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(54) WASHING MACHINE HAVING DRYING FUNCTION

(57) A washing machine having a drying function includes: a cabinet; a tub disposed inside the cabinet and configured to store water; a drying device provided at the upper side of the tub and supplying hot air into the tub; a condensation duct for connecting an air discharge port provided through the tub and the drying device to guide air discharged from the tub to the drying device; a water feed pipe connected to an upper part of the condensation duct and formed to supply water into the condensation duct; a middle scattering protrusion provided at the middle of the one-side inner surface of the condensation duct and formed to scatter water flowing along the one side surface; and a lower scattering protrusion installed below the middle scattering protrusion and formed to scatter water passing by the middle scattering protrusion and then flowing downward.

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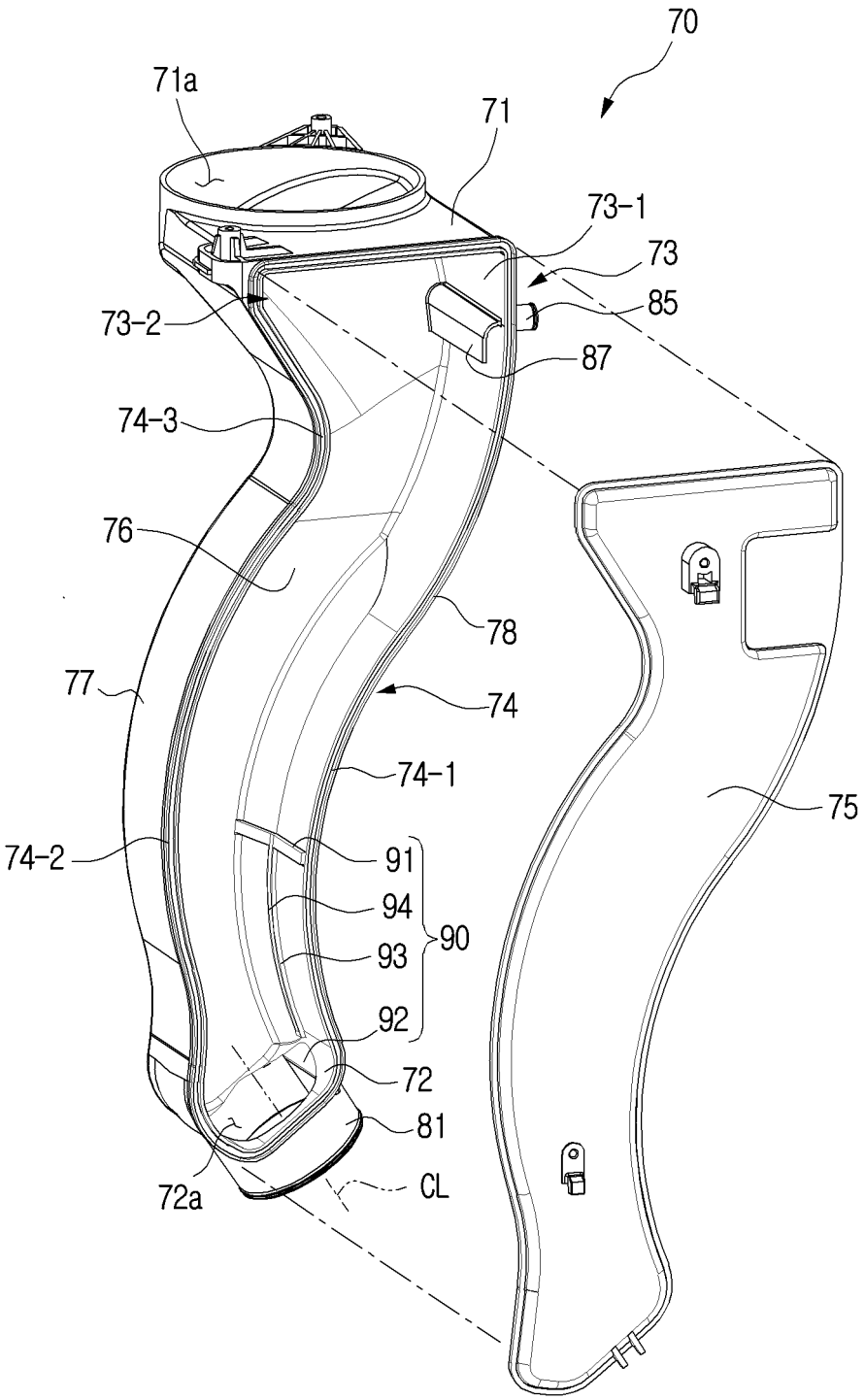
FIG. 8


70
71a
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73-1
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85
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74-3
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74-2
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72a
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Description

[Technical Field]

[0001] The disclosure relates to a washing machine, and more particularly to a washing machine having a drying function.

[Background Art]

[0002] Generally, a washing machine for washing laundry and a dryer for drying laundry are formed as separate devices.

[0003] Accordingly, consumers use a washing machine to wash laundry and then use a dryer to dry the washed laundry.

[0004] However, in this case where the washing machine and the dryer are formed as separated devices, there is inconvenience because the user must wait for washing to be completed and then move the washed laundry to the dryer.

[0005] To solve this inconvenience, washing machines having a drying function have been developed and used.

[0006] The washing machine having a drying function according to the prior art includes a drying device having a blowing fan and a heater, and a condenser that connects the drying device and a tub to circulate air.

[0007] The condenser is configured to condense and remove water vapor contained in the air discharged from the tub. However, the condenser according to the prior art has a problem of low condensation efficiency because the contact area between the air containing water vapor discharged from the tub and the water supplied to the condenser is small.

[Disclosure of Invention]

[Technical Problem]

[0008] The disclosure has been developed in order to overcome the above drawbacks and other problems associated with the conventional arrangement. An aspect of the disclosure is to provide a washing machine having a drying function that can improve condensation efficiency by increasing the contact area between water and air containing water vapor passing through a condensation duct.

[Technical Solution]

[0009] According to an aspect of the disclosure, a washing machine having a drying function may include a cabinet; a tub disposed inside the cabinet and configured to store water; a drying device disposed above the tub and configured to supply heated air into the tub; a condensation duct that connects an air outlet provided in the tub and the drying device and guides air discharged from the tub to the drying device; a water feed pipe connected to an upper portion of the condensation duct and configured to supply water into the condensation duct; a middle scattering protrusion provided in a middle of an inner surface of one side surface of the condensation duct and formed to scatter water flowing along the one side surface; and a lower scattering protrusion disposed below the middle scattering protrusion and formed to scatter water flowing downward past the middle scattering protrusion.

[0010] The condensation duct may have a rectangular cross-section.

[0011] The washing machine having a drying function may further include a guide protrusion disposed between the middle scattering protrusion and the lower scattering protrusion on the inner surface of the one side surface of the condensation duct and formed to guide the water.

[0012] An upper end of the guide protrusion may be connected to the middle scattering protrusion, and a lower end of the guide protrusion may be formed adjacent to the lower scattering protrusion.

[0013] The middle scattering protrusion may be formed to have a size corresponding to a width of the one side surface of the condensation duct.

[0014] The middle scattering protrusion may have a bar shape.

[0015] A height of the middle scattering protrusion may be 1 mm to 60 mm.

[0016] A portion between the middle scattering protrusion and the lower scattering protrusion on one side surface of the condensation duct may have a V-shaped cross-section.

[0017] The middle scattering protrusion may have a V-shaped bent bar shape.

[0018] The washing machine having a drying function may further include a guide protrusion disposed at a center of a V of the V-shaped bent bar shape between the middle scattering protrusion and the lower scattering protrusion and formed to guide the water.

[0019] The condensation duct may include: an upper surface having a discharge port connected to the drying device; a vertical portion extending vertically downward from the upper surface; a curved portion extending from the vertical portion; and a lower surface disposed at a lower end of the curved portion and having an inlet connected to the air outlet of the tub. The curved portion is bent so that a straight line passing through a center of the inlet on the lower surface does not pass through the discharge port on the upper surface.

[0020] The vertical portion may include a first vertical side surface to which the water feed pipe is connected and a second vertical side surface facing the first vertical side surface. The curved portion may include a first curved side surface extending from the first vertical side surface and a second curved side surface facing the first curved side surface and connected to the second vertical side surface. The curved portion may be configured so that air flowing into the inlet on the lower surface collides with the second curved side surface.

[0021] The middle scattering protrusion may be disposed adjacent to a top of the first curved side surface.

[0022] One end of the water feed pipe may be connected to a water hole provided on one side surface of the condensation duct. A water guide part is disposed in front of the water hole of the condensation duct.

[0023] The water guide part may have an L shape.

[Brief Description of Drawings]

[0024]

FIG. 1 is a cross-sectional view illustrating a washing machine having a drying function according to an embodiment of the disclosure.

FIG. 2 is a functional block diagram of a washing machine having a drying function according to an embodiment of the disclosure.

FIG. 3 is a side view illustrating a drying device and a condensation duct of a washing machine having a drying function according to an embodiment of the disclosure.

FIG. 4 is a rear view illustrating a drying device and a condensation duct of a washing machine having a drying function according to an embodiment of the disclosure.

FIG. 5 is a perspective view illustrating a condensation duct of a washing machine having a drying function according to an embodiment of the disclosure.

FIG. 6 is a rear perspective view illustrating a condensation duct of a washing machine having a drying function according to an embodiment of the disclosure.

FIG. 7 is a plan view illustrating a condensation duct of a washing machine having a drying function according to an embodiment of the disclosure.

FIG. 8 is a perspective view illustrating a condensation duct of a washing machine having a drying function according to an embodiment of the disclosure with a front side surface separated.

FIG. 9 is a front view of the condensation duct of FIG. 8.

FIG. 10 is a cross-sectional view of the condensation duct of FIG. 8 taken along line I-I.

FIG. 11 is a view for explaining an operation of a condensation duct of a washing machine having a drying function according to an embodiment of the disclosure.

FIG. 12 is a view illustrating a case where a guide protrusion is not provided between a middle scattering protrusion and a lower scattering protrusion of a condensation duct of a washing machine having a drying function according to an embodiment of the disclosure.

FIG. 13 is a view illustrating an example of a middle scattering protrusion provided in a condensation duct of a washing machine having a drying function according to an embodiment of the disclosure.

FIG. 14 is a view illustrating an example of a middle scattering protrusion provided in a condensation duct of a washing machine having a drying function according to an embodiment of the disclosure.

FIG. 15 is a view illustrating an example of a middle scattering protrusion provided in a condensation duct of a washing machine having a drying function according to an embodiment of the disclosure.

[Best Mode for Carrying out the Invention]

[0025] Descriptions below, which takes into reference the accompanying drawings, is provided to assist in a comprehensive understanding of various embodiments of the disclosure as defined by the claims and its equivalent. Although various specific details are included to assist in the understanding herein, the above are to be understood as merely example embodiments. Accordingly, it will be understood by those of ordinary skill in the art that various modifications may be made to various embodiments described herein without departing from the scope and spirit of the disclosure. In addition, descriptions on well-known functions and configurations will be omitted for clarity and conciseness.

[0026] Terms and words used in the description below and in the claims are not limited to its bibliographical meaning, and are used merely to assist in a clear and coherent understanding of the disclosure. Accordingly, the description below on the various embodiments of the disclosure are provided simply as examples and it will be clear to those of ordinary skill in the art that the example embodiments as defined by the appended claims and its equivalent are not for limiting the disclosure.

