryer, high-pressure high-speed drying air need not be always directly blown toward clothes. In order to increase a flow rate of drying air, for example, two blower fan motors need not be always used. As a result, the drying process can be executed within a short period of time with a low overall power consumption. Furthermore, clothes are suppressed from being unevenly dried and wrinkled, and a preferable finishing state of the dried clothes can be efficiently realized.

[0095] The exemplary embodiment explains the example in which, in the drying opening stage and the drying middle stage of the drying process, drying air is applied to the window glass from the first air passage. However, the present invention is not limited to the configuration. For example, in the period of the drying opening stage of the drying process, the drying air may be blown from the second air passage into the drum. This is effective for prevention of wrinkles and tangles of the clothes when a dryness factor of the clothes before the drying process is executed is low.

[0096] According to the exemplary embodiment, in a period from the drying opening stage to the drying middle stage or in the period of the drying middle stage, high-speed and low-flow-rate drying air is applied from nozzle 30 arranged on first air passage 11 to window glass 90 through drying air guide member 80 while being converged. The drying air that strikes on window glass 90 is blown toward lower inner wall C of drum 1 along the shape of window glass 90 while being diffused. At this time, when the clothes raised with rotation of drum 1 falls down to lower inner wall C of the inner wall of drum 1, the clothes are in contact with the drying air blown to lower inner wall C of drum 1. In this manner, motion such as agitation of the clothes in drum 1 is increased, heat of drying air is circulated around the interior of drum 1, and the clothes can be dried while being tense. As a result, the clothes can be efficiently dried while being suppressed from being unevenly dried. A mechanical action to suppress clothes from being wrinkled is caused to efficiently act on the clothes to make it possible to prevent the clothes from being wrinkled.

[0097] According to the exemplary embodiment, in at least one of the drying opening stage and the drying closing stage of the drying process, high-flow-rate, low-flow-rate drying air is blown from second air outlet 8 of second air passage 9 and applied to the clothes. In this manner, when first air passage 11 and second air passage 9 are switched in the drying process to apply the drying air to the clothes, the clothes are suppressed from being unevenly dried and wrinkled, and a power consumption in the drying process can be reduced.

[0098] According to the exemplary embodiment, in the middle of the drying process, first air passage 11 and second air passage 9 can be timely switched. In this manner, by one blower unit 4, the clothes can be dried while being effectively suppressed from being unevenly dried and wrinkled.

[0099] 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 FIGS. 7 and 8 with reference to FIG. 1.

[0100] FIGS. 7 and 8 are time charts 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. 7 shows a time chart obtained when a quantity of clothes is small, and FIG. 8 shows a time chart obtained when a quantity of clothes is large.

[0101] The exemplary embodiment is different from the exemplary embodiment described above in that, by using quantity-of-clothes detecting unit 15 shown in FIG. 1, depending on a quantity of clothes put in drum 1, settings of the first predetermined time and the second predetermined time are changed.

[0102] More specifically, in the exemplary embodiment described by using FIG. 6, control unit 70, on the basis of a time (the first predetermined time and the second predetermined time) set in advance from the start of a drying process, determines timings of periods of a drying opening stage, a drying middle stage, and a drying closing stage.

[0103] However, in general, depending on a quantity of clothes to be dried, a total time for the drying process and lengths of the periods change.

[0104] Thus, in the exemplary embodiment, quantity-of-clothes detecting unit 15 detects a quantity of clothes to be dried, and changes, based on the detection result of the detected clothes, settings of the first predetermined time and the second predetermined time serving as criteria of judgment of the periods in the drying process by the following method.

[0105] First, in control unit 70, quantity-of-clothes detecting unit 15 shown in FIG. 1 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 position 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, in a state in which clothes are present in drum 1, the displacement of damper 14 is detected. In the above two states, on the basis of a difference between, for example, the vertical displacements of damper 14 detected in the axial direction 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 the first predetermined time and the second predetermined time. More specifically, when a quantity of clothes to be dried shown in FIG. 7 is small, control unit

70 sets the first predetermined time to A1 and sets the second predetermined time to A2. On the other hand, when the quantity of clothes shown in FIG. 8 is large, control unit 70 sets the first predetermined time to B1 and sets second predetermined time to B2.

[0107] More specifically, when the quantity of clothes shown in FIG. 8 is large, in comparison with the case in which the quantity of clothes shown in FIG. 7 is small, a total time for the drying process is long, and a timing at which a dryness factor reaches 90% or 100% also delays. Thus, control unit 70 sets the first predetermined time and the second predetermined time to satisfy A1 < B1 and A2 < B2. More specifically, control unit 70 sets first predetermined time and the second predetermined time to be long when a quantity of clothes to be dried is large. In this manner, depending on a quantity of clothes, clothes can be dried under optimum drying conditions.

[0108] 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 with reference to FIG. 7. Since the control operation in the drying process in FIG. 8 is basically the same as the control operation in FIG. 7 except for the first predetermined time and the second predetermined time, a description thereof will be omitted.

[0109] As shown in FIG. 7, in the period of the drying opening stage until first predetermined time A1 has elapsed after the start of the drying operation, control unit 70 controls air passage switching unit 12 to switch the air passage to second air passage 9.

[0110] At this time, from second air outlet 8 communicating with second air passage 9 having a large air-passing sectional area and a small pressure loss, low-speed and high-flow-rate drying air obtained with low-speed rotation of blower fan motor 4b of blower unit 4 is blown into drum 1. In this manner, the blown drying air is applied to clothes in drum 1 to start a drying operation.

[0111] Control unit 70 continues an open state of second air passage 9 until timer 71 measures first predetermined time A1.

[0112] In this case, since the pressure loss of second air passage 9 is small, even though a rotating speed of blower fan motor 4b is made relatively low to drive blower unit 4 with a low power consumption, high-flow-rate drying air can be obtained. High-flow-rate drying air is sent into drum 1 to increase the opportunity to bring the moisture in the clothes into contact with the drying air so as to make it possible to dry clothes within a short period of time. In this manner, in the drying opening stage of the drying process, shortening of the drying time and a reduction in power consumption can be achieved.

[0113] In the period of the drying middle stage after first predetermined time A1 is measured with timer 71 of control unit 70, control unit 70 controls air passage switching unit 12 to switch the air passage to first air passage 11 and increases a rotating speed of blower fan motor 4b.

[0114] In this manner, in the period of the drying middle stage of the drying process, from first air outlet 10 having an air-passing sectional area smaller than that of second air outlet 8, high-pressure, high-speed and low-flow-rate drying air obtained by high-speed rotation of blower fan motor 4b is sent into drum 1.

[0115] Control unit 70 continues an open state of first air passage 11 until timer 71 measures second predetermined time A2.

[0116] In this manner, with rotation of drum 1, the clothes are agitated by high-pressure, high-speed and low-flow-rate drying air and are always pressed and spread. In this manner, the clothes can be suppressed from being tangled or wrinkled.

[0117] In the period of the drying closing stage after second predetermined time A2 is measured with timer 71 of control unit 70, control unit 70 controls air passage switching unit 12 to switch the air passage to second air passage 9 and controls blower unit 4 to decrease a rotating speed of blower fan motor 4b.

