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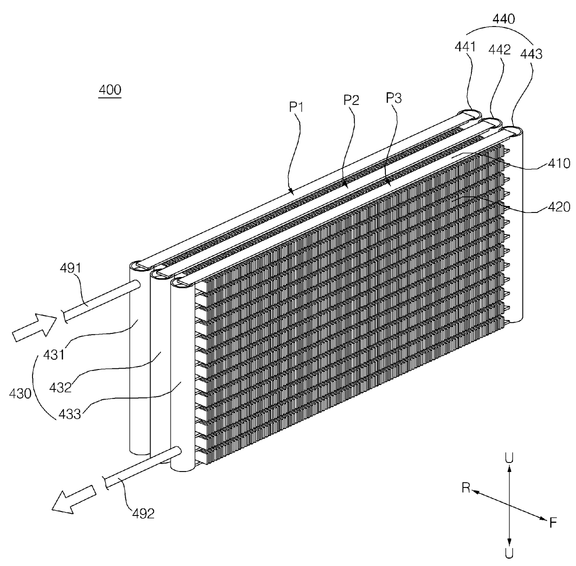
(54) **HEAT EXCHANGER AND CLOTHING PROCESSING EQUIPMENT HAVING THE SAME**

(57) A heat exchanger and a clothing processing equipment according to the present disclosure includes first to third heat exchangers, and the refrigerant discharged from the first heat exchanger is supplied to the lower portion of the second heat exchanger, the refrigerant heat-exchanged in the second heat exchanger is discharged to the upper portion of the second heat exchanger, the refrigerant discharged from the second heat exchanger is supplied to the upper portion of the third heat exchanger, and the refrigerant heat-exchanged in the third heat exchanger is discharged to the lower portion of the third heat exchanger.

Fig. 5



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Description

TECHNICAL FIELD

[0001] This disclosure relates to a heat exchanger which can prevent compressor oil accumulation, thereby securing compressor reliability and performance, further securing heat exchange performance, increasing heat exchange amount, and sufficiently securing supercooling, and a clothing processing equipment including the same.

BACKGROUND

[0002] In general, a heat exchanger can be used as a condenser or evaporator in a refrigeration cycle device consisting of a compressor, a condenser, an expansion device, and an evaporator.

[0003] In addition, a heat exchanger is installed in vehicles, refrigerators, and clothing processing equipments to exchange heat between refrigerant and air.

[0004] In general, a clothing processing equipment is a device that evaporates moisture contained in laundry by blowing hot air generated by a heater into the inside of a drum to dry laundry.

[0005] Depending on a method of processing the moist air that passed through a drum after drying a laundry, a clothing processing equipment can be classified into an exhaust type clothing processing equipment and a condensation type clothing processing equipment.

[0006] The exhaust type clothing processing equipment exhausts the humid air passed through a drum to the outside of the clothing processing equipment. The condensation type clothing processing equipment does not exhaust the humid air passed through a drum to the outside of the clothing processing equipment, but circulates it, and cools the humid air to below a dew point temperature through a condenser to condense the moisture contained in the humid air.

[0007] The condensation type clothing processing equipment heats the condensed water condensed in the condenser by a heater before resupplying it to a drum, and then flows the heated air into the drum. Here, the humid air is cooled during the condensation process, so that a loss of thermal energy contained in the air occurs, and a separate heater, etc., is required to heat it to the temperature required for drying.

[0008] The exhaust-type clothing processing equipment also needs to discharge a high-temperature humid air to the outside and bring in a room temperature outside air to heat it to a required temperature level through a heater or the like. In particular, as drying progresses, the humidity of the air discharged from a drum outlet decreases, thereby losing the heat of the air that is discharged to the outside without being used to dry a drying target in a drum, so that the thermal efficiency is reduced.

[0009] Therefore, recently, a clothing processing equipment having a heat pump cycle that can increase energy efficiency by recovering the energy discharged from a drum and using it to heat the air flowing into the drum has been introduced.

[0010] The condensation type clothing processing equipment of Patent Document 1 (Korean Publication No. 2016-0069333) includes a drum 1 into which a drying target flows, a circulation duct 2 providing a path for air to circulate through the drum 1, a circulation fan 3 for flowing a circulating air along the circulation duct 2, and a heat pump cycle 4 equipped with an evaporator 5 and a condenser 6 that are installed in series in the circulation duct 2 so that the air circulating along the circulation duct 2 passes through.

[0011] The heat pump cycle 4 may be equipped with a circulation pipe forming a circulation path for refrigerant to circulate through the evaporator 5 and the condenser 6, and a compressor 7 and an expansion valve 8 that are installed in the circulation pipe between the evaporator 5 and the condenser 6.

[0012] The heat pump cycle 4, configured as described above, transmits the heat energy of the air passed through the drum 1 to the refrigerant through the evaporator 5, and then transmits the heat energy of the refrigerant to the air flowing into the drum 1 through the condenser 6.

[0013] Here, both the evaporator and the condenser use a general heat exchanger, but since the air flowing through the circulation duct contains fiber lint, if the lint gets caught in a louver of the heat exchanger, the flow resistance of the air flowing through the circulation duct increases, and the heat exchange efficiency decreases.

[0014] If a multi-row microchannel heat exchanger is used to improve the heat exchange efficiency of a clothing processing equipment, when the oil at the lower end of the vertical header sinks downward due to a density difference and accumulates, there is a problem in that the refrigerant is not evenly distributed for each tube but only flows upward.

[0015] Unlike the refrigerant, the oil exists in a liquid state. Accordingly, there is a problem in that the latent heat cannot be utilized, the heat transfer area is reduced, and the heat amount is reduced.

[0016] In the case of Patent Document 2 (Korean Publication No. 2018-0040330), a header 20 on both sides, a plurality of tubes 30 connected to the header, and a plurality of fins 4 connecting the tubes are disclosed.

[0017] In the case of Patent Document 2 (Korean Publication No. 2018-0040330), a microchannel heat exchanger is disclosed, but if it is configured in a multi-row, there is a problem in that oil accumulates at the lower end of the header, thereby reducing the heat exchange efficiency.

SUMMARY

[0018] The disclosure has been made in view of the above problems, and may provide a heat exchanger that improves heat exchange efficiency by using a microchannel type heat exchanger as a condenser of clothing processing equipment, and improves heat exchange performance by preventing accumulation of droplets in a header of microchannel heat exchanger, and a clothing processing equipment including the same.

[0019] The disclosure may further provide a heat exchanger that uses a multi-row microchannel type heat exchanger as a condenser of clothing processing equipment, and allows refrigerant to be supercooled in the last row, and a clothing processing equipment including the same.

[0020] The disclosure may further provide a heat exchanger that uses a multi-row microchannel type heat exchanger as a condenser of clothing processing equipment, and facilitates connection of a compressor and an expansion valve with refrigerant piping in a machine room through a plurality of path structures, and optimizes space utilization, and a clothing processing equipment including the same.

[0021] The disclosure may further provide a clothing processing equipment that adjusts a distance between an evaporator and a condenser in an air path of a machine room to an optimal distance, thereby preventing condensed water generated in the evaporator from splashing onto the evaporator, thereby lowering a heat exchange efficiency of the evaporator and lowering the efficiency of the clothing processing equipment.

[0022] The disclosure may further provide a clothing processing equipment having improved heat exchange performance by configuring a heat exchanger using microchannels as a multi-row condenser.

[0023] The problems of the present disclosure are not limited to the problems mentioned above, and other problems that are not mentioned can be clearly understood by those skilled in the art from the description below.

[0024] A heat exchanger and a clothing processing equipment according to the present disclosure includes first to third heat exchangers, and the refrigerant discharged from the first heat exchanger is supplied to the lower portion of the second heat exchanger, the refrigerant heat-exchanged in the second heat exchanger is discharged to the upper portion of the second heat exchanger, the refrigerant discharged from the second heat exchanger is supplied to the upper portion of the third heat exchanger, and the refrigerant heat-exchanged in the third heat exchanger is discharged to the lower portion of the third heat exchanger.