[0027] Terms such as first and second may be used in describing various elements, but the elements are not limited by the above-described terms. The above-described terms may be used only for the purpose of distinguishing one element from another element. For example, a first element may be designated as a second element, and likewise, a second element may be designated as a first element without exceeding the scope of protection.

[0028] The terms used in the embodiments of the disclosure may be interpreted to have meanings generally understood to one of ordinary skill in the art unless otherwise defined.

[0029] In addition, terms such as 'tip end,' 'back end,' 'upper part,' 'lower part,' 'upper end,' 'lower end,' and the like used in the disclosure may be defined based on the drawings, and forms and locations of each element are not limited by these terms.

[0030] Hereinafter, a washing machine having a drying function according to an embodiment of the disclosure will be described in detail with reference to the accompanying drawings.

[0031] FIG. 1 is a cross-sectional view illustrating a washing machine having a drying function according to an embodiment of the disclosure. FIG. 2 is a functional

block diagram of a washing machine having a drying function according to an embodiment of the disclosure.

[0032] Referring to FIGS. 1 and 2, a washing machine having a drying function 1 includes a cabinet 10, a tub 20, a drum 30, and a drying device 60.

[0033] The cabinet 10 forms the exterior of the washing machine 1 and is formed in a substantially rectangular parallelepiped shape. The cabinet 10 may include a front cover 11, a rear cover 12, a left cover, a right cover, an upper cover 13, and a lower cover 14.

[0034] The front cover 11 of the cabinet 10 is provided with a laundry inlet 15 through which laundry may be placed and taken out from the inside of the cabinet 10. A door 17 is disposed in the laundry inlet 15 to be able to open and close. A control panel configured to control the washing machine 1 may be provided on the upper portion of the front cover 11 of the cabinet 10.

[0035] The control panel may include a user input part 19 configured to receive user input related to the operation of the washing machine 1 from the user, a display 18 configured to display information related to the washing machine 1 and the washing process, and a processor 99 configured to control the washing machine 1.

[0036] The user input part 19 may include a plurality of buttons for receiving user input, and may be configured to output an electrical signal corresponding to the received user input the processor 99.

[0037] The tub 20 is disposed inside the cabinet 10 of the washing machine 1 and is formed in a hollow cylindrical shape with an opening facing the laundry inlet 15 of the front cover 11. The tub 20 may store a predetermined amount of water needed for washing. The tub 20 is supported and fixed on the inner surface of the cabinet 10 by tension springs 21, oil dampers 22, etc.

[0038] A diaphragm 25 is disposed between the tub 20 and the front cover 11 of the cabinet 10. The diaphragm 25 is formed in a substantially annular shape. One end of the diaphragm 25 is fixed to the front surface of the tub 20 having an opening, and the other end of the diaphragm 25 is fixed to the inner periphery of the laundry inlet 15 of the front cover 11 of the cabinet 10.

[0039] The diaphragm 25 prevents the washing water contained in the tub 20 from leaking to the outside of the tub 20 and forms a passage through the laundry passes. In addition, the diaphragm 25 may block vibration generated when the drum 30 rotates from being transmitted to the front cover 11 of the cabinet 10 through the tub 20.

[0040] The drum 30 is rotatably disposed inside the tub 20 and formed in a substantially hollow cylindrical shape. A drum opening corresponding to the laundry inlet 15 of the cabinet 10 is provided on the front surface of the drum 30.

[0041] A plurality of through holes 31 through which washing water may pass are provided on the side surface of the drum 30. Accordingly, the air inside the drum 30 may be discharged into the space between the drum 30 and the tub 20 through the plurality of through holes 31 formed on the side surface of the drum 30.

[0042] The air discharged into the space between the drum 30 and the tub 20 may be discharged to the outside of the tub 20 through an air outlet 23 (see FIG. 4) formed at the rear surface of the tub 20. A condensation duct 70 may be connected to the air outlet 23 of the tub 20.

[0043] In addition, a plurality of lifts 33 capable of raising laundry 34 are provided on the inner circumferential surface of the drum 30. The drum 30 may rotate around its central axis by a driving device including a driving motor 35 disposed at the rear surface.

[0044] Awater supply device 40 is provided above the tub 20 to supply water to the tub 20. A drainage device 50 is provided below the tub 20 to drain water from the tub 20 to the outside.

[0045] The water supply device 40 includes a water supply pipe 41 connected to an external water supply source (not illustrated) and a water supply valve 43 that opens and closes the water supply pipe 41. A detergent suction part 45 is provided in the water supply pipe 41. In addition, the water supply pipe 41 may be branched to be connected to a water feed pipe 85.

[0046] The detergent suction part 45 is formed as a venturi pipe. A detergent pipe 46 connected to a detergent supply part 47 is provided in the middle portion of detergent suction part 45. When the water supply valve 43 is opened and water is supplied through the water supply pipe 41, the detergent from the detergent supply part 47 is mixed with and dissolved in water in the detergent suction part 45 by the venturi effect. Accordingly, the water mixed with detergent is supplied to the drum 30 through the water supply pipe 41.

[0047] The drainage device 50 may include a drain pump 51, a first drain pipe 52, and a second drain pipe 53. The drain pump 51 is configured to suck water from the tub 20. One end of the first drain pipe 52 is connected to the lower portion of the tub 20, and the other end thereof is connected to the drain pump 51 to guide water in the tub 20 to the drain pump 51. One end of the second drain pipe 53 is connected to the drain pump 51, and the other end thereof extends outside the cabinet 10 to discharge water from the tub 20 to the outside. Accordingly, when the drain pump 51 operates, the water in the tub 20 is discharged to the outside of the washing machine 1 through the first drain pipe 52 and the second drain pipe 53.

[0048] The drying device 60 may be disposed on the upper side of the tub 20 to dry the laundry 34 washed by the drum 30. The drying device 60 is configured to heat the air discharged from the tub 20 and to circulate hot air, that is, heated air into the inside of the tub 20, thereby drying the laundry 34 located inside the drum 30. In other words, the drying device 60 is configured to supply heated air into the inside of the tub 20.

[0049] Hereinafter, the drying device 60 of the washing machine 1 having a dry function according to an embodiment of the disclosure will be described with reference to FIGS. 3 and 4.

[0050] FIG. 3 is a side view illustrating a drying device

and a condensation duct of a washing machine having a drying function according to an embodiment of the disclosure. FIG. 4 is a rear view illustrating a drying device and a condensation duct of a washing machine having a drying function according to an embodiment of the disclosure.

[0051] Referring to FIGS. 3 and 4, the drying device 60 includes a blowing fan 61, a drying duct 63, and a discharge duct 65.

[0052] The blowing fan 61 is configured to suck air from the tub 20 and supply the air to the drying duct 63. The condensation duct 70 is disposed at the suction port of the blowing fan 61. One end of the condensation duct 70 is connected to the suction port of the blowing fan 61, and the other end of the condensation duct 70 is connected to the tub 20. In other words, the condensation duct 70 connects the air outlet 23 provided in the tub 20 and the drying device 60.

[0053] The condensation duct 70 may be formed to condense water vapor contained in the high-temperature and humid air discharged from the tub 20 and discharge the air from which the water vapor has been removed toward the blowing fan 61.

[0054] The water feed pipe 85 is disposed at the upper portion of the condensation duct 70. The water feed pipe 85 may be formed to supply water into the inside of the condensation duct 70. The water supplied into the condensation duct 70 through the water feed pipe 85 comes into contact with the air passing through the inside of the condensation duct 70, and condenses and removes moisture contained in the air.

[0055] Therefore, when the blowing fan 61 operates, the moisture air containing water vapor discharged from the tub 20 moves along the condensation duct 70 and the water vapor is condensed and removed from the moisture air. The air from which the water vapor has been removed is sucked into the blowing fan 61. The detailed structure of the condensation duct 70 will be described later.

[0056] The drying duct 63 is connected to the outlet of the blowing fan 61, heats the air being supplied by the blowing fan 61, and discharges the heated air to the discharge duct 65. For this purpose, a heater 64 (see FIG. 1) may be disposed inside the drying duct 63.

[0057] The air flowing into the drying duct 63 by the blowing fan 61 is heated while passing through the heater 64 disposed inside the drying duct 63 and becomes hot air, that is, heated air.

[0058] The discharge duct 65 is connected to one end of the drying duct 63 and connects the drying duct 63 and the diaphragm 25. An opening 26 to which the discharge port of the discharge duct 65 is connected is provided at the upper portion of the diaphragm 25.

[0059] The discharge duct 65 may be bent depending on the shape and arrangement of the tub 20 and the diaphragm 25 to connect one end of the drying duct 63 and the diaphragm 25. In the case of the drying device 60 shown in FIG. 3, an end portion of the discharge duct 65 is formed in a curved shape.

[0060] Accordingly, the heated air discharged from the drying duct 63 is discharged into the inside of the diaphragm 25 through the discharge duct 65. Because the diaphragm 25 is in communication with the opening of the drum 30, the heated air discharged from the discharge duct 65 is supplied to the inside of the drum 30 to dry the laundry 34.

[0061] The condensation duct 70, the blowing fan 61, the drying duct 63, and the discharge duct 65 form a circulation flow path that communicates the front and rear sides of the tub 20. Therefore, the moisture air discharged from the rear surface of the tub 20 is dried and heated while moving along the condensation duct 70, the blowing fan 61, the drying duct 63, and the discharge duct 65, and is returned to the front of the drum 30. The high-temperature dry air supplied to the front of the drum 30 dries the laundry 34 inside the drum 30 as it passes through the drum 30.

[0062] Hereinafter, the condensation duct 70 disposed in the washing machine having a drying function 1 according to an embodiment of the disclosure will be described in detail with reference to FIGS. 5, 6, and 7.

[0063] FIG. 5 is a perspective view illustrating a condensation duct of a washing machine having a drying function according to an embodiment of the disclosure. FIG. 6 is a rear perspective view illustrating a condensation duct of a washing machine having a drying function according to an embodiment of the disclosure. FIG. 7 is a plan view illustrating a condensation duct of a washing machine having a drying function according to an embodiment of the disclosure.

[0064] The condensation duct 70 is formed to remove moisture from the high-temperature and humid air discharged from the tub 20 and discharge the dehumidified air to the drying device 60.

[0065] The condensation duct 70 is formed to condense moisture such as water vapor contained in the moisture air by bringing low-temperature water into contact with the high-temperature and humid air discharged from the tub 20. The air from which moisture has been removed moves upward along the condensation duct 70 and flows into the drying device 60.

[0066] Referring to FIG. 4, the condensation duct 70 is disposed to communicate with the drying device 60 and the tub 20. One end of the condensation duct 70 is connected to the blowing fan 61 of the drying device 60, and the other end thereof is connected to a connection duct 80.

[0067] The connection duct 80 may be formed as an angle pipe bent at approximately 90 degrees. One end of the connection duct 80 is connected to the air outlet 23 provided at the rear surface of the tub 20, and the other end of the connection duct 80 is connected to the lower end of the condensation duct 70. An expansion and contraction part may be provided in the portion of the connection duct 80 connected to the lower end of the condensation duct 70.

[0068] Accordingly, the high-temperature and humid air discharged from the air outlet 23 of the tub 20 may flow into the lower end of the condensation duct 70 through the connection duct 80.

