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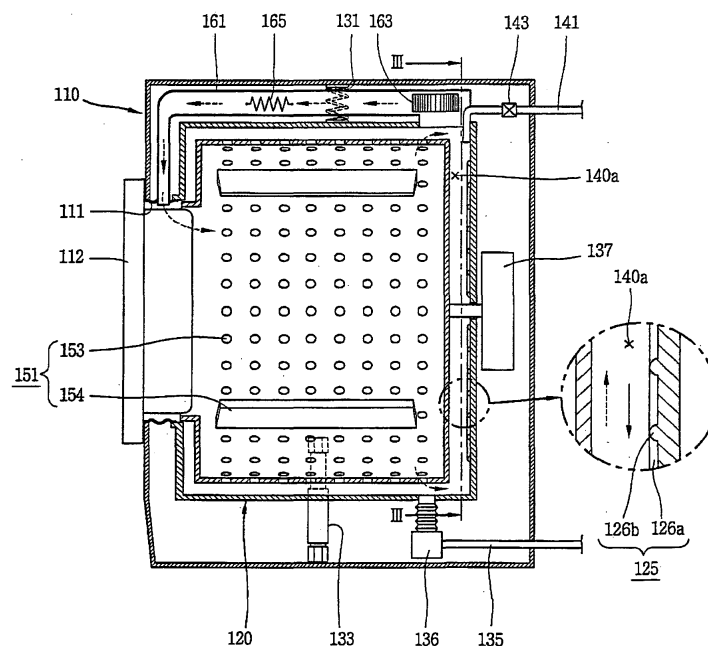
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(54) **Washing-drying machine**

(57) A washing-drying machine comprises a cabinet (110); a tub (120) installed in the cabinet (110); a washing tub (151) rotatably arranged in the tub (120); a water supplying pipe (141) connected to the tub (120) for supplying water in order that wet air can be condensed inside

the tub (120); and a circulation duct (161) arranged outside the tub (120) and having both ends connected to the tub (120), for circulating air inside the tub (120) there-through. Accordingly, a drying efficiency is enhanced without increasing a size of the cabinet (110), and a drying time is shortened.

FIG. 2



## Description

### RELATED APPLICATION

**[0001]** The present disclosure relates to subject matter contained in priority Korean Application No. 10-2005-0074560, filed on August 13, 2005, which is herein expressly incorporated by reference in its entirety.

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

**[0002]** The present invention relates to a washing-drying machine, and more particularly, to a washing-drying machine capable of enhancing a drying efficiency without increasing a size of a cabinet.

#### 2. Description of the Background Art

**[0003]** Generally, a washing-drying machine serves to perform both a washing function and a drying function.

**[0004]** As shown in FIG. 1, the washing-drying machine comprises a cabinet 11 having a receiving space therein, a tub 21 received in the cabinet 11, a washing tub 31 rotatably installed in the tub 21, a condensing duct 41 formed outside the tub 21 for condensing moisture exhausted from the tub 21, a heating duct 51 connected to a lower side of the condensing duct 41 in an air flow direction for heating air thereby providing the heated air into the tub 21, and a blower 53 for circulating the air inside the tub 21 along the condensing duct 41 and the heating duct 51.

**[0005]** An inlet 12 for inputting laundry is formed at one side of the cabinet 11, and a door 14 for opening and closing the inlet 12 is provided at one side of the inlet 12.

**[0006]** The tub 21 having a cylindrical shape of which one side is open for receiving water is arranged in the cabinet 11. Also, a spring 23 and a damper 24 for supporting the tub 21 are respectively provided at upper and lower portions of the tub 21.

**[0007]** A drain passage 25 where a drain pump 26 is installed is provided at a lower portion of the tub 21, and a washing tub motor 27 is provided at a rear end of the tub 21. The washing tub 31 having a cylindrical shape of which one side is open is received in the tub 21 so as to be rotatable by the washing tub motor 27. A plurality of through holes 32 are penetratingly-formed at a circumference of the washing tub 31. A plurality of lifts 33 for lifting laundry are spaced from each other at an inner surface of the washing tub 31 in a circumferential direction.

**[0008]** The condensing duct 41 for exhausting air inside the tub 21 and condensing is coupled to a rear surface of the tub 21, and a water supplying pipe 43 for supplying water into the condensing duct 41 is installed at an upper portion of the condensing duct 41. A water supplying valve 44 for opening and closing the water sup-

plying pipe 43 is provided at the water supplying pipe 43. One end of the heating duct 51 is connected to an upper end of the condensing duct 41, and another end of the heating duct 51 is connected to a front portion of the tub 21. A blower 53 for circulating air inside the tub 21 is installed in the heating duct 51, and a heater 55 for heating air inside the heating duct 51 is provided at a lower side of the blower 53.

**[0009]** However, the related art washing-drying machine has the following problems. Since the condensing duct 41 is arranged at a rear surface of the tub 21, collision between the condensing duct 41 and the cabinet 11 is caused by vibration of the tub 21 in back and forth directions when the washing-drying machine is driven. To solve the problem, a space is obtained between the cabinet 11 and the condensing duct 41, which causes a limitation in a length of the tub 21 and a thickness (sectional area for air flow) of the condensing duct 41 in back and forth directions. Furthermore, since the sectional area for air flow of the condensing duct 41 can not be increased, a flow loss of circulating air is increased. As the result, a drying efficiency is lowered thus to prolong a drying time and to increase water consumption.

### SUMMARY OF THE INVENTION

**[0010]** Therefore, an object of the present invention is to provide a washing-drying machine capable of enhancing a drying efficiency by decreasing a flow resistance of air inside a condensing area.

**[0011]** Another object of the present invention is to provide a washing-drying machine capable of enhancing a drying efficiency by increasing a heat exchange area between water and air.

**[0012]** To achieve these and other advantages and in accordance with the purpose of the present invention, as embodied and broadly described herein, there is provided A washing-drying machine, comprising: a cabinet; a tub installed in the cabinet; a washing tub rotatably arranged in the tub; a water supplying pipe connected to the tub for supplying water in order that wet air can be condensed inside the tub; and a circulation duct arranged outside the tub and having both ends connected to the tub, for circulating air inside the tub therethrough.

**[0013]** According to another aspect of the present invention, there is provided a washing-drying machine, comprising: a cabinet; a tub installed in the cabinet; a washing tub rotatably arranged in the tub; a water supplying pipe connected to the tub so that water flow on an inner surface of the tub; and a circulation duct arranged outside the tub and having both ends connected to the tub, for circulating air inside the tub therethrough.

**[0014]** According to still another aspect of the present invention, there is provided a washing-drying machine, comprising: a cabinet; a tub installed in the cabinet; a washing tub rotatably arranged in the tub; a water supplying pipe arranged at the tub so that water be dropped by contacting the washing tub; and a circulation duct ar-

ranged outside the tub and having both ends connected to the tub, for circulating air inside the tub.

**[0015]** The foregoing and other objects, features, aspects and advantages of the present invention will become more apparent from the following detailed description of the present invention when taken in conjunction with the accompanying drawings.

#### BRIEF DESCRIPTION OF THE DRAWINGS

**[0016]** The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention.

**[0017]** In the drawings:

FIG. 1 is a sectional view showing a washing-drying machine in accordance with the related art;

FIG. 2 is a longitudinal section view showing a washing-drying machine according to a first embodiment of the present invention;

FIG. 3 is a sectional view taken along line III-III of FIG. 2;

FIG. 4 is a sectional view showing a water dropping delaying portion, which is taken along line IV-IV of FIG. 3;

FIGS. 5A to 5C are sectional views showing a modification of the water dropping delaying portion of FIG. 4 according to a first embodiment of the present invention;

FIG. 6 is a sectional view showing a washing-drying machine according to a second embodiment of the present invention;

FIG. 7 is a sectional view taken along line VII-VII of FIG. 6;

FIG. 8 is a side view of a washing tub of FIG. 6;

FIGS. 9 and 10 are side views showing a modification of a washing tub of the washing-drying machine according to a second embodiment of the present invention;

FIG. 11 is a sectional view showing a washing-drying machine according to a third embodiment of the present invention;

FIG. 12 is a sectional view showing a washing-drying machine according to a fourth embodiment of the present invention;

FIG. 13 is a sectional view showing a tub and a washing tub taken along line XIII-XIII of FIG. 12; and

FIG. 14 is a sectional view showing a washing-drying machine according to a fifth embodiment of the present invention.

