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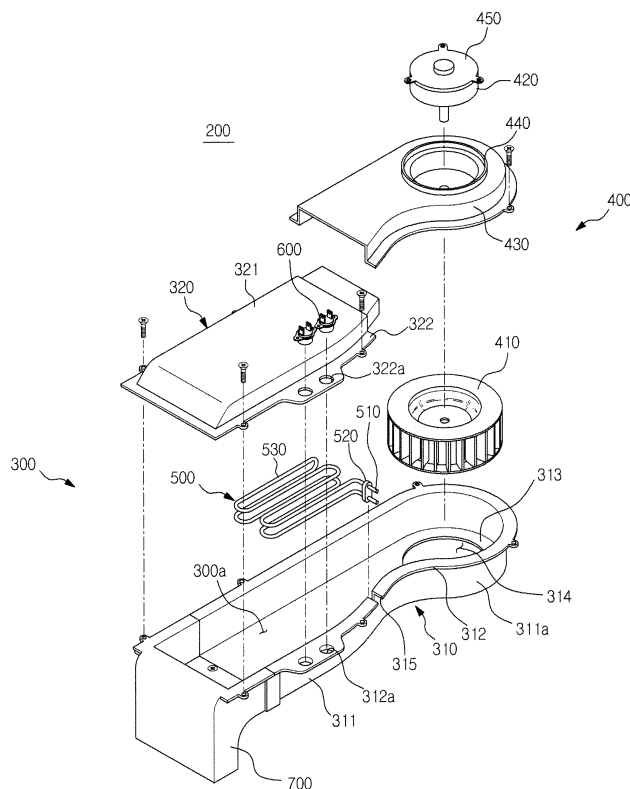
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(54) **Drum washing machine and drying unit thereof**

(57) Disclosed herein is a drum washing machine wherein a thermostat (600) is mounted at a housing (300) of a drying unit (200) to sensitively detect the temperature of a heater, wherein said housing (300) of said drying

unit (200) is made of stainless steel and comprises a heater (500) and a thermostat (600) tightly mounted to the housing (300) to detect a temperature of one side of said housing (300) by conduction.

FIG. 3



Description

BACKGROUND

1. Field

[0001] Embodiments of the present invention relate to a drum washing machine wherein the temperature of a heater is sensitively detected to prevent the occurrence of fire due to overheating of the heater and a drying unit thereof.

2. Description of the Related Art

[0002] Generally, a drum washing machine washes laundry in such a manner that a drum horizontally disposed in a machine body is rotated in alternating directions to lift the laundry along the inner circumference of the drum together with wash water and drop the laundry.

[0003] In the drum washing machine, the drum is mounted in a tub to contain wash water such that the drum is rotated by a drive unit. At the front of the tub is hingedly mounted a door through which laundry is put into or removed from the drum.

[0004] The drum washing machine may further include a drying unit to dry the washed laundry. Generally, the drying unit includes a housing having an air suction port and a hot air discharge port formed at opposite ends thereof, the housing being disposed above the tub such that the housing communicates with the drum, and a heater mounted in the housing. Consequently, when washing of laundry placed in the drum through a washing operation and a spin-drying operation performed by the rotation of the drum is completed, the laundry is dried by the drying unit. That is, the heater mounted in the housing is operated to heat air from the drum into the housing through the air suction port to make hot air, and the hot air is supplied to the drum through the hot air discharge port. Through this circulation process, the laundry placed in the drum is dried.

[0005] Meanwhile, a thermostat is mounted at one side of the heater to prevent air to be introduced into the drum from overheating. The temperature of air to be introduced into the drum is appropriately controlled by the thermostat.

SUMMARY

[0006] Therefore, it is an aspect of the present invention to provide a drum washing machine wherein the temperature of a heater is sensitively detected to prevent the occurrence of fire due to overheating of the heater and a drying unit thereof.

[0007] Additional aspects of the invention will be set forth in part in the description which follows and, in part, will be obvious from the description, or may be learned by practice of the invention.

[0008] In accordance with one aspect of the present

invention, a drum washing machine includes a drying unit, and the drying unit includes a housing made of stainless steel, a heater to emit heat in the housing, and a thermostat tightly mounted to the housing to detect a temperature of one side of the housing by conduction.

[0009] The thermostat may be spaced apart from a passageway defined in the housing by a predetermined distance.

[0010] The housing may include a first housing and a second housing coupled to a top of the first housing to define a predetermined space through which air flows, and the thermostat may be mounted at regions where the first housing and the second housing are assembled.