[0025] In detail, the present disclosure includes a first heat exchanger including a plurality of refrigerant tubes through which refrigerant flows, and which extends in a first direction, a pair of headers which are connected to both ends of the plurality of refrigerant tubes and extend in a second direction, and a fin which conducts heat of the plurality of refrigerant tubes; a second heat exchanger which includes a plurality of refrigerant tubes through which refrigerant flows, and which extends in the first direction, a pair of headers which are connected to both ends of the plurality of refrigerant tubes and extend in the second direction, and a fin which conducts heat of the plurality of refrigerant tubes, and through which refrigerant discharged from the first heat exchanger flows; and a third heat exchanger which includes a plurality of refrigerant tubes through which refrigerant flows, and which extends in the first direction, a pair of headers which are connected to both ends of the plurality of refrigerant tubes and extend in the second direction, and a fin which conducts heat of the plurality of refrigerant tubes, and through which refrigerant discharged from the second heat exchanger flows, in which the refrigerant discharged from the first heat exchanger is supplied to a lower portion of the second heat exchanger, refrigerant heat-exchanged in the second heat exchanger is discharged to an upper portion of the second heat exchanger, the refrigerant discharged from the second heat exchanger is supplied to an upper portion of the third heat exchanger, and refrigerant heat-exchanged in the third heat exchanger is discharged to a lower portion of the third heat exchanger.

[0026] In addition, the present disclosure further includes: an inlet pipe for supplying refrigerant to the first heat exchanger; and an outlet pipe through which the refrigerant of the third heat exchanger is discharged.

[0027] The inlet pipe is connected to a header of the first heat exchanger, and the outlet pipe is connected to a header of the third heat exchanger which is located to overlap the header of the first heat exchanger to which the inlet pipe is connected in a third direction.

[0028] The inlet pipe is located higher than the outlet pipe.

[0029] A first connection pipe through which the refrigerant discharged from the first heat exchanger flows into the second heat exchanger is located lower than the inlet pipe.

[0030] A second connection pipe through which the refrigerant heat-exchanged in the second heat exchanger is discharged is located higher than the outlet pipe.

[0031] A second connection pipe through which the refrigerant heat-exchanged in the second heat exchanger is discharged is located higher than the first connection pipe.

[0032] The first connection pipe is connected to any one header of the second heat exchanger, and the second connection pipe is connected to the other header of the second heat exchanger.

[0033] The second connection pipe and the outlet pipe are located in the same header of the third heat exchanger.

[0034] The third heat exchanger is located upstream in an air flow direction than the second heat exchanger, and the second heat exchanger is located upstream in an air flow direction than the first heat exchanger.

[0035] The first heat exchanger, the second heat exchanger, and the third heat exchanger are located to overlap with each other in an air flow direction.

[0036] The second heat exchanger includes: a second-first path which allows the refrigerant discharged from the first heat exchanger to flow in the first direction; a second-second path which is located above the second-first path, and allows the refrigerant discharged from the second-first path to flow in a direction opposite to the first direction; and a second-third path which is located above the second-second path, and allows the refrigerant discharged from the second-second path to flow in the first direction.

[0037] The third heat exchanger includes: a third-first path which allows the refrigerant discharged from the second heat exchanger to flow in the first direction; a third-second path which is located below the third-first path, and allows refrigerant discharged from the third-first path to flow in a direction opposite to the first direction; a third-third path which is located below the third-second path, and allows refrigerant discharged from the third-second path to flow in the first direction; and a third-fourth path which is located below the third-third path, and allows refrigerant discharged from the third-third path to flow in a direction opposite to the first direction.

[0038] In addition, the present disclosure includes a plurality of heat exchangers including a plurality of refrigerant tubes through which refrigerant flows, and which extends in a first direction, a pair of headers which are connected to both ends of the plurality of refrigerant tubes and extend in a second direction, and a fin which conducts heat of the plurality of refrigerant tubes, in which the plurality of heat exchangers are N heat exchangers that are arranged in a plurality of rows in a third direction intersecting with the first direction and the second direction, and refrigerant flows in the order of a first heat exchanger to Nth heat exchanger, refrigerant flowing in N-1th heat exchanger flows from a bottom to a top, and the refrigerant flowing in the Nth heat exchanger flows from a top to a bottom.

[0039] The heat exchanger further includes: an inlet pipe for supplying refrigerant to the first heat exchanger; and an outlet pipe for discharging refrigerant from the Nth heat exchanger.

[0040] The inlet pipe is connected to a header of the first heat exchanger, and the outlet pipe is connected to a header of the Nth heat exchanger which is located to overlap with the header of the first heat exchanger to which the inlet pipe is connected in the third direction.

[0041] The inlet pipe is located higher than the outlet pipe.

[0042] Refrigerant discharged from N-2th heat exchanger is supplied to a lower portion of N-1th heat exchanger, refrigerant heat-exchanged in the N-1th heat exchanger is discharged to an upper portion of the N-1th heat exchanger, refrigerant discharged from the N-1th heat exchanger is supplied to an upper portion of the Nth heat exchanger, and refrigerant heat-exchanged in the Nth heat exchanger is discharged to a lower portion of the Nth heat exchanger.

[0043] The Nth heat exchanger is located upstream in an air flow direction than the N-1th heat exchanger.

[0044] In addition, the present disclosure includes a heat pump which has an evaporator, a compressor, a condenser, and an expansion valve, and applies heat to air circulating through a drum; and an air flow path forming a movement path so that the air is circulated through the drum, in which the condenser includes a plurality of heat exchangers including a plurality of refrigerant tubes through which refrigerant flows, and which extends in a first direction, a pair of headers which are connected to both ends of the plurality of refrigerant tubes and extend in a second direction, and a fin which conducts heat of the plurality of refrigerant tubes, in which the plurality of heat exchangers are N heat exchangers which are arranged in a plurality of rows in a third direction intersecting with the first direction and the second direction, and refrigerant flows in the order of a first heat exchanger to Nth heat exchanger, refrigerant flowing in N-1th heat exchanger flows from a bottom to a top, and the refrigerant flowing in the Nth heat exchanger flows from a top to a bottom.

BRIEF DESCRIPTION OF THE DRAWINGS

[0045] The above and other objects, features and advantages of the present invention will be more apparent from the following detailed description in conjunction with the accompanying drawings, in which:

FIG. 1 is a schematic diagram showing the flow of air and refrigerant in a clothing processing equipment according to an embodiment of the present disclosure;

FIG. 2 is a schematic diagram showing a configuration of a clothing processing equipment according to an embodiment of the present disclosure;

FIG. 3 is a diagram showing a machine room and an air flow path section of a clothing processing equipment according to an embodiment of the present disclosure;

FIG. 4 is a diagram showing an evaporator and a condenser shown in FIG. 3;

FIG. 5 is a perspective view showing the condenser shown in FIG. 3;

FIG. 6 is a plan view showing the condenser shown in FIG. 3;

FIG. 7A is a diagram for explaining a path of the condenser shown in FIG. 3;

FIG. 7B is a diagram showing a second heat exchanger shown in FIG. 7A;

FIG. 7C is a diagram showing a third heat exchanger shown in FIG. 7A;

FIG. 8 is a longitudinal cross-sectional view of a first heat exchanger of the condenser shown in FIG. 4;

FIG. 9 is a cross-sectional view of the first heat exchanger shown in FIG. 8;

FIG. 10 is a perspective view showing the evaporator shown in FIG. 3; and

FIG. 11 is a diagram showing a condenser according to an embodiment of the present disclosure.

DETAILED DESCRIPTION

[0046] Advantages and features of the present invention and methods for achieving those of the present invention will become apparent upon referring to embodiments described later in detail with reference to the attached drawings. However, embodiments are not limited to the embodiments disclosed hereinafter and may be embodied in different ways. The embodiments are provided for perfection of disclosure and for informing persons skilled in this field of art of the scope of the present invention. The same reference numerals may refer to the same elements throughout the specification.