#### DETAILED DESCRIPTION OF THE INVENTION

**[0018]** Reference will now be made in detail to the preferred embodiments of the present invention, examples

of which are illustrated in the accompanying drawings.

**[0019]** Hereinafter, a washing-drying machine according to the present invention will be explained in more detail.

**[0020]** Referring to FIGS. 2 and 3, a washing-drying machine comprises: a cabinet 110; a tub 120 installed in the cabinet 110; a washing tub 151 rotatably arranged in the tub 120; a water supplying pipe 141 arranged between the tub 120 and the washing tub 151 and having a condensing area 140a to condense flowing wet air, for supplying water therebetween; and a circulation duct 161 arranged outside the tub 120 and having both ends connected to the tub 120, for circulating air inside the tub 120 therethrough.

**[0021]** An inlet 111 for inputting laundry is formed at a front surface of the cabinet 110, and a door 112 is provided so as to open and close the inlet 111. The tub 120 is arranged in the cabinet 110 so as to be supported by a spring 131 and a damper 133. A drain passage 135 where a drain pump 136 is installed is provided at a lower portion of the tub 120. The washing tub 151 is arranged in the tub 120 so as to be rotatable centering around a horizontally-arranged rotation shaft. A washing tub motor 137 for driving the washing tub 151 is integrally coupled to a rear end of the tub 120. A plurality of through holes 153 are penetratingly-formed at a circumference of the washing tub 151. Also, a plurality of lifts 154 for upwardly moving laundry are provided at an inner surface of the washing tub 151.

**[0022]** A duct connecting portion 122 upwardly protruding so as to be connected to an inlet of the circulation duct 161 is formed at a rear upper portion of the tub 120. In order to prevent collision with the cabinet 110, the duct connecting portion 122 is protruding from a portion spaced from a center line (Lvc) of the tub 120 in upper and lower directions. Also, a rear end of the duct connecting portion 122 is not more protruding than a rear end of the tub 120 towards a rear side of the cabinet 110. A blower 163 for circulating air is rotatably installed in the circulation duct 161, and a heater 165 for heating air is provided at a lower side of the blower 163.

**[0023]** The water supplying pipe 141 for supplying water to the tub 120 is arranged at an upper side of a rear end of the tub 120. A condensing area 140a for condensing moisture exhausted from the washing tub 151 is formed between an inner rear region of the tub 120 and the washing tub 151. A water supply valve 143 for opening and closing the water supplying pipe 141 is provided at the water supplying pipe 141. A water dropping delaying portion 125 for delaying dropping of water supplied from the water supplying pipe 141 is formed at an inner surface of a rear end of the tub 120.

**[0024]** The water dropping delaying portion 125 comprises a first rib 126a protruding from an inner surface of a rear end of the tub 120 and extending along a radial direction of the tub 120, and a plurality of second ribs 126b protruding from an inner surface of the tub 120 and extending as a circular shape. As shown in FIG. 4, the

first rib 126a and the second rib 126b are protruding so as to have a section of a semi-circular shape. However, a rib 127a having a section of a circular shape can be constructed as shown in FIG. 5A, and a rib 127b having a section of a square shape can be constructed as shown in FIG. 5B. Also, a rib 127c having a section of a square shape and upwardly protruding with an inclination angle can be constructed as shown in FIG. 5C.

**[0025]** When laundry having undergone a washing operation is to be dried, the blower 163 is rotated so as to circulate air inside the tub 120 and the heater 165 is driven so as to heat the air. The air heated by the heater 165 is introduced into the washing tub 151 thereby to contain moisture evaporated from the laundry. Then, the wet air is exhausted outside the washing tub 151 via the through holes 153 of the washing tub 151.

**[0026]** When the water supplying valve 143 is opened, water is supplied to the inner surface of the rear end of the tub 120 through the water supplying pipe 141. The water downwardly flows along the inner surface of the rear end of the tub 120. Herein, the water dropping delaying portion 125 delays dropping of the water thereby to prolong a heat exchange time between the wet air exhausted outside the washing tub 151 and the water. The wet air exhausted outside the washing tub 151 flows along the condensing area 140a, and contacts the inner surface of the tub 120 having a relatively low temperature or contacts the water thus to be condensed. The condensed air has a lowered humidity thereby to become a dry air and thus to upwardly flow.

**[0027]** The upwardly flowing dry air is heated by the heater 165 via the blower 163 thus to become high-temperature dry air. Then, the air flows along the circulation duct 161 thus to be introduced into the tub 120, which is repeated. Herein, the washing tub 151 is intermittently rotated in forward and backward directions so that the heated air can uniformly contact the laundry for acceleration of a drying of the laundry. Also, the water supplying valve 143 is intermittently opened and closed thereby to supply the water to the inner surface of the rear end of the tub 120.

**[0028]** FIG. 6 is a sectional view showing a washing-drying machine according to a second embodiment of the present invention, FIG. 7 is a sectional view taken along line VII-VII of FIG. 6, FIG. 8 is a side view of a washing tub of FIG. 6, and FIGS. 9 and 10 are side views showing a modification of a washing tub of the washing-drying machine according to a second embodiment of the present invention.

**[0029]** The same reference numerals are applied to the same parts as those of the aforementioned embodiments, and its detail explanation will be omitted

**[0030]** Referring to FIGS. 6 and 7, the washing-drying machine comprises: a cabinet 110 having a receiving space therein; a tub 120 installed in the cabinet 110; a washing tub 171 rotatably arranged in the tub 120; a water supplying pipe 141 arranged at the tub 120 for dropping water to the washing tub 171; and a circulation duct

161 arranged outside the tub 120 for circulating air inside the tub 120 therethrough.

**[0031]** The tub 120 is arranged in the cabinet 110 so as to be supported by a spring 131 and a damper 133. The washing tub 171 is rotatably arranged in the tub 120, and a washing tub motor 137 for driving the washing tub 171 is integrally coupled to a rear end of the tub 120.

**[0032]** A duct connecting portion 122 upwardly protruding so as to be connected to an inlet of the circulation duct 161 is formed at a rear upper portion of the tub 120. In order to prevent collision with the cabinet 110, the duct connecting portion 122 is protruding from a portion spaced from a center line (Lvc) of the tub 120 in upper and lower directions. Also, a rear end of the duct connecting portion 122 is not more protruding than a rear end of the tub 120 towards a rear side of the cabinet 110

**[0033]** The washing tub 171 has a cylindrical shape of which one side is opened. The washing tub 171 includes a perforation portion 172a having a plurality of through holes 153 penetratingly formed at a circumference of the washing tub 171, and a non-perforation portion 172b formed at one side of the perforation portion 172a with a certain width in an axial line direction of the washing tub 171. A water supplying pipe 141 is installed at the tub 120 so that a condensing area 140b can be formed near the non-perforation portion 172b. The water supplying pipe 141 is arranged at an upper side of the non-perforation portion 172b so that water can be dropped by contacting the non-perforation portion 172b. A water supplying valve 143 for opening and closing the water supplying pipe 141 is provided at the water supplying pipe 141.

**[0034]** As shown in FIG. 9, it is possible to construct a washing tub 181 having a rib 183 protruding along a radial direction and extending along a circumferential direction of the washing tub 181 for preventing water dropped to the non-perforation portion 172b from the water supplying pipe 141 from flowing to the perforation portion 172a. As shown in FIG. 10, it is also possible to construct a washing tub 191 having a guide portion 193 inwardly concaved along a radial direction and extending along a circumferential direction at the non-perforation portion 172b.

**[0035]** A water dropping delaying portion 129 for delaying dropping of water dropped to the non-perforation portion 172b thus to be dispersed to an inner wall of the tub 120 is formed at the inner wall of the tub 120. The water dropping delaying portion 129 is implemented as a plurality of ribs protruding from the inner wall of the tub 120 and extending in a longitudinal direction.

**[0036]** When a drying operation for laundry starts, the blower 163 and the heater 165 are operated. Then, air heated by the heater 165 flows along the circulation duct 161 thus to be introduced into the washing tub 171. Then, the high temperature air introduced into the washing tub 171 contains wet air evaporated from the laundry thus to become wet air, and is exhausted outside the washing tub 171 via the through holes 153 of the perforation portion 172a.

