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(54) WASHING MACHINE AND DRYER HAVING BEING IMPROVED DUCT STRUCTURE THEREOF

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(57) **ABSTRACT**

The present invention relates to a washing machine and dryer with an improved duct structure. A cabinet (**100**) form a an outer shell of the washing machine and dryer, and a tub (**200**) is installed within the cabinet (**100**). A drum (**250**) is rotatably installed within the tub (**200**). Since a drying duct (**300**) is installed in an upper portion of the tub (**200**) that is eccentric toward one side when viewed from the front of the tub (**200**), an internal space utilization of the cabinet (**100**) is enhanced and the equipment can be compact. The drying duct (**300**) is manufactured with two bodies that are a lower part (**310**) and an upper part (**320**) formed by extending a discharge part (**330**) from one end portion of the drying duct (**300**), so that the number of parts and the number of assemble processes are reduced and the productivity is improved. Since the discharge part (**330**) and the lower part (**310**) are formed in one body, it can prevent the damage and the air leakage, caused in a connection portion due to vibration, and the flowing noise caused by them. The discharge part (**330**) is extended to be slant in a rotation direction of the drum (**250**) and a guidance part is extended in a tangential direction with respect to a rotation direction of the drum (**250**) at one end portion of the discharge part (**330**), thus smoothly supplying air to the drum (**250**). A condensation duct (**400**) has one end connected to the drying duct (**300**) and the other end connected to an inside of the tub (**200**). A heater (**800**) is installed within the drying duct (**300**) and a circulation fan (**350**) is installed in the other end of the drying duct (**300**) to which the condensation duct is connected.

