



(19) **United States**

(12) **Patent Application Publication**
Hong et al.

(10) **Pub. No.: US 2011/0041352 A1**

(43) **Pub. Date: Feb. 24, 2011**

(54) **CLOTHES DRYER**

(30) **Foreign Application Priority Data**

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Aug. 24, 2009 (KR) 10-2009-78037

Publication Classification

(51) **Int. Cl.**
D06F 58/04 (2006.01)
F28F 7/00 (2006.01)
(52) **U.S. Cl.** **34/134; 165/185**
(57) **ABSTRACT**

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A clothes dryer having a preheating unit preheating drawn air is provided. The clothes dryer includes a main body, a drying tub rotatably mounted to receive an object to be dried, and a hot air duct supplying hot air into the drying tub. The hot air duct includes a heating unit heating drawn air, and a hot air supply unit connecting the heating unit with the drying tub, thereby forming a path for heated air. The heating unit includes a first heating unit having a heater part generating heat, and a second heating unit surrounding an entrance and outer walls of the first heating unit, thereby forming a path for the air flowing to the first heating unit. The second heating unit includes one or more preheating fins formed on the first heating unit to contact the air flowing in the second heating unit.

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(21) Appl. No.: **12/805,196**

(22) Filed: **Jul. 16, 2010**

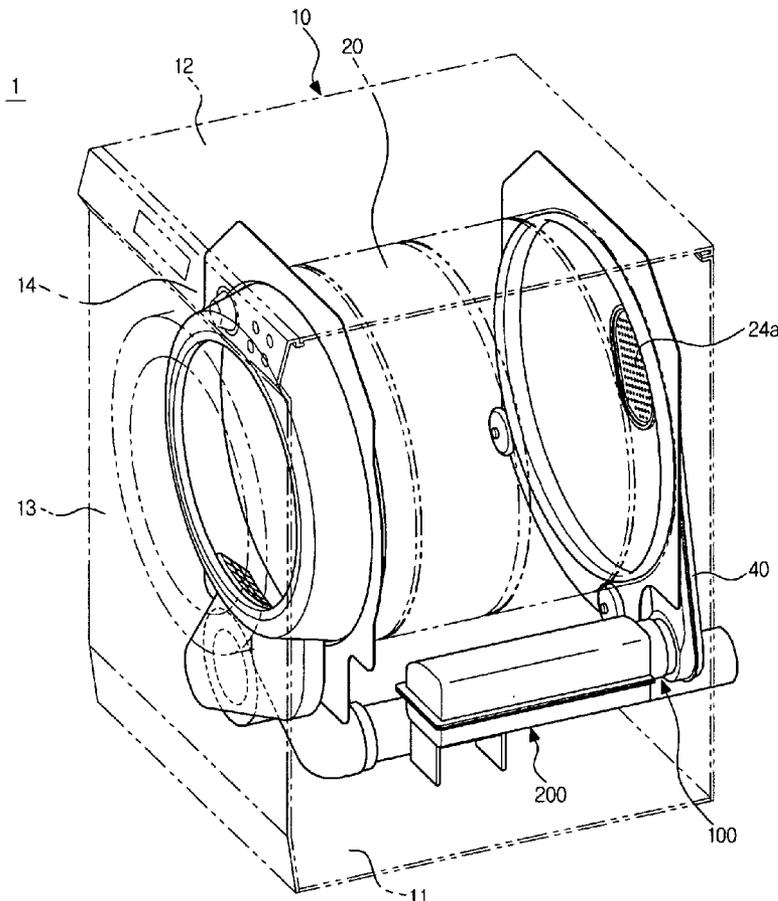


FIG. 1

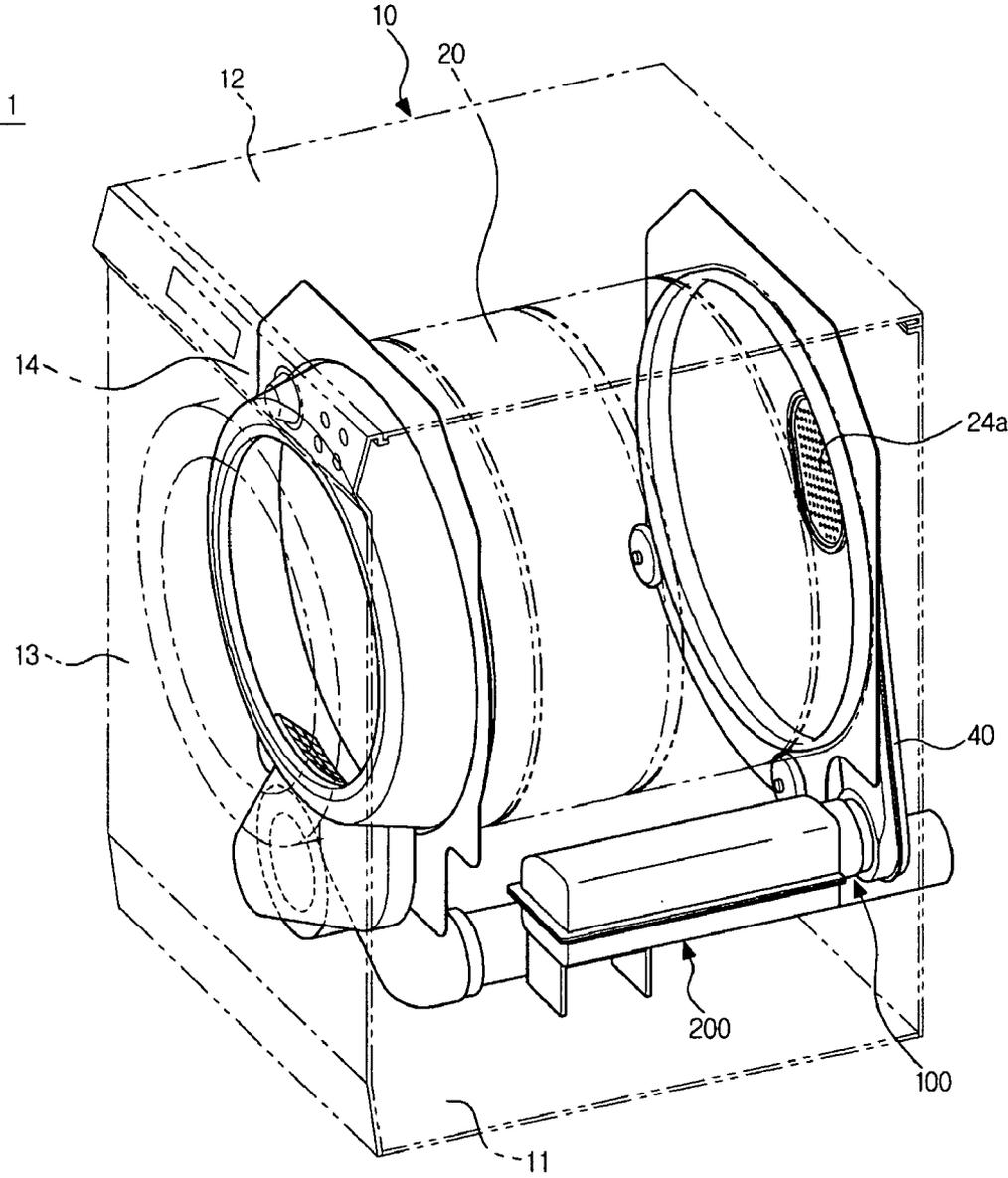


FIG. 2

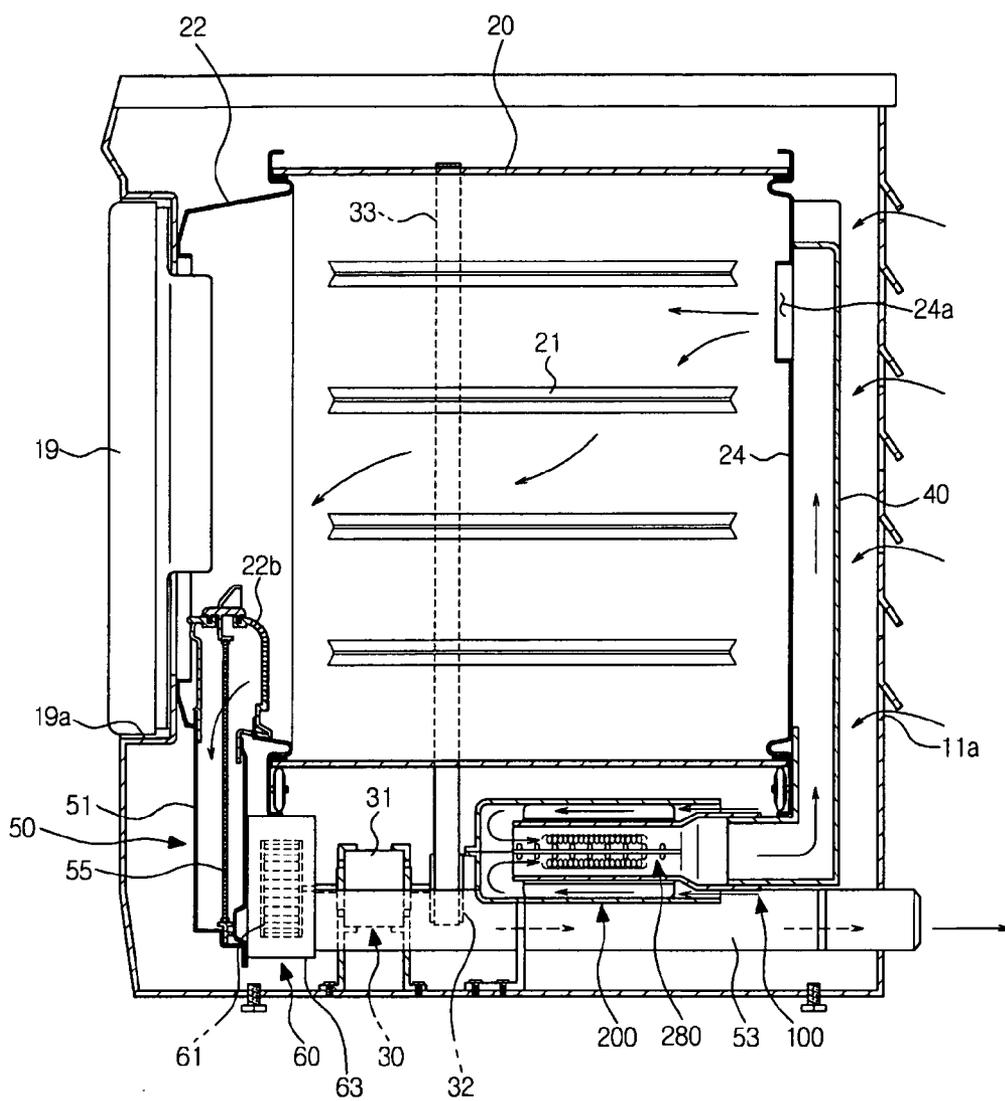


FIG. 3

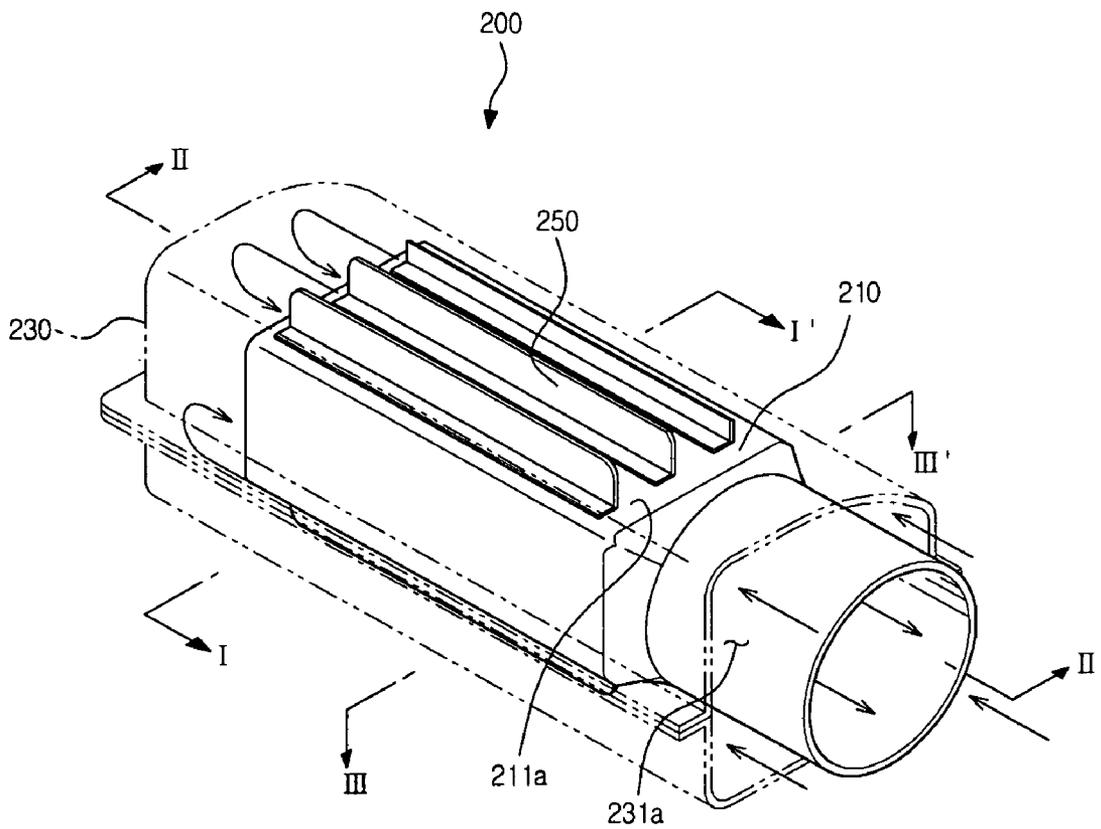


FIG. 4

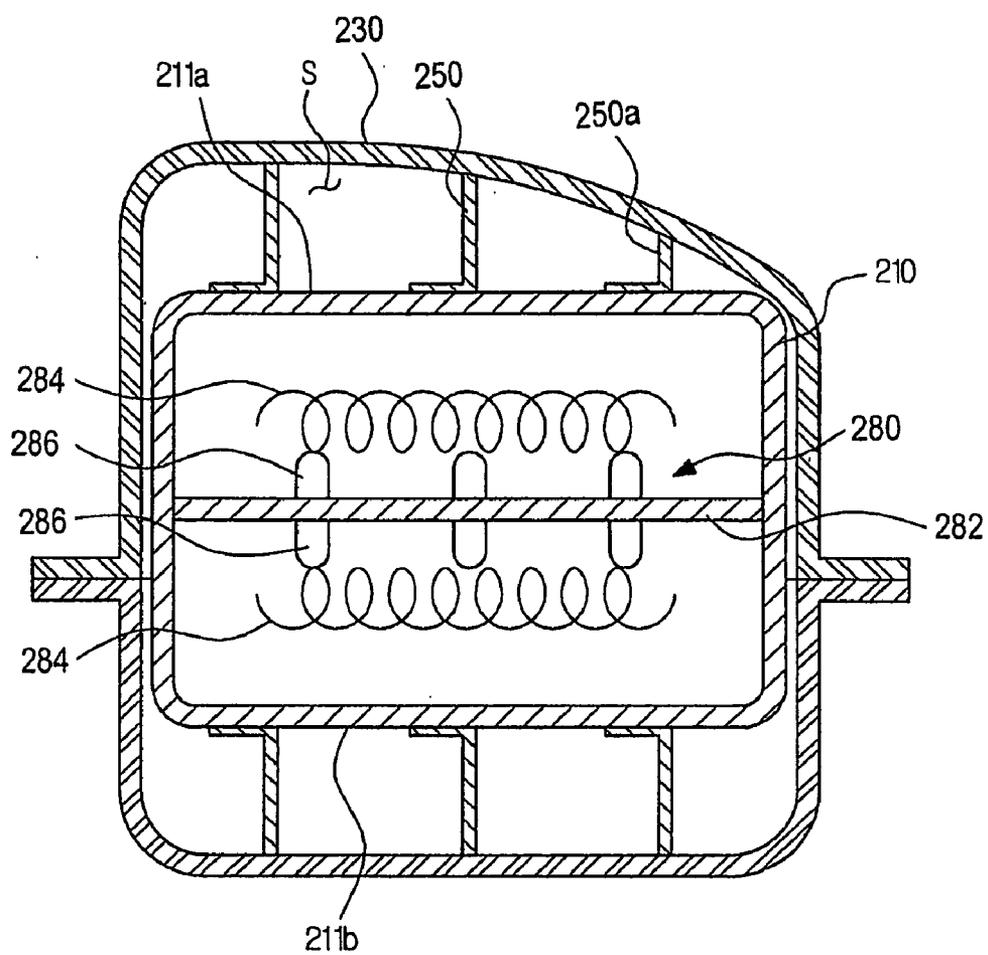


FIG. 5

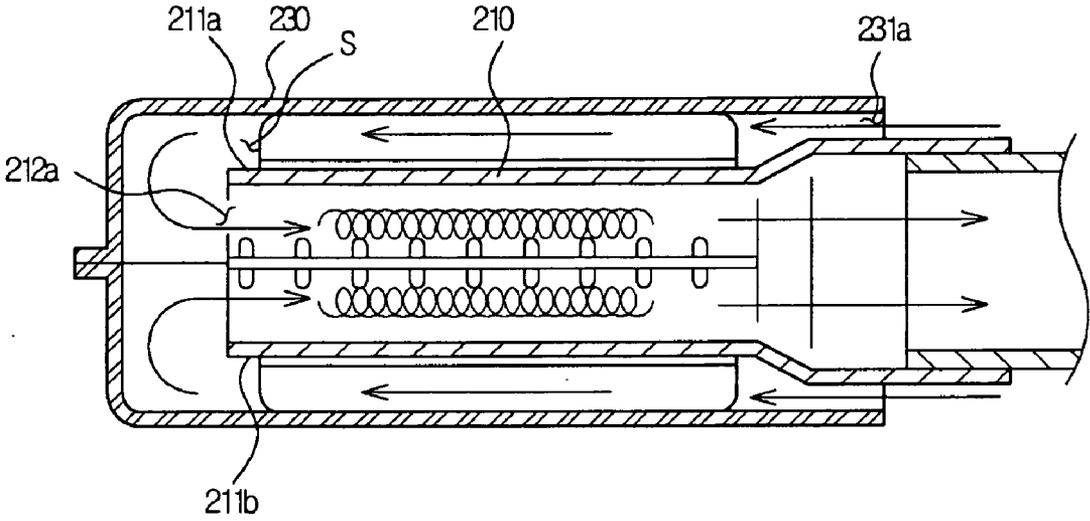


FIG. 6

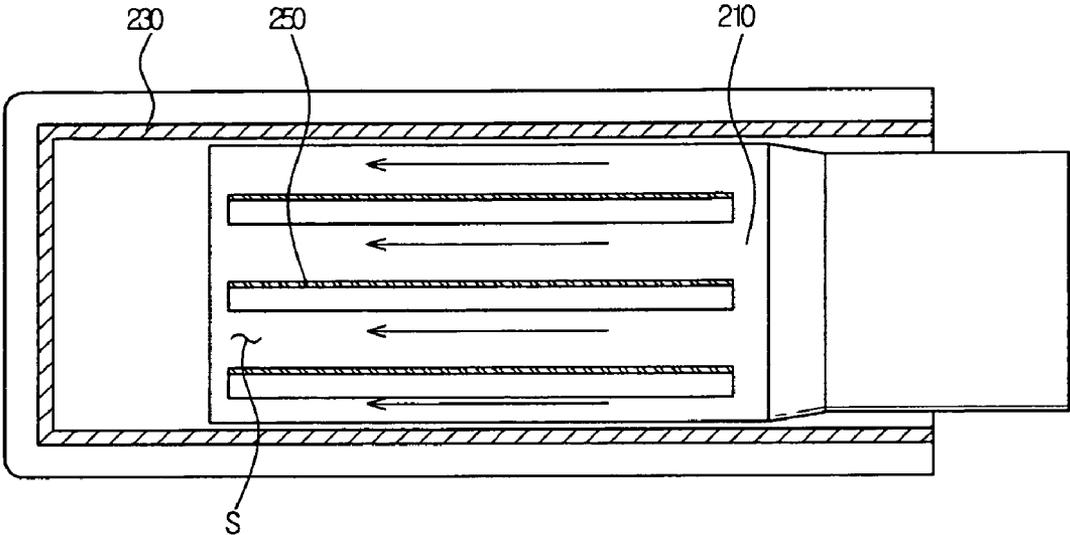


FIG. 7

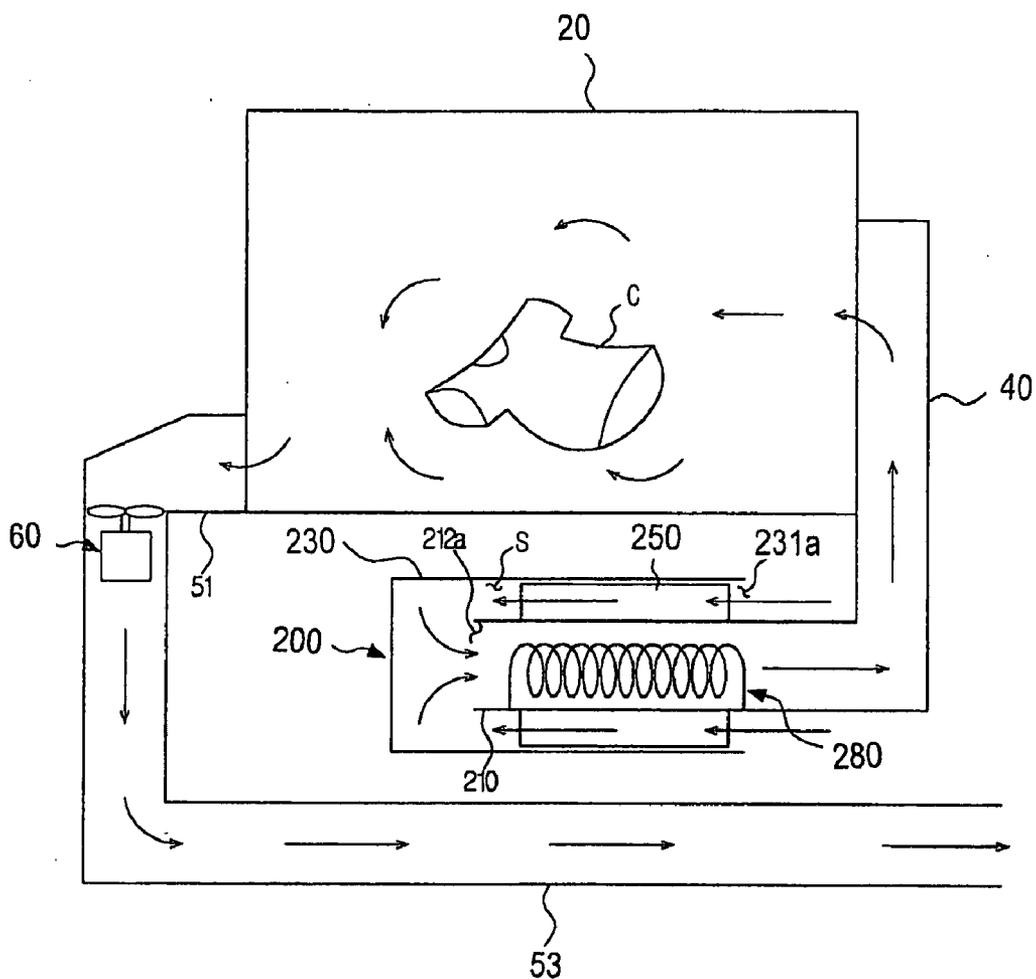


FIG. 8

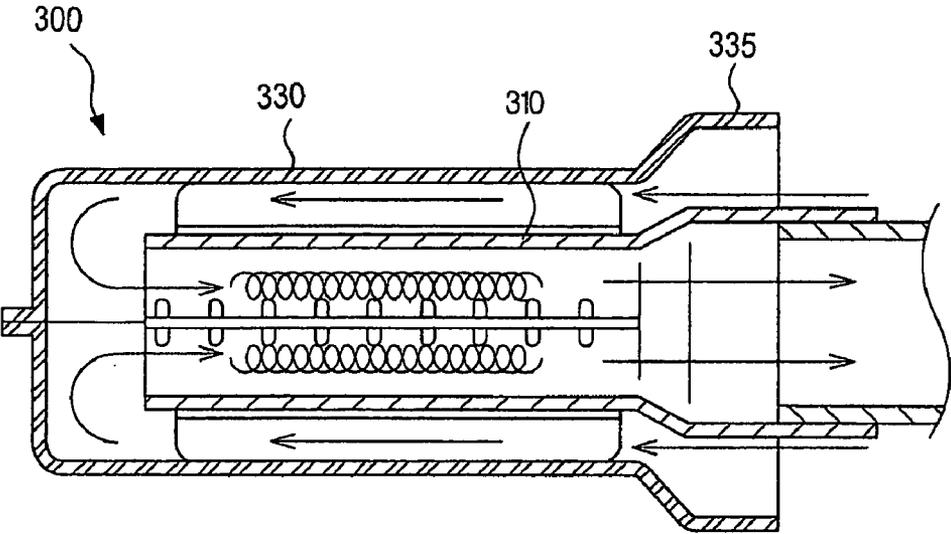
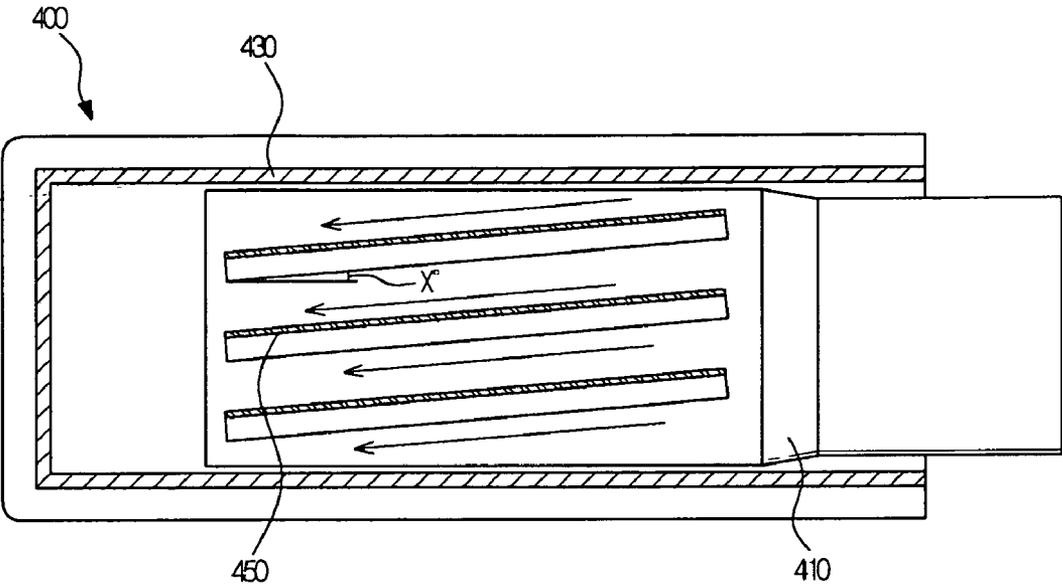


FIG. 9



CLOTHES DRYER

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of Korean Patent Application No. 2009-0078037, filed on Aug. 24, 2009 in the Korean Intellectual Property Office, the disclosure of which is incorporated herein by reference.

BACKGROUND

[0002] 1. Field

[0003] Embodiments relate to a clothes dryer having a pre-heat function.

[0004] 2. Description of the Related Art

[0005] A clothes dryer is an apparatus that sends hot air into a drying tub and thereby dries an object to be dried, which is received in the drying tub.