**[0037]** While the drying operation is performed, the water supplying valve 143 intermittently opens and closes the water supplying pipe 141 thereby to supply water to the non-perforation portion 172b. Also, the washing tub 171 is intermittently driven in forward and backward directions so that the laundry can smoothly contact the high temperature air. Some of the water dropped to the non-perforation portion 172b is heat-exchanged with the washing tub 171 with flowing along the non-perforation portion 172b, and other is dispersed to be spaced from the washing tub 171. The water dropping delaying portion 129 formed at the inner wall of the tub 120 increases a heat exchange area between water and air, and delays a dropping speed of water dispersed from the washing tub 171, thereby increasing an entire heat exchange amount.

**[0038]** The wet air exhausted outside the washing tub 171 through the perforation portion 172a flows along the condensing area 140b, and contacts the surface of the washing tub 171, the inner surface of the tub 120, and water thus to be condensed. Then, the condensed air becomes dry air thus to upwardly flow. The upwardly flowing dry air passes through the blower 163, is heated by the heater 165, and then is introduced into the washing tub 171, which is repeated thus to perform a drying operation.

**[0039]** FIG. 11 is a sectional view showing a washing-drying machine according to a third embodiment of the present invention.

**[0040]** Referring to FIG. 11, a washing-drying machine according to a fifth embodiment of the present invention comprises a cabinet 110; a tub 120 installed in the cabinet 110; a washing tub 151 rotatably arranged in the tub 120; a water supplying pipe 141 for supplying water to the tub 120 so that water can be dropped via the washing tub 151; and a circulation duct 161 arranged outside the tub 120 for circulating air inside the tub 120 therethrough; and a channel member 201 coupled to a rear end of the washing tub 151 for passing water supplied from the water supplying pipe 141.

**[0041]** The tub 120 is supported by a spring 131 and a damper 133 in the cabinet 110, and the washing tub 151 is rotatably installed in the tub 120.

**[0042]** A duct connecting portion 122 upwardly protruding so as to be connected to an inlet of the circulation duct 161 is formed at a rear upper portion of the tub 120. Also, a blower 163 and a heater 165 respectively for blowing air inside the tub 120 and heating the air are provided in the circulation duct 161.

**[0043]** A water supplying pipe 141 for dropping water to the channel member 201 so as to form a condensing area 140c near the channel member 201 is provided at an upper portion of a rear end of the washing tub 151. A water supplying valve 143 for opening and closing the water supplying pipe 141 is provided at the water supplying pipe 141.

**[0044]** The channel member 201 having a circular ring shape for passing water dropped from the water supply-

ing pipe 141 is rotatably coupled to a rear end of the washing tub 151. The channel member 201 has a center portion inwardly concaved in a radial direction of the washing tub 151, and is extending in a circumferential direction. Preferably, the channel member 201 has an outer diameter smaller than that of the washing tub 151 so as to prevent water from flowing or being dispersed to the through holes 153 of the washing tub 151.

**[0045]** When the water supplying valve 143 opens the water supplying pipe 141 as a drying operation starts, water drops through the water supplying pipe 141. Some of the dropped water contacts the channel member 201 thus to be heat-exchanged and be dropped to a lower portion of the tub 120, and other is dispersed to a peripheral portion of the channel member 201. The wet air containing moisture of the laundry in the washing tub 151 is exhausted outside the washing tub 151 via the through holes 153 of the washing tub 151, and moves along the condensing area 140c. Then, the air contacts the channel member 201, the inner surface of the tub 120, and water thus to be condensed. Then, the condensed air becomes dry thus to upwardly flow. The upwardly flowing dry air is heated by the heater 165 thus to become high-temperature dry air, and then is introduced into the washing tub 151 thus to contact the laundry. The above processes are repeated to perform a drying operation.

**[0046]** FIG. 12 is a sectional view showing a washing-drying machine according to a fourth embodiment of the present invention, and FIG. 13 is a sectional view showing a tub and a washing tub taken along line XIII-XIII of FIG. 12.

**[0047]** Referring to FIGS. 12 and 13, a washing-drying machine according to a sixth embodiment of the present invention comprises a cabinet 110; a tub 120 installed in the cabinet 110; a washing tub 151 rotatably arranged in the tub 120; a water supplying pipe 141 arranged at the tub 120 so that water can be dropped via the washing tub 151; a circulation duct 161 arranged outside the tub 120 for circulating air inside the tub 120 therethrough; and a condensing disc 211 coupled to a rear end of the washing tub 151 so as to contact water.

**[0048]** The tub 120 is supported by a spring 131 and a damper 133 in the cabinet 110, and the washing tub 151 is rotatably installed in the tub 120.

**[0049]** A duct connecting portion 122 upwardly protruding so as to be connected to an inlet of the circulation duct 161 is formed at a rear upper portion of the tub 120. Also, a blower 163 and a heater 165 respectively for blowing air inside the tub 120 and heating the air are provided in the circulation duct 161.

**[0050]** The water supplying pipe 141 for dropping water towards the condensing disc 211 so that the condensing area 140c can be formed at a peripheral portion of the condensing disc 211 is formed at an upper side of a rear end of the washing tub 151. A water supplying valve 143 for opening and closing the water supplying pipe 141 is provided at the water supplying pipe 141.

**[0051]** The condensing disc 211 is coupled to a rear

end of the washing tub 151 so as to contact water dropped from the water supplying pipe 141. The condensing disc 211 is formed of a metal having an excellent conductivity, and has a disc shape. The condensing disc 211 has a plurality of first water dropping delaying ribs 212a protruding from a surface of the condensing disc 211 and extending in a radial direction, and a plurality of second water dropping delaying ribs 212b protruding from a surface of the condensing disc 211 and extending in a circumferential direction.

**[0052]** A plurality of water dropping delaying portions 129 for delaying dropping of water dispersed from the condensing disc 211 is provided at an inner wall of the tub 120 where the condensing disc 211 is installed. The water dropping delaying portions 129 are implemented as ribs protruding from the inner wall of the tub 120 and extending in a direction crossing a water dropping direction.

**[0053]** When the water supplying valve 143 opens a channel as a drying operation starts, water is supplied to the condensing disc 211 through the water supplying pipe 141. Some of the water dropped to the condensing disc 211 is heat-exchanged with the condensing disc 211; and other is dispersed from the condensing disc 211. The water dropping delaying portion 129 delays a dropping speed of water dispersed from the condensing disc 211 thereby to accelerate a heat exchange rate. The air heated by the heater 165 and introduced into the washing tub 151 contacts the laundry thus to contain moisture. The wet air is exhausted outside the washing tub 151 via the through holes 153. Then, the wet air flows along the condensing area 140c, and contacts the condensing disc 211, the tub 120, and water thus to be condensed. The condensed air becomes dry air thus to upwardly flow, flows along the circulation duct 161, is heated thus to become high-temperature dry air, and is introduced into the washing tub 151. The above processes are repeated thus to perform a drying function.

**[0054]** FIG. 14 is a sectional view showing a washing-drying machine according to a fifth embodiment of the present invention. As shown, a washing-drying machine according to a seventh embodiment of the present invention comprises a cabinet 310; a tub 320 installed in the cabinet 310; a washing tub 340 rotatably arranged in the tub 320; a water supplying pipe 357 arranged between the tub 320 and the washing tub 340 for supplying water to the tub 320 so that wet air can be condensed; and a circulation duct 351 arranged outside the tub 320 for circulating air inside the tub 320 therethrough.

**[0055]** A door 312 through which laundry is introduced into the washing tub is rotatably provided at an upper portion of the cabinet 310 in upper and lower directions. The tub 320 having an upwardly opened cylindrical shape for receiving water is supported by a plurality of rods 322 having springs (not shown) in the cabinet 310. A water supplying pipe 313 for supplying water into the tub 320 is installed at an upper rear portion of the cabinet 310. A valve for supplying water or shielding water supply is pro-

vided at the water supplying pipe 313.

**[0056]** The washing tub 340 having an upwardly opened cylindrical shape is arranged in the tub 320 so as to be rotatable centering around a rotation shaft arranged in upper and lower directions. A plurality of through holes 343 for passing water or air are penetratingly formed at a circumference of the washing tub 340. An agitator or a pulsator 345 for forming a water vortex is provided at an inner lower portion of the washing tub 340. A motor 347 for rotating the washing tub 340 and the pulsator 345 is installed at a lower portion of the tub 320. A drain pipe 325 having a drain valve 326 for exhausting water is connected to one side of the tub 320.