[0118] In the drying closing stage of the drying process, since a moisture content of the clothes is low, a long time is required to vaporize a small amount of moisture by bring the moisture into contact with the drying air. In this case, high-flow-rate drying air must be sent into drum 1 to increase the opportunity to bring the moisture into contact with the drying air.

[0119] Thus, the air passage is switched to second air passage 9 having a large air-passing sectional area and a small pressure loss, high-flow-rate and low-speed drying air is blown from second air outlet 8 at the rear of drum 1 and applied to the clothes.

[0120] Control unit 70 continues an open state of second air passage 9 until the drying closing stage of the drying process is ended.

[0121] In this case, since the pressure loss of second air passage 9 is small, even though a rotating speed of blower fan motor 4b is made relatively low to drive blower unit 4 with a low power consumption, high-flow-rate drying air can be obtained. In this manner, in the drying closing stage of the drying process, shortening of the drying time and a reduction in power consumption can be achieved.

[0122] According to another example of the exemplary embodiment, depending on a quantity of clothes to be dried, times (periods) of the drying opening stage, the drying middle stage, and the drying closing stage of the drying process can be optimized. On the basis of the optimized times, control unit 70 controls air passage switching unit 12 to make it possible to effectively switch first air passage 11 and second air passage 9. In this manner, unlike in a conventional drum type washer-dryer, high-pressure high-speed drying air need not be always directly blown toward clothes. In order to increase a flow rate of drying air, for example, two blower fan motors need not be always used. As a result, the drying process can be executed within a short period of time with a low overall power consumption. Furthermore, clothes are suppressed from being unevenly dried and

wrinkled, and a preferable finishing state of the dried clothes can be efficiently realized.

[0123] The method that changes settings of the first predetermined time and the second predetermined time on the basis of a quantity of clothes to execute the drying process as described in the exemplary embodiment can be applied to the exemplary embodiment described with reference to FIG. 6, as a matter of course.

[0124] In the exemplary embodiment, as quantity-of-clothes detecting unit 15, a scheme that detects a vertical displacement of damper 14 in the axial direction 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.

[0125] 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 the first predetermined time and the second predetermined time. 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 the first predetermined time and the second predetermined time.

[0126] The exemplary embodiment 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.

[0127] 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.

[0128] Each of the exemplary embodiments explains an example in which the first air passage and the second air passage are switched through the air passage switching unit. Another configuration may be used. For example, a configuration having only a first air passage may be used. In this manner, the configuration can be simplified. Furthermore, with a configuration in which drying air is striked to a window glass once, heat of drying air is avoided from being concentrated on a part in the drum to make it possible to uniformly send the drying air into the drum while being diffused. As a result, the clothes can be suppressed from being unevenly dried.

[0129] As described above, the clothes dryer according to the present invention includes a drum that is supported in a housing and agitates clothes, a window glass arranged in front of the drum and having a shape protruding toward a bottom part of the drum along a top-to-bottom direction, and a blower unit that sends drying air. The clothes dryer further includes a first air passage having an opening in front of the drum and having a first air outlet that blows drying air, and a nozzle arranged on the first air outlet outside the drum to blow the drying air toward the window glass. The window glass has a configuration that guides the drying air blown from the nozzle to a lower part of the drum.

[0130] With the configuration, the drying air blown from the nozzle arranged outside the drum is applied to the window glass once and guided into the drum. More specifically, in the configuration, unlike in a conventional technique, the drying air is not directly guided into the drum by a drying air guide member, and is applied to the window glass once. In this manner, heat of the drying air is avoided from being concentrated on a part in the drum to make it possible to uniformly send the drying air into the drum. As a result, the clothes can be suppressed from being unevenly dried.

[0131] The clothes dryer according to the present invention includes a drum that is rotatably supported in a housing and agitates clothes, a window glass arranged in front of the drum and having a shape protruding toward a bottom part of the drum along a top-to-bottom direction, and a blower unit that sends drying air. The clothes dryer further includes a first air passage having an opening in front of the drum and having a first air outlet that blows drying air, and a nozzle arranged on the first air outlet outside the drum to blow the drying air toward the window glass. The clothes dryer includes a second air passage having an opening at the rear of the drum and a second air outlet that blows drying air into the drum, an air passage switching unit that selectively switches the first air passage and the second air passage, a storage unit that stores at least a first predetermined time and a second predetermined time, and a control unit having a timer. The control unit performs control to selectively switch the first air passage and the second air passage through the air passage switching unit when the first predetermined time and the second predetermined time stored in the storage unit are measured with the timer.

[0132] With the configuration, the drying air blown from the nozzle arranged on the first air outlet outside the drum is applied to the window glass once and guided into the drum. More specifically, in the configuration, unlike in a conventional technique, the drying air is not directly guided into the drum by a drying air guide member, and is applied to the window glass once. In this manner, heat of the drying air is avoided from being concentrated on a part in the drum to make it possible to uniformly send

the drying air into the drum. As a result, the clothes can be suppressed from being unevenly dried.

[0133] Furthermore, depending on drying conditions of the clothes, on the basis of the first predetermined time and the second predetermined time, the first air outlet or the second air outlet is switched to make it possible to apply the drying air to the clothes while changing a flow rate and a wind speed of the drying air. 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.

[0134] The clothes dryer according to the present invention has a configuration in which drying air is blown toward substantially a center of the window glass.

[0135] With the configuration, the drying air can be more uniformly sent into the drum.

[0136] The clothes dryer according to the present invention, the nozzle further includes a drying air guide member that guides a blowing direction of drying air to the window glass. The window glass has a lower part inclined to the inside of the drum.

[0137] With the configuration, the drying air guided by the drying air guide member strikes on the window glass and goes toward the interior of the drum while being diffused. In this manner, when the drying air curls up in the drum, the drying air is in contact with the clothes, and the clothes can be dried while being blown up. As a result, the clothes can be efficiently dried while being suppressed from being wrinkled.

[0138] The clothes stored in the drum are agitated while being raised with rotation of the drum, and the blown-up clothes are in contact with drying air curling from the lower part of the drum. At this time, by a fall speed of the blown-up clothes and a speed of drying air curling from the lower part of the drum, a relative speed between the clothes and the drying air that are brought into contact with each other increases. In this manner, physical action that is necessary and sufficient to dry clothes acts on the clothes, and drying air spreads in the entire drum. As a result, since the drying air is efficiently brought into contact with small parts of clothes and overall clothes, the clothes can be efficiently dried while being suppressed from being unevenly dried.

[0139] The clothes dryer according to the present invention, a drying air guide member is formed in an arc shape along the edge of a circular opening formed in the housing.

[0140] With the configuration, the drying air guide member is formed in an arc shape along the edge of the opening. In this manner, in comparison with a configuration in which drying air is guided from a flat, long-narrow nozzle into the drum, the drying air can be made difficult to be spread. As a result, the drying air can be converged and guided to a predetermined position of the window glass, and the drying air can be uniformly guided to a lower part of the drum while being diffused with the window glass.

[0141] The clothes dryer according to the present invention has a configuration in which the air-passing sectional area of the first air outlet is smaller than the air-passing sectional area of the second air outlet.

[0142] With the configuration, the drying air can be applied to the clothes while changing a flow rate or a wind speed of drying air 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.