[0006] Clothes dryers are mainly divided into an exhausting-type dryer that exhausts hot and humid air passed through the drying tub to the outside of the clothes dryer, and a condensing-type dryer that dehumidifies the hot and humid air and recirculates the dehumidified air into the drying tub.

[0007] Generally, a clothes dryer has a heating device in a hot air duct which is an air flow path, so as to produce the hot air by heating air inside the hot air duct.

[0008] According to the clothes dryer with this structure, the hot air flowing through the hot air duct is produced as air is brought into contact with or passed by the heating device emitting heat. The hot air is supplied into the drying tub to dry the object to be dried.

[0009] However, since the air is heated only when flowing near the heating device, most of the heat emitted by the heating device is wasted. Furthermore, in order to produce hot air having a desired temperature, the heating device needs to be maintained at a considerably high temperature. Therefore, the energy efficiency is poor.

SUMMARY

[0010] Therefore, it is an aspect to provide a clothes dryer having a preheat unit to improve energy efficiency.

[0011] Additional aspects will be set forth in part in the description which follows and, in part, will be apparent from the description, or may be learned by practice of the invention.

[0012] The foregoing and/or other aspects are achieved by providing, a clothes dryer including a main body, a drying tub rotatably mounted to receive an object to be dried, and a hot air duct supplying hot air into the drying tub, wherein the hot air duct includes a heating unit heating air supplied thereto, and a hot air supply unit connecting the heating unit with the drying tub, thereby forming a path for heated air, and the heating unit includes a first heating unit having a heater part disposed therein to generate heat, and a second heating unit surrounding an entrance and outer walls of the first heating unit, thereby forming a path for the air flowing to the first heating unit.

[0013] The second heating unit may include one or more preheating fins formed on the outer walls of the first heating unit to contact the air flowing in the second heating unit. The one or more preheating fins may be arranged parallel with one another in a length direction of the first heating unit. The one or more preheating fins may be slanted with respect to the length direction of the first heating unit. The one or more

preheating fins may be slanted by about 3°~7° with respect to the length direction of the first heating unit.

[0014] The second heating unit may include a flow loss reduction part to reduce loss of flow during air suction, and the flow loss reduction part may be formed by increasing a diameter of an air suction part of the second heating unit to be larger than a diameter of a main body of the second heating unit.

[0015] The heating unit may include a galvanized steel sheet.

[0016] The preheating fins may include at least one of a galvanized steel sheet, aluminum, and copper.

[0017] The one or more preheating fins may be arranged at constant intervals.

[0018] The heating unit may include a heater plate formed across the inside of the first heating unit, a nichrome wire emitting heat by supplied electricity, and a ceramic member fixing the nichrome wire to the heater plate.

[0019] The foregoing and/or other aspects may be achieved by providing a clothes dryer including a main body, a drying tub rotatably mounted to receive an object to be dried, and a hot air duct supplying hot air into the drying tub, wherein the hot air duct includes a heating unit having a heater part to heat air drawn thereinto to provide hot air and a hot air supply unit guiding the heated air into the drying tub, and the heating unit includes a main heating unit that heats the drawn air using the heat of the heater part, and a preheating unit that forms a path for the air flowing to the main heating unit and heats the air using the heat of the main heating unit.