**[0057]** The water supplying pipe 357 for supplying water between the washing tub 340 and the tub 320 so as to form a condensing area 331 for condensing wet air is installed at one side of the tub 320. A plurality of water dropping delaying portions 327 protruding from an inner surface of the tub 340 for increasing a heat exchange area so as to increase a heat exchange amount between wet air and water and reducing a water dropping speed is provided at a lower side of the water supplying pipe 357. Preferably, the water dropping delaying portions 327 are spaced from one another in a circumferential direction of the tub 340 so as to be alternately arranged in upper and lower directions of the tub 340. One end of the circulation duct 351 is connected to an upper side of the tub 340 so as to be positioned above the water supplying pipe 357 so that condensed dry air can be exhausted outwardly, and another end of the circulation duct 351 is inserted into the washing tub 340 through a cover 324.

**[0058]** A blower 353 for accelerating air flow is installed at the circulation duct 351, and a heater 355 for heating air is provided at a lower side of the blower 353 in the circulation duct 351.

**[0059]** When the laundry having undergone a washing operation and a dehydrating operation are to be dried, power is applied to the blower 353 and the heater 355. When the blower 353 starts to be rotated, air between the washing tub 340 and the tub 320 is exhausted thus to flow along the circulation duct 351. The air inside the circulation duct 351 is heated by the heater 355 thus to be introduced into the washing tub 340, and contains moisture from the laundry thus to become high-temperature wet air. The high-temperature wet air flows between the washing tub 340 and the tub 320 via the through holes 343, and passes through the condensing area 331 having a relatively low temperature by heat-exchanging with water supplied from the water supplying pipe 357 thereby to be condensed. Then, the condensed dry air flows along the circulation duct 351, and is heated by the heater 355 thus to become high-temperature dry air. Then, the high-temperature dry air is introduced into the washing tub 340 thus to contain moisture of the laundry. The above processes are repeated thus to perform a drying operation.

**[0060]** As aforementioned, in the washing-drying machine according to the present invention, the condensing

area for condensing high-temperature wet air is provided between the tub and the washing tub, thereby reducing a flow resistance of air and increasing a condensing area. Accordingly, a drying efficiency is enhanced, a drying time is shortened, and a water usage amount for a drying operation is reduced.

**[0061]** Furthermore, in the washing-drying machine according to the present invention, a condensing duct is not provided between the tub and the cabinet, thereby increasing each capacity of the tub and the washing tub without increasing a size of the cabinet.

**[0062]** Also, in the washing-drying machine according to the present invention, the washing tub comes in contact with water for a condensing operation, thereby increasing a heat exchange area between water and air and thus enhancing a drying efficiency.

**[0063]** Besides, in the washing-drying machine according to the present invention, when the washing tub is formed so as to be rotated centering around a horizontal rotation shaft, the duct connecting portion is formed at an upper side of the tub. Herein, the duct connecting portion is arranged so that a rear end thereof can be on the same line as a rear end of the tub or can be at a front side of the rear end of the tub, thereby facilitating an assembly and preventing collision with the cabinet.

**[0064]** As the present invention may be embodied in several forms without departing from the spirit or essential characteristics thereof, it should also be understood that the above-described embodiments are not limited by any of the details of the foregoing description, unless otherwise specified, but rather should be construed broadly within its spirit and scope as defined in the appended claims, and therefore all changes and modifications that fall within the metes and bounds of the claims, or equivalents of such metes and bounds are therefore intended to be embraced by the appended claims.

## Claims

### 1. A washing-drying machine, comprising:

a cabinet;  
a tub installed in the cabinet;  
a washing tub rotatably arranged in the tub;  
a water supplying pipe connected to the tub for supplying water in order that wet air can be condensed inside the tub; and  
a circulation duct arranged outside the tub and having both ends connected to the tub, for circulating air inside the tub therethrough.

2. The washing-drying machine of claim 1, wherein the water supplying pipe is coupled to the tub so that water be dropped along an inner surface of the tub.

3. The washing-drying machine of claim 1, wherein a water dropping delaying portion for delaying a water

dropping speed is formed at an inner surface of the tub.

4. The washing-drying machine of claim 1, wherein a duct connecting portion is integrally provided at an upper portion of the tub, to which an inlet of the circulation duct is connected.

5. The washing-drying machine of claim 4, wherein the duct connecting portion is arranged so that a rear end thereof may be on the same line as a rear end of the tub or may be at a front side of the rear end of the tub in back and forth directions of the cabinet.

6. The washing-drying machine of claim 1, wherein the washing tub is rotated centering around a horizontally-arranged rotation shaft, and the water supplying pipe is arranged at the tub so that water be dropped by contacting the washing tub.

7. The washing-drying machine of claim 6, wherein the washing tub includes a perforation portion having a plurality of through holes penetratingly formed at a circumferential surface, and a non-perforation portion formed at one side of the perforation portion along an axial line direction of the washing tub.

8. The washing-drying machine of claim 7, wherein the washing tub is provided with a rib protruding along a radial direction and extending along a circumferential direction for preventing water from flowing to the perforation portion.

9. The washing-drying machine of claim 6, wherein a guide portion inwardly concaved along a radial direction and extending along a circumferential direction for guiding flow of water is formed at the washing tub.

10. The washing-drying machine of claim 6, further comprising a channel member having a circular ring shape, having a sectional surface of which center portion is inwardly concaved, rotatably coupled to a rear end of the washing tub, for passing water supplied from the water supplying pipe.

11. The washing-drying machine of claim 6, further comprising a condensing disc having a disc shape and coupled to a rear end of the washing tub, for heat-exchanging with water supplied from the water supplying pipe.

12. The washing-drying machine of claim 6, wherein a water dropping delaying portion for delaying dropping of water is formed at an inner surface of the tub.

13. The washing-drying machine of one of claims 1 to 12, further comprising a blower for accelerating flow

of air inside the circulation duct.