[0143] The clothes dryer according to the present invention includes a quick clockwise/counterclockwise rotation function that performs clockwise rotation and counterclockwise rotation of the drum within a short period of time.

[0144] With the configuration, clockwise and counterclockwise half-turns of the drum are repeated within a short period of time to frequently blow up the clothes to make it possible to accelerate blowing-up of the clothes in the drum. In this manner, drying air is brought into uniform contact with the clothes, and the clothes can be dried while suppressing the clothes from being wrinkled and effectively suppressing uneven drying and tangling of the clothes.

[0145] The washer-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 first predetermined time and a second predetermined time depending on a quantity of clothes detected by the quantity-of-clothes detecting unit.

[0146] With the configuration, the first predetermined time and the second predetermined time can be set depending on a quantity of clothes. For this reason, on the basis of a quantity of clothes to be dried, the clothes can be prevented from being unevenly dried and wrinkled, and shortening of a drying time and a low power consumption can be realized.

[0147] 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.

[0148] With the configuration, when the clothes dryer is applied, a clothes dryer that can suppress clothes from being unevenly dried, wrinkled, and tangled with a low power consumption can be realized.

INDUSTRIAL APPLICABILITY

[0149] 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

[0150]

1, 300 Drum

(continued)

2	Water tank
3	Drum drive motor (drum drive unit)
4	Blower unit
4a	Blower fan
4b	Blower fan motor
5	Discharge port
6	Dehumidification unit
7	Heating unit
8	Second air outlet
9	Second air passage
10	First air outlet
11	First 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
30, 320	Nozzle
30a	Internal surface
32	Input setting unit
35	Door
40	Drain pipe
50	Heat pump device
70	Control unit
71	Timer
80, 310	Drying air guide member
80a	Surface
80b	Support member
90	Window glass
100	Housing
101	Circular opening

Claims

1. A clothes dryer comprising:

a drum that is rotatably supported in a housing, and agitates clothes;
a window glass openably arranged in front of the drum, and having a shape protruding toward a bottom part of the drum along a top-to-bottom direction;
a blower unit that sends drying air;
a first air passage having a first air outlet opened in front of the drum for blowing the drying air; and
a nozzle arranged on the first air outlet outside the drum to blow the drying air toward the window glass,
wherein the window glass guides the drying air blown from the nozzle to a lower part of the drum.

2. A clothes dryer comprising:

a drum that is rotatably supported in a housing, and agitates clothes;
a window glass arranged in front of the drum, and having a shape protruding toward a bottom part of the drum along a top-to-bottom direction;
a blower unit that sends drying air;
a first air passage having a first air outlet opened in front of the drum for blowing the drying air;
a nozzle arranged on the first air outlet outside the drum to blow the drying air toward the window glass;
a second air passage having a second air outlet opened at a rear 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 storage unit that stores at least a first predetermined time and a second predetermined time; and
a control unit having a timer,
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 the timer clocks any of the first predetermined time and the second predetermined time stored in the storage unit.

3. The clothes dryer according to any one of claims 1 and 2, wherein the drying air is blown toward substantially the center of the window glass.

4. The clothes dryer according to any one of claims 1 and 2, wherein the nozzle further includes a drying air guide member that guides a blowing direction of the drying air to the window glass.

5. The clothes dryer according to any one of claims 1 and 2, wherein the window glass has a lower part inclined to an inside of the drum.

6. The clothes dryer according to claim 4, wherein the drying air guide member is formed in an arc shape along an edge of a circular opening formed in the housing.

7. The clothes dryer according to claim 2, wherein an air-passing sectional area of the first air outlet is

smaller than an air-passing sectional area of the second air outlet.

8. The clothes dryer according to any one of claims 1 and 2, comprising;
a quick clockwise/counterclockwise rotation function that performs clockwise rotation and counterclockwise rotation of the drum within a short period of time.

9. The clothes dryer according to any one of claims 1 and 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 first predetermined time and the second predetermined time depending on the quantity of the clothes detected by the quantity-of-clothes detecting unit.

10. A washer-dryer comprising:

at least the clothes dryer according to any one of claims 1 and 2; and
a water tank that includes the drum and stores washing water.

FIG. 1

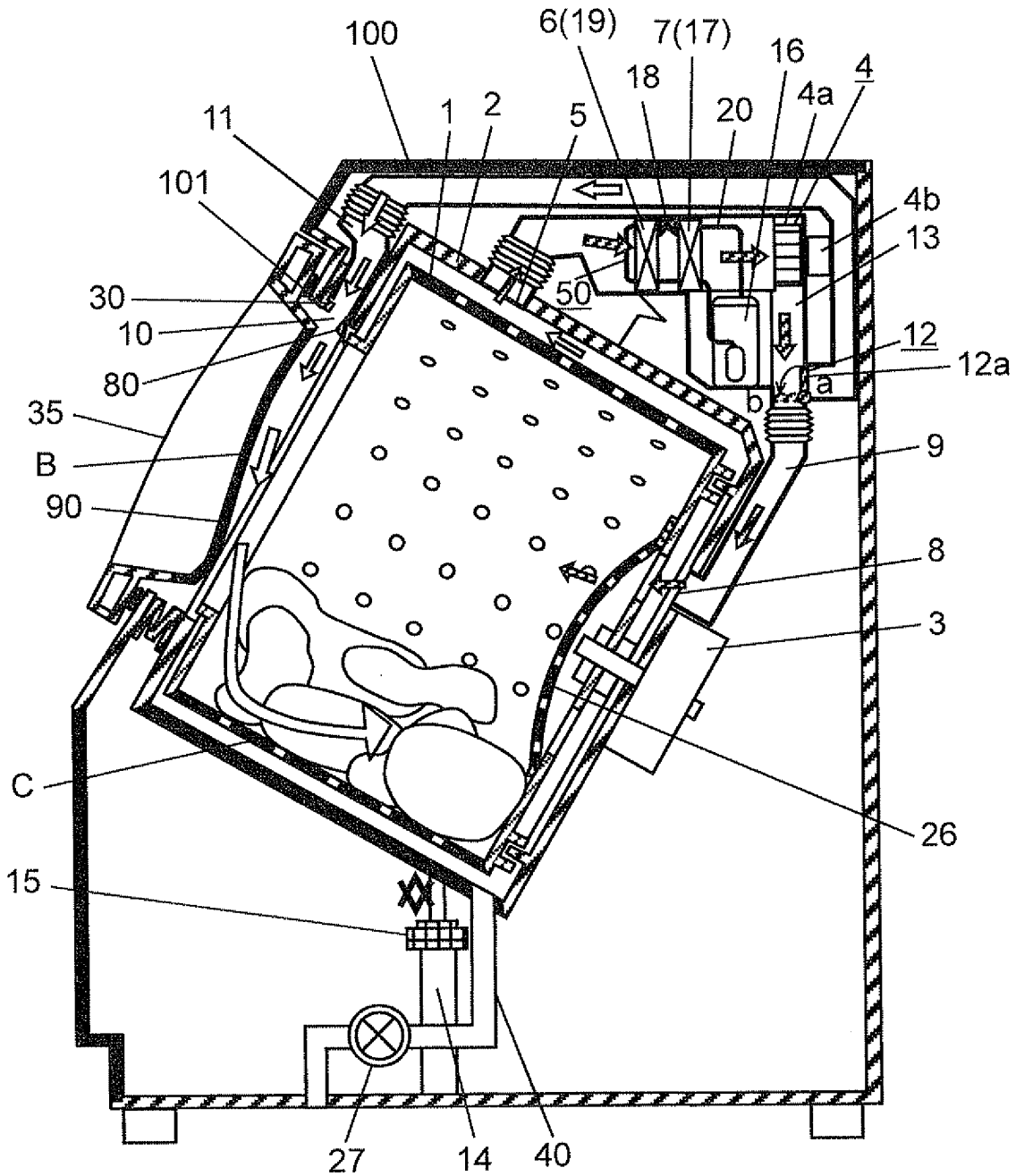

100
6(19)
7(17)
16
4
18
4a
11
1
2
5
20
101
4b
13
30
50
10
12
12a
80
a
b
35
9
B
90
8
3
C
26
15
27
14
40