[0020] The preheating unit may include a preheating fin formed on the outside of the main heating unit so that the heat of the main heating unit is efficiently transmitted to the preheating unit.

[0021] The foregoing and/or other aspects are achieved by providing a clothes dryer having a hot air duct that supplies hot air, wherein the hot air duct may include a heating unit to heat air supplied thereto, and the heating unit may include a first heating unit directly heating the air flowing therein, and a second heating unit disposed adjacent to the first heating unit, thereby forming an air path guiding air in the opposite direction to the air flowing in the first heating unit, the second heating unit indirectly heating the air flowing into the first heating unit using the heat of the first heating unit.

[0022] The first heating unit may include one or more preheating fins formed on outer walls thereof to contact the air flowing in the second heating unit.

[0023] The foregoing and/or other aspects are also achieved by providing a clothes dryer including a main body, a heating unit heating drawn air, a hot air supply unit connected to an end of the heating unit, thereby forming a path for the heated air, a drying tub connected to the hot air supply unit and structured to receive an object to be dried, a ventilation device circulating the air, and an exhaust duct guiding the air exhausted from the drying tub to the outside of the main body, wherein the heating unit includes a first heating unit connected to the hot air supply unit and equipped with a heater part that generates heat therein, and a second heating unit forming an air path in which air flows in contact with outer walls of the first heating unit and guiding the air to the first heating unit.

[0024] The second heating unit may include a preheating fin formed on the outer walls of the first heating unit to enhance heating of the air flowing in the second heating unit.

[0025] As described above, the clothes dryer according to the embodiments is capable of improving the efficiency of hot air production, by employing a preheat unit which preheats drawn air.

[0026] Also, the hot air production efficiency may be further improved by adopting a preheating fin.

[0027] In addition, since an air circulation structure of a heating unit of the clothes dryer is improved, energy may be conserved.

BRIEF DESCRIPTION OF THE DRAWINGS

[0028] 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:

[0029] FIG. 1 is a perspective view of a clothes dryer according to one embodiment;

[0030] FIG. 2 is a longitudinal-sectional view of the clothes dryer of FIG. 1;

[0031] FIG. 3 is a perspective view showing a heating unit of the clothes dryer of FIG. 1 in detail;

[0032] FIG. 4 is a sectional view cut along line I-I' shown in FIG. 3;

[0033] FIG. 5 is a sectional view cut along line II-II' shown in FIG. 3;

[0034] FIG. 6 is a sectional view cut along line shown in FIG. 3;

[0035] FIG. 7 is a conceptual view showing the operational processes of the clothes dryer according to the embodiment;

[0036] FIG. 8 is a longitudinal-sectional view showing a heating unit of a clothes dryer according to another embodiment; and

[0037] FIG. 9 is an upper-sectional view showing a heating unit of a clothes dryer according to still another embodiment.

DETAILED DESCRIPTION

[0038] Reference will now be made in detail to the embodiments, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to like elements throughout.

[0039] FIG. 1 is a perspective view of a clothes dryer according to one embodiment. FIG. 2 is a longitudinal-sectional view of the clothes dryer shown in FIG. 1.

[0040] Referring to FIGS. 1 and 2, the clothes dryer 1 according to one embodiment includes a main body 10, a drying tub 20 rotatably mounted in the main body 10, a driving device 30 rotating the drying tub 20, and a hot air duct 100 supplying hot air into the drying tub 20.

[0041] The main body 10 includes a cabinet 11, a top cover 12 covering a top side of the cabinet 11, a front panel 13 disposed on a front of the cabinet 11, and a control panel 14 equipped with various operation buttons for control of the clothes dryer 1 and a display screen.

[0042] The drying tub 20 has a cylindrical form opened at front and rear sides, and includes a plurality of lifters 21 protruded from an inner surface thereof in the form of a ridge having a triangular sectional shape and adapted to lift and drop objects to be dried. In addition, a front supporting board 22 and a rear supporting board 24 are fixed to an inner front part and an inner rear part of the main body 10, respectively, to cover the front and the rear opened sides of the drying tub 20 while rotatably supporting the front and the rear opened sides.

[0043] An input opening 19a is formed through the front side of the main body 10 and the front supporting board 22. The object to be dried is put in and out of the drying tub 20 through the input opening 19a. A door 19 to open and close the input opening 19a is connected to the front of the main body 10.

[0044] The driving device 30 includes a drive motor 31 mounted at an inner lower part of the cabinet 10, and a pulley 32 and a rotation belt 33 transmitting power of the drive motor 31 to the drying tub 20. The rotation belt 33 is wound on an outer surface of the drying tub 20 and the pulley 32 connected to a shaft of the drive motor 31.

[0045] The hot air duct 100 includes a heating unit 200 heating air supplied thereto, and a hot air supply unit 40 connecting the heating unit 200 to the drying tub 20.

[0046] The heating unit 200 is disposed below the drying tub 20 to guide entry of external air and heat the air. To this end, the heating unit 200 includes a heater part 280 emitting heat in the heating unit 200. The heating unit 200 will be more specifically described later.

[0047] The hot air supply unit 40 connects the heating unit 200 with a drying tub suction port 24a formed at an upper part of the rear supporting board 24, thereby forming an air path. Also, the hot air supply unit 40 guides the heated air toward the drying tub 20.

[0048] An exhaust duct 50 is connected to a front lower part of the drying tub 20 to guide discharge of the air guided into the drying tub 20. The exhaust duct 50 is divided into a front exhaust duct 51 connecting an exhaust port 22b disposed at a lower part of the front supporting board 22 with an entrance of a ventilation device 60 disposed below the drying tub 20, and a rear exhaust duct 53 formed at a lower part of the cabinet 11 so that an exit of the ventilation device 60 is fluidly communicated with a rear outside of the cabinet 11.

[0049] A filter member 55 is mounted to the front exhaust duct 51 to filter out foreign substances such as dust and lint contained in the hot air discharged from the drying tub 20.

[0050] The ventilation device 60 circulates the air, and includes a ventilation fan 61 and a ventilation case 63. The ventilation fan 61 is mounted at the lower front part of the drying tub 20. The ventilation case 63 is formed to surround the ventilation fan 61 and connected to the first and the second exhaust ducts 51 and 53.