[0011] The thermostat may be mounted at an edge of the housing bent downward from a middle of the housing with a step to reduce interference between the thermostat and a machine body.

[0012] The first and second housing may include first and second covers between which the heater is located and first and second brims disposed at edges of the first and second covers, respectively, and the thermostat may be coupled to the first and second brims such that the thermostat is adjacent to the heater.

[0013] The first brim may have a hole through which the thermostat is inserted, and the second brim may have a groove depressed in one side thereof to receive the thermostat.

[0014] The drum washing machine may further include a tub and a drum rotatably mounted in the tub, and the housing may be disposed to communicate with the drum to circulate air.

[0015] Heat from the heater may be transferred to the side of the housing by convection.

[0016] The thermostat may include a body fitted in a brim of the housing, a bimetal mounted inside the body to interrupt supply of electric current to the heater when a temperature of the heater reaches a predetermined temperature level to prevent the heater from overheating, and a terminal provided at the bimetal to be connected to the heater.

[0017] The body may be fitted in the brim from an outside of the brim.

[0018] In accordance with another aspect of the present invention, a drum washing machine includes a tub to contain wash water, a drum rotatably mounted in the tub, a drying housing disposed to communicate with the drum, a heater to generate hot air in the drying housing, a thermostat tightly mounted to one side of the drying housing to detect overheating of the heater.

[0019] The drying housing may be made of stainless steel, and the thermostat may be coupled to a brim of the drying housing to detect a temperature of one side of the drying housing.

[0020] The housing may include a first housing and a second housing, and the thermostat may be mounted at regions where the first housing and the second housing are assembled.

[0021] One of the regions may be provided with a hole

through which the thermostat is inserted, and the other region may be provided with a groove depressed in one side thereof to receive the thermostat.

[0022] In accordance with a further aspect of the present invention, a drying unit of a washing machine includes a housing forming an external appearance of the drying unit, a heater to emit high-temperature heat in the housing, and a thermostat tightly mounted to the housing to detect a temperature of one side of the housing to prevent the heater from overheating.

[0023] The housing may be made of stainless steel, and the thermostat may detect the temperature of the side of the housing through a heat transfer mechanism by conduction.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] These and/or other aspects of the invention will become apparent and more readily appreciated from the following description of the embodiments, taken in conjunction with the accompanying drawings of which:

FIG. 1 is a view illustrating a drum washing machine according to an embodiment of the present invention;

FIG. 2 is a view illustrating a drying unit according to an embodiment of the present invention;

FIG. 3 is an exploded perspective view of the drying unit shown in FIG. 2;

FIG. 4 is a plan view of the drying unit shown in FIG. 2; and

FIG. 5 is a side view of the drying unit shown in FIG. 2.

DETAILED DESCRIPTION

[0025] Reference will now be made in detail to the embodiments of the present invention, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to the like elements throughout.

[0026] FIG. 1 is a view illustrating a drum washing machine according to an embodiment of the present invention.

[0027] As shown in FIG. 1, the drum washing machine includes a machine body 100 approximately forming the external appearance of the washing machine, a cylindrical tub 110 horizontally mounted in the machine body 100 to contain wash water, a drum 120 rotatably mounted in the tub 110, and a drive unit 130 to rotate the drum 120.

[0028] The fronts of the tub 110 and the drum 120 are open to allow laundry to be put into or removed from the drum 120 therethrough. To the front of the machine body 100 is hingedly coupled a door 140 to open and close the fronts of the tub 110 and the drum 120.

[0029] At the inner circumference of the drum 120 are disposed lifters 121, which are arranged at regular intervals, to lift laundry and wash water from a predetermined height and drop the laundry and the wash water during the rotation of the drum 120, thereby washing the laundry.

[0030] At the top of the machine body 110 are mounted a water supply hose 150 to allow wash water to be supplied from the outside therethrough and a detergent box 160 containing detergent to be mixed with the wash water supplied through the water supply hose 150. At the bottom of the machine body 110 are mounted a drainage pump 170 and a drainage hose 180 to drain the wash water out of the machine body 100.

[0031] Above the tub 110 is mounted a drying unit 200 to blow high-temperature air to the laundry placed in the drum 120 to dry the washed laundry. The drying unit 200 is configured such that opposite ends of the drying unit 200 are connected to gateways 110a and 110b formed at the front and rear of the tub 110. Also, the drying unit 200 communicates with the drum 120 to increase the temperature of air from the drum 120 as the air passes through the drying unit 200.