[0047] Spatially-relative terms such as "below", "beneath", "lower", "above", or "upper" may be used herein to describe one element's relationship to another element as illustrated in the Figures. It will be understood that spatially-relative terms are intended to encompass different orientations of the device in addition to the orientation depicted in the Figures. For example, if the device in one of the figures is turned over, elements described as "below" or "beneath" other elements would then be oriented "above" the other elements. The exemplary terms "below" or "beneath" can, therefore, encompass both an orientation of above and below. Since the device may be oriented in another direction, the spatially-relative terms may be interpreted in accordance with the orientation of the device.

[0048] The terminology used in the present disclosure is for the purpose of describing particular embodiments only and is not intended to limit the disclosure. As used in the disclosure and the appended claims, the singular forms "a", "an" and "the" are intended to include the plural forms as well, unless context clearly indicates otherwise. It will be further understood that the terms "comprises" and/or "comprising," when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof.

[0049] Unless otherwise defined, all terms including technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art. It will be further understood that terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and the present disclosure, and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

[0050] In the drawings, the thickness or size of each layer is exaggerated, omitted, or schematically illustrated for convenience of description and clarity. Also, the size or area of each constituent element does not entirely reflect the actual size thereof.

[0051] Hereinafter, exemplary embodiments of the present invention will be described with reference to the accompanying drawings.

[0052] FIG. 1 is a schematic diagram showing the flow of air and refrigerant in a clothing processing equipment according to an embodiment of the present disclosure, and FIG. 2 is a schematic diagram showing a configuration of a clothing processing equipment according to an embodiment of the present disclosure.

[0053] Referring to FIG. 1 and FIG. 2, a clothing processing equipment 100 according to the present disclosure is an example of a drum-type dryer, and may be configured to include a cabinet 110, a drum 130, a driving unit (not shown), a blower fan 170, and a heat pump 160, and the air of the drum 130 is connected to the heat pump 160 by an air path 150.

[0054] Here, the cabinet 110 may include a door 112 provided on a front side to insert clothing while forming an outer shape of a product, and a base 114 on which an internal configuration of the clothing processing equipment 100 is installed.

[0055] Meanwhile, the drum 130 may rotate around a rotation axis that is arranged horizontally or inclined at a certain angle inside the cabinet. Meanwhile, the drum 130 has a hollow cylindrical shape, and provides an accommodation space for drying clothing, which are drying target, by putting the clothing into the space.

[0056] The drum 130 is formed in a cylindrical shape having front and rear sides that are open. The drum 130 has a front support portion 132 that rotatably supports the drum 130 at a front side. In addition, the drum 130 has a rear support portion 133 that rotatably supports the drum 130 at a rear side.

[0057] In addition, a front roller 142 and a rear roller 143 in the form of roller that rotatably support the drum 130 may be additionally provided at the front and rear lower portions of the drum 130. That is, the front support portion 132 and the rear support portion 133 block the front and rear surfaces of the drum 130 to form a drying space for drying target, and at the same time, serve to support the front and rear ends of the drum 130.

[0058] Meanwhile, an inlet 132b for inserting the drying target into the drum 130 is formed in the front support portion 132, and the inlet is selectively opened and closed by the door 112. In addition, an air discharge port 132a to which an air path 150 described later is connected is located at the lower portion of the front support portion 132. A suction path 151 of air path 150 described later is provided in the air discharge port 132a to communicate.

[0059] In addition, an air inlet 133a formed with a plurality of holes is formed in the rear support portion 133 so that air is supplied to the drum 130. The air inlet 133a is provided so that an exhaust path 152 of the air path 150 described later is communicated.

[0060] Here, in order to efficiently dry the clothing, which are the objects to be dried, a lifter 131a for tumbling the clothing that is put in may be further provided on the inner surface of the drum 130.

[0061] In addition, a driving unit provides rotational power by using a motor (not shown), and the output shaft of the motor and the drum 130 are connected by a power transmission means such as a belt, and the rotational power of the motor is transmitted to the drum 130, thereby rotating the drum 130.

[0062] In addition, the air path 150 may be connected to the drum 130 to form a closed loop for air circulation. For example, the air path 150 may be formed in the form of duct. The suction path 151 for air discharge is formed at the lower portion of the front support portion 132 of the drum 130, and the exhaust path 152 for air supply is formed at the rear support portion 133 of the drum 130.

[0063] Meanwhile, the blower fan 170 may be installed inside the air path 150 extending from the suction path 151 to an evaporator 300 of the heat pump 160, or installed inside the air path 150 extending from the condenser 400 of the heat pump 160 to the exhaust path 152.

[0064] Here, the blower fan 170 may be driven by a separate fan motor, and may apply power to the air to path it through the inside of the drum 130, and may circulate the air discharged from the drum 130 back into the drum 130.

[0065] In addition, a lint filter 162 (see FIG. 3) for filtering a lint in the circulating air is installed in the suction path 151. The lint filter 162 may capture the lint contained in the air as the air sucked from the drum 130 passes through the suction path 151.

[0066] Therefore, the clothing (also called 'cloth') evaporates moisture by a hot air supplied into the drum 130, and the air passing through the drum 130 is discharged from the drum 130 while containing the moisture evaporated from the clothing. The high-temperature and humid air discharged from the drum 130 moves along the air path 150, receives heat from the heat pump 160 to be heated, and then is circulated to the drum 130.

[0067] Meanwhile, the heat pump 160 is configured to include an evaporator 300, a compressor 163, a condenser 400, and an expansion valve 164. The heat pump 160 may use a refrigerant as a working fluid. The refrigerant moves along a refrigerant pipe 165, and the refrigerant pipe 165 forms a closed loop for the circulation of the refrigerant. The evaporator 300, the compressor 163, the condenser 400, and the expansion valve 164 are connected by the refrigerant pipe 165, so that the refrigerant passes through the evaporator 300, the compressor 163, the condenser 400, and the expansion valve 164 in sequence.

[0068] Here, the evaporator 300 is installed in the air path 150 so as to be connected to a drum outlet, and heat-exchanges the air discharged from the drum outlet with the refrigerant, thereby recovering the heat of the air discharged from the drum 130 without discharging it to the outside of a dryer.

[0069] In addition, the condenser 400 is installed in the air path 150 so as to be connected to a drum inlet, and heat-exchanges the air passing through the evaporator 300 with the refrigerant, thereby dissipating the heat of the refrigerant absorbed in the evaporator 300 to the air to be flowed into the drum 130.

[0070] The compressor 163 compresses the refrigerant evaporated in the evaporator 300 to create a high-temperature, high-pressure refrigerant, and moves the high-temperature, high-pressure refrigerant to the condenser 400 along the refrigerant pipe 165. The compressor 163 may be an inverter-type compressor 163 capable of varying a frequency to control the discharge amount of the refrigerant.

[0071] The expansion valve 164 is installed in the refrigerant pipe 165 extending from the condenser 400 to the evaporator 300, and expands the refrigerant condensed in the condenser 400 to make a low-temperature, low-pressure refrigerant and transmits it to the evaporator 300.

[0072] Looking at the movement path of the refrigerant according to a configuration, the refrigerant is flowed into the compressor 163 in a gaseous state and becomes high-temperature, high-pressure by compression of the compressor 163, and the high-temperature, high-pressure refrigerant is flowed into the condenser 400 and changed from a gaseous state to a liquid state as the condenser 400 dissipates heat to the air.

[0073] Next, the liquid refrigerant flows into the expansion valve 164 and is changed into low-temperature, low-pressure by a wire drawing effect of the expansion valve 164 (or including a capillary tube, etc.), and the low-temperature, low-pressure liquid refrigerant flows into the evaporator 300 and absorbs heat from the air in the evaporator 300, thereby evaporating the refrigerant from the liquid state into the gas state.

[0074] As described above, the heat pump 160 repeatedly circulates the refrigerant in the order of the compressor 163, the condenser 400, the expansion valve 164, and the evaporator 300, and provides a heat source to the air circulated to the drum 130.