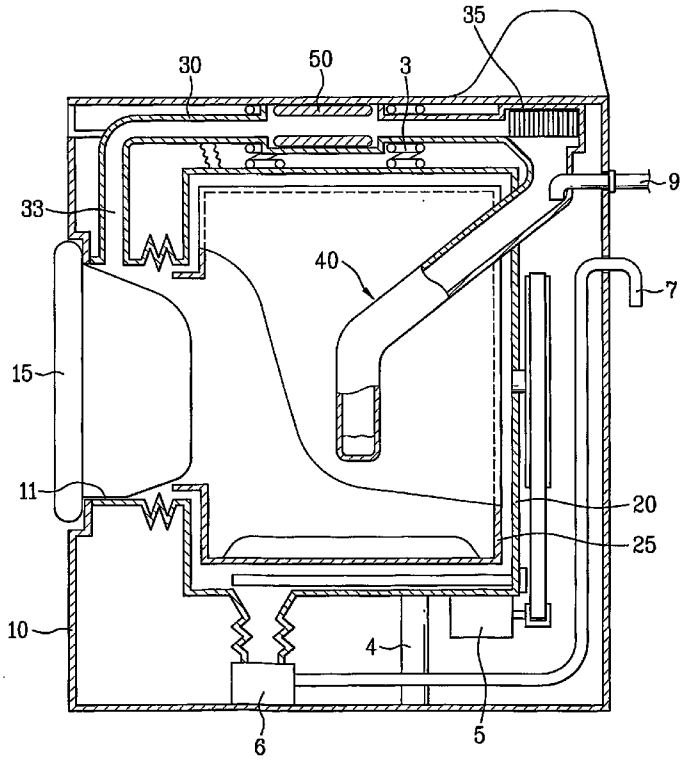


FIG.1

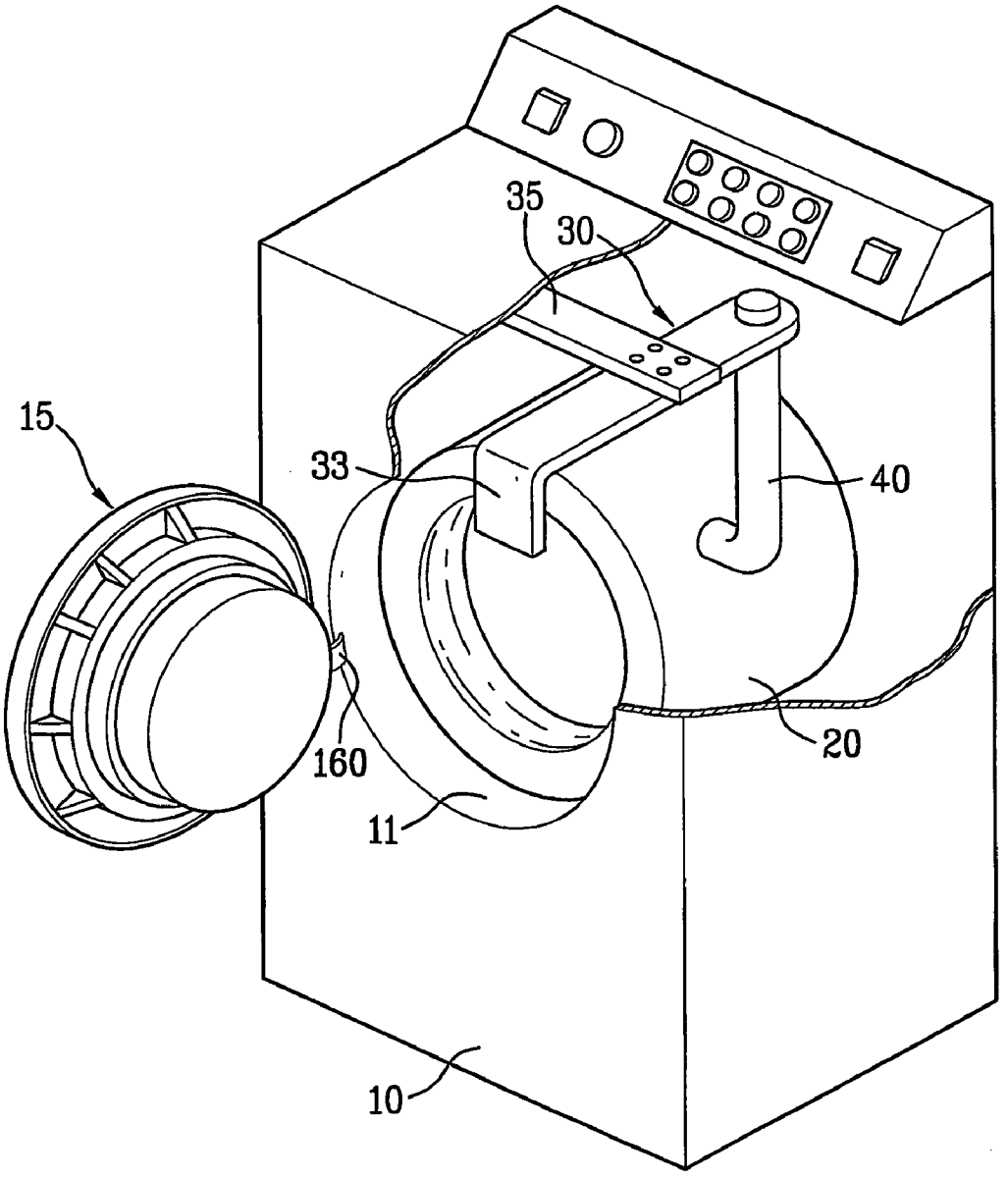


FIG.2

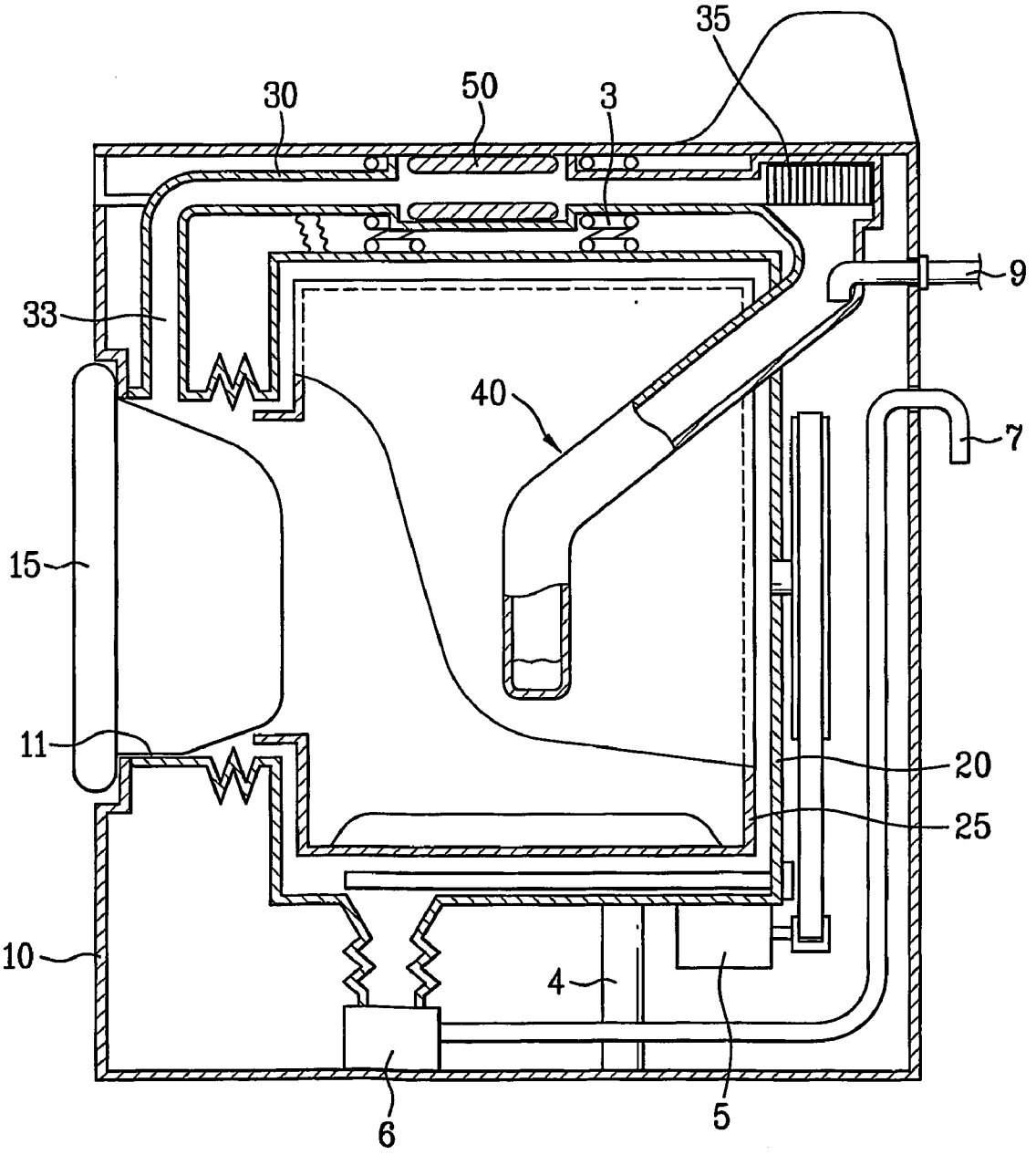


FIG. 3

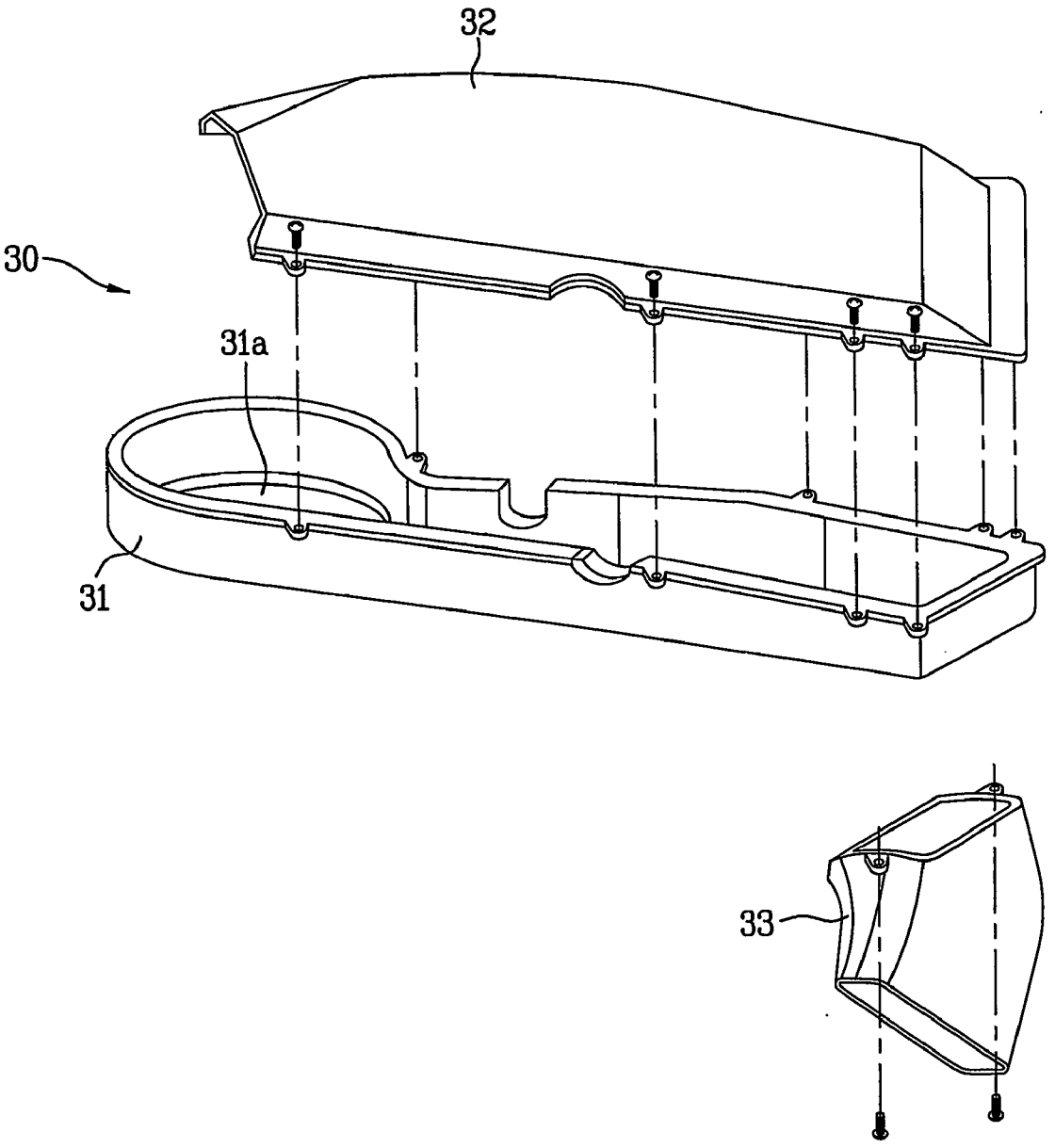


FIG. 4

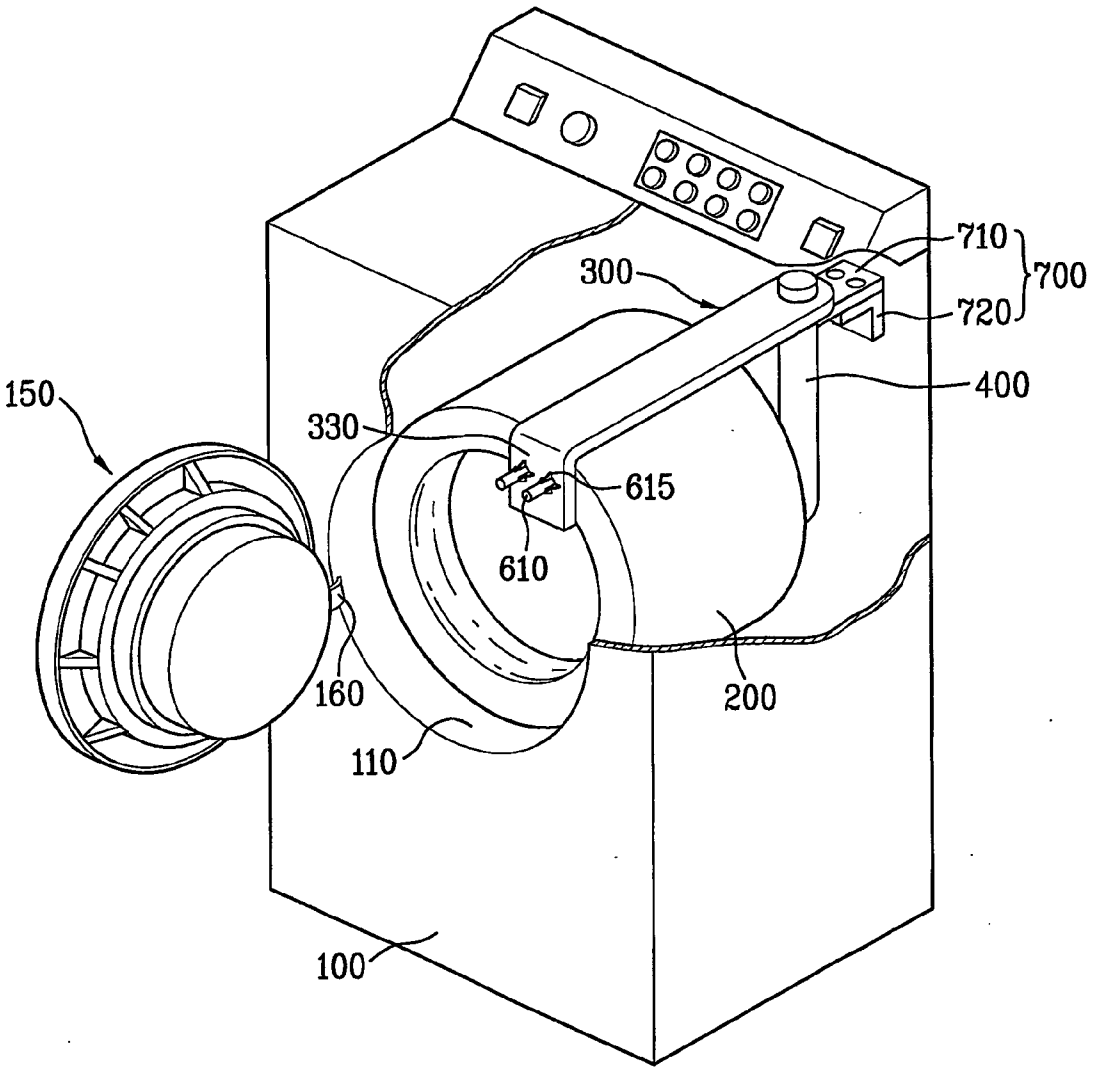


FIG.5

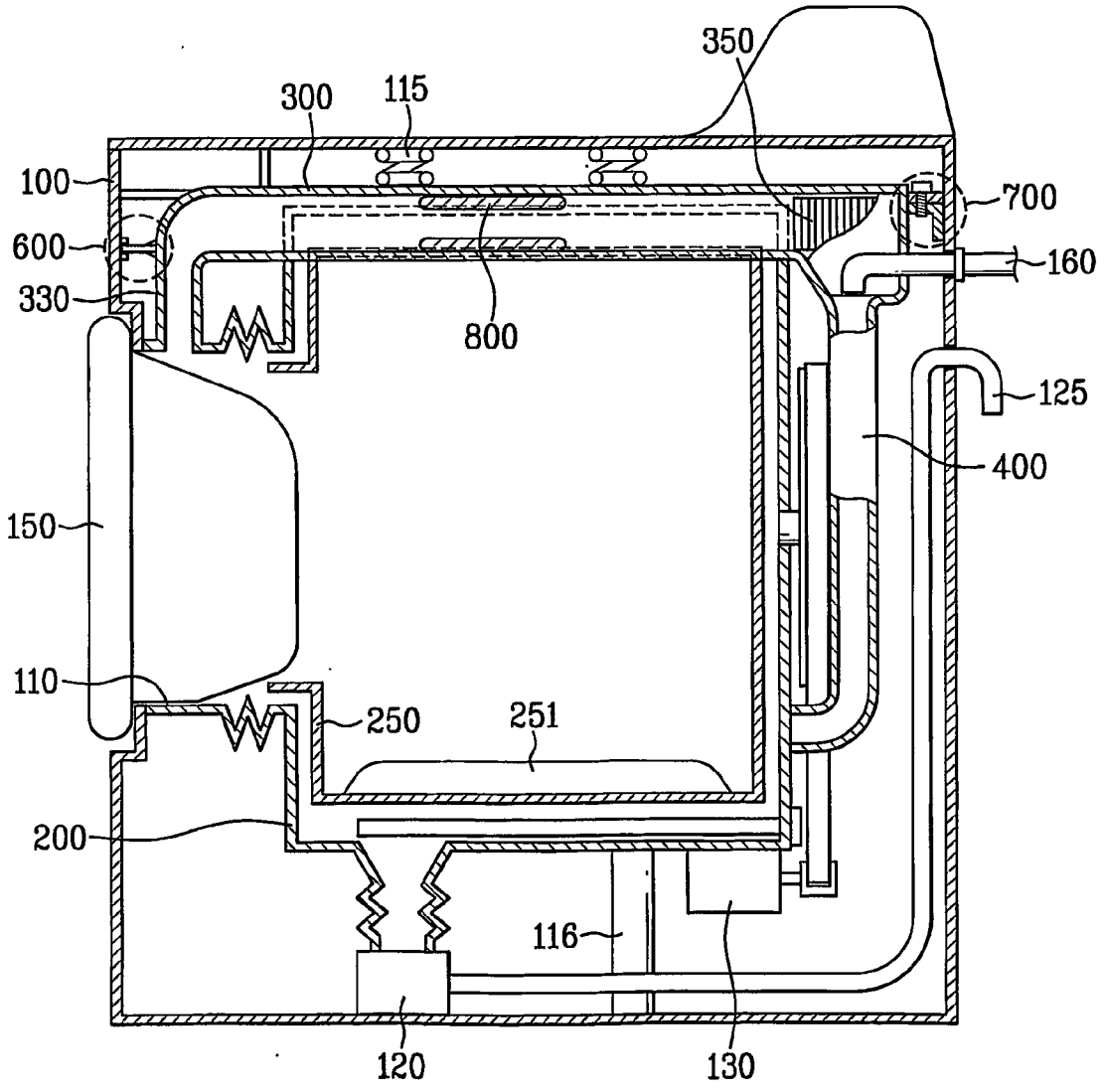

350
300
115
100
700
600
160
330
800
125
400
150
110
250
251
200
116
120
130

FIG. 6

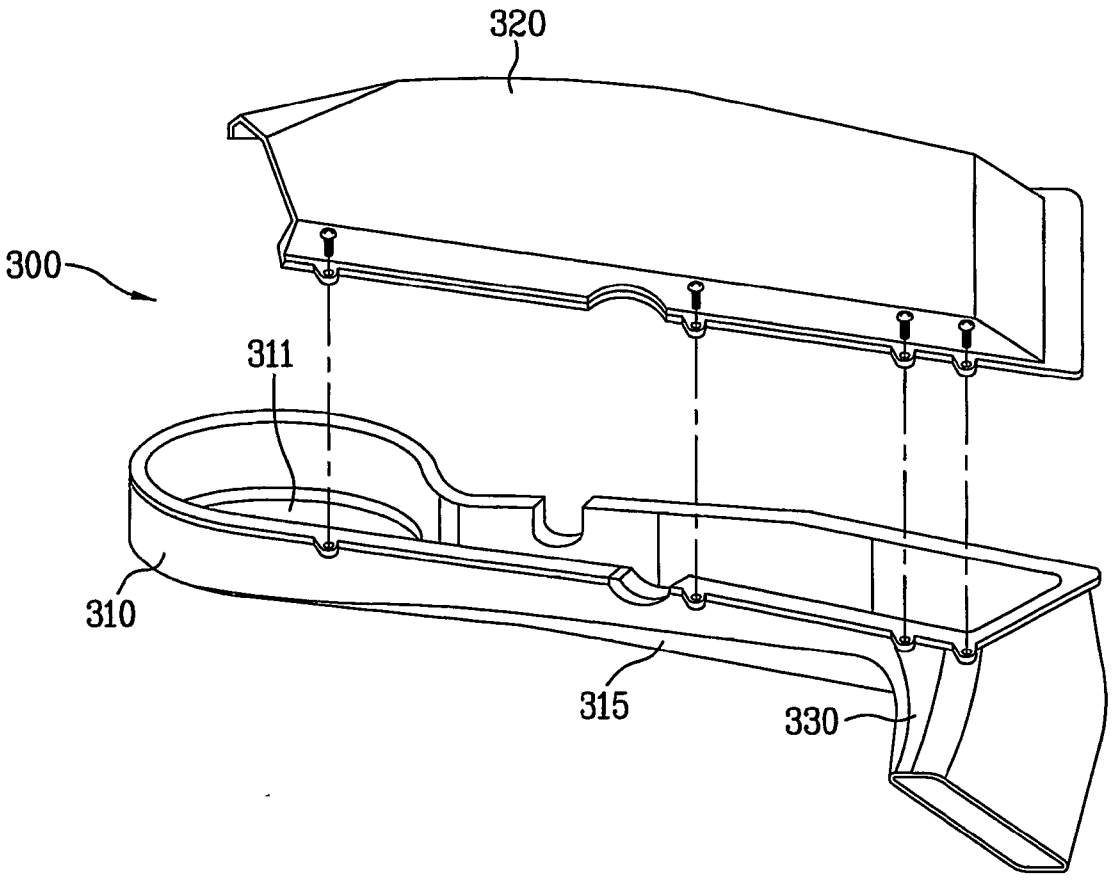


FIG. 7

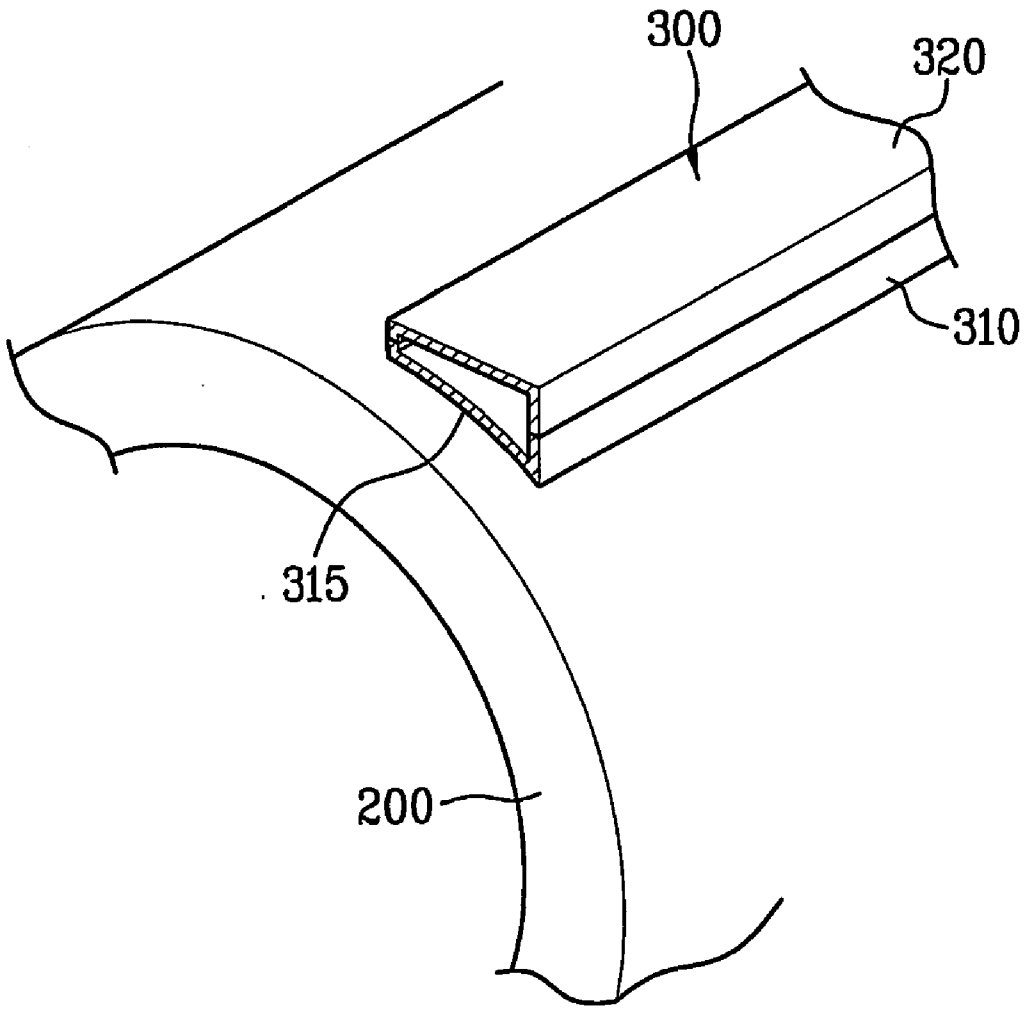


FIG.8

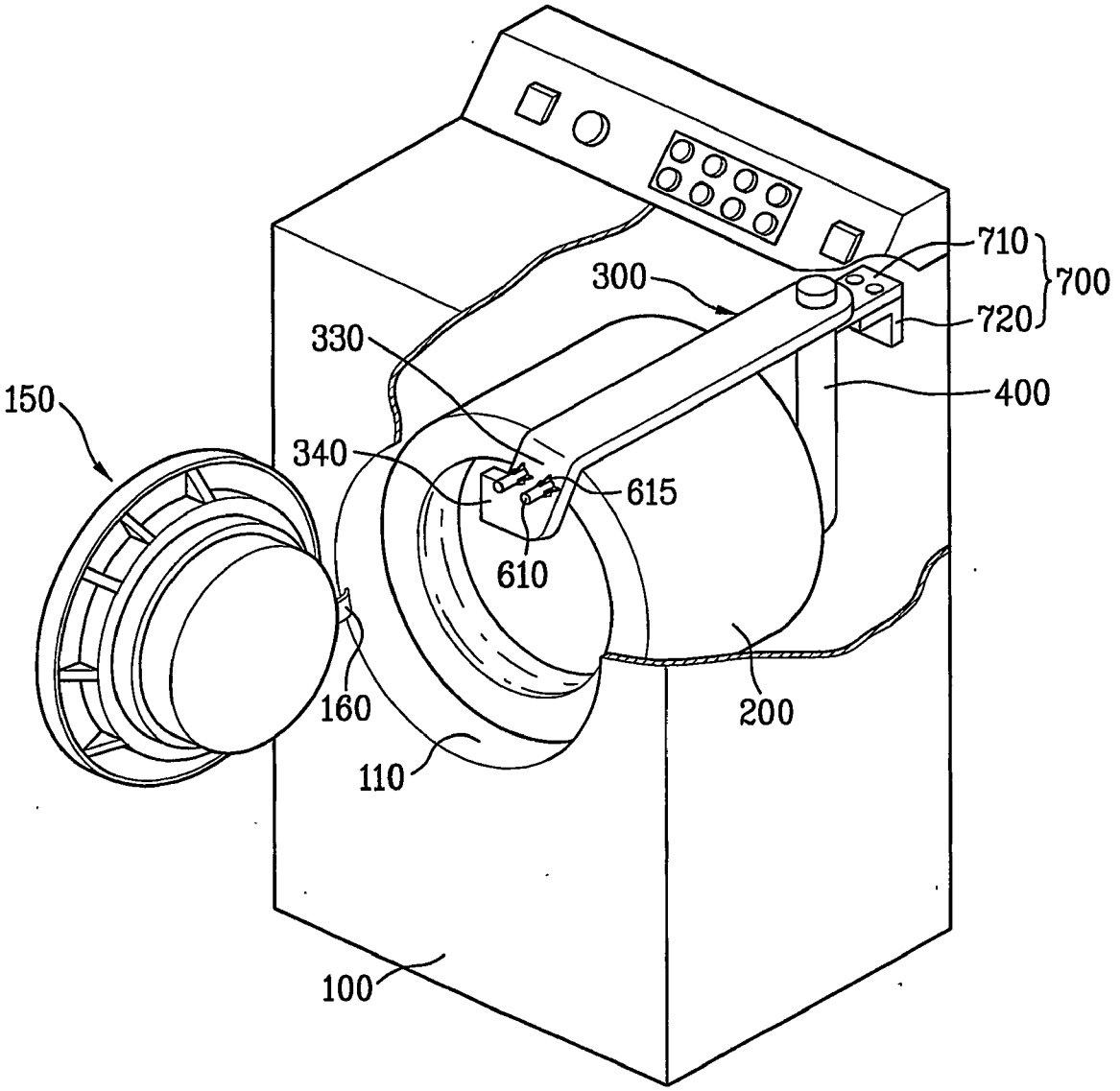


FIG. 9

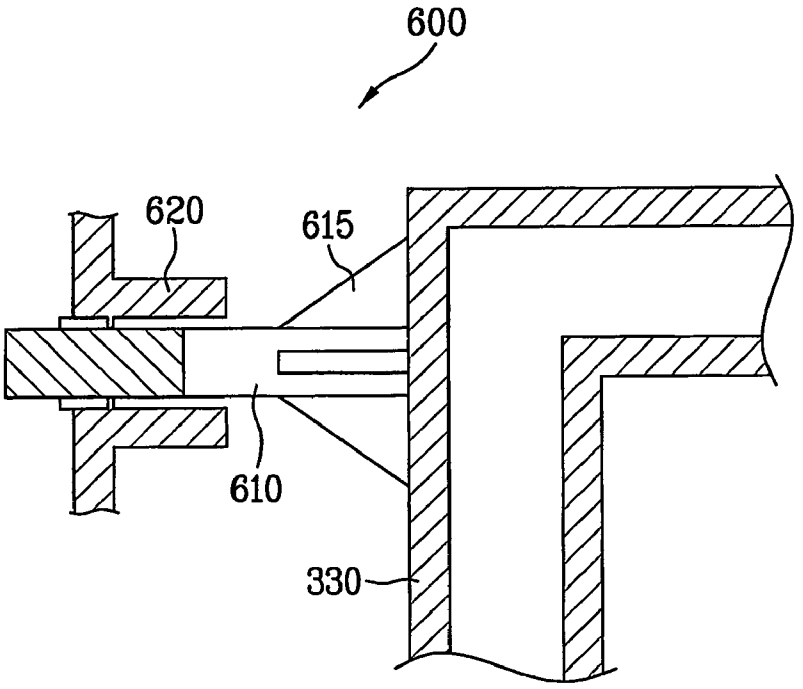
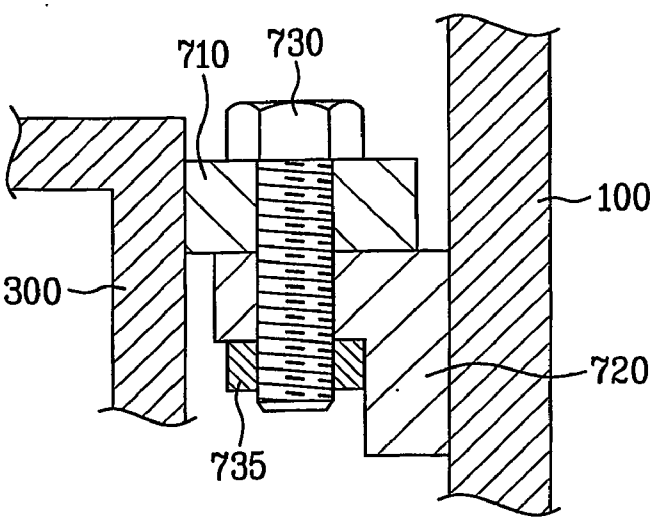


FIG. 10



WASHING MACHINE AND DRYER HAVING BEING IMPROVED DUCT STRUCTURE THEREOF

TECHNICAL FIELD

[0001] The present invention relates to a washing machine and dryer with a drying function, and more particularly, to a washing machine and dryer with an improved drying duct structure, which dried air whose moisture is removed flows through.

BACKGROUND ART

[0002] Generally, a washing machine is an apparatus which performs washing, rinsing and dewatering so as to separate dirt from clothes by the interaction of detergent and water, and is classified into agitator type, pulsator type and drum type washing machines.