[0032] At the rear of the tub 110 is mounted a condensation duct 111. In the condensation duct 111 is disposed a cooling unit 112 to cool high-temperature air containing a large amount of moisture discharged from the laundry after passing through the drum 120 into low-humidity, low-temperature air. Upon completion of washing, therefore, the drum 120 is rotated at a low speed and, at the same time, the drying unit 200 is driven to circulate air from the drum 120 along the drum 120 and the drying unit 200 through the gateways 110a and 110b, thereby drying the laundry. At this time, the moisture discharged from the laundry and contained in the air is condensed by water sprayed through the cooling unit 112 into low-humidity, low-temperature air, which is introduced into the drying unit 200.

[0033] FIG. 2 is a view illustrating a drying unit according to an embodiment of the present invention, and FIG. 3 is an exploded perspective view of the drying unit shown in FIG. 2.

[0034] As shown in FIGS. 1 to 3, the drying unit 200 includes a housing 300 configured to communicate with the drum 120 while opposite ends of the housing 300 are coupled to the tub 110, a fan assembly 400 mounted in one end of the housing 300, a heater 500 disposed in the housing 300 to generate high-temperature heat, and thermostats 600 tightly mounted to the housing 300 to interrupt the flow of electric current to the heater 500 when the temperature of the heater 500 reaches a predetermined temperature level.

[0035] The housing 300 forms the external appearance of the drying unit 200. The housing 300 and the drum 120 constitute a closed circuit in which air circulates. The housing 300 may be made of metal exhibiting high heat conductivity. The housing 300 may be made of stainless steel. In this case, the housing 300 may be manufactured by pressing STS 430.

[0036] The housing 300 includes a first housing 310 and a second housing 320 coupled to the top of the first housing 310 to define a predetermined space through which air flows.

[0037] Opposite ends of the first housing 310 and the second housing 320 are open to communicate with the tub 110. Between the first housing 310 and the second housing 320 is defined a passageway 300a through which air flows. To define the passageway 300a in the housing 300, a first cover 311 of the first housing 310 and a second cover 321 of the second housing 320 are coupled to each other.

[0038] The first cover 311 is provided at one end thereof with a fan location part 313 having a predetermined diameter. At the bottom of the fan location part 313 is formed an introduction port 314 having a predetermined size to allow air to be introduced therethrough. The first cover 311 extends to a side cover 311a having a predetermined height. At the edge of the side cover 311a is formed a first brim 312. In the first brim 312 are formed grooves 312a, which are depressed downward to allow the thermostats 600, which will be described later, to be fitted therein.

[0039] At the edge of the second cover 321 is formed a second brim 322. The second brim 322 may be coupled to the first brim 312 by screws or any other coupling members to achieve the assembly of the housing 300. The second brim 322 is bent downward from the second cover 312 with a predetermined height difference. In the second brim 322 are formed holes 322a through which the thermostats 600 are inserted.

[0040] The fan assembly 400 includes a blowing fan 410 configured to introduce air in the axial direction and discharge the air in the radial direction, a fan motor 420 disposed above the blowing fan 410 to rotate the blowing fan 410, an air guide 430 to guide the flow of air suctioned by the blowing fan 410, a motor housing 440 protruding from the top of the air guide 430 with a predetermined height and diameter to receive the fan motor 420, and a motor mount 450 located at the top of the motor housing 440 to support the fan motor 420.

[0041] The heater 500 is configured in a serpentine fashion, and is disposed throughout the width in the passageway defined in the housing 300. The heater 500 includes a terminal 510 connected to an electric wire through which electric current flows, a heater seal 520 spaced from the terminal 510 by a predetermined distance to prevent leakage of air, and a heat emitter 530 extending from the terminal 510 with a predetermined diameter and length such that the heat emitter 530 is bent several times.

[0042] Unexplained reference numeral 700 indicates a coupling member mounted to the other end of the first housing 310 to couple the drying unit 200 to the tub 110, and 315 indicates a heater seal location groove formed in the side cover 311a of the first housing 310 to allow the heater seal 520 to be located therein.

[0043] The drying unit 200 with the above-stated con-

struction is operated as follows. First, when a drying process is initiated, electric current is supplied to the fan motor 430 to rotate the blowing fan 410. Also, electric current is supplied to the heater 500 such that the heater 500 is heated to high temperature. Air from the drum is suctioned by the blowing fan 410. The suctioned air is introduced into the housing 300, and is heat-exchanged with the heater 500, with the result that the air is heated to high temperature. The heated air is introduced into the tub 110 through the coupling member 700. The air introduced into the tub 110 evaporates moisture contained in laundry placed in the drum 120 to dry the laundry.