[0075] Meanwhile, the clothing processing equipment 100 according to the present disclosure can supply pressurized air into the inside of the drum 130 separately from the circulation supply of heated air by the heat pump 160, thereby shocking the drying target inside the drum 130 and changing the movement path of the heated air inside the drum 130 simultaneously.

[0076] That is, in the case of the drying target loaded into the drum 130, various types of moisture may be contained according to the material of the drying target, and by supplying pressurized air, relatively large moisture contained in the drying target may be removed from the drying target, or broken down into relatively small-sized moisture, thereby allowing faster drying of the moisture by the heated air.

[0077] In addition, in the case of the heated air supplied to the drum 130, while moving from the air inlet 133a at the rear of the drum 130 to the air outlet 132a at the front of the drum 130, it dries the drying target inside the drum 130, passes through the air path 150 and circulates the drum 130 and the heat pump 160. In the case of the movement path of such heated air, the drying degree of the drying target may be improved as the heated air is in contact with the drying target over a large area and for a long time. Here, in the case of pressurized air supplied separately from the heated air, it is supplied at a higher pressure than the heated air through a different location and different path from the heated air, thereby impacting the drying target and changing the path along which the heated air moves inside the drum 130, so that the heated air can dry moisture faster.

[0078] Meanwhile, in order to supply pressurized air into the inside of the drum 130, there may be provided a pressurized air generator 200 that generates pressurized air and a pressurized air nozzle 300 that sprays the pressurized air generated from the pressurized air generator 200 into the inside of the drum 130.

[0079] Hereinafter, the arrangement of the evaporator 300 and the condenser 400 will be described in detail.

[0080] FIG. 3 is a diagram showing a machine room and an air flow path section of a clothing processing equipment according to an embodiment of the present disclosure, and FIG. 4 is a diagram showing the evaporator 300 and the condenser 400 shown in FIG. 3.

[0081] Referring to FIGS. 3 and 4, the evaporator 300 and the condenser 400 may be installed inside the air flow path 150. The evaporator 300 may be connected to the drum outlet, and the condenser 400 may be connected to the drum inlet.

[0082] Meanwhile, the present disclosure may include a machine room 161 in which a compressor 163, an expansion valve, and a refrigerant pipe 165 are located. The machine room 161 may be arranged next to the air flow path 150. Since the high temperature and humidity air discharged from the drum 130 has a higher temperature than the refrigerant of the evaporator 300, as it passes through the evaporator 300, the heat of the air is absorbed by the refrigerant of the evaporator 300, thereby being condensed and generating condensed water. Accordingly, the moisture of the high temperature-humidity air is removed by the evaporator 300, and the condensed water can be collected into a separate condensed water tank (not shown) and drained.

[0083] Meanwhile, the heat source of the air absorbed in the evaporator 300 is moved to the condenser 400 via the refrigerant, and the compressor 163 may be located between the evaporator 300 and the condenser 400 to move the heat source from the evaporator 300 (low heat source portion) to the condenser 400 (high heat source portion).

[0084] Meanwhile, the evaporator 300 may be a fin & tube type heat exchanger. The fin & tube type is a type in which a plurality of flat fins are attached to a hollow tube, and the refrigerant flows along the inside of the tube, and the air can exchange heat with the refrigerant as it passes between the plurality of fins attached to the tube. Here, the fin is used to expand the heat exchange area between the air and the refrigerant.

[0085] For example, the evaporator 300 may include a plurality of evaporation refrigerant tubes 310 through which refrigerant flows, and an evaporation fin 320 that conducts heat of the evaporation refrigerant. The evaporator 300 may include an evaporation inlet pipe 391 that supplies refrigerant to the evaporation refrigerant tube 310, and an evaporation outlet pipe 392 through which refrigerant is discharged from the evaporation refrigerant tube 310.

[0086] The evaporation inlet pipe 391 is connected to the expansion valve 164 and the evaporation refrigerant tube 310, and the evaporation outlet pipe 392 is connected to the compressor 163 and the evaporation refrigerant tube 310. The detailed structure of the evaporator 300 is described later in FIG. 10.

[0087] The condenser 400 may include a microchannel type heat exchanger. The condenser 400 includes a condensation refrigerant tube 410 including a plurality of channels 410a through which refrigerant flows, and a condensation fin 420 for conducting heat of the condensation refrigerant tube 410.

[0088] The condenser 400 may include a condensation inlet pipe 491 for supplying refrigerant to the condensation refrigerant tube 410, and a condensation outlet pipe 492 for discharging refrigerant from the condensation refrigerant tube 410. The condensation inlet pipe 491 is connected to the compressor 163 and the condensation refrigerant tube 410, and the condensation outlet pipe 492 is connected to the expansion valve 164 and the condensation refrigerant tube 410. The condensation inlet pipe 491 can be used interchangeably as an inlet pipe, and the condensation outlet pipe 492 can be used interchangeably as an outlet pipe. The detailed structure of the condenser 400 is described later in FIGS. 5 to 9.

[0089] If a micro-channel type heat exchanger is used for the condenser 400, the temperature of the air passing through the condenser 400 can be increased more than when a fin tube heat exchanger is used, and the air can be heated to a target temperature in a much shorter heat exchange time. Therefore, if a micro-channel type heat exchanger is used for the condenser 400, the drying efficiency of the clothing processing equipment can be improved.

[0090] Here, the cross-sectional area of each channel 410a of the refrigerant tube of the condenser 400 is smaller than the cross-sectional area of the refrigerant tube of the evaporator 300. In the case of the evaporator

300, a fin tube heat exchanger is used rather than a micro-channel heat exchanger because a large amount of heat exchange is not required.

[0091] The air flowing in the air flow path 150 exchanges heat with the evaporator 300 and then flows into the condenser 400. At this time, if the evaporator 300 and the condenser 400 are disposed too close together, the condensed water generated in the evaporator 300 flows into the condenser 400, thereby reducing the heat exchange efficiency of the condenser 400.

[0092] In order to prevent the condensed water generated in the evaporator 300 from flowing into the condenser 400, the separation distance D1 between the evaporator 300 and the condenser 400 may be larger than the width W1 of the air flow direction of the evaporator 300.

[0093] The width W1 of the airflow direction of the evaporator 300 may be larger than the width W2 of the airflow direction of the condenser 400. The height H1 of the evaporator 300 may be smaller than the height H2 of the condenser 400.

[0094] Preferably, the separation distance D1 of the condenser 400 may be larger than the sum of the width W1 of the airflow direction of the evaporator 300 and the width W2 of the airflow direction of the condenser 400. More preferably, the separation distance D1 of the condenser 400 may be 100 mm to 250 mm.

[0095] If the separation distance D1 of the condenser 400 is larger than the sum of the width W1 of the air flow direction of the evaporator 300 and the width W2 of the air flow direction of the condenser 400, the condensed water generated in the evaporator 300 by the air flow falls into a space between the condenser 400 and the evaporator 300.

[0096] The condensation inlet pipe 491 and the condensation outlet pipe 492 may be located in the same direction with respect to the condensation refrigerant tube 410. Specifically, the condensation inlet pipe 491 and the condensation outlet pipe 492 may extend from the condensation refrigerant tube 410 toward the machine room.

[0097] More specifically, if the air flow direction is defined as a forward-rearward direction FR, the condensation inlet pipe 491 and the condensation outlet pipe 492 extend to the right from the condensation refrigerant tube 410.

[0098] If the condensation inlet pipe 491 and the condensation outlet pipe 492 are located in the same direction with respect to the condensation refrigerant tube 410, a space for arranging the refrigerant pipe can be reduced, the length of the refrigerant pipe can be reduced, and a sufficient space for the air flow path 150 can be secured.

[0099] An evaporation inlet pipe 391 and an evaporation outlet pipe 392 can be located in the same direction with respect to an evaporation refrigerant tube 310. Specifically, the evaporation inlet pipe 391 and the evaporation outlet pipe 392 can be extended from the evaporation refrigerant tube 310 toward the machine room.

[0100] More specifically, the evaporation inlet pipe 391 and the evaporation outlet pipe 392 are extended to the right from the evaporation refrigerant tube 310.