[0003] Among them, In the drum type washing machine, water, detergent and laundry are loaded into a drum with a plurality of protruded tumbling ribs installed in an inner surface of the drum and the drum is rotated at a low speed. Then, the laundry is washed due to an impact caused when the laundry is lifted by the tumbling ribs and then drops. The drum type washing machine has an advantage in that the laundry is not damaged. In addition, a small amount of water is consumed and the laundry is not tangled with each other.

[0004] Meanwhile, a dryer is a machine for automatically drying a wet laundry after completing a washing operation. In general, the wet laundry is loaded into a drum installed in an inner side of a cabinet and the drum is rotated. Then, a hot wind is supplied to an inside of the drum to thereby dry the wet laundry.

[0005] Recently, a combination dryer and drum washing machine, in which a dryer function as well as a washing function is added to the drum type washing machine, is practically available and its use increases gradually.

[0006] **FIG. 1** is a cross-sectional perspective view showing a duct structure of a conventional washing machine and dryer, and **FIG. 2** is a cross-sectional view showing an internal structure of the conventional washing machine and dryer. Referring to **FIGS. 1 and 2**, the conventional washing machine and dryer includes a cabinet **10**, a tub **20**, a drum **25**, a condensation duct **40**, a motor **5**, a heater **50**, a circulation fan **35** and a drain pump **6**.

[0007] The cabinet **10** constitutes an outer shell of the washing machine and dryer, and includes a loading portion **11** and a door **15** for opening/closing the loading portion **11**, which are formed at one portion thereof. The tub **20** is formed in a cylinder shape. The tub **20** is installed within the cabinet **10** and supported by a spring **3** and a damper **4**. The drum **25** is rotatably installed within the tub **20** and the motor **5** is installed in order to enable the drum **25** to be rotated.

[0008] The condensation duct **40** is connected with the tub **20**, and a drying duct **30** has one end connected to the tub **20** and the other end connected to the condensation duct **40**. Here, as shown in **FIGS. 1 and 2**, the drying duct **30** is disposed at a middle upper portion of the tub **20**. One end of the drying duct **30** is connected to a discharge part **33** at a lower portion, in which the discharge part **33** is directly connected with an inside of the tub **20**. The drying duct **30** installed as above is fixedly connected to a support bar **35** using a fastener member such as a bolt, in which the support bar **35** crosses an upper portion of an inner space of the cabinet **10**.

[0009] The heater **50** is installed within the drying duct **30**, and the circulation fan **35** is installed in a portion to which the drying duct **30** and the condensation duct **40** are connected. In addition, the drain pump **6** is installed so as to drain water gathered in a lower portion of the tub **20**. A reference numeral **9** denotes a cooling-water supplying unit for supplying cooling water to an inside of the condensation duct **40**.

[0010] Meanwhile, as shown in **FIG. 3**, in the conventional washing machine and dryer constructed as above, the drying duct **30** includes a lower part **31** whose upper portion is opened, an upper part **32** covering the opened upper portion of the lower part **31**, and the discharge part **33** connected to a lower portion of one end of the lower part **31**. Further, a communication hole **31***a* is formed at a lower portion of the other end of the lower part **31** in order to connect the drying duct **30** with the condensation duct **40**.

[0011] Hereinafter, a drying operation of the conventional washing machine and dryer will be described in detail.