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FIG. 1

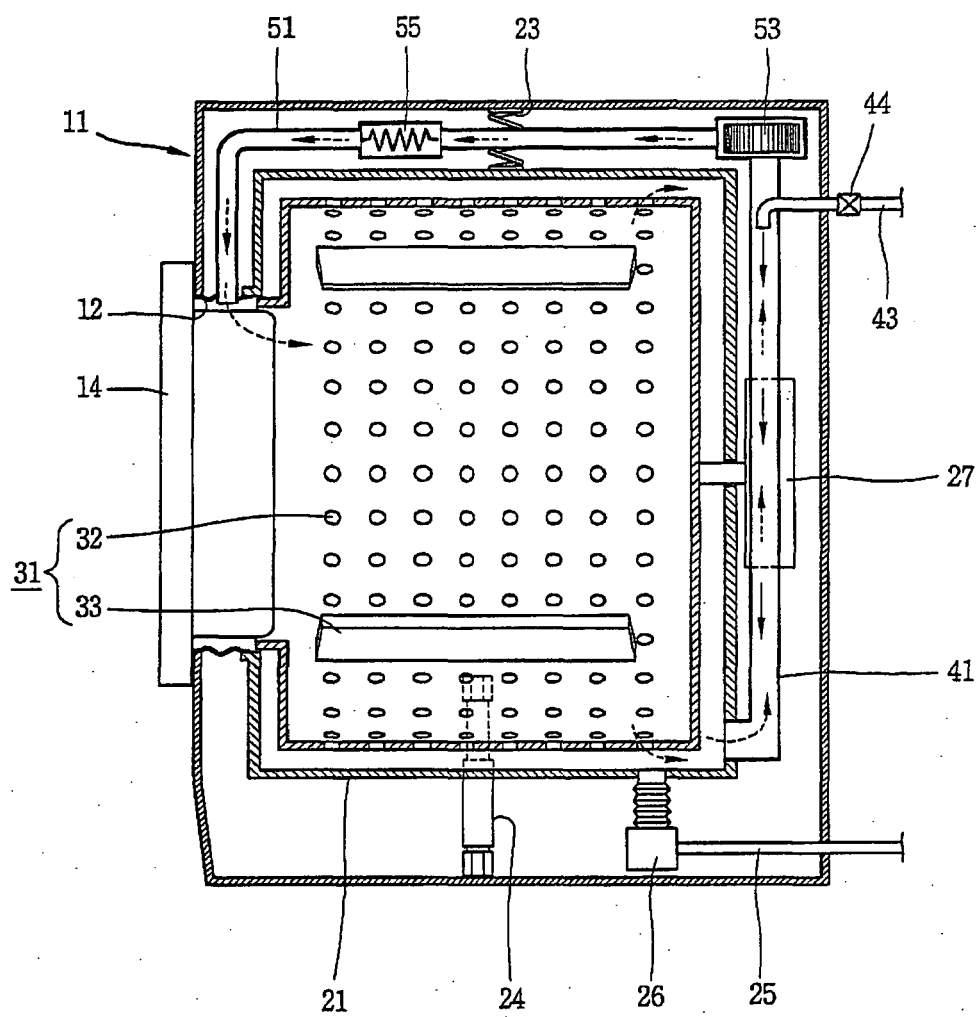


FIG. 2

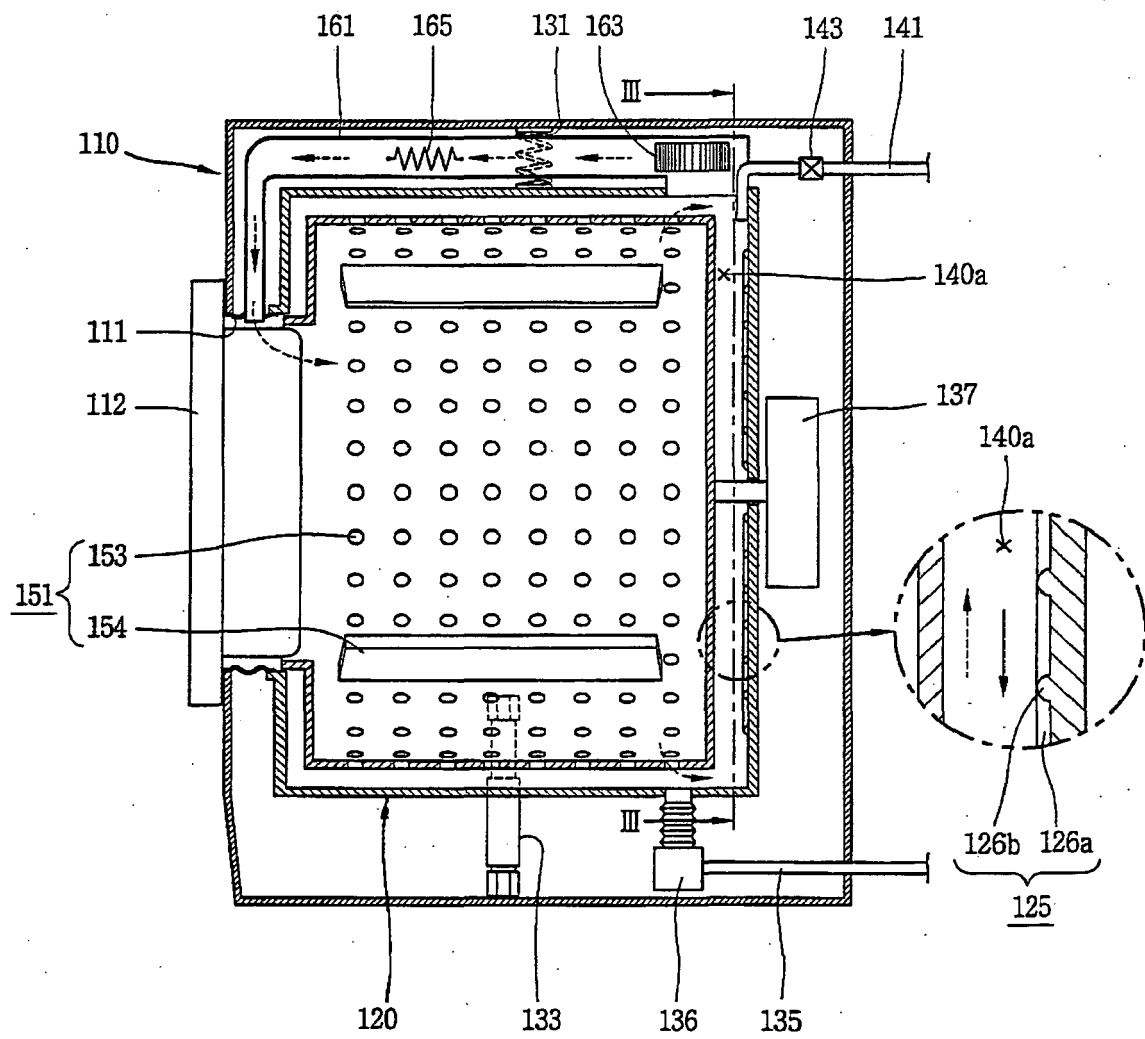


FIG. 3

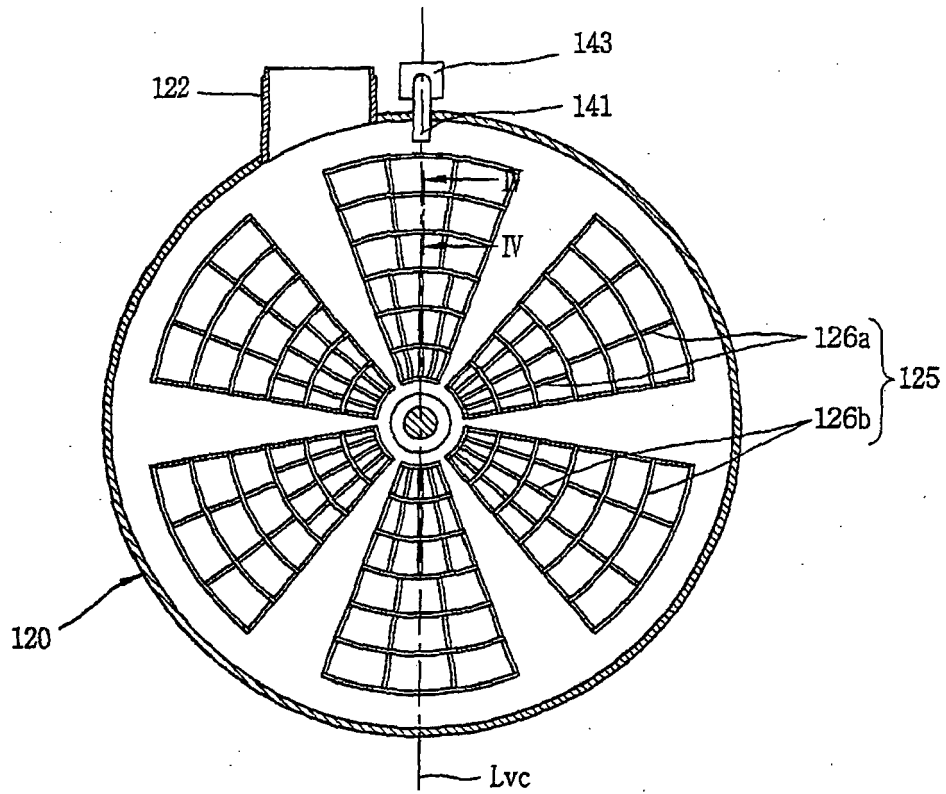


FIG. 4

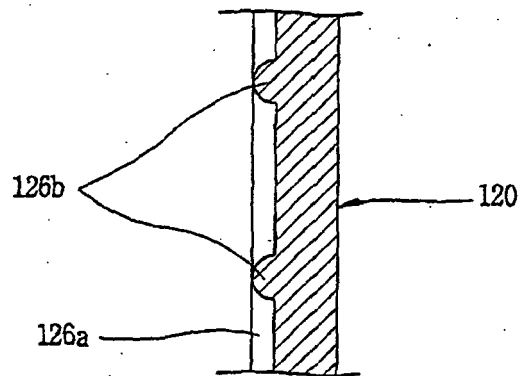


FIG. 5A

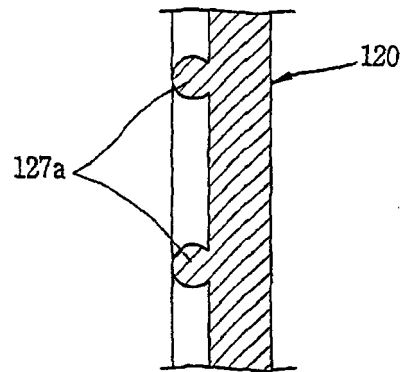


FIG. 5B