[0101] If the evaporation inlet pipe 391 and the evaporation outlet pipe 392 are located in the same direction with respect to the evaporation refrigerant tube 310, a space for arranging the refrigerant pipe can be reduced, the length of the refrigerant pipe can be reduced, and sufficient space for the air path 150 can be secured.

[0102] Preferably, the evaporation inlet pipe 391, the evaporation outlet pipe 392, the condensation inlet pipe 491, and the condensation outlet pipe 492 can extend in the same direction from the air path 150. The evaporation inlet pipe 391, the evaporation outlet pipe 392, the condensation inlet pipe 491, and the condensation outlet pipe 492 extend in the right direction from the air path 150.

[0103] Hereinafter, the structure of the condenser 400 will be described in detail. The condenser 400 includes a heat exchanger of the present disclosure. Hereinafter, the description of the condenser is the same as the description of the heat exchanger.

[0104] FIG. 5 is a perspective view showing the condenser 400 shown in FIG. 3, FIG. 6 is a plan view showing the condenser 400 shown in FIG. 3, FIG. 7A is a diagram for explaining a path of the condenser shown in FIG. 3, FIG. 7B is a diagram showing a second heat exchanger shown in FIG. 7A, and FIG. 7C is a diagram showing a third heat exchanger shown in FIG. 7A.

[0105] Referring to FIGS. 5 to 7, the condenser 400 is a microchannel type heat exchanger. The condenser 400 is made of aluminum material.

[0106] The condenser 400 may include a first heat exchanger P1, a second heat exchanger P2, and a third heat exchanger P3. Unlike the present embodiment, the condenser 400 may have three or more heat exchangers that are stacked.

[0107] The first heat exchanger P1, the second heat exchanger P2, and the third heat exchanger P3 can be arranged along the forward-rearward direction which is the air flow direction. The first heat exchanger P1, the second heat exchanger P2, and the third heat exchanger P3 can be arranged to overlap with each other in one direction.

[0108] The condenser 400 includes a first heat exchanger P1, a second heat exchanger P2 located to overlap with the first heat exchanger P1 in the forward-rearward direction, a third heat exchanger P3 located to overlap the second heat exchanger P2 in the forward-rearward direction, a condensation inlet pipe 491 connected to the first heat exchanger P1 to supply refrigerant, a condensation outlet pipe 492 connected to the third heat exchanger P3 to discharge refrigerant, a first connection pipe 493 that connects the first heat exchanger P1 and the second heat exchanger P2, and allows the refrigerant to flow from the first heat exchanger P1 to the second heat exchanger P2, and a second connection pipe 494 that connects the second heat exchanger P2 and the third heat exchanger P3, and allows the refrigerant to flow from the second heat exchanger P2 to the third heat exchanger P3.

[0109] The first heat exchanger P1 is arranged to exchange heat with air that has been heat-exchanged with the second heat exchanger P2, and the second heat exchanger P2 is arranged to exchange heat with air that has been heat-exchanged with the third heat exchanger P3. That is, air that has been heat-exchanged in the third heat exchanger P3 is heat-exchanged in the second heat exchanger P2, and then heat-exchanged in the first heat exchanger P1.

[0110] Specifically, the first heat exchanger P1, the second heat exchanger P2, and the third heat exchanger P3 are arranged on a path through which external air flows, and the external air is firstly heat-exchanged with the third heat exchanger P3, secondly heat-exchanged with the second heat exchanger P2, and thirdly heat-exchanged with the first heat exchanger P1.

[0111] More specifically, the refrigerant discharged from the first heat exchanger P1 is supplied to the lower portion of the second heat exchanger P2, the refrigerant heat-exchanged in the second heat exchanger P2 is discharged to the upper portion of the second heat exchanger P2, the refrigerant discharged from the second heat exchanger P2 is supplied to the upper portion of the third heat exchanger P3, and the refrigerant heat-exchanged in the third heat exchanger P3 is discharged to the lower portion of the third heat exchanger P3.

[0112] The refrigerant discharged from the first heat exchanger P1 is supplied to the lower portion of the second heat exchanger P2, the refrigerant heat-exchanged in the second heat exchanger P2 is discharged to the upper portion of the second heat exchanger P2, the refrigerant discharged from the second heat exchanger P2 is supplied to the upper portion of the third heat exchanger P3, and the refrigerant heat-exchanged in the third heat exchanger P3 is discharged to the lower portion of the third heat exchanger P3, so that the droplets are not accumulated while passing through the second heat exchanger P2 and the third heat exchanger P3, and moves through the heat exchanger together with the refrigerant, and droplet accumulation can be reduced.

[0113] Specifically, when the refrigerant is flowed into the center of the second heat exchanger P2 and the refrigerant is discharged to the center or upper portion of the second heat exchanger P2, the oil is collected at the lower portion by gravity due to the difference in specific gravity between the oil discharged from the compressor and the refrigerant, and the oil collected at the lower portion of the second heat exchanger P2 prevents the refrigerant from being flowed in. Therefore, the refrigerant does not flow through the entire second heat exchanger P2, but only flows through a portion of it, thereby reducing the heat exchange efficiency. The efficiency of the third heat exchanger P3 is also reduced for the same reason as the second heat exchanger P2.

[0114] Accordingly, when the second heat exchanger P2 and the third heat exchanger P3 are configured as in the present disclosure, the oil is prevented from being collected at the lower portion of each heat exchanger, so that the refrigerant flows through the entire heat exchanger, thereby increasing the heat exchange efficiency.

[0115] The third heat exchanger P3 may be located upstream in the air flow direction than the second heat exchanger P2, and the second heat exchanger P2 may be located upstream in the air flow direction than the first heat exchanger P1.

[0116] Specifically, the third heat exchanger P3 may be located closer to the suction path 151 through which air is flowed in than the second heat exchanger P2, and the first heat exchanger P1 may be located closer to the exhaust path 152 through which air is discharged than the second heat exchanger P2.

[0117] Accordingly, the heat exchange efficiency of the condenser 400 is improved, by disposing the first heat exchanger P1 through which high-temperature refrigerant flows in an area where the outside temperature is high, and disposing the third heat exchanger P3 through which low-temperature refrigerant flows in an area where the outside temperature is low.

[0118] The first heat exchanger P1, the second heat exchanger P2, and the third heat exchanger P3 may include a plurality of condensation refrigerant tubes 410 and a condensation fin 420 located between the condensation refrigerant tubes 410 that are adjacent to each other to conduct heat.

[0119] The first heat exchanger P1, the second heat exchanger P2, and the third heat exchanger P3 are manufactured by stacking a plurality of condensation refrigerant tubes 410. Each condensation refrigerant tube 410 extends in a horizontal direction (left-right direction LeRi) so that the refrigerant moves horizontally.

[0120] Specifically, the condensation refrigerant tubes 410 of the first heat exchanger P1, the second heat exchanger P2, and the third heat exchanger P3 are arranged long in a horizontal direction (transverse direction) when the air flow direction is forward-rearward direction, and a plurality of condensation refrigerant tubes 410 can be stacked vertically. As air passes through a space between the plurality of condensation refrigerant tubes 410 stacked in a vertical direction (longitudinal direction), heat is exchanged with the refrigerant in the condensation refrigerant tubes 410. The plurality of condensation refrigerant tubes 410 stacked vertically define a heat exchange surface together with the condensation fin 420 described below.

[0121] The first heat exchanger P1 may include a plurality of refrigerant tubes through which refrigerant flows and extends in a first direction (horizontal direction), a pair of headers which are connected to both ends of the plurality of refrigerant tubes and extend in a second direction (vertical direction), and a fin that conducts heat of the plurality of refrigerant tubes. The refrigerant tube, the pair of headers, and the fin of the first heat exchanger

P1 are defined as a first condensation refrigerant tube 411, a first left header 431, a first right header 441, and a first condensation fin 421.