FIG. 2

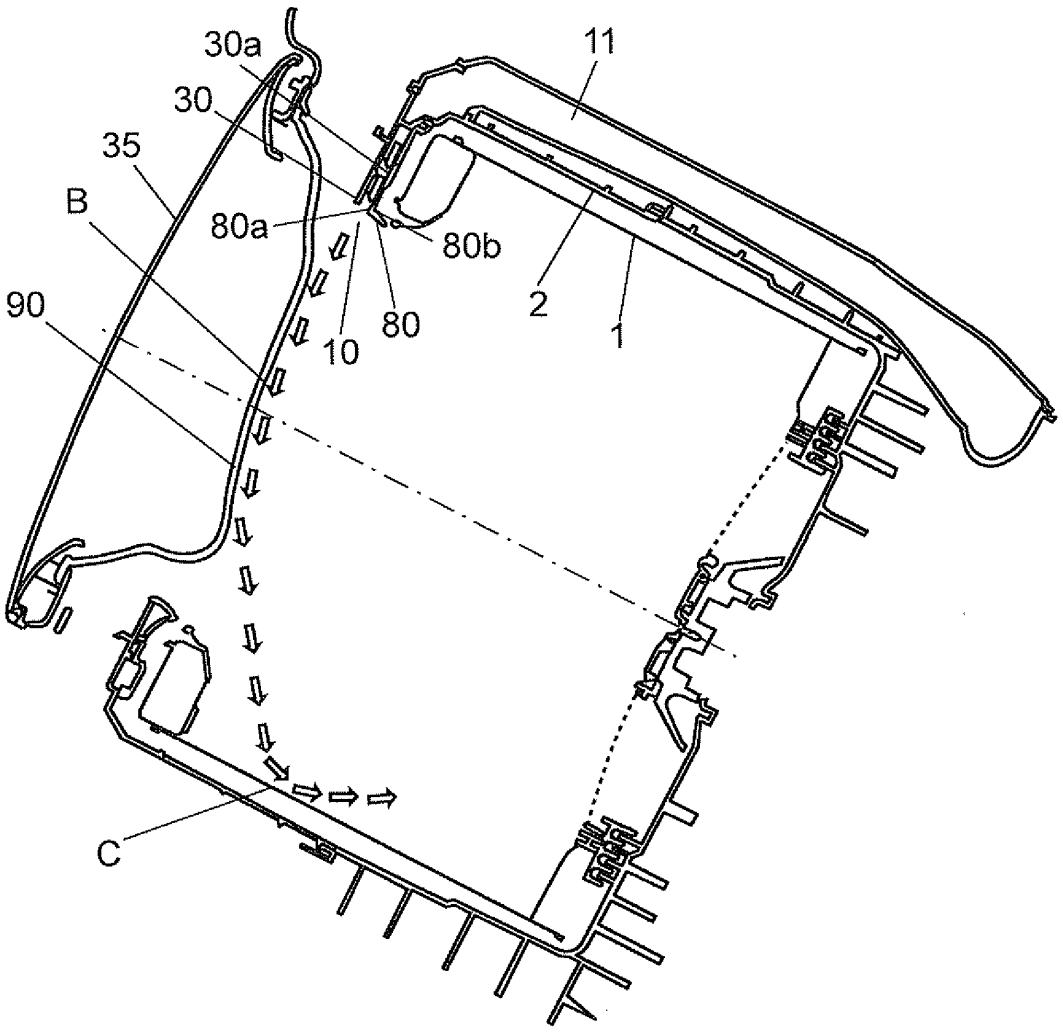


FIG. 3

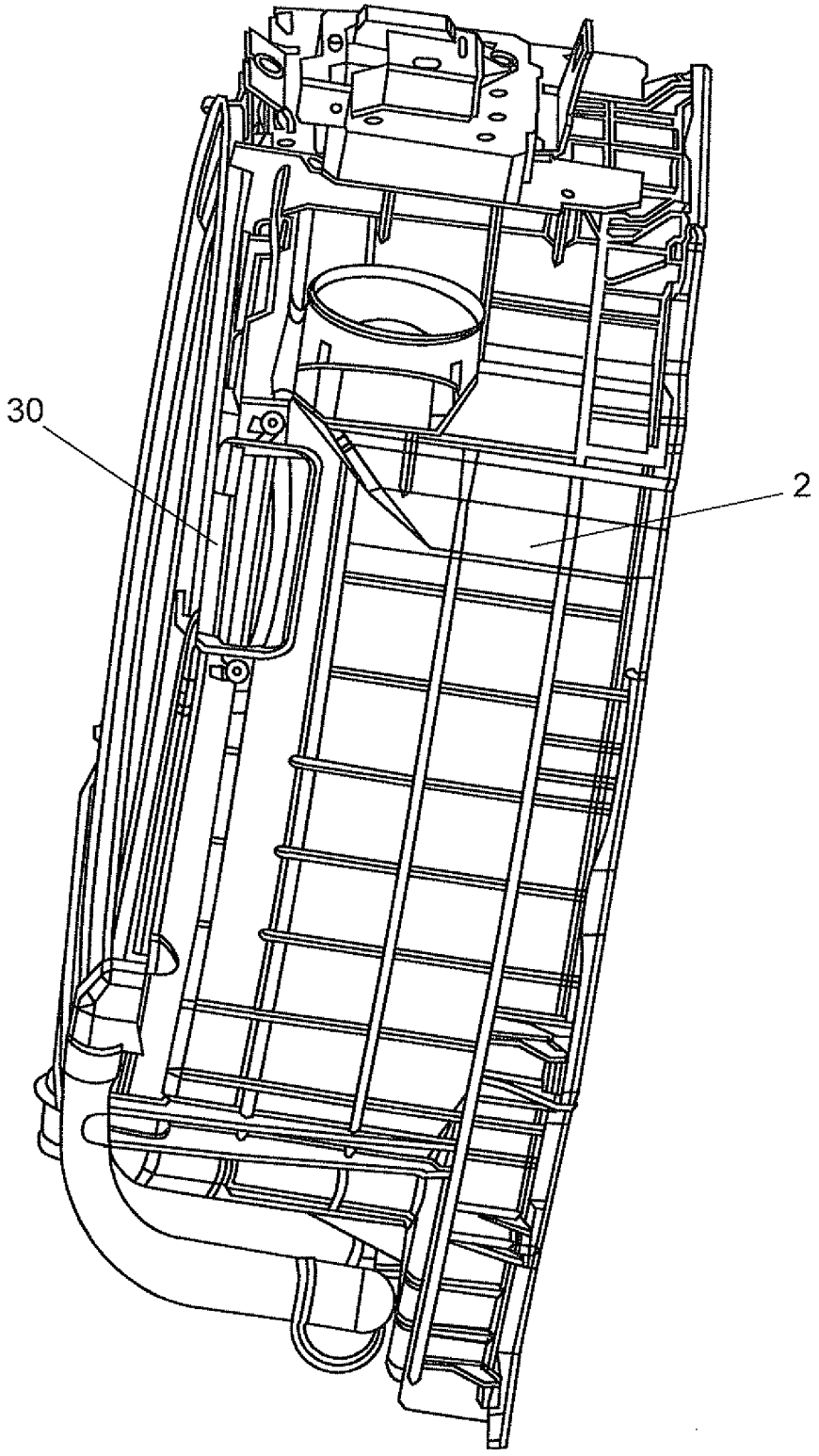


FIG. 4

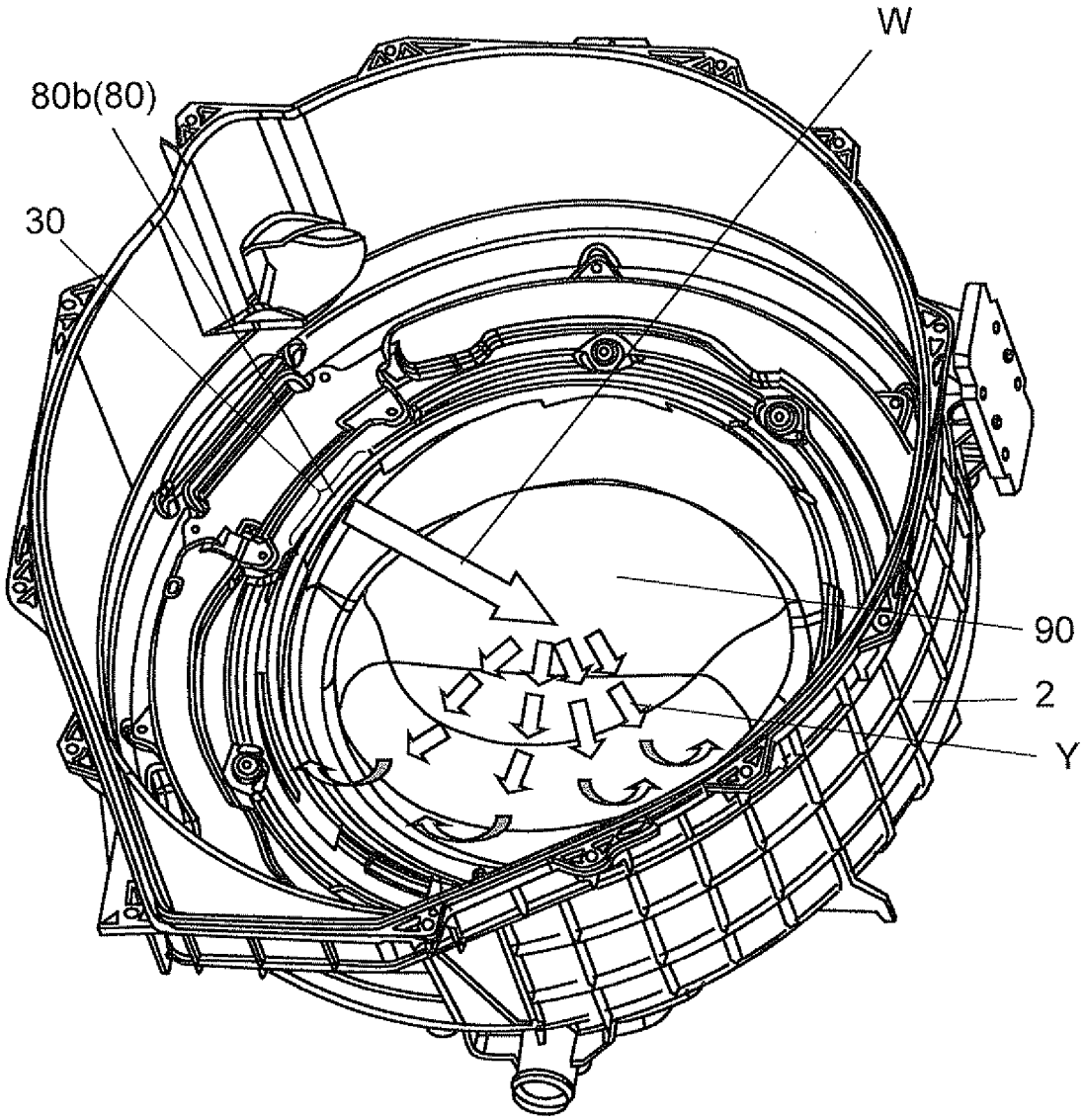


FIG. 5

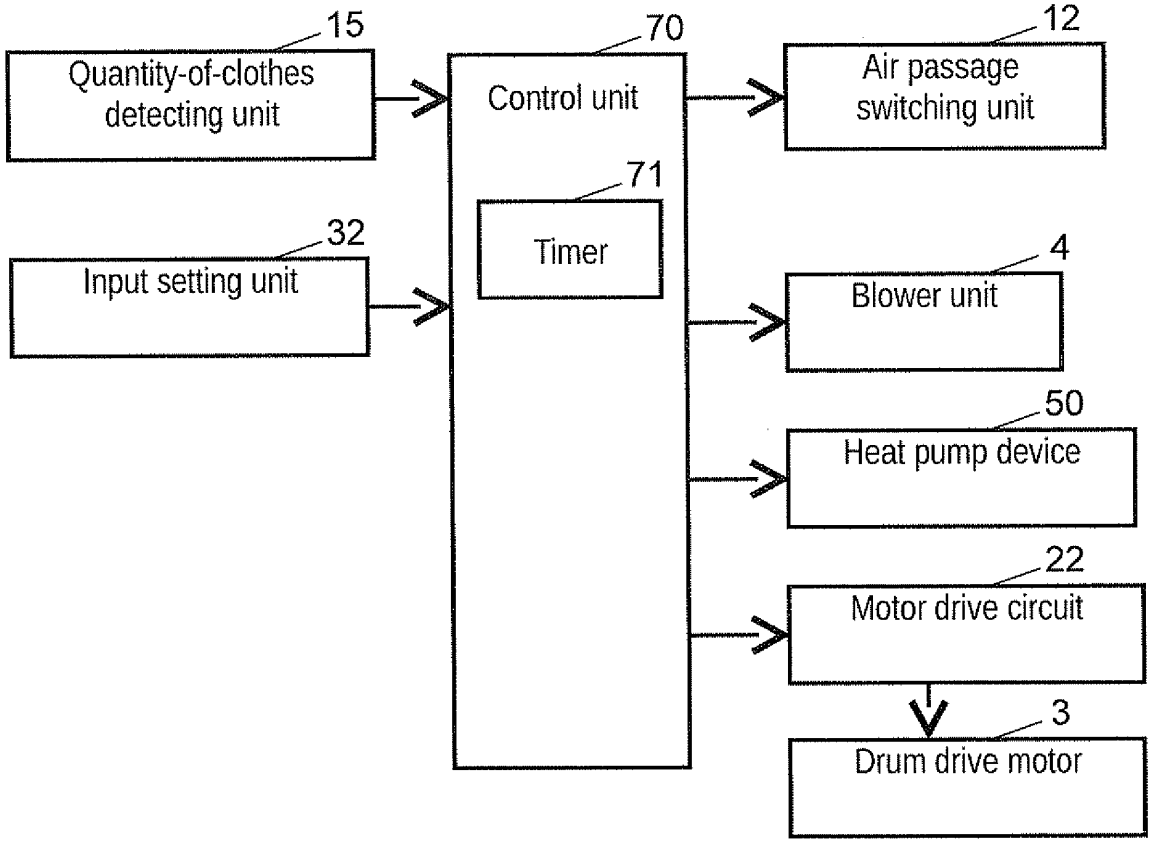