[0051] FIG. 3 is a detailed perspective view of the heating unit of the clothes dryer. FIG. 4 is a sectional view cut along line I-I' shown in FIG. 3, FIG. 5 is a sectional view cut along line II-II' of FIG. 3, and FIG. 6 is a sectional view cut along line of FIG. 3.

[0052] As shown in FIGS. 3 to 6, the heating unit 200 includes a first heating unit 210 in which the heater part 280 is disposed, and a second heating unit 230 surrounding an entrance 212a and upper and lower outer walls 211a and 211b of the first heating unit 210.

[0053] The first heating unit 210 substantially has a rectangular sectional shape and is structured so that air flows therein.

[0054] The first heating unit 210 includes the heater part 280 therein to emit heat, and one or more preheating fins 250 formed at the upper and lower outer walls 211a and 211b to transmit heat by contacting the air flowing in the second heating unit 230.

[0055] The heater part 280 includes a heater plate 282 formed across the inside of the first heating unit 210, a nichrome wire 284 emitting heat by being supplied with

electric power, and a ceramic member **286** fixing the nichrome wire **284** to the heater plate **282**.

[0056] The nichrome wire **284** is fixed to the heater plate **282** through the medium of the ceramic member **286**, which is capable of enduring high temperatures. In this case, the heater plate **282** may be prevented from being damaged by the high temperature of the nichrome wire **284**.

[0057] According to an exemplary embodiment, the heater plate **282** is made of the same material as the first heating unit **210**.

[0058] The preheating fin **250** transmits heat of the first heating unit **210** to the air flowing in the second heating unit **230**. For this purpose, a plurality of the preheating fins **250** may be formed on the upper and the lower outer walls **211a** and **211b** of the first heating unit **210**.

[0059] The preheating fins **250** are arranged at constant intervals to be parallel with one another in a length direction of the first heating unit **210**. Such a structure is intended to improve the efficiency of thermal transmission into the second heating unit **230** while reducing the resistance of the airflow. Additionally, a preheating fin **250a** disposed near the drying tub **20** may be formed and is smaller than the other preheating fins **250** due to positional relationship with the drying tub **20**.

[0060] The second heating unit **230** has a larger appearance than the first preheating unit **210** so as to surround the entrance **212a** and the outer walls **211a** and **211b** of the first heating unit **210**. Therefore, a space **S** is formed as an air path between the first and the second heating units **210** and **230**.

[0061] That is, the second heating unit **230** is disposed adjacent to the first heating unit **210**, thereby forming the air path wherein air flows in the opposite direction to the air flowing through the first heating unit **210**.

[0062] According to the above structure, the air drawn from the outside of the main body **10** is guided in through an entrance **231a** of the second heating unit **230**, passed through the inner space **S** of the second heating unit **230**, guided to the entrance **212a** of the first heating unit **210**, and then passed through the first heating unit **210**, thereby being heated into hot air.

[0063] The heater part **280** and the first heating unit **210** of the heating unit **200** function as a main heating unit that directly heats the air. On the other hand, the preheating fins **250** and the second heating unit **230** function as a preheating unit that heats the air not yet heated by the main heating unit.

[0064] The heating unit **200** includes a galvanized steel sheet since it is inexpensive, easily processed and durable.

[0065] The preheating fins **250** may include at least one of a galvanized steel sheet, aluminum, and copper.

[0066] Although the galvanized steel sheet is generally used for the material of the preheating fins **250** due to low cost, aluminum has a higher thermal conductivity as compared to galvanized steel, but is more expensive. Copper has higher thermal conductivity than aluminum but is still more expensive.

[0067] Hereinafter, the operation of the clothes dryer **1** according to the embodiment of FIG. **1** will be described.

[0068] FIG. **7** is a conceptual view illustrating the operation processes of the clothes dryer **1**.

[0069] Referring to FIG. **7**, when a user puts an object to be dried **C** in the drying tub **20** and operates the buttons of the control panel **14**, the ventilation fan **61** of the ventilation device **60** is rotated and the heater part **280** emits heat.

[0070] As the ventilation fan **61** rotates, pressure in the drying tub **20** is reduced. Accordingly, the external air of the main body **10** is drawn into the second heating unit **230** of the heating unit **200** through via holes **11a** formed on a rear surface of the cabinet **11**.

[0071] The air passes through the entrance **231a** of the second heating unit **230** and flows in the inner space of the second heating unit **230**. Here, since the first heating unit **210** is already heated by the heat of the heater part **280**, heat of the outer walls **211a** and **211b** of the first heating unit **210** heats the air in the second heating unit **230**.

[0072] In addition, the heat of the first heating unit **210** is also transmitted to the preheating fins **250**, thereby heating the air in the second heating unit **230**. The preheating fins **250** may have a plate form to effectively emit heat, and may be disposed midway within the airflow so as to effectively heat the air.

[0073] That is, the preheating fins **250** and the second heating unit **230** indirectly heat the air.

[0074] The preheated air passes through the entrance **212a** of the first heating unit **210** and flows into the first heating unit **210**. At this time, the heater part **280** directly heats the air flowing in the first heating unit **210**.

[0075] Since the air is sufficiently preheated, time for the direct heating by the heater part **280** will be greatly reduced. Therefore, hot air having a desired temperature may be produced in a short time.

[0076] Furthermore, consumption of power supplied for the heater part **280** is reduced, thereby conserving energy.

[0077] The hot air produced through the heating unit **200** is passed through the hot air supply unit **40** and supplied to the drying tub **20**. While the drying tub **20** is being rotated by the drive motor **31**, the object to be dried **C** in the drying tub **20** is repeatedly raised and dropped and accordingly dried through contact with the supplied hot air.

[0078] Wet air in the drying tub **20** is exhausted out of the main body **10** through the front and the rear exhaust ducts **51** and **53**. Since the ventilation device **60** is continuously operated during this operation, the external air is newly drawn in and the above processes are repeated, thereby continuing the drying operation.

[0079] Hereinafter, another embodiment will be described with reference to the accompanying drawings. The same structures and functions as in the previous embodiment will not be described again.

[0080] FIG. **8** is a longitudinal-sectional view showing a heating unit of a clothes dryer according to another embodiment.

[0081] As shown in FIG. **8** a heating unit **300** has generally the same structure as the heating unit **200** of the previous embodiment, but further includes a flow loss reduction unit **335** adapted to reduce loss of air drawn into a second heating unit **330**.