[0069] The condensation duct 70 is thin and may be formed in the shape of a substantially quadrangle pipe with a curved portion 74. In other words, the condensation duct 70 may be formed to have a rectangular cross-section.

[0070] Referring to FIGS. 5, 6, and 7, the condensation duct 70 includes an upper surface 71 on which a discharge port 71a connected to the drying device 60 is provided. The discharge port 71a may be connected to the suction port of the blowing fan 61 of the drying device 60.

[0071] The condensation duct 70 includes a vertical portion 73 extending vertically downward from the upper surface 71 and the curved portion 74 extending from the vertical portion 73. The curved portion 74 may be bent at a predetermined curvature with respect to the vertical portion 73.

[0072] The condensation duct 70 includes a lower surface 72 that is provided at the lower end of the curved portion 74 and has an inlet 72a communicating with the air outlet 23 of the tub 20. The inlet 72a may be connected to the air outlet 23 formed at the rear surface of the tub 20 through the connection duct 80.

[0073] The condensation duct 70 may be formed so that air flowing into the inlet 72a of the lower surface 72 is not immediately discharged through the discharge port 71a of the upper surface 71. To this end, the curved portion 74 of the condensation duct 70 may be formed so that the inlet 72a of the lower surface 72 and the discharge port 71a of the upper surface 71 do not face each other.

[0074] Referring to FIG. 7, the condensation duct 70 is formed so that the projection surface of the discharge port 71a of the upper surface 71 does not overlap the inlet 72a of the lower surface 72. In other words, the curved portion 74 of the condensation duct 70 may be bent so that the virtual straight line CL passing through the center of the inlet 72a of the lower surface 72 does not pass through the discharge port 71a of the upper surface 71.

[0075] When the condensation duct 70 includes the curved portion 74 as described above, the air flowing into the inlet 72a of the lower surface 72 is not directly discharged through the discharge port 71a of the upper surface 71, but first collides with the inner surface of the curved portion 74 and then is discharged through the discharge port 71a of the upper surface 71. When the air flowing into the inlet 72a of the lower surface 72 collides with the inner surface of the curved portion 74, moisture contained in the air may be condensed.

[0076] The water feed pipe 85 that supplies water into the inside of the condensation duct 70 may be disposed on one side surface of the condensation duct 70. The water feed pipe 85 may be disposed on one side surface of the vertical portion 73 of the condensation duct 70. A water hole 88 to which the water feed pipe 85 is connected may be provided on one side surface of the condensation duct 70.

[0077] Hereinafter, the internal structure of the condensation duct 70 will be described in detail with reference to FIGS. 8, 9, and 10.

[0078] FIG. 8 is a perspective view illustrating a condensation duct of a washing machine having a drying function according to an embodiment of the disclosure with a front side separated. FIG. 9 is a front view of the condensation duct of FIG. 8. FIG. 10 is a cross-sectional view of the condensation duct of FIG. 8 taken along line I-I.

[0079] The condensation duct 70 includes a front surface 75, a rear surface 76, a upper surface 71, a lower surface 72, a left surface 77, and a right surface 78.

[0080] The rear surface 76, the upper surface 71, the lower surface 72, the left surface 77, and the right surface 78 are formed as a single body to form a channel through which air flows.

[0081] The front surface 75 and the rear surface 76 are formed in shapes corresponding to each other and are disposed parallel to each other. The front surface 75 may be formed to cover the upper side of the channel. For example, the front surface 75 may be formed as a cover that covers the upper side of the channel.

[0082] The upper surface 71 of the condensation duct 70 is disposed at the upper end of the rear surface 76, and is provided with the discharge port 71a connected to the drying device 60. The discharge port 71a may be connected to the suction port of the blowing fan 61 of the drying device 60. The discharge port 71a may be formed in a circular shape to correspond to the suction port of the blowing fan 61.

[0083] The left surface 77 and the right surface 78 of the condensation duct 70 are disposed on the left and right sides of the rear surface 76. The upper ends of the left surface 77 and right surface 78 are connected to the upper surface 71. The water feed pipe 85 may be disposed at the upper portion of the right surface 78.

[0084] The left surface 77 and the right surface 78 of the condensation duct 70 may be formed of the vertical portion 73 and the curved portion 74.

[0085] The vertical portion 73 may include a first vertical side surface 73-1 to which the water feed pipe 85 is connected and a second vertical side surface 73-2 facing the first vertical side surface 73-1.

[0086] The curved portion 74 may include a first curved side surface 74-1 extending from the first vertical side surface 73-1 and a second curved side surface 74-2 facing the first curved side surface 74-1 and connected to the second vertical side surface 73-2.

[0087] The gap between the first curved side surface 74-1 and the second curved side surface 74-2 may be narrower than the gap between the first vertical side surface 73-1 and the second vertical side surface 73-2. The gap between the first curved side surface 74-1 and the

second curved side surface 74-2 may be formed to widen from the bottom to the top.

[0088] The upper portion of the second curved side surface 74-2 may include a connection portion 74-3 curved in the opposite direction so as to be connected to the second vertical side surface 73-2.

[0089] The first vertical side surface 73-1 and the first curved side surface 74-1 form the right surface 78 of the condensation duct 70. The second vertical side surface 73-2 and the second curved side surface 74-2 form the left surface 77 of the condensation duct 70.

[0090] The lower surface 72 of the condensation duct 70 is disposed at the lower end of the rear surface 76, and is provided with the inlet 72a connected to the tub 20. The lower surface 72 is connected to the lower ends of the left surface 77 and the right surface 78.

[0091] The inlet 72a is connected to one end of the connection duct 80 disposed in the air outlet 23 of the tub 20. Accordingly, the inlet 72a of the lower surface 72 may communicate with the air outlet 23 of the tub 20.

[0092] An insertion ring portion 81 that is inserted into and coupled to the connection duct 80 is formed to protrude downward from the lower surface 72 of the condensation duct 70. The insertion ring portion 81 may be formed around the inlet 72a.

[0093] The inlet 72a of the lower surface 12 may be formed to face the second curved side surface 74-2. In other words, the inlet 72a is formed so that all virtual straight lines extending parallel to the center line CL of the inlet 72a from the inner circumferential surface of the inlet 72a interfere with the second curved side surface 74-2 and do not interfere with the first curved side surface 74-1. Accordingly, the air flowing into the inlet 72a of the lower surface 72 collides with the second curved side surface 74-2.

[0094] In other words, the condensation duct 70 may be formed so that the air flowing into the inlet 72a of the lower surface 72 collides with the inner surface of the curved portion 74 facing the inlet 72a.

[0095] A scattering protrusion 90 may be disposed on the inner surface of the condensation duct 70 to scatter water supplied from the water feed pipe 85 and bring the scattered water into contact with the air flowing into the inlet 72a.

[0096] For example, a middle scattering protrusion 91 and a lower scattering protrusion 92 may be disposed on the inner surface of the one side surface of the condensation duct 70. In detail, the middle scattering protrusion 91 and the lower scattering protrusion 92 may be disposed on the inner surface of the right surface 78 of the condensation duct 70.

[0097] The middle scattering protrusion 91 is provided in the middle of the inner surface of the one side surface of the condensation duct 70, and may be formed to scatter water supplied from the water feed pipe 85 and flowing along the one side surface of the condensation duct 70.

[0098] The middle scattering protrusion 91 may be formed in a size corresponding to the width of one side surface of the condensation duct 70. In other words, the middle scattering protrusion 91 is formed to cover the entire width of one side surface of the condensation duct 70. When the middle scattering protrusion 91 is formed to have a size corresponding to the width of one side surface of the condensation duct 70, water flowing along the one side surface of the condensation duct 70 may collide with the middle scattering protrusion 91 and scatter.

[0099] The middle scattering protrusion 91 may be disposed adjacent to the top of the curved portion 74. For example, the middle scattering protrusion 91 may be disposed adjacent to the top of the inner surface of the first curved side surface 74-1. In detail, the middle scattering protrusion 91 may be disposed at the top of the inner surface of the first curved side surface 74-1. Alternatively, the middle scattering protrusion 91 may be disposed slightly below the top of the inner surface of the first curved side surface 74-1.

[0100] The middle scattering protrusion 91 may be formed in a bar shape. The middle scattering protrusion 91 may be formed in a straight bar shape. The length of the straight bar may have the same size as the width of the first curved side surface 74-1.

[0101] The height of the middle scattering protrusion 91 may be formed so that when water flowing downward along the first curved side surface 74-1 collides with the middle scattering protrusion 91, the water scatters. When the height of the middle scattering protrusion 91 is too high, the middle scattering protrusion 91 may act as resistance to air passing through the condensation duct 70. When the height of the middle scattering protrusion 91 is too low, water does not scatter. Therefore, the height of the middle scattering protrusion 91 may be set to 1 mm to 60 mm.

[0102] The lower scattering protrusion 92 is disposed below the middle scattering protrusion 91 on the inner surface of the one side surface of the condensation duct 70, and may be formed to scatter water flowing downward past the middle scattering protrusion 91.

[0103] The lower scattering protrusion 92 may be formed on the lower surface 72 of the condensation duct 70. The lower scattering protrusion 92 may be formed to block a portion of the inlet 72a. The lower scattering protrusion 92 may be formed to block a portion of the inlet 72a adjacent to one end of the lower surface 72 connected to the first curved side surface 74-1.

[0104] When the lower scattering protrusion 92 is provided at the inlet 72a, the water flowing down along the first curved side surface 74-1 collides with the lower scattering protrusion 92 and scatters, and the scattered water contacts the air flowing into the inlet 72a.

[0105] A guide protrusion 93 may be formed on the inner surface of one side surface of the condensation duct 70 between the middle scattering protrusion 91 and the lower scattering protrusion 92. The guide protrusion 93 may be formed to guide water flowing over the middle scattering protrusion 91 to the lower scattering protrusion

92.

[0106] The upper end of the guide protrusion 93 may be connected to the middle scattering protrusion 91, and the lower end of the guide protrusion 93 may be formed adjacent to the lower scattering protrusion 92. In other words, the lower end of the guide protrusion 93 may be formed so as not to contact the lower scattering protrusion 92.

[0107] The guide protrusion 93 may be formed in a bar shape. The guide protrusion 93 may be formed in a straight bar shape. The guide protrusion 93 may be formed integrally with the middle scattering protrusion 91.

[0108] The guide protrusion 93 may be connected to the center of the middle scattering protrusion 91. Then, the middle scattering protrusion 91 and the guide protrusion 93 form a T-shape. In this case, a furrow 94 may be formed along the entire length on the upper surface of the middle scattering protrusion 91 and the upper surface of the guide protrusion 93.

[0109] The height of the guide protrusion 93 may be formed to guide water flowing over the middle scattering protrusion 91 to the lower scattering protrusion 92. The guide protrusion 93 may be formed at the same height as the middle scattering protrusion 91. For example, the height of the guide protrusion 93 may be set to 1 mm to 60 mm.

[0110] In this way, when the guide protrusion 93 is disposed between the middle scattering protrusion 91 and the lower scattering protrusion 92, the water flowing over the middle scattering protrusion 91 moves downward along the guide protrusion 93, collides with the lower scattering protrusion 92, and scatters. When the guide protrusion 93 is disposed, the amount of water scattered by the lower scattering protrusion 92 may be increased.