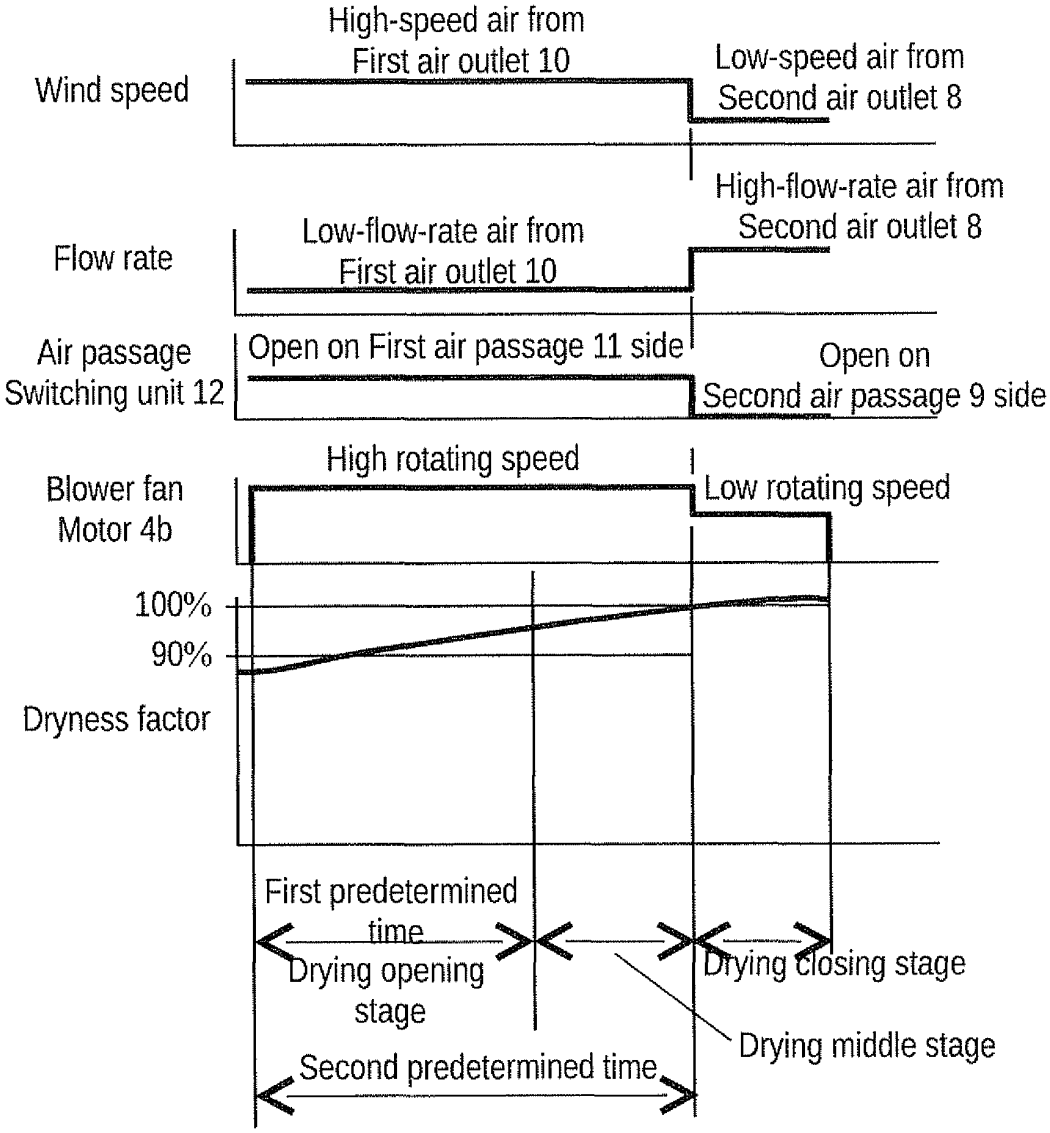

15
Quantity-of-clothes detecting unit
32
Input setting unit
70
Control unit
71
Timer
12
Air passage switching unit
4
Blower unit
50
Heat pump device
22
Motor drive circuit
3
Drum drive motor

FIG. 6



Drum rotation sequence

Process time		123 seconds	8 seconds
Rotating speed	Clockwise ON OFF Counter-clockwise ON	51r/min/57s 3s 51r/min/57s	60r/min/0.5s 0.4s 60r/min/0.5s