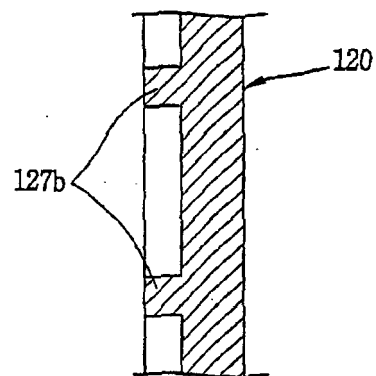


FIG. 5C

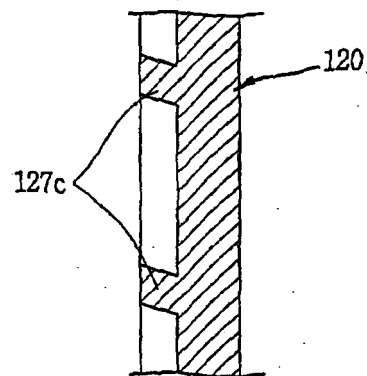


FIG. 6

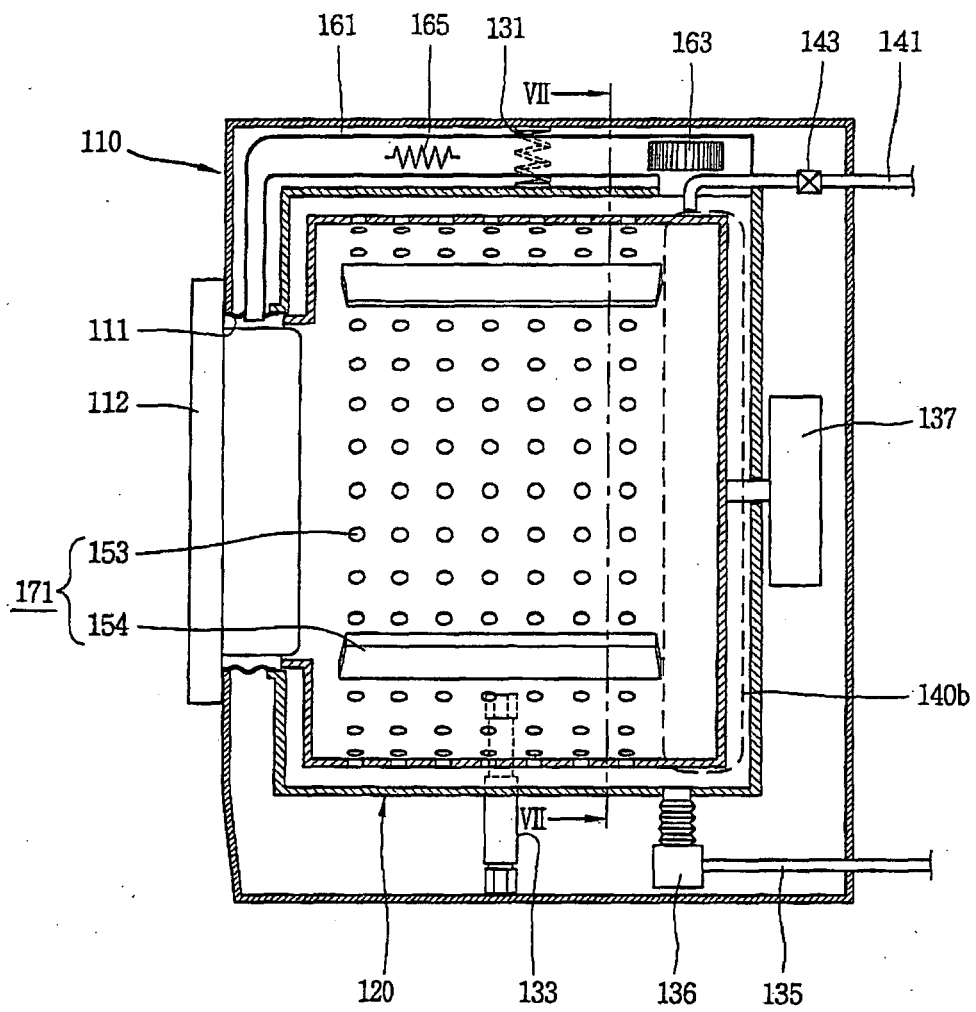


FIG. 7

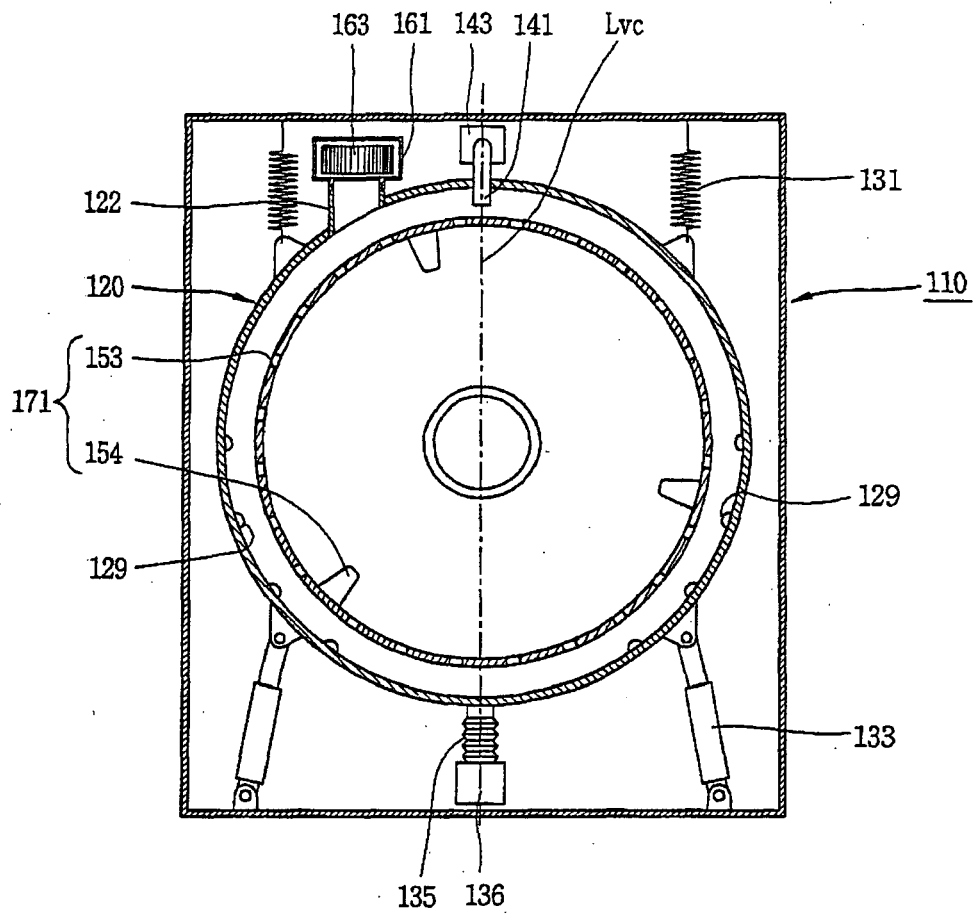


FIG. 8

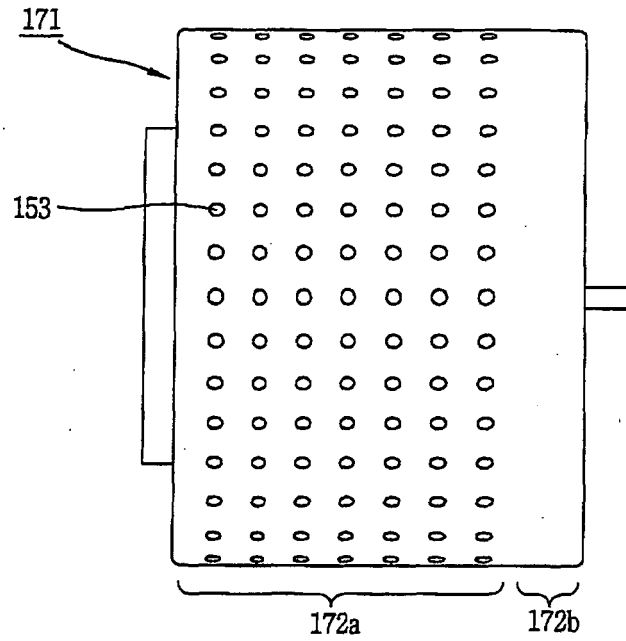


FIG. 9

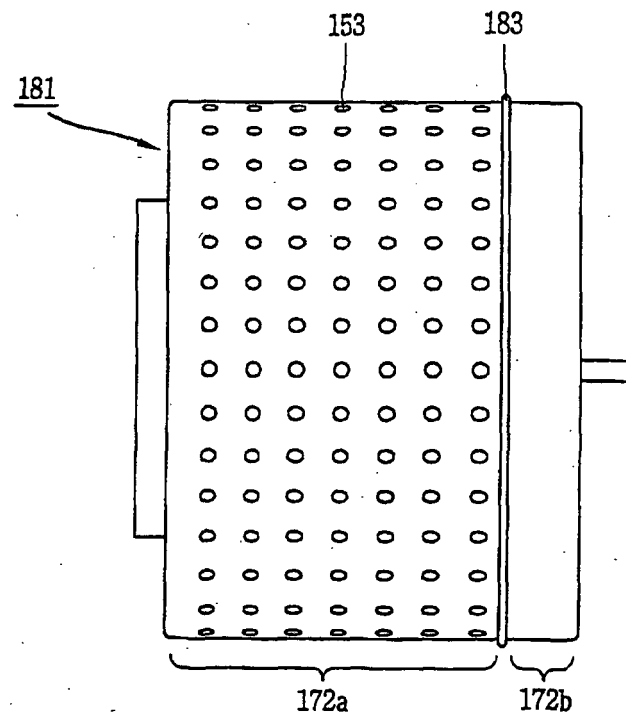


FIG. 10

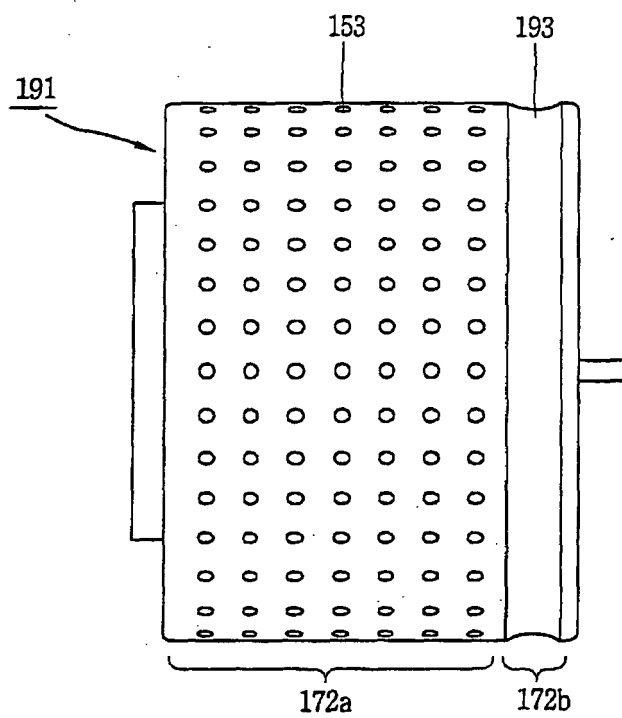