[0111] As described above, when two scattering protrusions 90, that is, the middle scattering protrusion 91 and the lower scattering protrusion 92, are disposed on the first curved side surface 74-1 of the condensation duct 70, the water supplied from the water feed pipe 85 is scattered twice by the middle scattering protrusion 91 and the lower scattering protrusion 92, so that the contact area between water and air flowing into the inlet 72a may be increased. Therefore, the condensation efficiency of the condensation duct 70 may be increased.

[0112] Meanwhile, a groove portion 79 may be provided in the curved portion 74 of the one side surface of the condensation duct 70, that is, the side surface where the water feed pipe 85 is disposed. The curved portion 74 of the one side surface of the condensation duct 70 may be formed in a groove shape over the entire width. In other words, the groove portion 79 may be formed by forming the cross-section of the curved portion 74 into a wide V shape. Here, the wide V shape refers to a case where the central angle of the V is greater than 100 degree and less than 180 degrees.

[0113] For example, the first curved side surface 74-1 of the condensation duct 70 may include the groove portion 79. The groove portion 79 may be formed from the lower end of the first curved side surface 74-1 to more than half the length of the first curved side surface 74-1. In the case of this embodiment, the length of the groove portion 79 may be formed to be approximately 2/3 of the length of the first curved side surface 74-1.

[0114] As illustrated in FIG. 10, the entire width of the first curved side surface 74-1 may be formed in a groove shape. In other words, the cross-section of the portion of the first curved side surface 74-1 where the groove portion 79 is formed may be formed in a wide V shape.

[0115] The lower end of the groove portion 79 of the first curved side surface 74-1 is connected to the lower surface 72 of the condensation duct 70.

[0116] Accordingly, the portion between the middle scattering protrusion 91 and the lower scattering protrusion 92 on one side surface of the condensation duct 70 may be formed in a V-shaped cross-section.

[0117] As described above, when the first curved side surface 74-1 is formed in a groove shape with a wide V-shaped cross-section, water supplied from the water feed pipe 85 may flow along the center of the wide V-shape of the first curved side surface 74-1.

[0118] In addition, the middle scattering protrusion 91 may be disposed adjacent to the top of the first curved side surface 74-1 having a wide V-shaped cross-section. In this case, the middle scattering protrusion 91 may be bent into a V-shape to correspond to the wide V-shaped cross-section of the first curved side surface 74-1. For example, the middle scattering protrusion 91 may be formed in a V-shaped bent bar shape.

[0119] In addition, the guide protrusion 93 disposed between the middle scattering protrusion 91 and the lower scattering protrusion 92 may be disposed at the center of the V-shape of the first curved side surface 74-1.

[0120] The water feed pipe 85 may be connected to one side surface of the condensation duct 70. The condensation duct 70 and the water feed pipe 85 may form a condenser that condenses high-temperature and humid air containing water vapor.

[0121] For example, one end of the water feed pipe 85 is connected to a water hole 88 provided on one side surface of the condensation duct 70. In detail, the water feed pipe 85 may be connected to the water hole 88 formed in the first vertical side surface 73-1 of the right surface 78 of the condensation duct 70.

[0122] A water guide part 87 may be disposed in front of the water hole 88 of the condensation duct 70. The water guide part 87 guides the water suppled from the water hole 88 to flow down the condensation duct 70. To this end, the water guide part 87 may be formed by bending a flat plate into an L shape. The water guide part 87 may be disposed on the inner surface of the first vertical side surface 73-1 of the right surface 78 of the condensation duct 70.

[0123] The other end of the water feed pipe 85 may be connected to the water supply pipe 41. A condensation valve 86 configured to open and close the water feed pipe 85 may be disposed in the water feed pipe 85. When

the condensation valve 86 is opened, the water feed pipe 85 is opened, and thus water is supplied from the water supply pipe 41 to the condensation duct 70. When the condensation valve 86 is closed, the water feed pipe 85 is blocked, and thus water is not supplied to the condensation duct 70.

[0124] The condensation valve 86 may be controlled by the processor 99 to open intermittently rather than always. In detail, the processor 99 may control the condensation valve 86 to turn on/off at regular intervals. For example, the condensation valve 86 may be turned on/off from 40/20 seconds to 55/5 seconds. Here, 40/20 seconds means that the condensation valve 86 is turned on for 40 seconds and turned off for 20 seconds. 55/5 seconds means that the condensation valve 86 is turned on for 55 seconds and turned off for 5 seconds.

[0125] Hereinafter, the operation of the condensation duct 70 of the washing machine having a drying function 1 according to an embodiment of the disclosure having the above structure will be described with respect to FIG. 11.

[0126] FIG. 11 is a view for explaining an operation of a condensation duct of a washing machine having a drying function according to an embodiment of the disclosure.

[0127] Referring to FIG. 11, high-temperature and humid air A discharged from the tub 20 flows into the inlet 72a of the condensation duct 70 and moves along the condensation duct 70.

[0128] Meanwhile, low-temperature water W is supplied from the water feed pipe 85 provided on one side surface of the condensation duct 70. Because the water guide part 87 is provided in front of the water feed pipe 85, the water W coming out of the water feed pipe 85 flows downward along one side surface of the condensation duct 70.

[0129] The water W flowing down along one side surface of the condensation duct 70, for example, the right surface 78, collides with the middle scattering protrusion 91 provided on the first curved side surface 74-1 and scatters.

[0130] The water W scattered by the middle scattering protrusion 91 comes into contact with the high-temperature and humid air A passing through the condensation duct 70. When the scattered low-temperature water W comes into contact with the high-temperature and humid air A, the temperature of the air decreases, so the moisture contained in the air easily condenses to form condensate and may be removed.

[0131] The water W that has gone over the middle scattering protrusion 91 moves downward along the guide protrusion 93, collides with the lower scattering protrusion 92 provided at the lower end of the first curved side surface 74-1, and scatters.

[0132] The water W scattered by the lower scattering protrusion 92 comes into contact with the high-temperature and humid air A flowing in through the inlet 72a. When the scattered low-temperature water W comes into contact with the high-temperature and humid air A, the temperature of the air decreases, so the moisture contained in the air easily condenses to form condensate and may be removed.

[0133] In the condensation duct 70 according to this disclosure, water for condensing moisture contained in high-temperature and humid air is scattered twice by two scattering protrusions 90, that is, the middle scattering protrusion 91 and the lower scattering protrusion 92, so that the contact area between the high-temperature and humid air and the water increases. Therefore, the condensation duct 70 according to this disclosure may have improved condensation efficiency.

[0134] The air, in which moisture has been removed and the temperature has been lowered by the water scattered twice, is discharged through the discharge port 71a of the condensation duct 70. The air discharged from the discharge port 71a of the condensation duct 70 is sucked into the blowing fan 61.

[0135] The blowing fan 61 discharges the sucked air into the drying duct 63. Because the drying duct 63 is provided with the heater 64, the air is heated while passing through the drying duct 63 and becomes heated air, that is, hot air.

[0136] The heated air is supplied into the drum 30 through the discharge duct 65. The heated air supplied into the drum 30 comes into contact with the laundry 34 located within the drum 30 and dries the laundry 34.

[0137] The air that dried the laundry 34 in the drum 30 is discharged into the space between the drum 30 and the tub 20 through the plurality of through holes 31 on the side surface of the drum 30.

[0138] The high-temperature and humid air discharged into the space between the drum 30 and the tub 20 is discharged through the air outlet 23 provided at the rear surface of the tub 20.

[0139] The air outlet 23 at the rear surface of the tub 20 is provided with the connection duct 80 connected to the condensation duct 70, so the high-temperature and humid air discharged from the tub 20 flows into the condensation duct 70.

[0140] The air flowing into the condensation duct 70 dries the laundry 34 located inside the drum 30 while repeating the above-described process.

[0141] In the above, the case where the guide protrusion 93 is provided between the middle scattering protrusion 91 and the lower scattering protrusion 92 has been described. However, in another embodiment of the disclosure, the guide protrusion 93 may not be provided between the middle scattering protrusion 91 and the lower scattering protrusion 92.

[0142] FIG. 12 is a view illustrating a case where a guide protrusion is not provided between a middle scattering protrusion and a lower scattering protrusion of a condensation duct of a washing machine having a drying function according to an embodiment of the disclosure.

[0143] Referring to FIG. 12, the guide protrusion 93 is not disposed between the middle scattering protrusion

91 and the lower scattering protrusion 92. In this case, the water going over the middle scattering protrusion 91 flows along the center of the wide V-shaped cross-section formed on the first curved side surface 74-1 between the middle scattering protrusion 91 and the lower scattering protrusion 92, that is, the groove portion 79.

[0144] Accordingly, the water going over the middle scattering protrusion 91 moves downward along the groove portion 79, collides with the lower scattering protrusion 92, and scatters.

[0145] However, as illustrated in FIG. 12, when there is no guide protrusion 93 between the middle scattering protrusion 91 and the lower scattering protrusion 92, the condensation efficiency may be lower than in the case where the guide protrusion 93 is provided between the middle scattering protrusion 91 and the lower scattering protrusion 92 as in the above-described embodiment.

[0146] In the above, the case where the middle scattering protrusion 91 is formed in a bar shape has been described, but the shape of the middle scattering protrusion 91 is not limited thereto. The middle scattering protrusion 91 may be formed in various shapes as long as it can scatter water flowing down along one side surface of the condensation duct 70.

[0147] Hereinafter, the middle scattering protrusion 91 of various shapes will be described with reference to FIGS. 13, 14, and 15.

[0148] FIG. 13 is a view illustrating an example of a middle scattering protrusion provided in a condensation duct of a washing machine having a drying function according to an embodiment of the disclosure.

[0149] Referring to FIG. 13, the middle scattering protrusion 91 may be formed in an approximately V shape. In this case, the width of the top of the V shape may be formed to correspond to the width of the first curved side surface 74-1. Then, the water flowing down from the water feed pipe 85 along the first curved side surface 74-1 may collide with the V-shaped middle scattering protrusion 91 and scatter.

[0150] In addition, the bottom of the middle scattering protrusion 91 formed in the V shape may be connected to the guide protrusion 93. Accordingly, the water going over the middle scattering protrusion 91 may move to the lower scattering protrusion 92 along the guide protrusion 93.

[0151] The water moving along the guide protrusion 93 may be scattered secondarily by the lower scattering protrusion 92.

[0152] FIG. 14 is a view illustrating an example of a middle scattering protrusion provided in a condensation duct of a washing machine having a drying function according to an embodiment of the disclosure.

[0153] Referring to FIG. 14, the middle scattering protrusion 91 may be formed in an approximately U shape. In this case, the width of the upper end of the U shape may be formed to correspond to the width of the first curved side surface 74-1. Then, the water flowing down from the water feed pipe 85 along the first curved side surface 74-1 may collide with the U-shaped middle scattering protrusion 91 and scatter.

[0154] In addition, the lower end of the middle scattering protrusion 91 formed in the U shape may be connected to the guide protrusion 93. Accordingly, the water going over the middle scattering protrusion 91 may move to the lower scattering protrusion 92 along the guide protrusion 93.

[0155] The water moving along the guide protrusion 93 may be scattered secondarily by the lower scattering protrusion 92.

[0156] FIG. 15 is a view illustrating an example of a middle scattering protrusion provided in a condensation duct of a washing machine having a drying function according to an embodiment of the disclosure.