[0082] The flow loss reduction unit **335** is structured by enlarging an air suction part of the second heating unit **330** so that flow loss is reduced during air suction. Specifically, as the air suction part is enlarged, a predetermined interval is formed between the air suction part of the second heating unit **330** and a first heating unit **310**, such that the air may be naturally drawn into the second heating unit **330**, without causing loss of flow.

[0083] The other features of this embodiment are the same as in the previous embodiment.

[0084] Hereinafter, a heating unit according to still another embodiment will be described, omitting a description about the same structures and functions as in previous embodiments.

[0085] FIG. 9 is an upper-sectional view showing the heating unit according to this additional embodiment.

[0086] Referring to FIG. 9, the heating unit 400 has the generally same structure as the heating unit 200 described above, except for the configuration of preheating fins 450.

[0087] The preheating fins 450 are slanted by a predetermined angle X° with respect to a length direction of the first heating unit 410.

[0088] According to this configuration, an air path of the air flowing in the second heating unit 430 is elongated, accordingly increasing a contact time between the preheating fins 450 and the first heating unit 410. As a result, the preheating efficiency is improved.

[0089] It is exemplary that the slant angle X° of the preheating fins 450 is $3^\circ\sim 7^\circ$ with respect to the length of the first heating unit 410 because, when the angle X° is excessively large, resistance of the airflow is increased, thereby deteriorating the air flow efficiency.

[0090] Although a few embodiments of the present invention have been shown and described, it would be appreciated by those skilled in the art that changes may be made in these embodiments without departing from the principles and spirit of the embodiments, the scope of which is defined in the claims and their equivalents.

What is claimed is:

1. A clothes dryer comprising:
 - a main body;
 - a drying tub rotatably mounted to receive an object to be dried; and
 - a hot air duct supplying hot air into the drying tub, wherein the hot air duct includes a heating unit heating drawn air, and a hot air supply unit connecting the heating unit with the drying tub, thereby forming a path for heated air, and
 - the heating unit includes a first heating unit having a heater part disposed therein to generate heat, and a second heating unit surrounding an entrance and outer walls of the first heating unit, thereby forming a path for the air flowing to the first heating unit.
2. The clothes dryer according to claim 1, wherein the second heating unit comprises a preheating fin formed on one of the outer walls of the first heating unit to contact the air flowing in the second heating unit.
3. The clothes dryer according to claim 2, further comprising a plurality of the preheating fins, wherein the preheating fins are arranged parallel with one another in a length direction of the first heating unit.
4. The clothes dryer according to claim 2, further comprising a plurality of the preheating fins, wherein the preheating fins are slanted with respect to a length direction of the first heating unit.
5. The clothes dryer according to claim 4, wherein the preheating fins are slanted by about $3^\circ\sim 7^\circ$ with respect to the length direction of the first heating unit.
6. The clothes dryer according to claim 1, wherein the second heating unit comprises a main body and a flow loss reduction part to reduce loss of flow during air suction, and the flow loss reduction part comprises an air suction part having a diameter larger than a diameter of the main body of the second heating unit.

7. The clothes dryer according to claim 1, wherein the heating unit further comprises a galvanized steel sheet.

8. The clothes dryer according to claim 2, wherein the preheating fins comprise at least one of a galvanized steel sheet, aluminum, and copper.

9. The clothes dryer according to claim 2, wherein the preheating fins are arranged at constant intervals.

10. The clothes dryer according to claim 1, wherein the heating unit comprises a heater plate formed across an inside of the first heating unit, a nichrome wire emitting heat by supplied electricity, and a ceramic member fixing the nichrome wire to the heater plate.

11. A clothes dryer comprising:

- a main body;
- a drying tub rotatably mounted to receive an object to be dried; and
- a hot air duct supplying hot air into the drying tub, wherein the hot air duct includes a heating unit having a heater part to heat air drawn thereinto to provide the hot air, and
- the heating unit includes a main heating unit that heats the drawn air using the heat of the heater part, and a preheating unit that forms a path for the air flowing to the main heating unit and heats the air using the heat of the main heating unit.

12. The clothes dryer according to claim 11, wherein the preheating unit is disposed on the air path that guides the air flowing to the main heating unit.

13. The clothes dryer according to claim 11, wherein the air path is configured so that the air guided to the preheating unit is reversed and guided to the main heating unit.

14. The clothes dryer according to claim 13, wherein the air path includes a body of the main heating unit having a pipe form, and the preheating unit having a pipe form surrounding the main heating unit.

15. The clothes dryer according to claim 14, wherein ends of the body of the main heating unit are opened, one end of the preheating unit being closed while another end of the preheating unit being opened to form an entrance for an airflow, and the air is guided in through the entrance of the preheating unit, reversed by the blocked end, and then guided into the main heating unit.

16. The clothes dryer according to claim 11, wherein the preheating unit comprises a preheating fin formed on an outside of the main heating unit so that the heat of the main heating unit is transmitted to the preheating unit.

17. A clothes dryer including a hot air duct that supplies hot air, wherein the hot air duct comprises a heating unit to heat air drawn therein, and

the heating unit comprises a first heating unit directly heating the air flowing therein, and a second heating unit disposed adjacent to the first heating unit, thereby forming an air path guiding air in the opposite direction to the air flowing in the first heating unit, the second heating unit indirectly heating the air flowing into the first heating unit using the heat of the first heating unit.

18. The clothes dryer according to claim 17, wherein the first heating unit comprises one or more preheating fins formed on outer walls thereof to contact the air flowing in the second heating unit.

19. A clothes dryer comprising:
a main body;
a heating unit heating drawn air;
a hot air supply unit connected to an end of the heating unit,
thereby forming a path for the heated air;
a drying tub connected to the hot air supply unit and structured to receive an object to be dried;
a ventilation device circulating the air; and
an exhaust duct guiding the air exhausted from the drying tub to the outside of the main body,

wherein the heating unit comprises a first heating unit connected to the hot air supply unit and equipped with a heater part that generates heat therein, and a second heating unit forming an air path in which air flows in contact with outer walls of the first heating unit and guiding the air to the first heating unit.

20. The clothes dryer according to claim **19**, wherein the second heating unit comprises a preheating fin formed on the outer walls of the first heating unit to enhance heating of the air flowing in the second heating unit.

* * * * *