[0044] The thermostats 600 are mounted to the brims 312 and 322 of the housing 300 to prevent the interior of the drying unit 200 from overheating. Although two thermostats 600 are shown as being connected to each other in series in the drawings, only one thermostat 600 may be provided.

[0045] FIG. 4 is a plan view of the drying unit shown in FIG. 2, and FIG. 5 is a side view of the drying unit shown in FIG. 2.

[0046] As shown in FIGS. 4 and 5, each of the thermostats 600 includes a body 610 fitted in the first and second brims 312 and 322 of the housing 300, a bimetal 620 to interrupt the supply of electric current to the heater 500 when the temperature of the heater 500 reaches a predetermined temperature level to prevent the heater 500 from overheating, and a terminal 630 protruding from the bimetal 620 to be connected to the heater 500 and a power supply (not shown).

[0047] The body 610 is tightly mounted to the housing 300 such that the body 610 detects the temperature of the housing 300 heated by the heater 500 through a heat transfer mechanism by conduction. That is, the heater 500 to emit heat is disposed in the housing 300, and each of the thermostats 600 is tightly mounted to the housing 300 to detect the temperature of the heater 500. When the temperature of the heater 500 reaches a predetermined temperature level, therefore, the supply of electric current to the heater 500 is rapidly and sensitively interrupted.

[0048] The body 610 is coupled to the first and second brims 312 and 322 of the housing 300. The body 610 may be inserted into the groove 312a of the first brim 312 through the hole 322a of the second brim 322. The groove 312a of the first brim 312 and the hole 322a of the second brim 322 may be spaced from the side cover 311a of the housing 300 by a predetermined distance.

[0049] Generally, conduction is a phenomenon of heat transfer through a solid material as a heat transfer medium. When the heat transfer medium is formed of a solid metal material, heat conductivity (Kcal/°C) may be much greater than convection. For example, when the heat transfer medium is formed of stainless steel, heat conductivity at 20°C is 20 Kcal/°C. On the other hand, when air is used as the heat transfer medium, heat conductivity at 20°C is 0.026 Kcal/°C. Consequently, when the heat transfer medium is formed of a solid metal material to

use a heat transfer mechanism by conduction, rapid and sensitive movement of heat is achieved. The thermostat 600 tightly mounted to the housing 300 sensitively detects the temperature of the housing 300 through a heat transfer mechanism by conduction to prevent the occurrence of fire due to overheating of the heater 500.

[0050] The terminal 630 includes a first terminal 630 coupled to the power supply and a second terminal 630 connected to the terminal 510 of the heater 500. The terminal 630 may be short to achieve easy manufacture, transportation, and installation thereof. The thermostat 600 may be easily coupled to the first and second brims 312 and 322 while being adjacent to the terminal 510 of the heater, whereby the terminal 630 and the terminal 510 of the heater 500 are minimally bent.

[0051] Hereinafter, the operation of the drum washing machine including the drying unit with the above-stated construction will be described.

[0052] When the blowing fan 410 and the heater 500 are operated, air from the drum 120 is introduced into the housing 300 through the introduction port 314, and is uniformly dispersed in the passageway having the heater 500 disposed therein, with the result that the air has uniform temperature. The air is supplied to the drum 120 through the coupling member 700 to dry laundry placed in the drum 120.

[0053] At this time, heat from the heater 500 is transferred to the surface of the housing 300, and the thermostats 600 rapidly and sensitively detect the surface temperature of the housing through a heat transfer mechanism by conduction to prevent the occurrence of fire due to overheating of the heater 500.

[0054] Also, the thermostats 600 are mounted to the second brim 322 bent downward from the second cover 321 with a step. Consequently, the thermostats 600 are spaced from the machine body 100 by a predetermined distance, thereby reducing interference between the thermostats 600 and the machine body 100 and achieving a compact structure.

[0055] The thermostats 600 are mounted at regions where the housing 300 is assembled, with the result that no additional gaps to allow the thermostats 600 to be inserted into the housing 500 therethrough may be necessary, thereby preventing the air heated in the housing 300 from leaking out of the housing 300 and, at the same time, preventing the occurrence of fire, which may occur upon failure to accurately detect the temperature of the heater 500 due to such leakage of air.

[0056] As is apparent from the above description, the drum washing machine according to the embodiment of the present invention is constructed such that the thermostats are tightly mounted to the housing forming the external appearance of the drying unit to sensitively detect the temperature of the heater through a heat transfer mechanism by conduction, thereby preventing the occurrence of fire due to overheating of the heater.