[0157] Referring to FIG. 15, the middle scattering protrusion 91 may be formed in an approximately W shape. In this case, the width of the upper end of the W shape may be formed to correspond to the width of the first curved side surface 74-1. Then, the water flowing down from the water feed pipe 85 along the first curved side surface 74-1 may collide with the W-shaped middle scattering protrusion 91 and scatter.

[0158] In addition, the lower end of the middle scattering protrusion 91 formed in the W shape may be connected to the guide protrusion 93. Accordingly, the water going over the middle scattering protrusion 91 may move to the lower scattering protrusion 92 along the guide protrusion 93.

[0159] The water moving along the guide protrusion 93 may be scattered secondarily by the lower scattering protrusion 92.

[0160] As described above, in the washing machine having a drying function, the water supplied to the condensation duct 70 scatters twice, so the contact area between the water and air containing water vapor passing through the condensation duct 70 may be increased. Accordingly, the condenser of the washing machine having a drying function according to an embodiment of the disclosure may have improved condensation efficiency.

[0161] While the disclosure has been illustrated and described with reference to various example embodiments thereof, it will be understood that the various example embodiments are intended to be illustrative, not limiting. It will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the true spirit and full scope of the disclosure, including the appended claims and their equivalents.

Claims

1. A washing machine having a drying function comprising:

a cabinet;
a tub disposed inside the cabinet and configured

to store water;
a drying device disposed above the tub and configured to supply heated air into the tub;
a condensation duct that connects an air outlet provided in the tub and the drying device and guides air discharged from the tub to the drying device;
a water feed pipe connected to an upper portion of the condensation duct and configured to supply water into the condensation duct;
a middle scattering protrusion provided in a middle of an inner surface of one side surface of the condensation duct and formed to scatter water flowing along the one side surface; and
a lower scattering protrusion disposed below the middle scattering protrusion and formed to scatter water flowing downward past the middle scattering protrusion.

2. The washing machine having a drying function of claim 1, wherein
the condensation duct has a rectangular cross-section.

3. The washing machine having a drying function of claim 2, further comprising:
a guide protrusion disposed between the middle scattering protrusion and the lower scattering protrusion on the inner surface of the one side surface of the condensation duct and formed to guide the water.

4. The washing machine having a drying function of claim 3, wherein
an upper end of the guide protrusion is connected to the middle scattering protrusion, and a lower end of the guide protrusion is formed adjacent to the lower scattering protrusion.

5. The washing machine having a drying function of claim 2, wherein
the middle scattering protrusion has a size corresponding to a width of the one side surface of the condensation duct.

6. The washing machine having a drying function of claim 5, wherein
the middle scattering protrusion has a bar shape.

7. The washing machine having a drying function of claim 5, wherein
a height of the middle scattering protrusion is 1 mm to 60 mm.

8. The washing machine having a drying function of claim 1, wherein
a portion between the middle scattering protrusion and the lower scattering protrusion on one side surface of the condensation duct has a V-shaped cross-section.

9. The washing machine having a drying function of claim 8, wherein
the middle scattering protrusion has a V-shaped bent bar shape.

10. The washing machine having a drying function of claim 9, further comprising:
a guide protrusion disposed at a center of a V of the V-shaped bent bar between the middle scattering protrusion and the lower scattering protrusion and formed to guide water.

11. The washing machine having a drying function of claim 1, wherein
the condensation duct includes:

an upper surface having a discharge port connected to the drying device;
a vertical portion extending vertically downward from the upper surface;
a curved portion extending from the vertical portion; and
a lower surface disposed at a lower end of the curved portion and having an inlet connected to the air outlet of the tub,
wherein the curved portion is bent so that a straight line passing through a center of the inlet on the lower surface does not pass through the discharge port on the upper surface.

12. The washing machine having a drying function of claim 11,

wherein the vertical portion includes a first vertical side surface to which the water feed pipe is connected and a second vertical side surface facing the first vertical side surface,
wherein the curved portion includes a first curved side surface extending from the first vertical side surface and a second curved side surface facing the first curved side surface and connected to the second vertical side surface, and
wherein the curved portion is configured so that air flowing into the inlet on the lower surface collides with the second curved side surface.

13. The washing machine having a drying function of claim 12, wherein
the middle scattering protrusion is disposed adjacent to a top of the first curved side surface.

14. The washing machine having a drying function of claim 1, wherein

one end of the water feed pipe is connected to

a water hole provided on one side surface of the condensation duct, and
wherein a water guide part is disposed in front of the water hole of the condensation duct.

15. The washing machine having a drying function of claim 14, wherein
the water guide part has an L shape.

FIG. 1

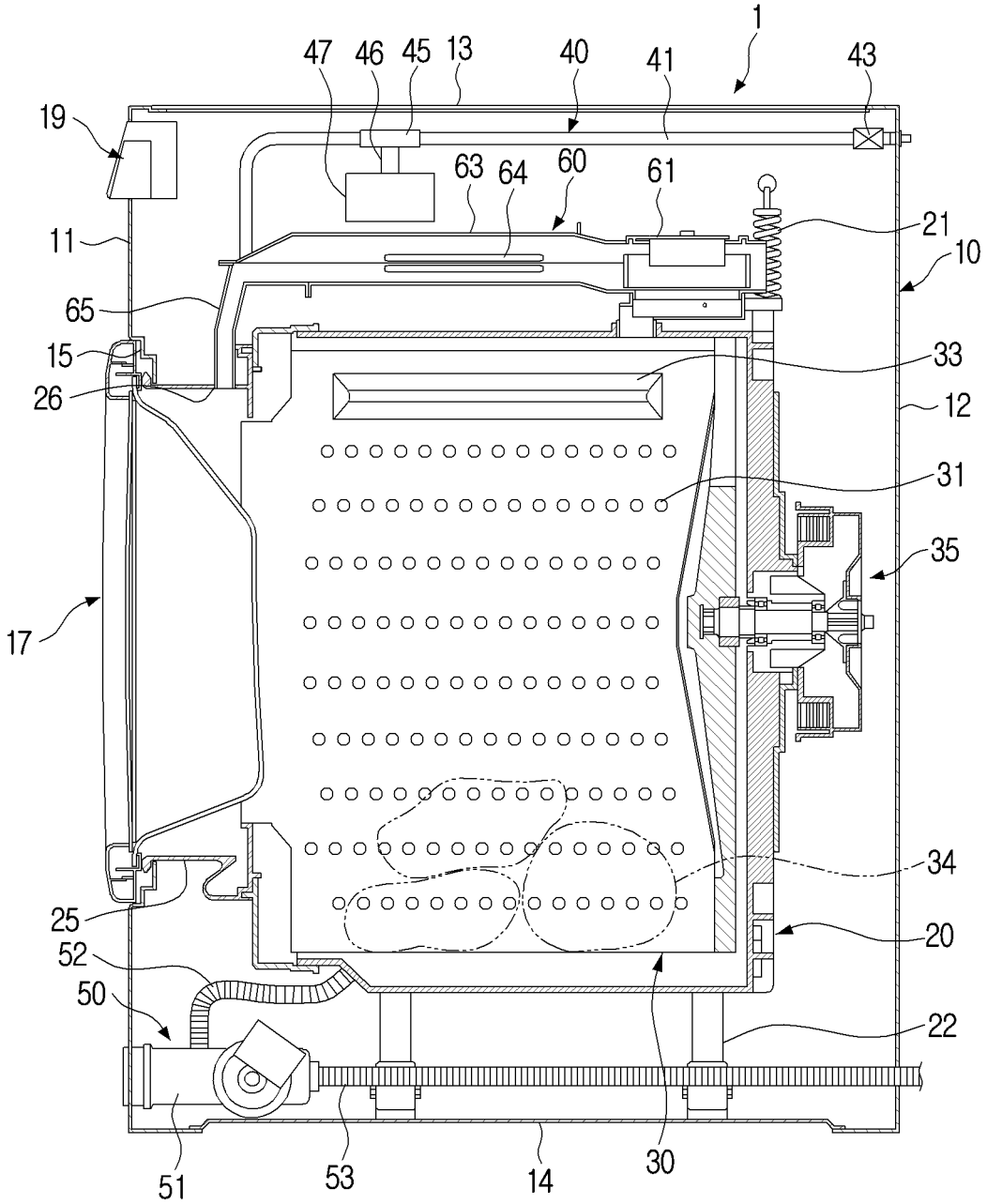
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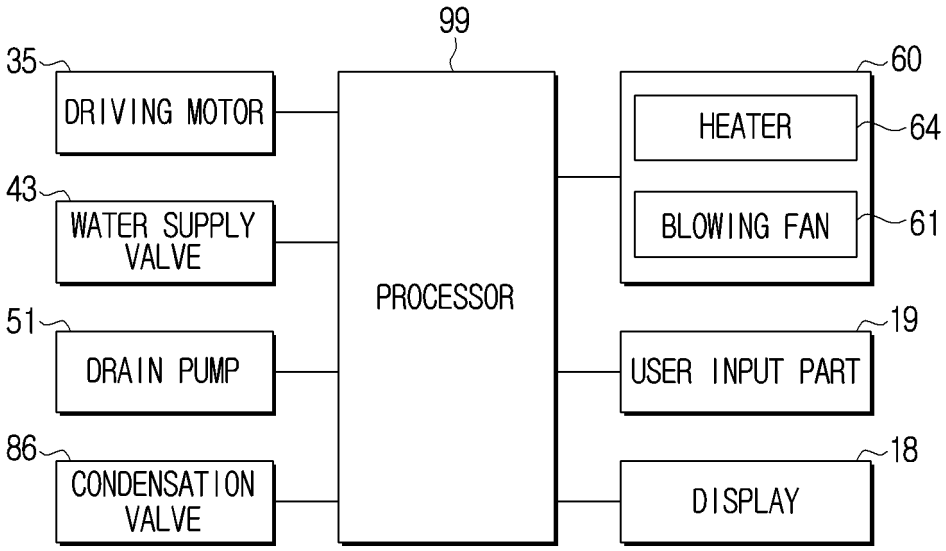
FIG. 2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35
DRIVING MOTOR
43
WATER SUPPLY VALVE
51
DRAIN PUMP
86
CONDENSATION VALVE
PROCESSOR
60
HEATER
64
BLOWING FAN
61
19
USER INPUT PART
18
DISPLAY