[0122] The first heat exchanger P1 may include the first condensation refrigerant tube 411, the first left header 431, the first right header 441, and the first condensation fin 421. Specifically, the first heat exchanger P1 includes a plurality of first condensation refrigerant tubes 411 having a plurality of flow paths formed therein, a first condensation fin 421 that connects the first condensation refrigerant tubes 411 to conduct heat, a first left header 431 that is coupled to one side of the plurality of first condensation refrigerant tubes 411 and communicates with one side of the plurality of first condensation refrigerant tubes 411 so that refrigerant flows, and a first right header 441 that is coupled to the other side of the plurality of first condensation refrigerant tubes 411 and communicates with the other side of the plurality of first condensation refrigerant tubes 411 so that refrigerant flows.

[0123] The first condensation refrigerant tube 411 is arranged horizontally, and a plurality of first condensation refrigerant tubes 411 are stacked in the up-down direction. A plurality of channels 410a may be formed inside the first condensation refrigerant tube 411.

[0124] The first condensation fin 421 is formed by being bent in the up-down direction, and conducts heat by connecting two first condensation refrigerant tubes 411 stacked in the up-down direction.

[0125] The inlet pipe may be connected to the header of the first heat exchanger P1. Specifically, the first left header 431 is connected to one side of a plurality of first condensation refrigerant tubes 411. The first left header 431 is arranged to extend in the up-down direction, and is connected to the condensation inlet pipe 491. The inside of the first left header 431 is formed as a single space, so that the refrigerant flowed in through the condensation inlet pipe 491 is distributed and supplied to the plurality of first condensation refrigerant tubes 411.

[0126] The first right header 441 is connected to the other side of the plurality of first condensation refrigerant tubes 411. The first left header 431 is arranged to extend in the up-down direction and is connected to the first connection pipe 493. The inside of the first right header 441 is formed as a single space, so that the refrigerant discharged to the other side of the plurality of first condensation refrigerant tubes 411 is guided to the first connection pipe 493.

[0127] Preferably, the first connection pipe 493 may be connected to the lower end of the first right header 441, and the condensation inlet pipe 491 may be connected to the upper end of the first left header 431.

[0128] One side of the first connection pipe 493 is connected to the first right header 441 of the first heat exchanger P1, and the other side of the first connection pipe 493 is connected to the second right header 442 of the second heat exchanger P2.

[0129] The refrigerant flowed in through the condensation inlet pipe 491 is supplied to each of the first condensation refrigerant tubes 411 through the first left header 431, and the refrigerant passing through the first condensation refrigerant tube 411 is heat-exchanged with air, and supplied to the first connection pipe 493 through the first right header 441. The condensation inlet pipe 491 is connected to the compressor 163(10) and supplies high-temperature and high-pressure refrigerant to the first heat exchanger P1.

[0130] In particular, referring to FIG. 7B, the second heat exchanger P2 includes a plurality of refrigerant tubes through which refrigerant flows, and which extend in a first direction, a pair of headers which are connected to both ends of the plurality of refrigerant tubes and extend in a second direction, and a fin which conducts heat of the plurality of refrigerant tubes. The refrigerant discharged from the first heat exchanger P1 flows in the second heat exchanger P2.

[0131] The refrigerant tube, the pair of headers, and the fin of the second heat exchanger P2 are defined as a second condensation refrigerant tube 412, a second left header 432, a second right header 442, and a second condensation fin 422.

[0132] The second heat exchanger P2 may include the second condensation refrigerant tube 412, the second left header 432, the second right header 442, and the second condensation fin 422. Specifically, the second heat exchanger P2 includes a plurality of second condensation refrigerant tubes 412 having a plurality of flow paths formed therein, a second condensation fin 422 that connects the second condensation refrigerant tube 412 to conduct heat, a second left header 432 that is coupled to one side of the plurality of second condensation refrigerant tubes 412 and communicates with one side of the plurality of second condensation refrigerant tubes 412 so that refrigerant flows, and a second right header 442 that is coupled to the other side of the plurality of second condensation refrigerant tubes 412 and communicates with the other side of the plurality of second condensation refrigerant tubes 412 so that refrigerant flows.

[0133] The second condensation refrigerant tube 412 is arranged horizontally, and a plurality of second condensation refrigerant tubes 412 are stacked in an up-down direction. A plurality of channels 410a may be formed inside the second condensation refrigerant tube 412.

[0134] The second condensation fin 422 is formed by being bent in the up-down direction and conducts heat by connecting two second condensation refrigerant tubes 412 that are stacked in the up-down direction.

[0135] The second right header 442 is connected to the other side of the plurality of second condensation refrigerant tubes 412. The second right header 442 is arranged to be extended in the up-down direction and is connected to the first connection pipe 493. The inside of the second right header 442 is formed as a single space so that the refrigerant flowed in through the condensation inlet pipe 491 can be distributed and supplied to the plurality of second condensation refrigerant tubes 412.

[0136] Preferably, the inside of the second right header 442 is formed as two spaces so that the refrigerant flowed in through the first connection pipe 493 can change direction several times while flowing through the plurality of second condensation refrigerant tubes 412.

[0137] Specifically, the inside of the second right header 442 may include a first baffle 442a that divides the internal space of the second right header 442 into two areas in the up-down direction. The first baffle 442a may be located to be offset from the center of the second right header 442 toward the bottom. The first connection pipe 493 is connected to the lower space of the second right header 442 located below the first baffle 442a. The first connection pipe 493 is connected to the second right header 442 located below the first baffle 442a.

[0138] The second left header 432 is connected to one side of a plurality of second condensation refrigerant tubes 412. The second left header 432 is arranged to be extended in the up-down direction and is connected to the second connection pipe 494. The inside of the second left header 432 is formed as a single space, so that the refrigerant discharged to one side of the plurality of second condensation refrigerant tubes 412 can be guided to the second connection pipe 494.

[0139] Preferably, the inside of the second left header 432 is formed into two spaces, so that the refrigerant flowed in through the second condensation refrigerant tube 412 can change a direction several times while flowing through the plurality of second condensation refrigerant tubes 412.

[0140] Specifically, the inside of the second left header 432 may include a second baffle 442a that divides the internal space of the second left header 432 into two areas in the up-down direction. The second baffle 432a may be located at the center of the second left header 432. The second connection pipe 494 is connected to the upper space of the second left header 432 located above the second baffle 432a.

[0141] The second baffle 432a may be located higher than the first baffle 442a. Therefore, through two baffles, the second heat exchanger P2 may allow the refrigerant flowing in the left-right direction to flow again in the right-left direction, and may allow it to flow again in the left-right direction.

[0142] The second heat exchanger P2 includes a second-first path (P2-1) for allowing the refrigerant discharged from the first heat exchanger P1 to flow in a first direction, a second-second path (P2-2) which is located above the second-first path (P2-1), and allows the refrigerant discharged from the second-first path (P2-1) to flow in the opposite direction to the first direction, and a second-third path (P2-3) which is located above the second-second path (P2-2), and allows the refrigerant discharged from the second-second path (P2-2) to flow in the first direction.

[0143] Here, the term "path" refers to a concept including a portion of a header divided by a condensation refrigerant tube, a condensation fin, and a baffle, and means dividing each heat exchanger in a vertical direction.

[0144] The second-first path (P2-1) allows the refrigerant discharged from the first heat exchanger P1 to flow in a first direction (left to right). The second-first path (P2-1) is a portion of the second heat exchanger P2 from the lower end of the second heat exchanger P2 to the first baffle 442a. The second-first path (P2-1) includes three second condensation refrigerant tubes 412.

[0145] The second-second path (P2-2) is located above the second-first path (P2-1) and allows the refrigerant discharged from the second-first path (P2-1) to flow in the opposite direction (right to left) to the first direction. The second-second path (P2-2) is a partial area of the second heat exchanger P2 from the first baffle 442a to the second baffle 432a of the second heat exchanger P2. The second-second path (P2-2) includes four second condensation refrigerant tubes 412.

[0146] The second-third path (P2-3) is located above the second-second path (P2-2) and allows the refrigerant discharged from the second-second path (P2-2) to flow in the first direction (left to right). The second-third path (P2-3) is a partial area of the second heat exchanger P2 from the second baffle 432a of the second heat exchanger P2 to the upper end of the second heat exchanger P2. The second-third path (P2-3) includes six second condensation refrigerant tubes 412.