FIG. 11

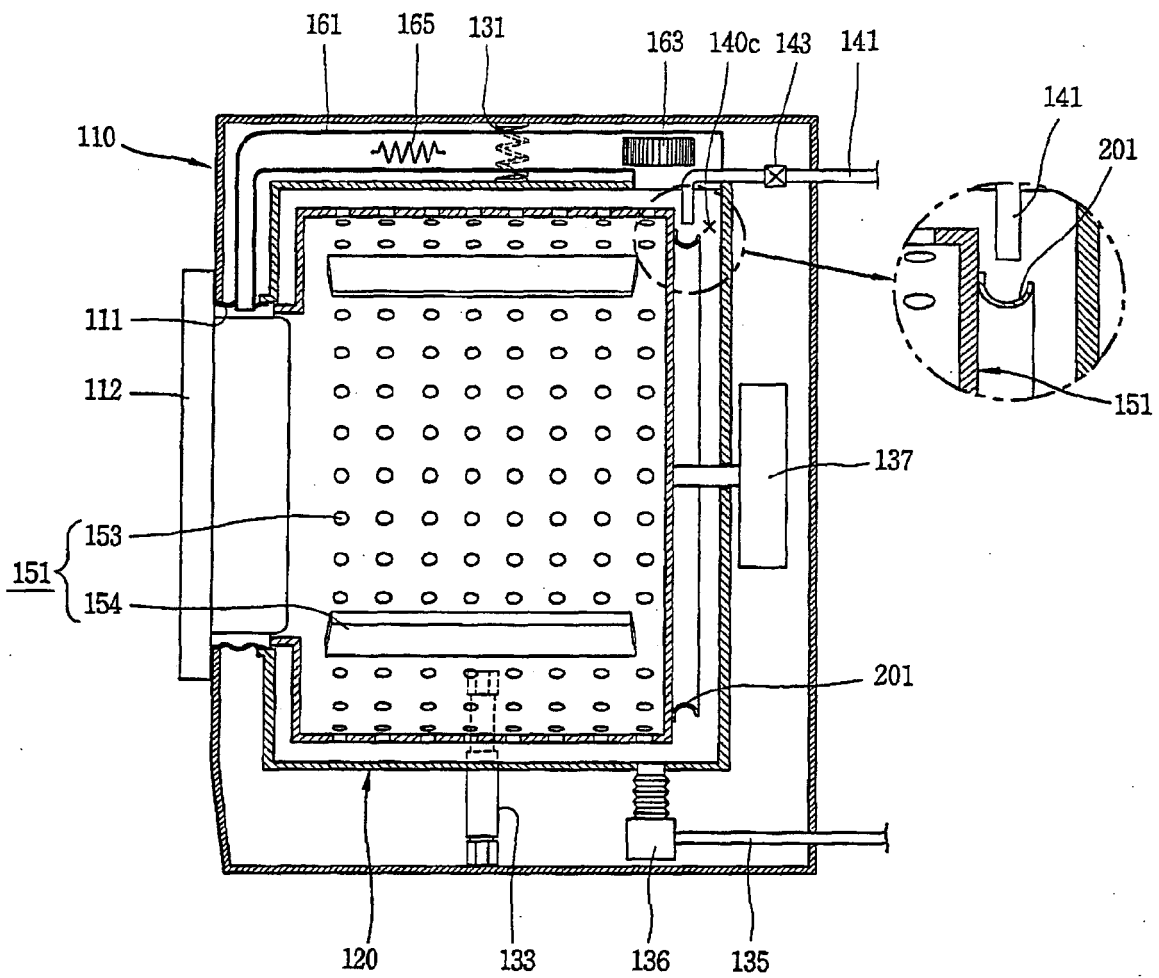


FIG. 12

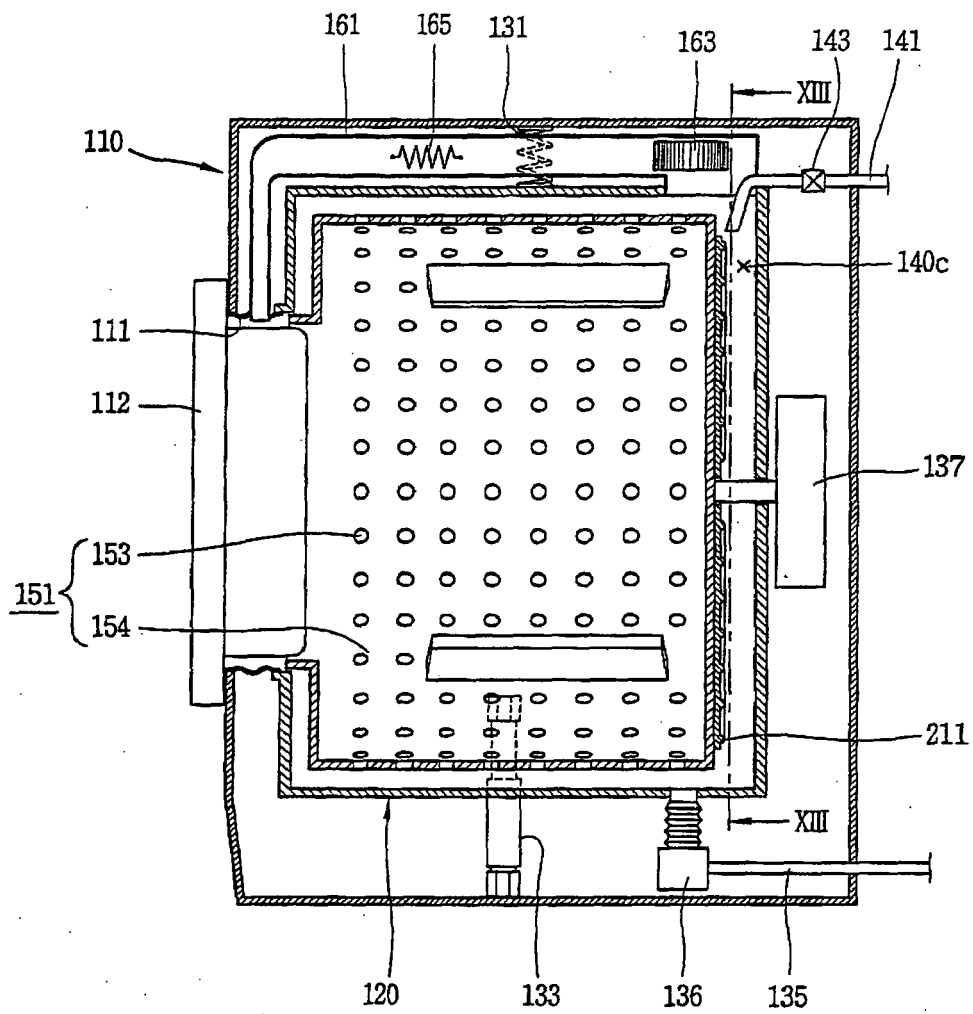


FIG. 13

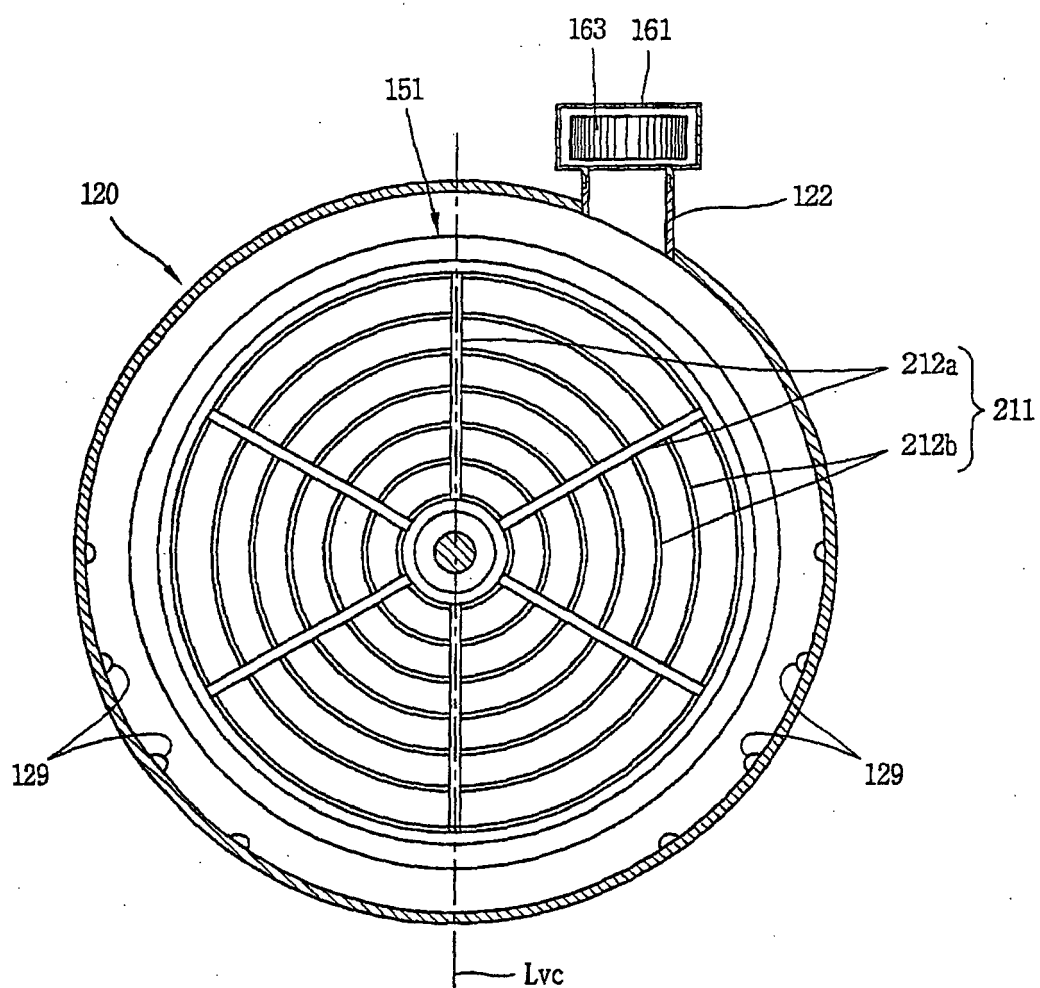
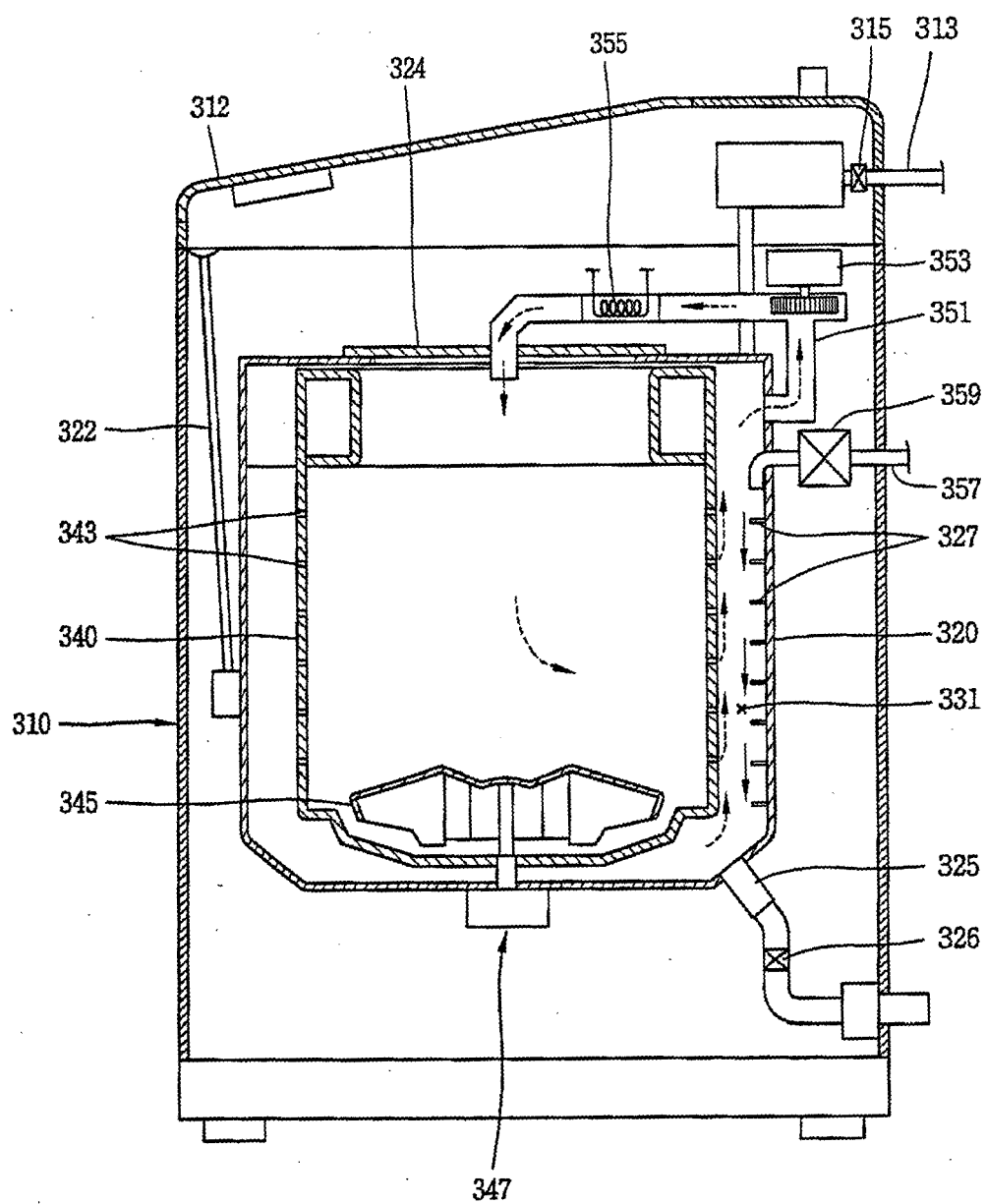


FIG. 14





European Patent  
Office

# EUROPEAN SEARCH REPORT

Application Number  
EP 06 01 6664

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			D06F
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 9 November 2006	Examiner Clivio, Eugenio
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ..... &amp; : member of the same patent family, corresponding document</p>			

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