FIG. 3

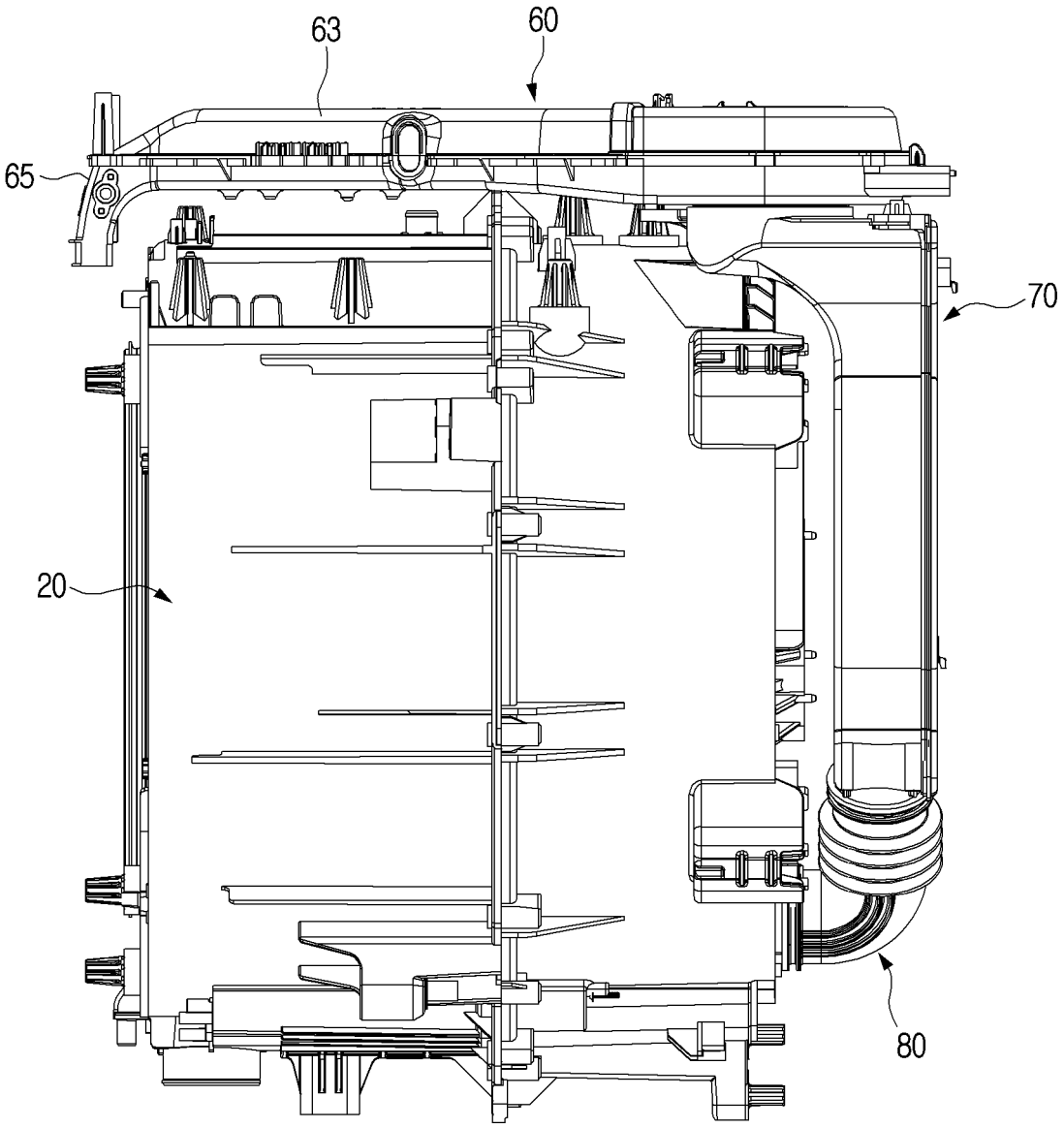


FIG. 4

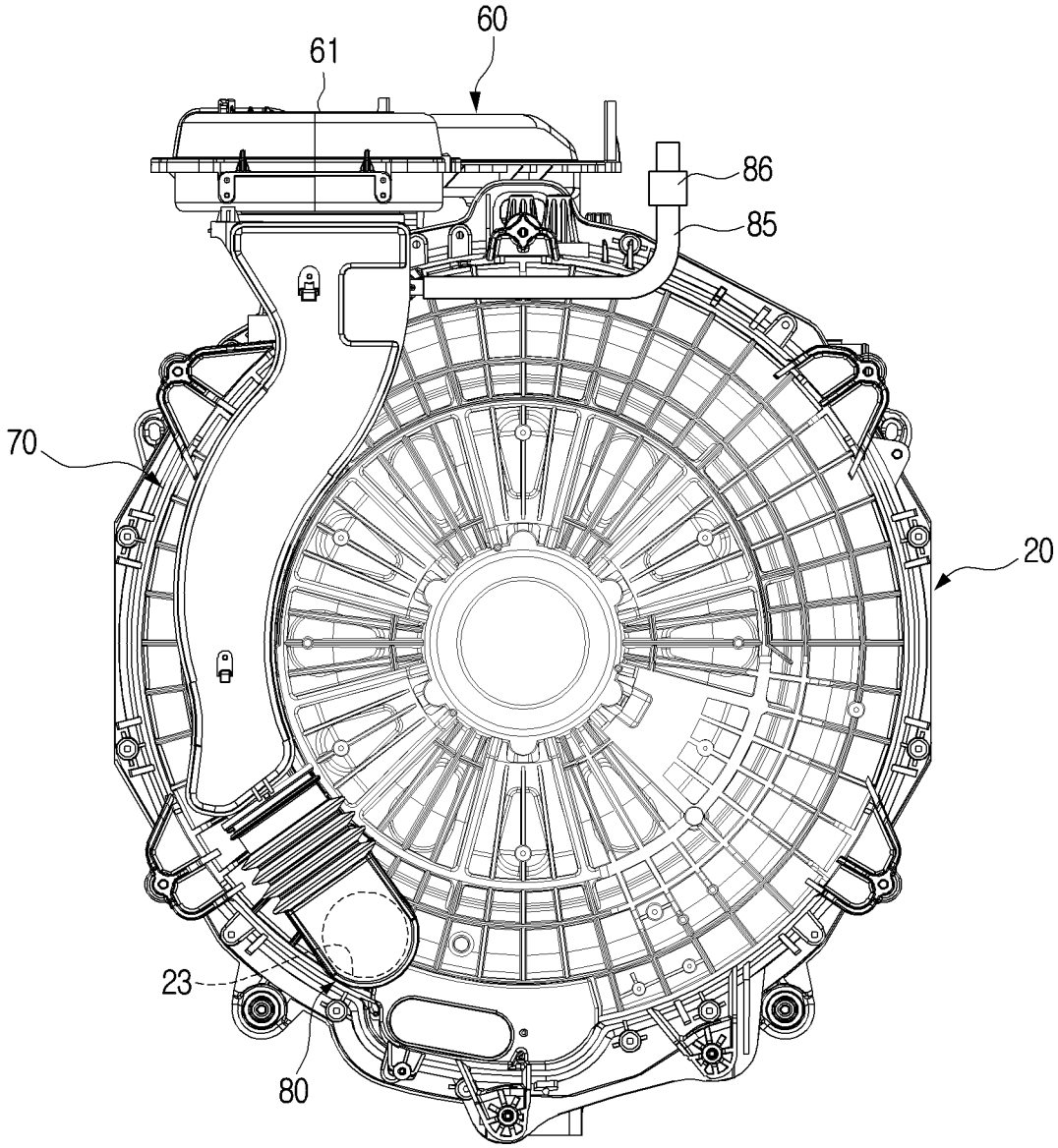


FIG. 5

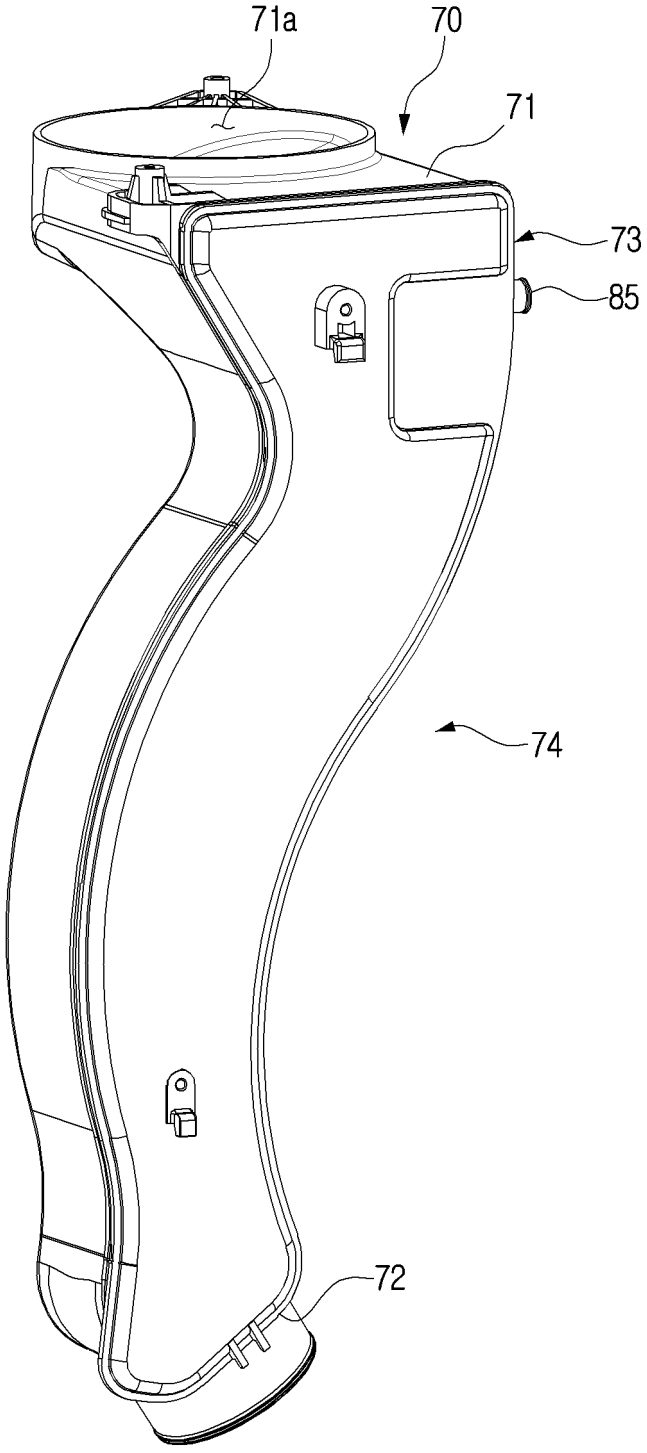