[0012] First, a wet laundry is loaded into the drum **25** and the drum **25** is rotated. Then, the circulation fan **35** is rotated to circulate internal air of the drum **25** via the condensation duct **40** and the drying duct **30**. The heater is operated to heat air. The air heated by the heater **50** dries the laundry within the drum **25**. At this time, moisture evaporated from the laundry is contained in air and introduced into the condensation duct **40**. In the condensation duct **40**, a heat exchange happens between the cooling water supplied from the cooling-water supplying unit **9** and air, so that moisture contained in the air is condensed and removed. The dried air whose moisture is removed is introduced into the drying duct **30**. The air introduced into the drying duct **30** is heated by the heater **50** and then again introduced into the drum **25**. By repeatedly performing the above procedures, the conventional washing machine and dryer removes the moisture of the wet laundry loaded into the drum **25**, thus drying the wet laundry.

[0013] However, the conventional washing machine and dryer with the above-described duct structure has following problems.

[0014] First, because the drying duct is disposed at the middle upper portion of the tub, the internal space utilization of the cabinet is degraded and the equipment generally increases in height.

[0015] Second, after the lower part, the upper part and the discharge part contained in the drying duct are separately manufactured, the respective parts are assembled so that the number of parts increases. Further, the number of assembly processes also increases, thereby causing a degradation of productivity.

[0016] Third, when the drum is rotated, the tub and the drying duct connected thereto are vibrated together. In this case, the connection portion between the lower part and the discharge part perpendicularly connected thereto may be loose and a gap therebetween may occur. In an excessive

case, the connection portion between the lower part and the discharge part may be broken.

[0017] Fourth, because the vibration causes a gap in the connection portion between the lower part and the discharge part, air flowing in the drying duct may be leaked out and thus noise may occur.

DISCLOSURE OF THE INVENTION

[0018] Accordingly, the present invention is directed to a washing machine and dryer that substantially obviates one or more of the problems due to limitations and disadvantages of the related art.

[0019] An object of the present invention is to provide a washing machine and dryer with an improved drying duct structure, in which an internal space utilization of a cabinet is enhanced and an entire height of the equipment is reduced.

[0020] Another object of the present invention is to provide a washing machine and dryer, in which the number of elements of a drying duct is reduced and thus the productivity is improved.

[0021] Further another object of the present invention is to provide a washing machine and dryer with an improved drying duct structure, in which a damage and an air leakage, caused by vibration of a tub, and a flowing noise caused by the air leakage are prevented.

[0022] Additional features and advantages of the invention will be set fourth in the description which follows, and in part will be apparent from the description, or may be learned by practice of the invention. The objectives and other advantages of the invention will be realized and attained by the structure particularly pointed out in the written description and claims thereof as well as the appended drawings.

[0023] To achieve these and other advantages and in accordance with the purpose of the present invention, as embodied and broadly described, a washing machine and dryer comprises: a cabinet; a cylinder-shaped tub installed within the cabinet; a drum rotatably installed within the tub; a drying duct having one end connected to an inner side of the tub, the drying duct being installed in an upper portion of the tub to be eccentric toward one side of the tub when viewed from the front of the tub; a condensation duct having one end connected to the drying duct and the other end connected to an inner side of the tub; a circulation fan for circulating air existing within the tub through the condensation duct and the drying duct; and a heater for heating the air.

[0024] An upper face of the drying duct is installed in a lower portion than that of the tub. A surface of the drying duct, which is adjacent to the tub, is formed to be slant. For example, the adjacent surface of the drying duct is formed in a curved surface with the same curvature as an outer surface of the tub.

[0025] The drying duct includes: a lower part of which an upper portion is opened, in which a discharge part connected to a front side of the tub is downwardly extended from one end in one body and a communication hole for connecting the lower part with the condensation duct is formed in a lower portion of the other end; and an upper part covering the opened upper portion of the lower part. The other end of the lower part in which the communication hole is formed is widely formed. The circulation fan is inserted into the other end of the lower part. A surface of the lower part, which is adjacent to the outer surface of the tub, is formed to be slant. The adjacent surface of the lower part is formed in a curved surface with the same curvature as an outer surface of the tub. A portion in which the discharge part is extended from one end of the lower part is formed roundly so as to smoothly guide air.

[0026] Meanwhile, the discharge part is extended to be slant from the lower part in a downward direction. In this case, for example, the discharge part is formed to be slant when viewed from the front of the tub so as to discharge air in a rotation direction of the drum.

[0027] The washing machine and dryer of the present invention can further comprise a guidance part extended from one end portion of the discharge part in a tangential direction with respect to the rotation direction of the tub when viewed from the front of the tub so as to discharge air in the tangential direction with respect to the rotation direction of the drum.

[0028] The drying duct has both ends fixed and supported to an inner surface of the cabinet by a first fixing member and a second fixing member.

[0029] Here, the first fixing member includes: a plurality of brackets protruded at one portion of an inner surface of the cabinet; and a fixing load protruded at one end portion of the drying duct and fixedly inserted between the plurality of brackets. At this time, the brackets and the fixing load are connected with each other by bolts and nuts. In addition, the washing machine and dryer can further comprises a plurality of reinforcement ribs for connecting a side surface of the fixing load with the drying duct, thereby reinforcing the fixing load.

[0030] The second fixing member includes: a fixing projection protruded at the other end of the drying duct; and a fixing angle protruded at other portion of an inner surface of the cabinet, for supporting the fixing projection at a lower portion. At this time, the fixing projection and the fixing angle are fixedly connected with each other by a bolt and a nut.

[0031] Meanwhile, in the washing machine and dryer of the present invention, the heater is installed in an inside of the drying duct. The condensation duct has one end connected to the drying duct and the other end connected to a rear lower portion of the tub.

[0032] In the washing machine and dryer of the present invention, the tub and the drum can be installed in parallel with a horizontal plane or can be installed to be slant, such that openings of the tub and the drum are disposed at an upper portion with respect to a horizontal plane.

[0033] It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0034] 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.

[0035] In the drawings:

[0036] **FIG. 1** is a partial cross-sectional perspective view showing a duct structure of a conventional washing machine and dryer;

[0037] **FIG. 2** is a cross-sectional view showing an internal structure of the conventional washing machine and dryer;

[0038] **FIG. 3** is an exploded perspective view showing the drying duct structure of the conventional washing machine and dryer;

[0039] **FIG. 4** is a partial cross-sectional perspective view showing a duct structure of a washing machine and dryer in accordance with an embodiment of the present invention;

[0040] **FIG. 5** is a cross-sectional view showing an internal structure of the washing machine and dryer in accordance with the present invention;

[0041] **FIG. 6** is an exploded perspective view of the drying duct in accordance with an embodiment of the present invention;

[0042] **FIG. 7** is a cross-sectional perspective view of the drying duct installed in accordance with the present invention;

[0043] **FIG. 8** is a partial cross-sectional perspective view showing a duct structure of a washing machine and dryer in accordance with another embodiment of the present invention;

[0044] **FIG. 9** is a cross-sectional view showing the drying duct fixed to the cabinet by the first fixing member; and

[0045] **FIG. 10** is a cross-sectional view showing the drying duct fixed to the cabinet by the second fixing member.

BEST MODE FOR CARRYING OUT THE INVENTION

[0046] Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings.

[0047] In embodiments of the present invention, the same reference numerals and symbols denote the same elements and structures and the duplicate descriptions will be omitted below.

[0048] In **FIGS. 4 and 5**, there is shown an internal structure of a washing machine and dryer in accordance with an embodiment of the present invention. Referring to **FIGS. 4 and 5**, the washing machine and dryer of the present invention includes a cabinet **100**, a tub **200**, a drum **250**, a motor **130**, a condensation duct **400**, a drying duct **300**, a heater **800** and a circulation fan **350**.

[0049] The cabinet **100** forms an outer shell of the washing machine and dryer and has a loading portion **110** formed on one side (e.g., a predetermined front side). The laundry is loaded/unloaded through the loading portion **110**. A door **150** is installed near the loading portion **110** and rotates around a hinge **160** to open/close the loading portion **110**.