FIG. 7

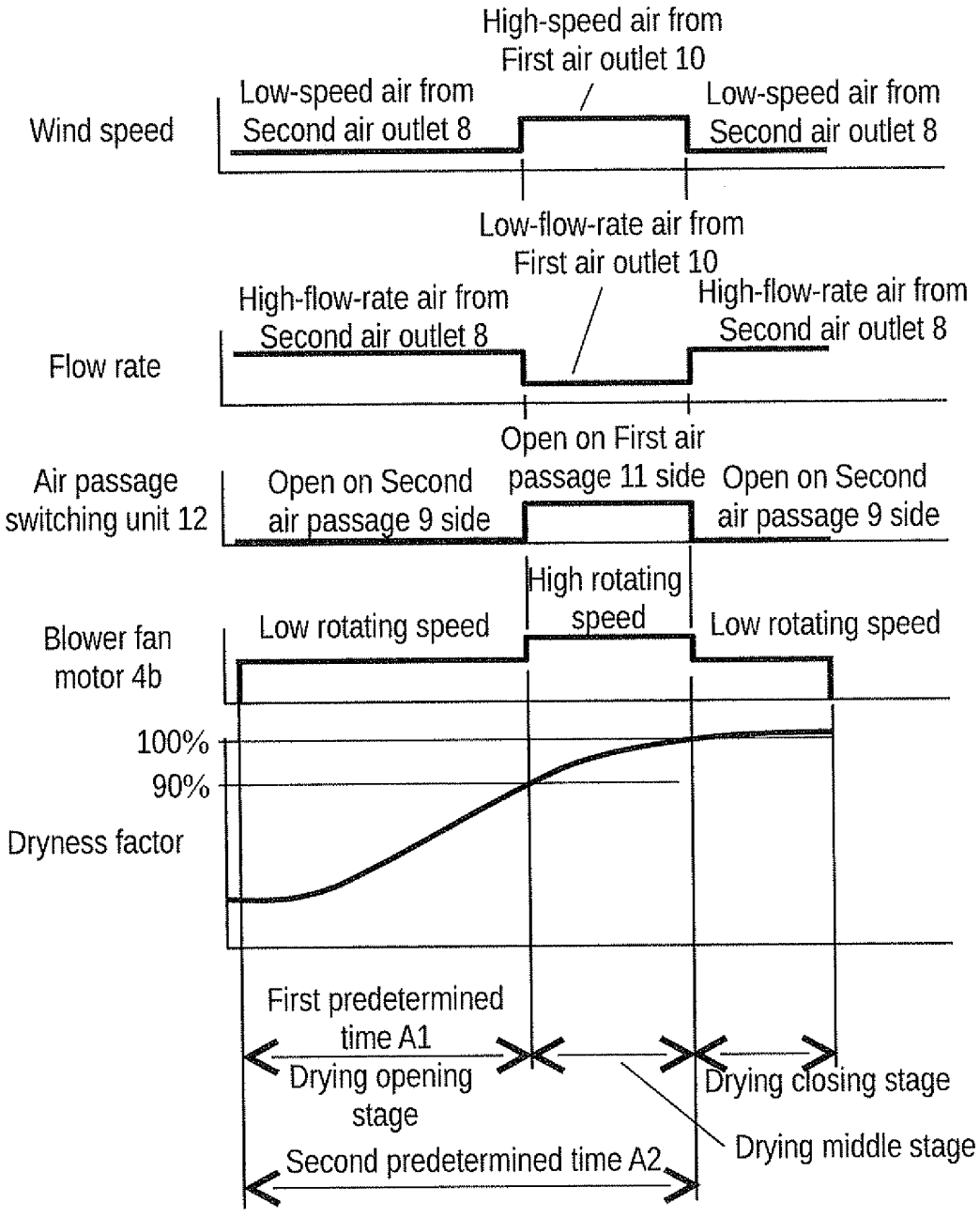

High-speed air from
First air outlet 10
Low-speed air from
Second air outlet 8
Low-speed air from
Second air outlet 8
Wind speed
Low-flow-rate air from
First air outlet 10
High-flow-rate air from
Second air outlet 8
High-flow-rate air from
Second air outlet 8
Flow rate
Open on First air
passage 11 side
Air passage
switching unit 12
Open on Second
air passage 9 side
Open on Second
air passage 9 side
High rotating
speed
Blower fan
motor 4b
Low rotating speed
Low rotating speed
100%
90%
Dryness factor
First predetermined
time A1
Drying opening
stage
Drying closing stage
Drying middle stage
Second predetermined time A2

FIG. 8

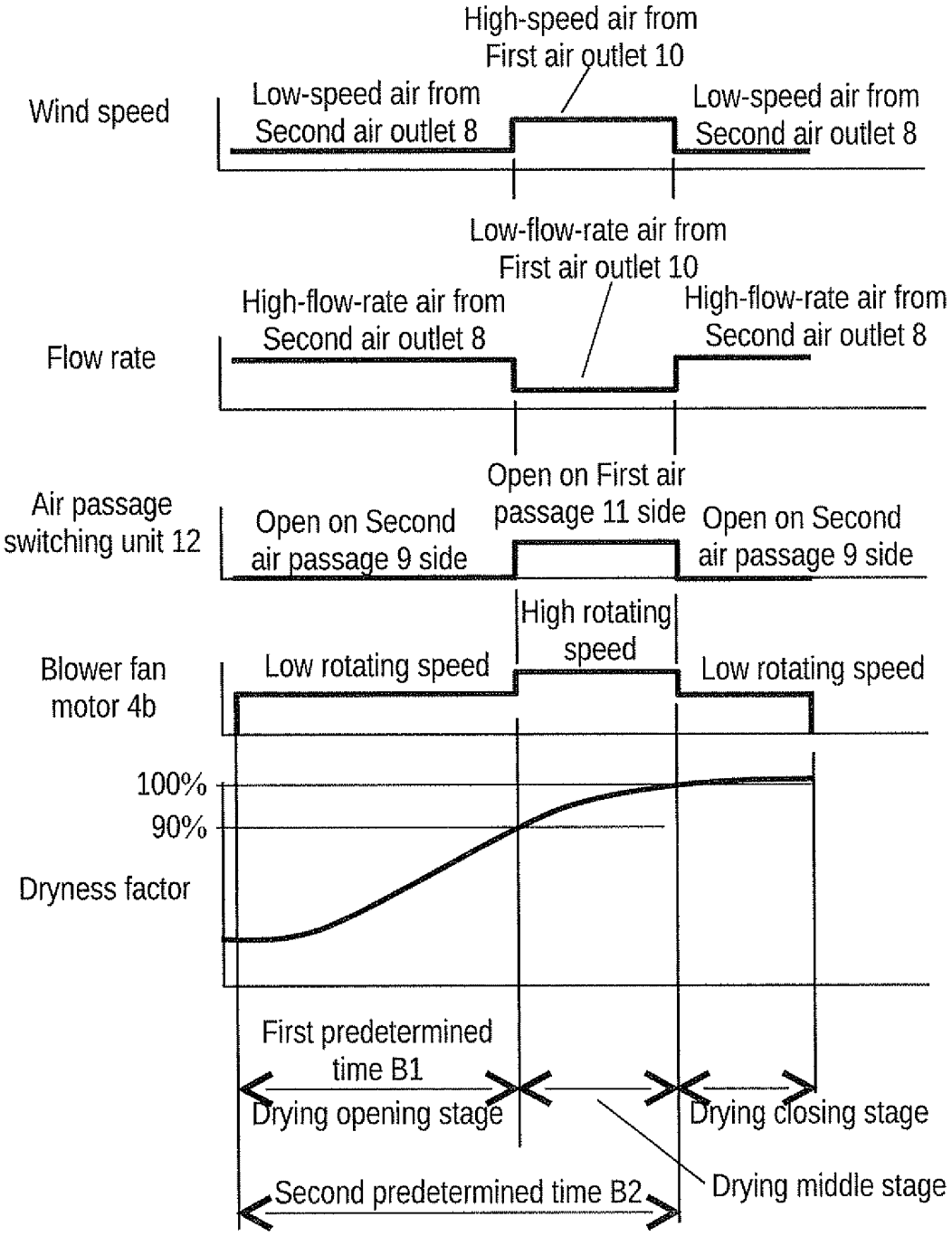

High-speed air from
First air outlet 10
Wind speed
Low-speed air from
Second air outlet 8
Low-speed air from
Second air outlet 8
Low-flow-rate air from
First air outlet 10
High-flow-rate air from
Second air outlet 8
High-flow-rate air from
Second air outlet 8
Flow rate
Open on First air
passage 11 side
Air passage
switching unit 12
Open on Second
air passage 9 side
Open on Second
air passage 9 side
High rotating
speed
Blower fan
motor 4b
Low rotating speed
Low rotating speed
100%
90%
Dryness factor
First predetermined
time B1
Drying opening stage
Drying closing stage
Drying middle stage
Second predetermined time B2