[0147] The second-third path (P2-3) has a wider width than the second-second path (P2-2), and the second-second path (P2-2) has a wider width than the second-first path (P2-1). The number of second condensation refrigerant tubes 412 of the second-third path (P2-3) is larger than the number of second condensation refrigerant tubes 412 of the second-second path (P2-2), and the number of second condensation refrigerant tubes 412 of the second-second path (P2-2) is larger than the number of second condensation refrigerant tubes 412 of the second-first path (P2-1).

[0148] Since the second heat exchanger P2 is divided into three passes in the vertical direction, even if the refrigerant flows upward from the lower portion, the height difference between each path is small, so that the accumulation of droplets due to gravity can be prevented.

[0149] The third heat exchanger P3 includes a plurality of refrigerant tubes through which refrigerant flows and which extend in a first direction, a pair of headers which are connected to both ends of the plurality of refrigerant tubes and extend in a second direction, and a fin that conducts heat of the plurality of refrigerant tubes. The third heat exchanger P3 flows the refrigerant discharged from the second heat exchanger P2.

[0150] The refrigerant tube, the pair of headers, and the fin of the third heat exchanger P3 are defined as a third condensation refrigerant tube 413, a third left header 433, a third right header 443, and a third condensation fin 423.

[0151] The third heat exchanger P3 may include the third condensation refrigerant tube 413, the third left header 433, the third right header 443, and the third condensation fin 423.

[0152] Specifically, the third heat exchanger P3 includes a plurality of third condensation refrigerant tubes 413 having a plurality of flow paths formed therein, the third condensation fin 423 that connects the third condensation refrigerant tube 413 to conduct heat, the third left header 433 that is coupled to one side of the plurality of third condensation refrigerant tubes 413 and communicates with one side of the plurality of third condensation refrigerant tubes 413 so that refrigerant flows, and the third right header 443 that is coupled to the other side of the plurality of third condensation refrigerant tubes 413 and communicates with the other side of the plurality of third condensation refrigerant tubes 413 so that refrigerant flows.

[0153] The third condensation refrigerant tube 413 is arranged horizontally, and a plurality of third condensation refrigerant tubes 413 are stacked in the up-down direction. A plurality of channels 410a may be formed inside the third condensation refrigerant tube 413.

[0154] The third condensation fin 423 is formed by being bent in the up-down direction, and conducts heat by connecting two third condensation refrigerant tubes 413 that are stacked in the up-down direction.

[0155] The third left header 433 communicates with one side of a plurality of third condensation refrigerant tubes 413. The third left header 433 is arranged to be extended in the up-down direction, and is connected to the second connection pipe 494 and the condensation outlet pipe 492.

[0156] The outlet pipe may be connected to the header of the third heat exchanger P3 that is located to overlap with the header of the first heat exchanger P1 to which the inlet pipe is connected in the forward-rearward direction. Specifically, the condensation outlet pipe 492 may be arranged in the third left header 433 that is located to overlap with the first left header 491 connected in the forward-rearward direction.

[0157] Preferably, the inside of the third left header 433 may be formed into three spaces, so that the refrigerant flowed in through the second connection pipe 494 may change a direction several times while flowing through the plurality of third condensation refrigerant tubes 413.

[0158] Specifically, the inside of the third left header 433 may include a third baffle 433a and a fourth baffle 433b that divide the internal space of the third left header 433 into three areas vertically. The third baffle 433a may be located higher than the fourth baffle 433b.

[0159] The second connection pipe 494 is connected to the upper space of the third left header 433 located above the third baffle 433a, and the condensation outlet pipe 492 is connected to the lower space of the third left header 433 located below the fourth baffle 433b.

[0160] The second connection pipe 494 is located higher than the condensation outlet pipe 492.

[0161] The condensation inlet pipe 491 may be located higher than the condensation outlet pipe 492. The condensation inlet pipe 491 may be located higher than the first connection pipe 493. The second connection pipe 494 may be arranged higher than the first connection pipe 493.

[0162] The first connection pipe 493 may be connected to one header of the second heat exchanger P2, and the second connection pipe 494 may be connected to another header of the second heat exchanger P2.

[0163] A central space of the third left header 433 may be located between the third baffle 433a and the fourth baffle 433b.

[0164] The third right header 443 is connected to the other side of a plurality of third condensation refrigerant tubes 413. The third right header 443 is arranged to extend in the up-down direction. The inside of the third right header 443 is formed as a single space, so that the refrigerant discharged to the other side of the plurality of third condensation refrigerant tubes 413 can be guided to the third connection pipe 494.

[0165] Preferably, the inside of the third right header 443 is formed as two spaces, so that the refrigerant flowed in through the third condensation refrigerant tube 413 can change a direction several times while flowing through the plurality of third condensation refrigerant tubes 413.

[0166] Specifically, the inside of the third right header 443 may include a fifth baffle 443a that divides the internal space of the third right header 443 into two areas in the up-down direction. The fifth baffle 443a may be located at the center of the third right header 443.

[0167] The fifth baffle 443a may be located higher than the fourth baffle 433b, and located lower than the third baffle 433a. Therefore, through the three baffles, the third heat exchanger P3 may allow the refrigerant flowing in the right-left direction to flow again in the left-right direction, and allow it to flow again in the right-left direction.

[0168] The third heat exchanger P3 includes a third-first path (P3-1) for allowing the refrigerant discharged from the second heat exchanger P2 to flow in the first direction, a third-second path (P3-2) which is located below the third-first path (P3-1) and allows the refrigerant discharged from the third-first path (P3-1) to flow in the opposite direction to the first direction, a third-third path (P3-3) which is located below the third-second path (P3-2) and allows the refrigerant discharged from the third-second path (P3-2) to flow in the first direction, and a third-fourth path (P3-4) located below the third-third path (P3-3) and allows the refrigerant discharged from the third-third path (P3-3) to flow in the opposite direction to the first direction.

[0169] The third-first path (P3-1) allows the refrigerant discharged from the second heat exchanger P2 to flow in the first direction (left-right direction). The third-first path (P3-1) is a partial area of the third heat exchanger P3 from the upper end of the third heat exchanger P3 to the third baffle 433a. The third-first path (P3-1) includes four third condensation refrigerant tubes 413.

[0170] The third-second path (P3-2) is located below the third-first path (P3-1) and allows the refrigerant discharged from the third-first path (P3-1) to flow in the opposite direction (right-left) to the first direction. The third-second path (P3-2) is a partial area of the third heat exchanger P3 from the third baffle 433a to the fifth baffle 443a of the third heat exchanger P3. The third-second path (P3-2) includes four third condensation refrigerant tubes 413.

[0171] The third-third path (P3-3) is located below the third-second path (P3-2), and allows the refrigerant discharged from the third-second path (P3-2) to flow in the first direction (left-right). The third-third path (P3-3) is a partial area of the third heat exchanger P3 from the fifth baffle 443a to the fourth baffle 433b of the third heat exchanger P3. The third-third path (P3-3) includes three third condensation refrigerant tubes 413.

[0172] The third-fourth path (P3-4) is located below the third-third path (P3-3), and allows the refrigerant discharged from the third-third path (P3-3) to flow in the opposite direction (right-left) to the first direction. The third-fourth path (P3-4) is a partial area of the third heat exchanger P3 from the fourth baffle 433b of the third heat exchanger P3 to the lower end of the third heat exchanger P3. The third-fourth path (P3-4) includes two third condensation refrigerant tubes 413.

[0173] The third-first path (P3-1) and the third-second path (P3-2) have a wider width than the third-third path (P3-3), and the third-third path (P3-3) has a wider width than the third-fourth path (P3-4). The number of third condensation refrigerant tubes 413 of the third-first path (P3-1) and the third-second path (P3-2) is larger than the number of third condensation refrigerant tubes 413 of the third-third path (P3-3), and the number of third condensation refrigerant tubes 413 of the third-third path (P3-3) is larger than the number of third condensation refrigerant tubes 413 of the third-fourth path (P3-4).