[0050] The tub **200** is formed in a cylinder shape and installed in an inner side of the cabinet **100**. An opening of the tub **200** is disposed corresponding to the loading portion **110**. The tub **200** installed as above can be installed in parallel with a horizontal plane. In addition, for the sake of user's convenience, the tub **200** can be installed to be slant with respect to the horizontal plane such that its opening faces slightly upwardly.

[0051] Both ends of the tub **200** is supported by a plurality of springs **115** and a damper **116**, which are connected to an outer face of the tub **200** and an inner face of the cabinet **100**, respectively. The springs **115** and the damper **116** attenuate a vibration transferred from the drum **250**.

[0052] The drum **250** is formed in a cylinder shape and disposed corresponding to the loading portion **110** of the cabinet **100** so that the drum **250** can be rotatable in an inner side of the cabinet **100**. As shown in **FIG. 5**, a plurality of tumbling ribs **251** are protruded in an inner side of the drum **250**. The tumbling ribs **251** functions to lift and drop the laundry while the drum **250** is rotated. Further, although not shown, a plurality of passage holes are formed in a circumference face of the drum **250**. By way of the passage holes, washing water required for the washing operation or water dropped from the laundry in the dehydrating and drying operations moves between the drum **250** and the tub **200**.

[0053] The motor **130** is installed to rotate the drum **250**, and a drain pump **120** is installed to drain water from the inside of the tub **200** to the outside of the cabinet **100** via a drain hose **125**.

[0054] In the washing machine and dryer of the present invention, the drying duct **300** is installed to have one end connected to the inside of the tub **200**. As shown in **FIG. 4**, when viewed from the front of the tub **200**, the drying duct **300** is installed in an upper portion of the tub **200** disposed to be eccentric toward one side from left and right central lines of the tub **200**. A more detailed construction of the drying duct **300** installed as above will be described with reference to **FIGS. 6 and 7**.

[0055] In accordance with an embodiment of the present invention, as shown in **FIG. 6**, the drying duct **300** is divided into two bodies, i.e., a lower part **310** and an upper part **320**

[0056] The lower part **310** is formed in a channel shape, in which an upper portion of the lower part **310** is opened and both ends thereof are closed. A discharge part **330** is downwardly extended in one body at one end of the lower part **310**. Here, as shown in **FIG. 6**, the portion in which the discharge part **330** is extended, i.e., a connection portion between the lower part **310** and the discharge part **330** is formed roundly so as to reduce a fluid resistance and smoothly guide air.

[0057] As shown in **FIG. 4**, the discharge part **330** constructed as above can be formed extended downwardly in a vertical direction. Meanwhile, it is desirable to form the discharge part **330** to be slant toward one side thereof so as to smoothly guide air toward the inside of the tub **200**, as shown in **FIG. 6**. At this time, when viewed from the front of the tub **200**, the slant direction is formed in a direction in which air can be discharged in the rotation direction of the drum **250**. If the discharge part **330** is formed to be slant as above, it is possible to reduce a turbulent air and a flowing noise, which are caused by a collision between air dis-

charged from the discharge part **330** and other air existing within the rotating drum **250**.

[**0058**] Meanwhile, disposed at an opposite side of the discharge part **330**, the other end of the lower part **310** is widely formed roughly in a cylinder shape. A communication hole **311** is formed at a lower bottom portion of the other end of the lower part **310** so as to connect the drying duct **300** to the condensation duct **400**. The circulation fan **350** is installed in the other end of the lower part **310** formed widely as above.

[**0059**] The upper part **320** is formed in a channel shape whose lower portion is opened. The upper part **320** is connected to an upper portion of the lower part **310** to cover the opened upper portion of the lower part **310**. At this time, the lower part **310** and the upper part **320** are connected to each other with a screw or a bolt and nut.

[**0060**] The drying duct **300** assembled with the separately manufactured lower and upper parts **310** and **320** is disposed at a position that is eccentric from the left and right center of the tub **200**, and the drying duct **300** is installed in the upper portion of the tub **200**. At this time, the drying duct **300** enhances the space utilization of the cabinet in the washing machine and dryer, and the upper face of the drying duct **300** is installed in a lower portion than that of the tub **200** so as to reduce an entire height of the equipment. However, in case of designing the above structure in consideration of a correlation between the condensation duct **400** and all other components, it is desirable to design the arrangement to have a small difference in height between the upper face of the tub **200** and that of the drying duct **300** if it is not easy to make the above arrangement, as shown in **FIG. 5**.

[**0061**] Meanwhile, as shown in **FIGS. 6 and 7**, in order to reduce an interference between the drying duct **300** and the circumference surface of the tub **200** and enhance the space utilization, the drying duct **300** disposed eccentrically to one side from the left and right center of the tub **200** is formed to have a surface, which is adjacent to the circumference surface of the tub **200** (e.g., a surface adjacent to the circumference surface of the lower part **310**), to be slant. At this time, for example, the slant surface **315** is formed to have a curved surface and it is desirable that the curved surface should have the same curvature as the outer surface of the tub **200**.

[**0062**] A drying duct **300** in accordance with another embodiment of the present invention further includes a guidance part **340** and the guidance part **340** will be described with reference to **FIG. 8**. When the drying duct **300** in accordance with another embodiment of the present invention is described, the same description as **FIGS. 6 and 7** will be omitted and only the description related to the guidance part **340** will be made below.

[**0063**] As shown in **FIG. 8**, the guidance part **340** is extended from one end portion of the discharge part **330**. When viewed from the front of tub **200**, it is desirable that the guidance part **340** be extended in a tangential direction with respect to the rotation direction of the drum **250**. The reason is that the flowing resistance and the flowing noise can be effectively reduced because air is discharged via the guidance part **340** in the tangential direction with respect to the rotation direction of the drum **250** and thus its direction is more similar to the flowing direction of air existing within the drum **250**.

[**0064**] Meanwhile, the drying duct **300** of the washing machine nd dryer in accordance with the present invention has oth ends fixed and supported to the inner surface of the cabinet **100** by a first fixing member **600** and a second fixing member **700**. The first and second fixing members **600** and **700** will be described below in detail with reference to the drawings.

[**0065**] Referring to **FIGS. 5, 8** and **9**, the first fixing member **600** fixes one end of the drying duct **300**, in which the discharge part **330** is formed, to the inner side of the cabinet **100**. The first fixing member **600** includes a plurality of brackets **620** and a fixing load **610**. Here, a plurality of the brackets **620** are protruded at one portion of the inner surface of the cabinet **100**. As shown in **FIG. 8**, the fixing load **610** is protruded at one end of the drying duct **300** in which the discharge duct **330** is formed. As shown in **FIG. 9**, the loading load **610** is inserted between the plurality of brackets **620** and rigidly fixed to the brackets **620** by a screw or a bolt and nut. Meanwhile, in order to reinforce the strength of the prolongedly protruded fixing load **610**, a plurality of reinforcement ribs **615** are formed to connect a side surface of the fixing load **610** with an outer surface of the drying duct **300**, as shown in **FIG. 9**.

[**0066**] Meanwhile, referring to **FIGS. 5, 8** and **10**, the second fixing member **700** includes a fixing projection **710** and a fixing angle **720**. Here, the fixing projection **710** is protruded at the other end of the drying duct **300**, which is disposed at an opposite side of the discharge part **330**. The fixing angle **720** is protruded at other portions of the inner surface of the cabinet **100** such that the fixing projection **710** can be supported at a lower portion. As shown in **FIG. 10**, the fixing projection **710** and the fixing angle **720** can be fixed by a bolt **730** and a nut **735** or can be fixed to each other by a screw and so on.

[**0067**] If both ends of the drying duct **300** is fixed and supported to the cabinet **100** by the first and second fixing members **600** and **700**, a height of the washing machine and dryer can be reduced much more.

[**0068**] Meanwhile, in the washing machine and dryer of the present invention, a heater **800** is formed in an inner side of the drying duct **300**.