FIG. 9

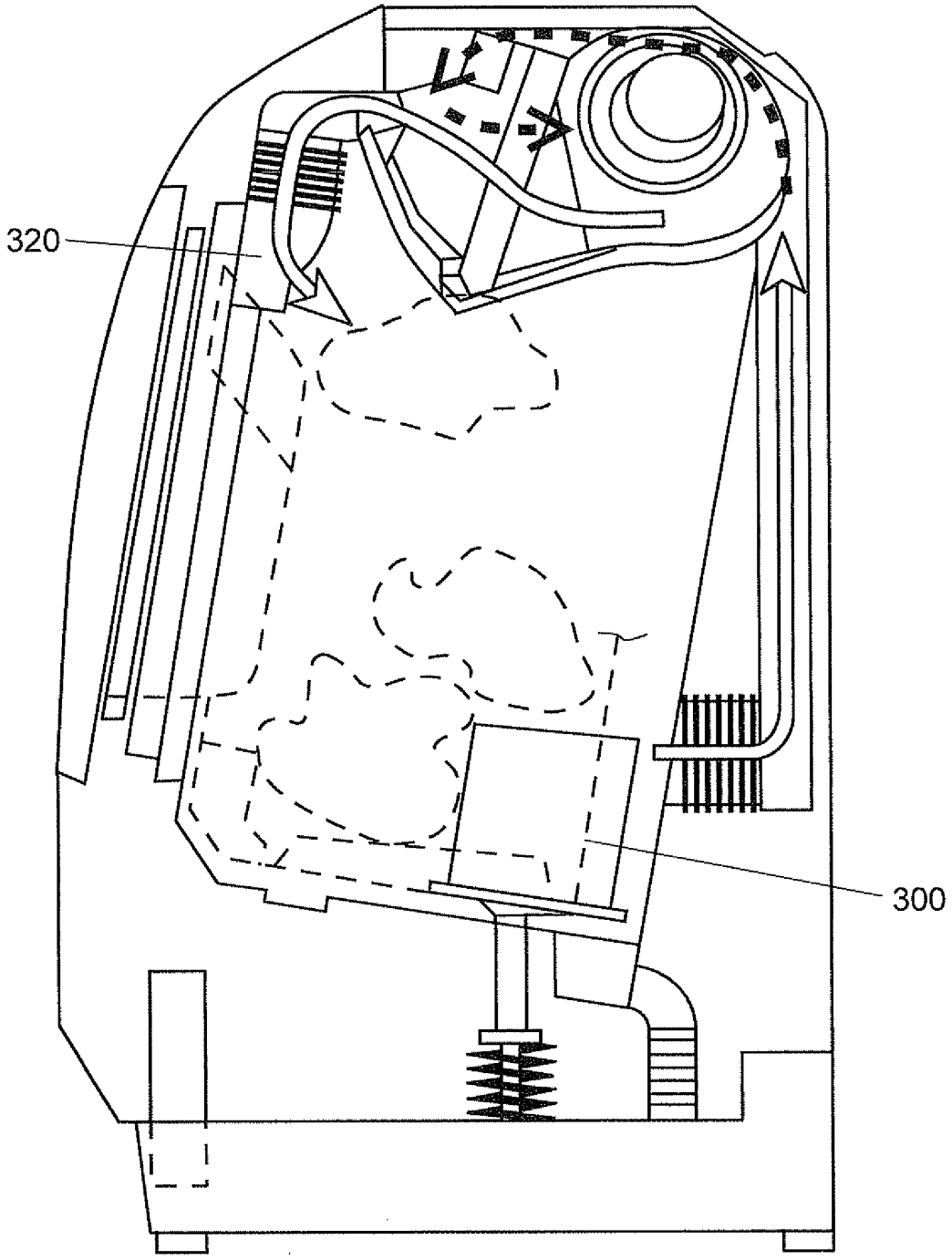
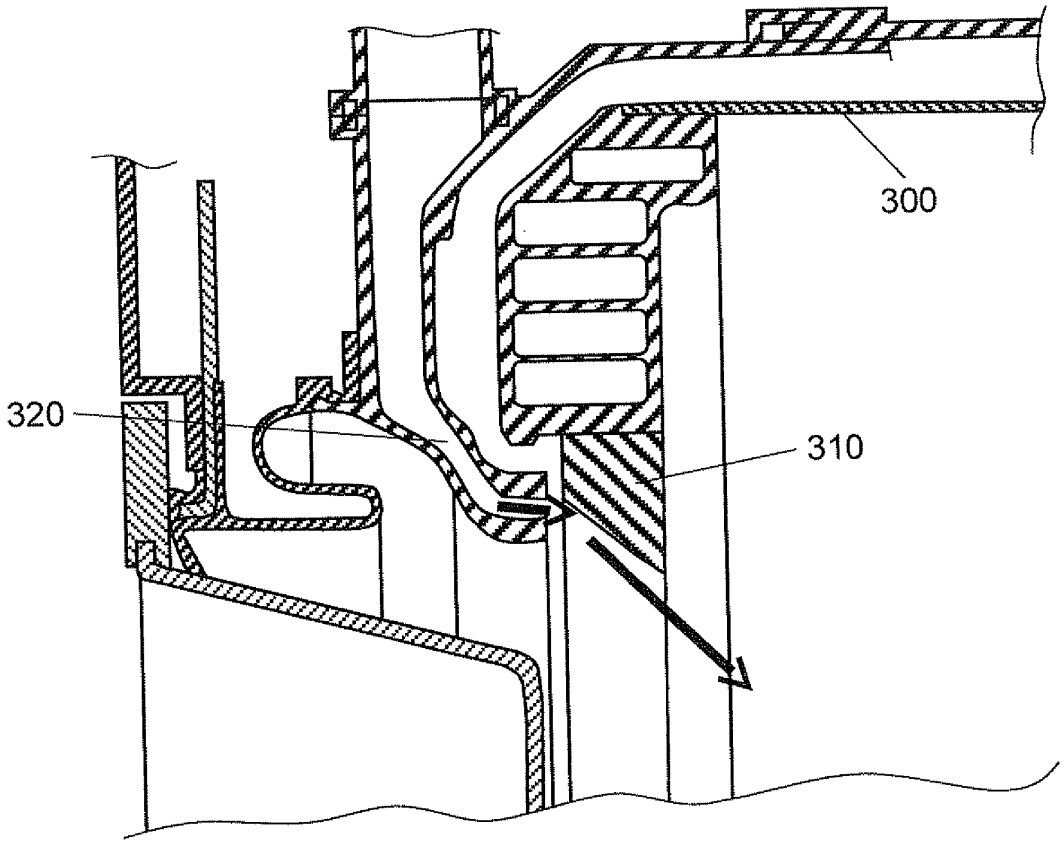


FIG. 10



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2012/005400

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

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.
Y A	JP 2011-83457 A (Panasonic Corp.), 28 April 2011 (28.04.2011), paragraphs [0057], [0075]; fig. 1, 4 & WO 2011/045914 A1 & CN 102482839 A	1,2,4-10 3
Y A	JP 2005-95226 A (Sharp Corp.), 14 April 2005 (14.04.2005), paragraphs [0007], [0057] to [0060]; fig. 3, 5 (Family: none)	1,2,4-10 3

☐ 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
25 September, 2012 (25.09.12)	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 2009050338 A **[0008]**
- JP 2010075216 A **[0008]**