FIG. 6

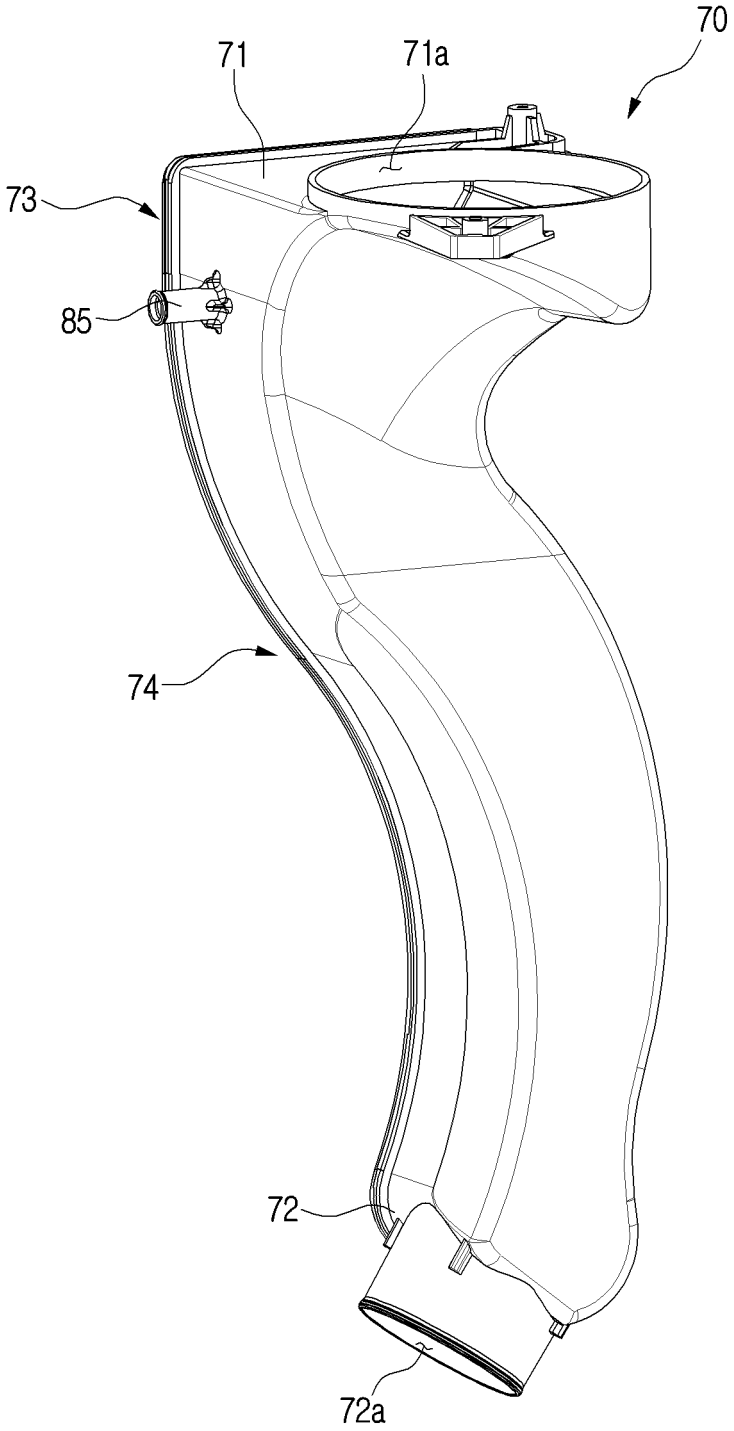


FIG. 7

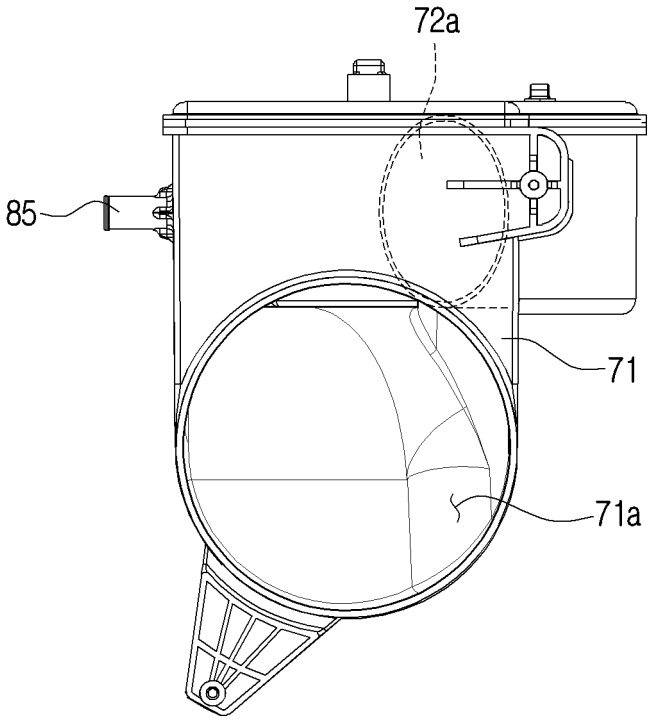
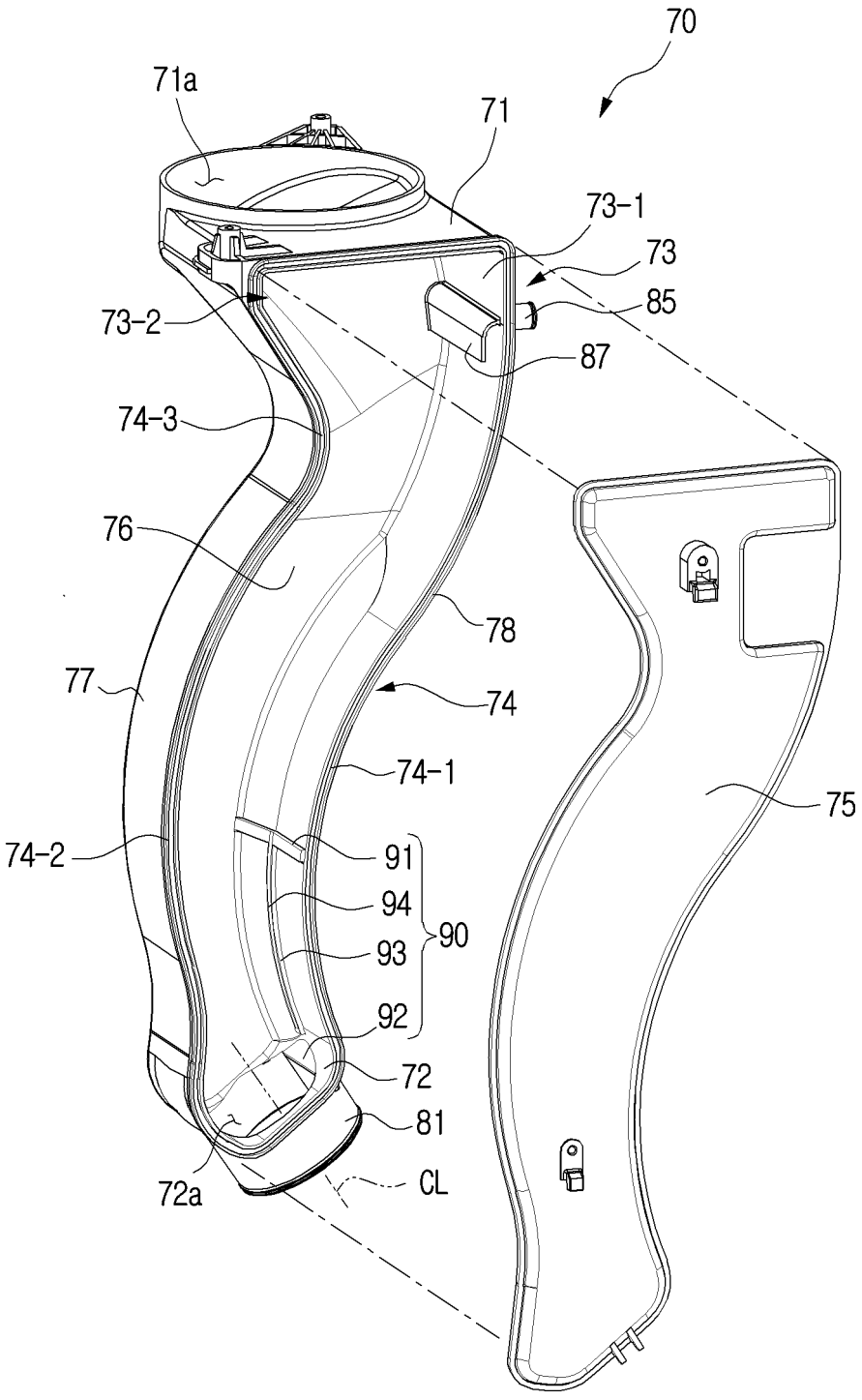