[**0069**] As shown in **FIGS. 4 and 5**, the condensation duct **400** has one end connected to the drying duct **300** and the other end connected to a rear lower portion of the tub **200**. A cooling-water supplying unit **160** is provided to supply a cooling water to an inside of the condensation duct **400** installed as above.

[**0070**] Hereinafter, a drying operation of the washing machine and dryer constructed as above in accordance with the present invention will be described in detail, in which the wet laundry is loaded into the drum **250**.

[**0071**] First, the wet laundry is loaded into the drum **250** and the motor **130** is operated to rotate the drum **250**. Simultaneously, the circulation fan **350** is rotated and the heater **800** is operated.

[**0072**] Then, air existing within the drum **250** sequentially passes through the condensation duct **400** and the drying duct **300** and is again introduced into the inside of the drum **250**. At this time, air passing through the drying duct **300** is hotly heated by the heater **800** and the heated air dries the

laundry loaded into the drum **250**. In addition, moisture contained in the laundry is evaporated in an internal air of the drum **250**.

[**0073**] Moist air containing moisture evaporated from the laundry is introduced into the condensation duct **400**. Meanwhile, the cooling-water supplying unit **160** keeps on supplying a cooling water to the inside of the condensation duct **400**. Thus, a heat exchange occurs between the moist air passing through the condensation duct **400** and the cooling water. At this time, moisture contained in air is condensed and removed, so that the air becomes dry.

[**0074**] The dried air passing through the condensation duct **400** passes through the circulation fan **350** and then is introduced into the drying duct **300**. The dried air introduced into the drying duct **300** is again heated hotly by the heater **800** and supplied to the drum **250**.

[**0075**] Meanwhile, the drying duct **300** of the present invention has a structure in which the discharge part **330** is extended from the lower part **310** in one body. Therefore, even when vibration occurs in the rotation of the drum **250**, air is not leaked out and a loud flowing noise does not occur.

[**0076**] In addition, since air passing through the drying duct **300** of the present invention is exhausted in a tangential direction with respect to the rotation direction of the drum **250** while passing through the discharge part **330** and the guidance part **340**, it is possible to prevent a turbulent air and a flowing noise, which are caused by a collision with air existing within the rotating drum **250**.

[**0077**] Meanwhile, the washing machine and dryer in accordance with the present invention repeatedly performs the above procedures to dry the laundry loaded into the drum **250**.

INDUSTRIAL APPLICABILITY

[**0078**] The washing machine and dryer in accordance with the present invention has following advantages.

[**0079**] First, unlike the related art in which the conventional drying duct is installed in the middle upper portion of the tub, the drying duct of the present invention is installed to be eccentric from the left and right center, so that the internal space utilization of the cabinet is improved and the washing machine and dryer becomes compact. Meanwhile, it is much more effective if the structure in which the drying duct is installed to be eccentric toward one side of the tub is applied to a washing machine and dryer in which the tub and the drum are installed to be slant.

[**0080**] Second, since the surface of the drying duct, which is adjacent to the tub, is formed to be slant, it is possible to minimize interference between the drying duct and the tub and effectively guide the surface through which air flows into the drying duct.

[**0081**] Third, unlike the related art in which the drying duct is separately manufactured and assembled with three bodies, the drying duct of the present invention is manufactured with two bodies, so that the number of parts and the number of assemble processes are reduced and the productivity is improved.

[**0082**] Fourth, since the discharge part and the lower part are formed in one body, it can fundamentally prevent the damage and the air leakage, caused in the connection portion due to vibration, and the flowing noise caused by them. Accordingly, the life of the equipment is prolonged.

[**0083**] Fifth, since the discharge part is formed to be slant and the guidance part is extended in the tangential direction with respect to the rotation direction of the drum, collision between air exhausted into the drum via the drying duct and air existing within the drum can be minimized, so that the occurrence of the turbulent air and the flowing noise is minimized.

[**0084**] While the present invention has been described and illustrated herein with reference to the preferred embodiments thereof, it will be apparent to those skilled in the art that various modifications and variations can be made therein without departing from the spirit and scope of the invention. Thus, it is intended that the present invention covers the modifications and variations of this invention that come within the scope of the appended claims and their equivalents.

What is claimed is:

1. A washing machine and dryer comprising:

a cabinet;

a cylinder-shaped tub installed within the cabinet;

a drum, rotatably installed within the tub;

a drying duct having one end connected to an inner side of the tub, the drying duct being installed in an upper portion of the tub to be eccentric toward one side of the tub when viewed from the front of the tub;

a condensation duct having one end connected to the drying duct and the other end connected to an inner side of the tub;

a circulation fan for circulating air existing within the tub through the condensation duct and the drying duct; and

a heater for heating the air.

2. The washing machine and dryer of claim 1, wherein an upper face of the drying duct is installed in a lower portion than that of the tub.

3. The washing machine and dryer of claim 1, wherein a surface of the drying duct, which is adjacent to the tub, is formed to be slant.

4. The washing machine and dryer of claim 3, wherein the adjacent surface of the drying duct is formed in a curved surface with the same curvature as an outer surface of the tub.

5. The washing machine and dryer of claim 1, wherein the drying duct includes:

a lower part of which an upper portion is opened, in which a discharge part connected to a front side of the tub is downwardly extended from one end in one body and a communication hole for connecting the lower part with the condensation duct is formed in a lower portion of the other end; and

an upper part covering the opened upper portion of the lower part.

6. The washing machine and dryer of claim 5, wherein the other end of the lower part in which the communication hole is formed is widely formed.

7. The washing machine and dryer of claim 6, wherein the circulation fan is inserted into the other end of the lower part.

8. The washing machine and dryer of claim 5, wherein a surface of the lower part, which is adjacent to the outer surface of the tub, is formed to be slant.

9. The washing machine and dryer of claim 5, wherein the adjacent surface of the lower part is formed in a curved surface with the same curvature as an outer surface of the tub.

10. The washing machine and dryer of claim 5, wherein a portion in which the discharge part is extended from one end of the lower part is formed roundly so as to smoothly guide air.

11. The washing machine and dryer of claim 5, wherein the discharge part is extended to be slant from the lower part in a downward direction.

12. The washing machine and dryer of claim 11, wherein the discharge part is formed to be slant when viewed from the front of the tub so as to discharge air in a rotation direction of the drum.

13. The washing machine and dryer of claim 12, further comprising a guidance part extended from one end portion of the discharge part in a tangential direction with respect to the rotation direction of the tub when viewed from the front of the tub so as to discharge air in the tangential direction with respect to the rotation direction of the drum.

14. The washing machine and dryer of claim 1, wherein the drying duct has both ends fixed and supported to an inner surface of the cabinet by a first fixing member and a second fixing member.

15. The washing machine and dryer of claim 14, wherein the first fixing member includes:

a plurality of brackets protruded at one portion of an inner surface of the cabinet; and

a fixing load protruded at one end portion of the drying duct and fixedly inserted between the plurality of brackets.

16. The washing machine and dryer of claim 15, wherein the brackets and the fixing load are connected to each other by bolts and nuts.

17. The washing machine and dryer of claim 15, further comprising a plurality of reinforcement ribs for connecting a side surface of the fixing load with the drying duct, thereby reinforcing the fixing load.

18. The washing machine and dryer of claim 14, wherein the second fixing member includes:

a fixing projection protruded at the other end of the drying duct; and

a fixing angle protruded at other portion of an inner surface of the cabinet, for supporting the fixing projection at a lower portion.

19. The washing machine and dryer of claim 18, wherein the fixing projection and the fixing angle are fixedly connected with each other by a bolt and a nut.

20. The washing machine and dryer of claim 1, wherein the heater is installed in an inside of the drying duct.

21. The washing machine and dryer of claim 1, wherein the condensation duct has one end connected to the drying duct and the other end connected to a rear lower portion of the tub.

22. The washing machine and dryer of claim 1, wherein the tub and the drum are installed in parallel with a horizontal plane.

23. The washing machine and dryer of claim 1, wherein the tub and the drum are installed to be slant, such that openings of the tub and the drum are disposed at an upper portion with respect to a horizontal plane.

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