[0057] Although a few embodiments of the present invention have been shown and described, it would be ap-

preciated by those skilled in the art that changes may be made in these embodiments without departing from the principles and spirit of the invention, the scope of which is defined in the claims and their equivalents.

Claims

1. A drum washing machine comprising a drying unit, wherein the drying unit comprises a housing made of stainless steel, a heater to emit heat in the housing, and a thermostat tightly mounted to the housing to detect a temperature of one side of the housing by conduction.
2. The drum washing machine according to claim 1, wherein the thermostat is spaced apart from a passageway defined in the housing by a predetermined distance.
3. The drum washing machine according to claim 1, wherein the housing comprises a first housing and a second housing coupled to a top of the first housing to define a predetermined space through which air flows, and the thermostat is mounted at regions where the first housing and the second housing are assembled.
4. The drum washing machine according to claim 1, wherein the thermostat is mounted at an edge of the housing bent downward from a middle of the housing with a step to reduce interference between the thermostat and a machine body.
5. The drum washing machine according to claim 1, wherein the first and second housing comprise first and second covers between which the heater is located and first and second brims disposed at edges of the first and second covers, respectively, and the thermostat is coupled to the first and second brims such that the thermostat is adjacent to the heater.
6. The drum washing machine according to claim 1, wherein the first brim has a hole through which the thermostat is inserted, and the second brim has a groove depressed in one side thereof to receive the thermostat.
7. The drum washing machine according to claim 1, further comprising a tub and a drum rotatably mounted in the tub, wherein the housing is disposed to communicate with the drum to circulate air.
8. The drum washing machine according to claim 1, wherein heat from the heater is transferred to the side of the housing by convection.

9. The drum washing machine according to claim 1, wherein the thermostat comprises a body fitted in a brim of the housing, a bimetal mounted inside the body to interrupt supply of electric current to the heater when a temperature of the heater reaches a predetermined temperature level to prevent the heater from overheating, and a terminal provided at the bimetal to be connected to the heater. 5
10. A drum washing machine comprising: 10
- a tub to contain wash water;
 - a drum rotatably mounted in the tub;
 - a drying housing disposed to communicate with the drum; 15
 - a heater to generate hot air in the drying housing;
 - a thermostat tightly mounted to one side of the drying housing to detect overheating of the heater. 20
11. The drum washing machine according to claim 10, wherein the drying housing is made of stainless steel, and the thermostat is coupled to a brim of the drying housing to detect temperature of one side of the drying housing. 25
12. The drum washing machine according to claim 10, wherein the housing comprises a first housing and a second housing, and the thermostat is mounted at regions where the first housing and the second housing are assembled. 30
13. The drum washing machine according to claim 12, wherein one of the regions is provided with a hole through which the thermostat is inserted, and the other region is provided with a groove depressed in one side thereof to receive the thermostat. 35
14. A drying unit of a washing machine, comprising: 40
- a housing forming an external appearance of the drying unit;
 - a heater to emit high-temperature heat in the housing; and
 - a thermostat tightly mounted to the housing to detect a temperature of one side of the housing to prevent the heater from overheating. 45
15. The drying unit according to claim 14, wherein the housing is made of stainless steel, and the thermostat detects the temperature of the side of the housing through a heat transfer mechanism by conduction. 50
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FIG. 1