FIG. 8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72a
CL

FIG. 9

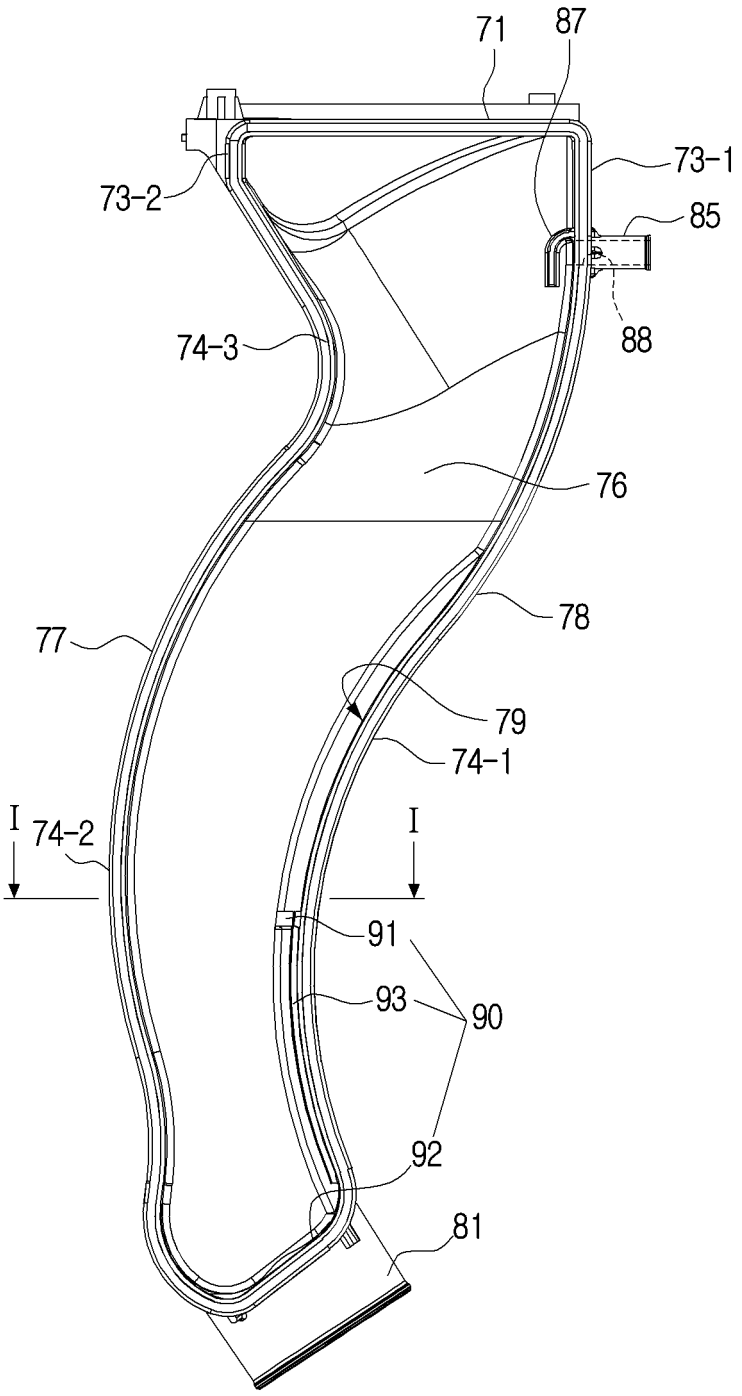


FIG. 10

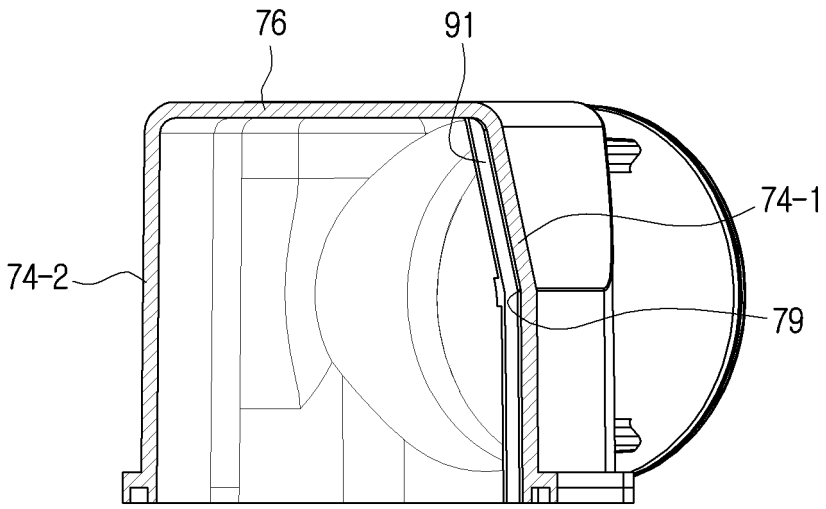


FIG. 11

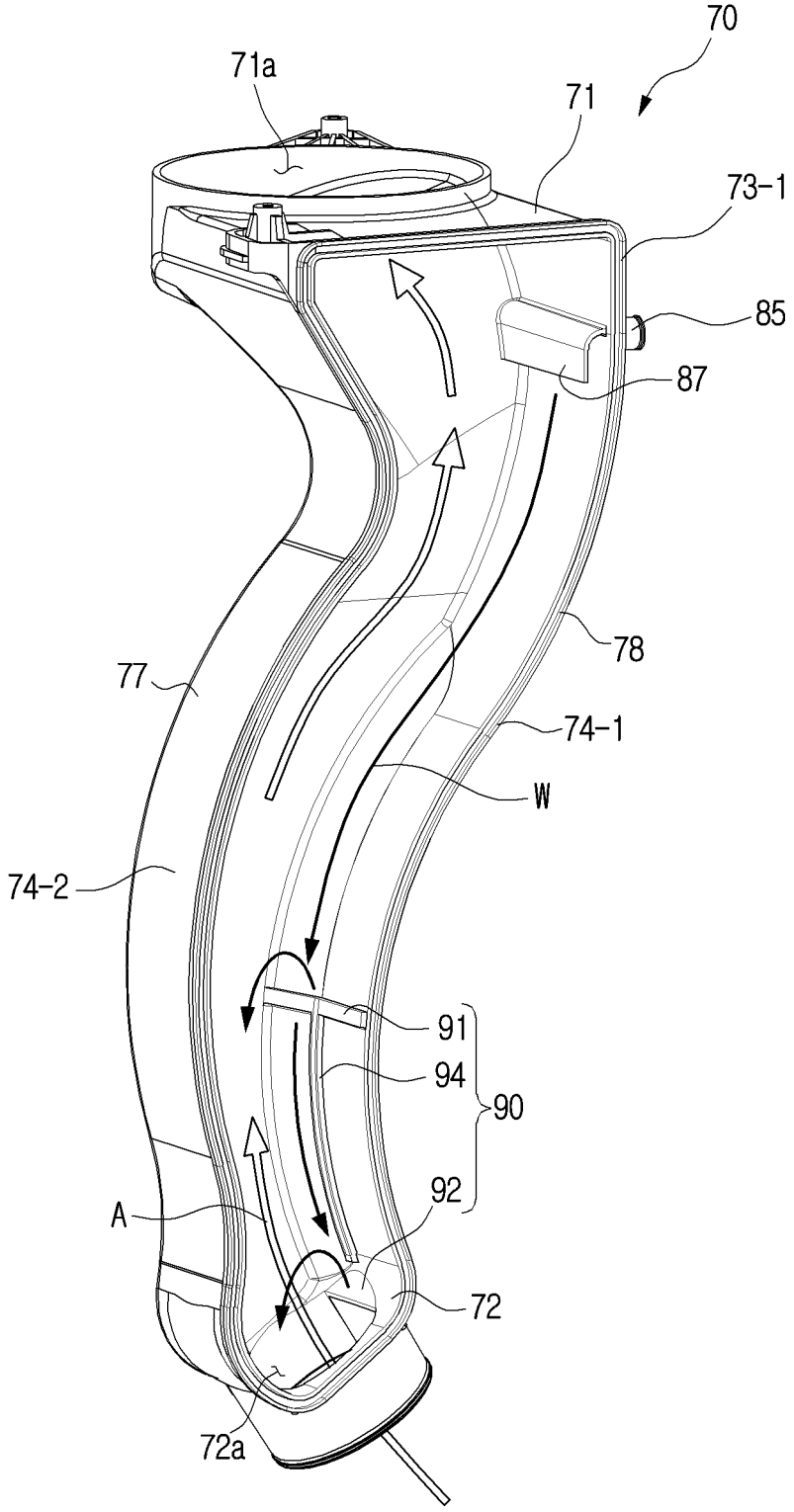


FIG. 12

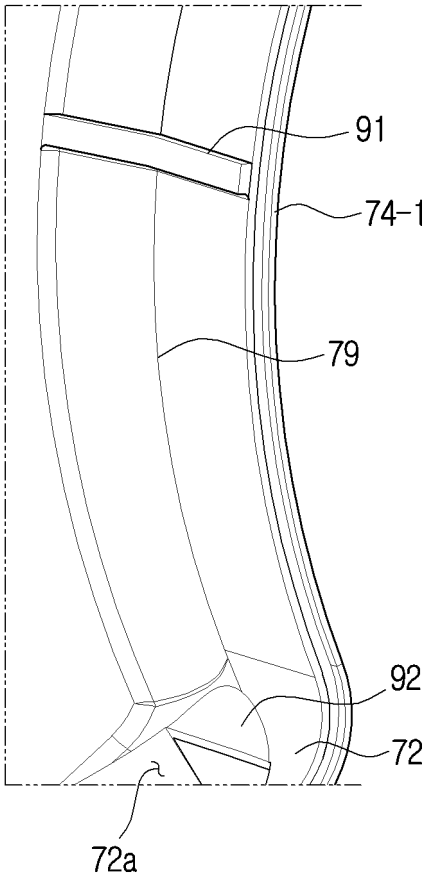


FIG. 13

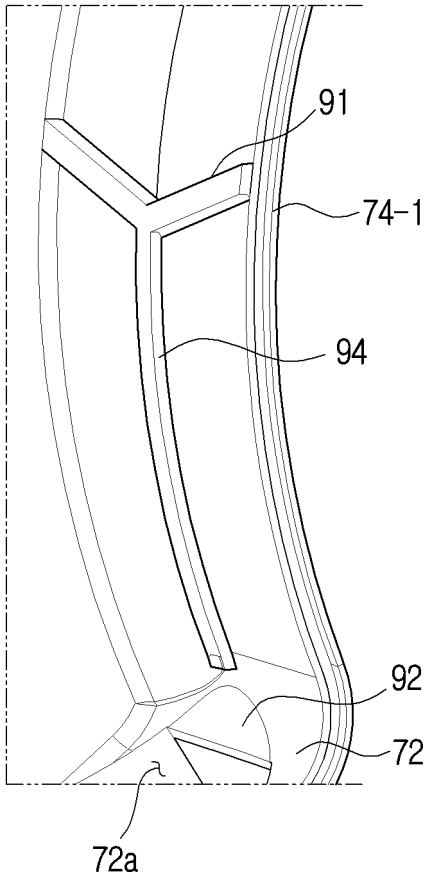


FIG. 14

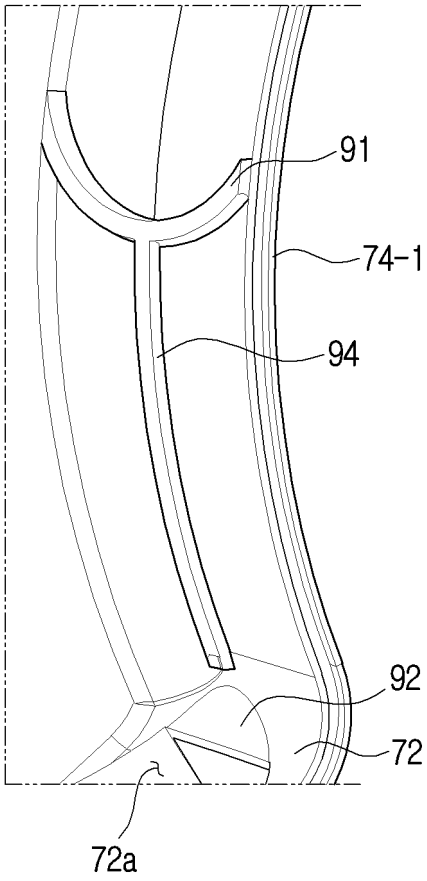
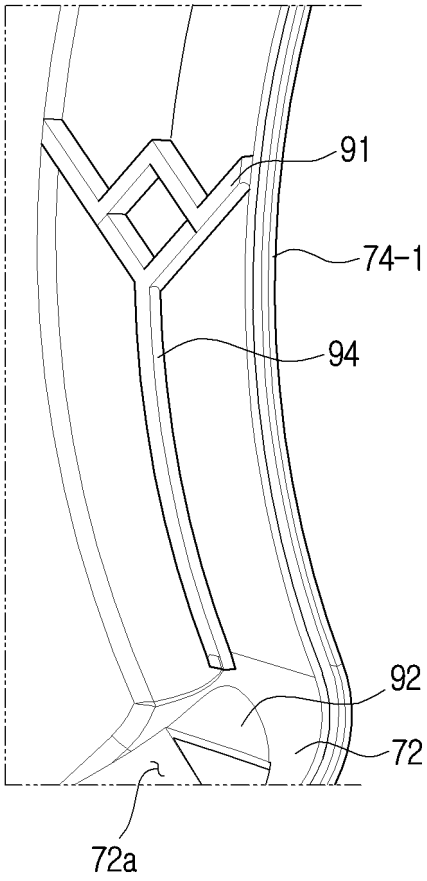


FIG. 15



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2022/021487

A. CLASSIFICATION OF SUBJECT MATTER

D06F 58/24(2006.01)i; **D06F 58/26**(2006.01)i; **D06F 58/04**(2006.01)i; **D06F 25/00**(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)

D06F 58/24(2006.01); D06F 25/00(2006.01); D06F 58/18(2006.01); D06F 58/20(2006.01)

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

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

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

eKOMPASS (KIPO internal) & keywords: 건조 겸용 세탁기(washing machine with drying function), 비산 돌기(scattering protrusion), 응축 덕트(condensing duct), 안내 돌기(guide protrusion)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	KR 10-2007-0075484 A (LG ELECTRONICS INC.) 24 July 2007 (2007-07-24) See paragraphs [0018]-[0034] and figures 2-3.	1-2,11-13
Y		3-10,14-15
Y	KR 10-2005-0101739 A (LG ELECTRONICS INC.) 25 October 2005 (2005-10-25) See claims 1 and 3-4 and figures 2 and 4.	3-4,10,14-15
Y	KR 10-2005-0123317 A (SAMSUNG ELECTRONICS CO., LTD.) 29 December 2005 (2005-12-29) See claim 4 and figures 4-5.	5-10
A	CN 1680654 A (LG ELECTRONICS INC.) 12 October 2005 (2005-10-12) See claims 1-30 and figures 1-5.	1-15
A	KR 10-2006-0095810 A (LG ELECTRONICS INC.) 04 September 2006 (2006-09-04) See claims 1-5 and figures 1-6.	1-15

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

* Special categories of cited documents:
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"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
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Date of the actual completion of the international search	Date of mailing of the international search report
12 April 2023	**14 April 2023**
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Information on patent family members

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