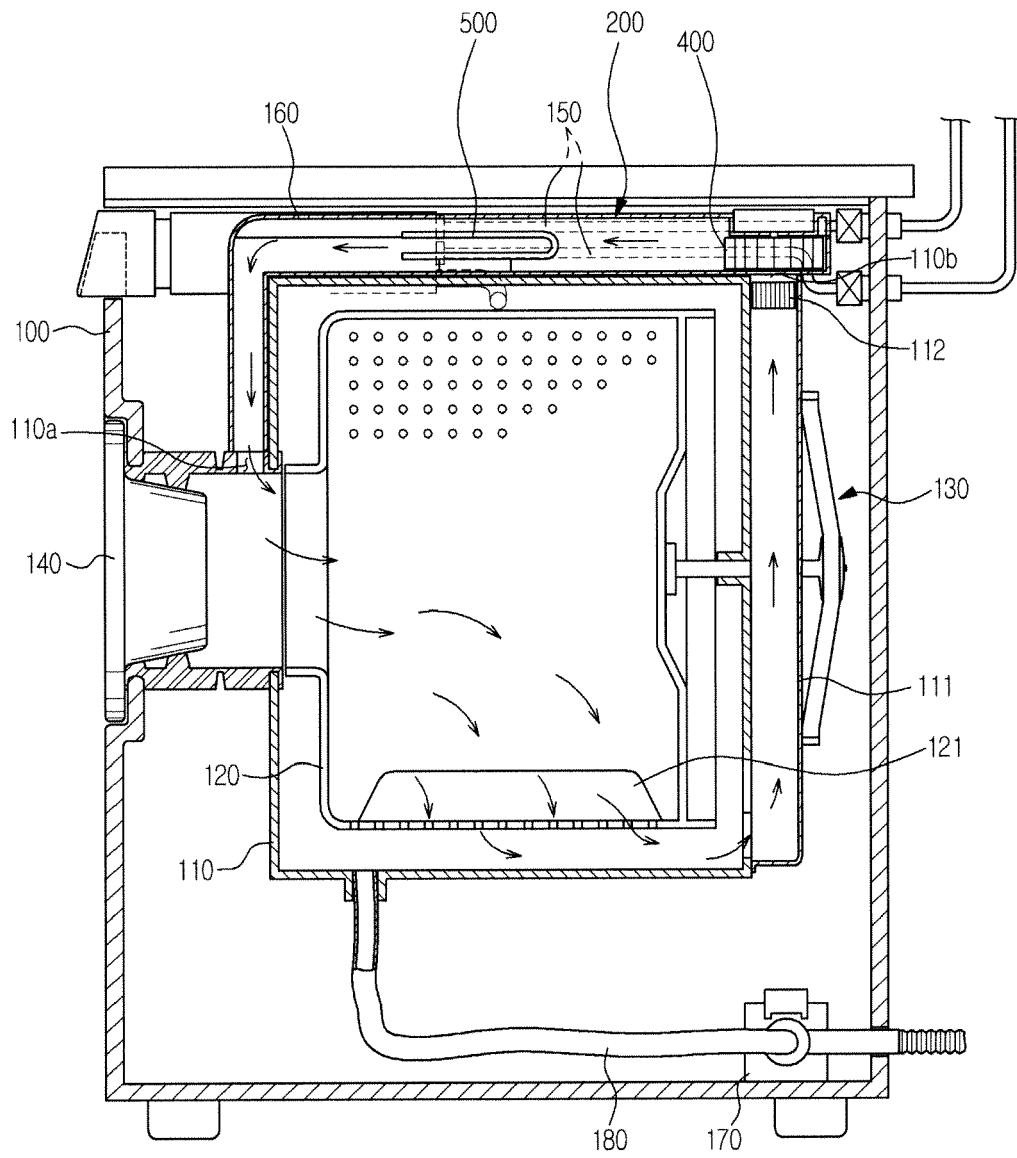


FIG. 2

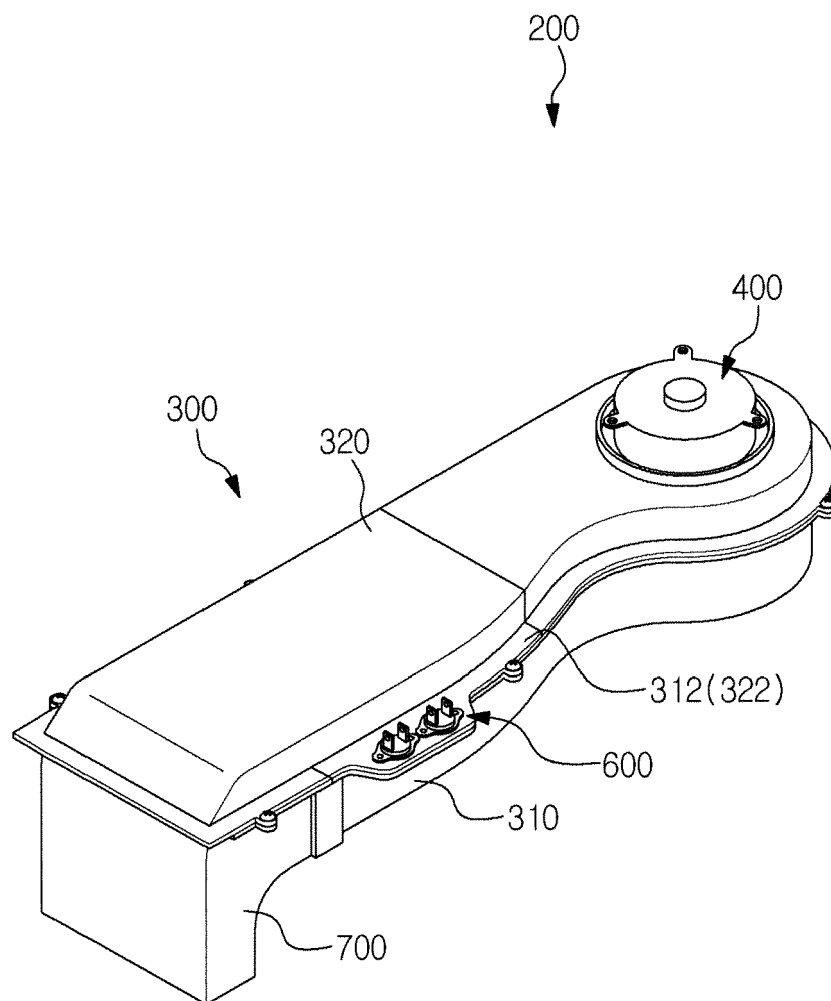


FIG. 3

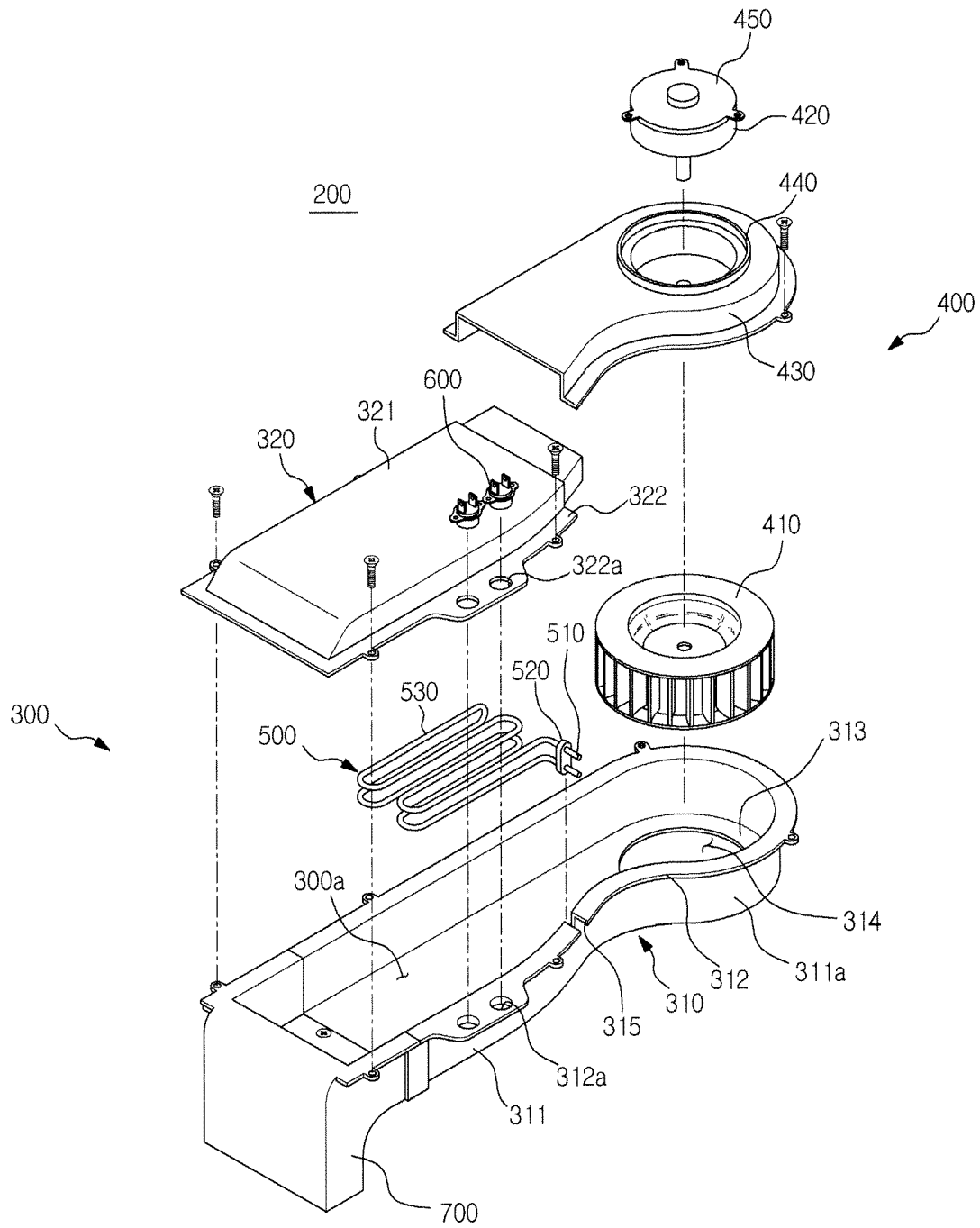


FIG. 4

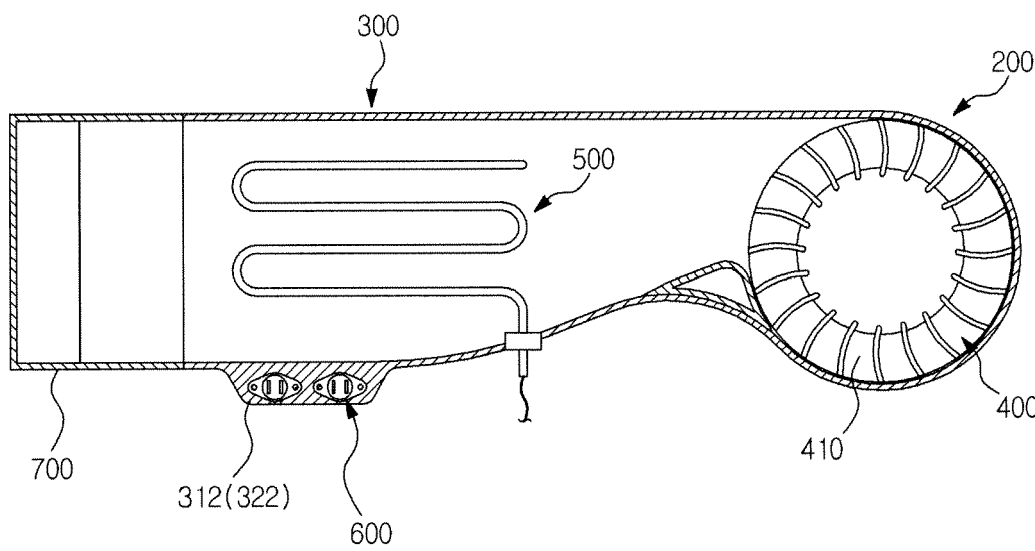
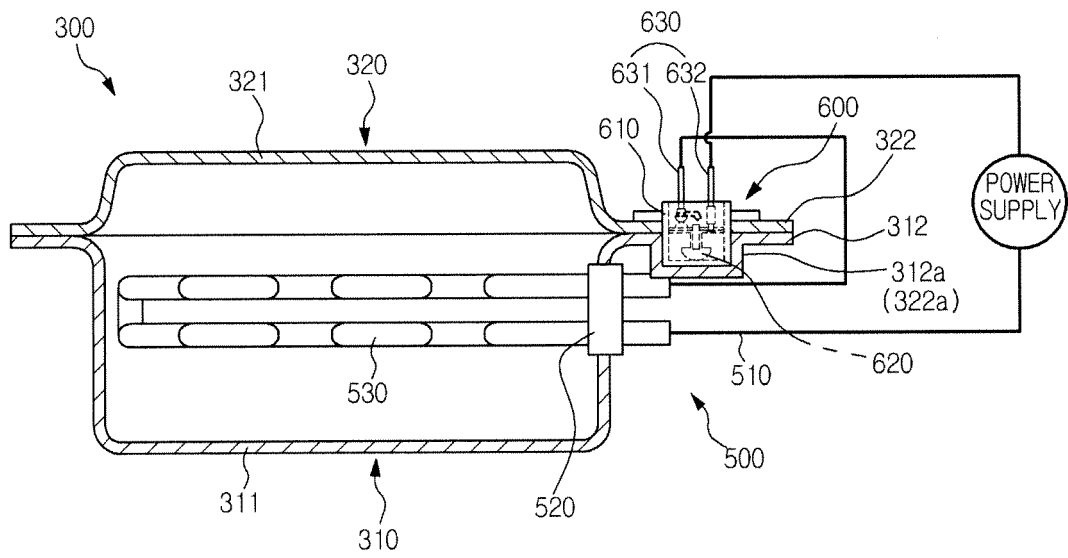


FIG. 5





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Application Number
EP 09 16 1466

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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A	* column 1, lines 15-68; column 3, lines 29-45; column 4, lines 7-26; column 6, lines 24-27, column 8, lines 19-49, figures 1, 4, 5 *	4-6,9, 11-13	
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Place of search Munich		Date of completion of the search 6 May 2010	Examiner Clivio, Eugenio
CATEGORY OF CITED DOCUMENTS 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 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 & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 09 16 1466

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The members are as contained in the European Patent Office EDP file on
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