[0174] The third heat exchanger P3 is divided into four passes in the vertical direction, and the number of refrigerant tubes becomes smaller as it goes downward, so that the refrigerant is sufficiently supercooled.

[0175] Hereinafter, the structure of the condensation refrigerant tube 410 and the condensation fin 420 of each heat exchanger will be described in detail.

[0176] FIG. 8 is a cross-sectional view of the first heat exchanger P1 of the condenser 400 illustrated in FIG. 4, and FIG. 9 is a cross-sectional view of the first heat exchanger P1 illustrated in FIG. 8.

[0177] FIGS. 8 and 9 illustrate the first heat exchanger P1, but the structures of the condensation refrigerant tube 410 and the condensation fin 420 of the second heat exchanger P2 and the third heat exchanger P3 are the same as that of the first heat exchanger P1.

[0178] Referring to FIGS. 8 and 9, the condensation refrigerant tube 410 may include a plurality of channels 410a therein. The plurality of channels 410a provide a space through which the refrigerant passes. A plurality of channels 410a may extend in a direction parallel to the condensation refrigerant tube 410.

[0179] Specifically, the cross-sectional shape of the condensation refrigerant tube 410 is a rectangular shape that has left and right sides longer than upper and lower sides, and the cross-sectional shape of the channel 410a may be a quadrangle shape.

[0180] The channels 410a are usually stacked in a single row in a direction (forward-rearward direction) FR intersecting with the longitudinal direction of the condensation refrigerant tube 410. The cross-sectional area of the channel 410a may be smaller than the cross-sectional area of the evaporation refrigerant tube 310.

[0181] The condensation fin 420 transmits heat from the condensation refrigerant tube 410. The condensation fin 420 increases the contact area with air to improve heat dissipation performance.

[0182] The condensation fin 420 is arranged between adjacent condensation refrigerant tubes 410. The condensation fin 420 may have various shapes, but may be formed by bending a plate having the same width as the condensation refrigerant tube 410. The condensation fin 420 may be coated with a clad (not shown).

[0183] The condensation fin 420 may connect two condensation refrigerant tubes 410 that are stacked in the up-down direction to conduct heat. The condensation fin 420 may be in direct contact with the condensation refrigerant tube 410, or may be connected to the condensation refrigerant tube 410 by a sacrificial sheet (not shown).

[0184] The condensation fin 420 may include a plurality of inclined surfaces having an inclination with respect to the air flow direction (forward-rearward direction). If the condensation fin 420 has an inclination, the contact area between the air and the condensation fin 420 may be improved, thereby improving the heat exchange efficiency.

[0185] If the condensation fin 420 has a louver, the louver protrudes from the condensation fin 420 and has a space between it and the condensation fin 420, so that lint may get stuck, thereby reducing the heat exchange efficiency. Therefore, if the condensation fin 420 has an inclined surface, the lint may be prevented from getting stuck.

[0186] The structure of the evaporator 300 will be described below.

[0187] FIG. 10 is a perspective view showing the evaporator 300 shown in FIG. 3.

[0188] Referring to FIG. 10, the evaporator 300 includes a plurality of evaporation refrigerant tubes 310 through which refrigerant flows, and an evaporation fin 320 that is connected to each evaporation refrigerant tube 310 and dissipate the heat transmitted from the evaporation refrigerant tube 310.

[0189] Obviously, the evaporator 300 further includes a plurality of collars 42 that surround at least a portion of the outer surface of each evaporation refrigerant tube 310, and at this time, the evaporation fin 320 may be connected to the plurality of collars 42.

[0190] The evaporation refrigerant tube 310 provides a space through which the refrigerant flows. The evaporation refrigerant tube 310 may be formed as a single pipe or as a plurality of pipes, but is not limited thereto.

[0191] The evaporation refrigerant tube 310 and the evaporation fin 320 may include aluminum or an aluminum alloy.

[0192] According to another embodiment, a condenser includes a plurality of refrigerant tubes through which a refrigerant flows, and which extends in a first direction, a pair of headers which are connected to both ends of the plurality of refrigerant tubes and extend in a second direction, and a plurality of heat exchange which includes a fin for conducting heat of the plurality of refrigerant tubes, wherein the plurality of heat exchangers are N-heat exchangers that are arranged in a plurality of rows in a third direction intersecting with the first and second directions, the refrigerant flows from the first heat exchanger P1 to the Nth heat exchanger in consecutive order, the refrigerant flowing through the N-1th heat exchanger flows from the bottom to the top, and the refrigerant flowing through the Nth heat exchanger flows from the top to the bottom.

[0193] That is, the refrigerant flowing through the next to last heat exchanger among the plurality of heat exchangers flows from the bottom to the top, and the refrigerant flowing through the last heat exchanger flows from the top to the bottom.

[0194] The refrigerant discharged from the N-2th heat exchanger is supplied to the lower portion of the N-1th heat exchanger, the refrigerant heat-exchanged in the N-1th heat exchanger is discharged to the upper portion of the N-1th heat exchanger, the refrigerant discharged from the N-1th heat exchanger is supplied to the upper portion of the N-th heat exchanger, and the refrigerant heat-exchanged in the N-th heat exchanger is discharged to the lower portion of the N-th heat exchanger.

[0195] The N-th heat exchanger is located upstream in the air flow direction than the N-1th heat exchanger. A heat exchanger further including an inlet pipe for supplying refrigerant to the first heat exchanger P1, and an outlet pipe through which refrigerant from the N-th heat exchanger is discharged. The inlet pipe may be connected to the header of the first heat exchanger P1, and the outlet pipe may be connected to the header of the first heat exchanger P1 to which the inlet pipe is connected, and may be connected to the header of the N-th heat exchanger which is located to overlap in the third direction (air flow direction).

[0196] FIG. 11 is a diagram showing a condenser 500 according to an embodiment of the present disclosure.

[0197] Referring to FIG. 11, FIG. 11 describes a condenser 500 including four heat exchangers, but is not limited thereto.

[0198] The condenser 500 may include a first heat exchanger P11, a second heat exchanger P22, a third heat exchanger P33, and a fourth heat exchanger P44.

[0199] The first heat exchanger P11, the second heat exchanger P22, the third heat exchanger P33, and the fourth heat exchanger P44 may be arranged along the forward-rearward direction which is the air flow direction.

[0200] The condenser 500 includes a first heat exchanger P11, a second heat exchanger P22 located to overlap with the first heat exchanger P11 in the forward-rearward direction, a third heat exchanger P33 located to overlap with the second heat exchanger P22 in the forward-rearward direction, a fourth heat exchanger P44 located to overlap with the third heat exchanger P33 in the forward-rearward direction, a condensation inlet pipe 591 that is connected to the first heat exchanger P11 and supplies refrigerant, a condensation outlet pipe 592 that is connected to the fourth heat exchanger P44 and discharges refrigerant, a first connection pipe 593 that connects the first heat exchanger P11 and the second heat exchanger P22 and allows the refrigerant to flow from the first heat exchanger P11 to the second heat exchanger P22, a second connection pipe 594 that connects the second heat exchanger P22 and the third heat exchanger P33 and allows the refrigerant to flow from the second heat exchanger P22 to the third heat exchanger P33, and a third connection pipe 595 that connects the third heat exchanger P33 and the fourth heat exchanger P44 and allows the refrigerant to flow from the third heat exchanger P33 to the fourth heat exchanger P44.

[0201] The first heat exchanger P11 is arranged to exchange heat with air that has been heat-exchanged with the second heat exchanger P22, and the second heat exchanger P22 is arranged to exchange heat with air that has been heat-exchanged with the third heat exchanger P33. The third heat exchanger P33 is arranged to exchange heat with air that has been heat-exchanged with the fourth heat exchanger P44. That is, the air that has been heat-exchanged in the fourth heat exchanger P44 is heat-exchanged in the third heat exchanger P33, and the air that has been heat-exchanged in the third heat exchanger P33 is heat-exchanged in the second heat exchanger P22 and then heat-exchanged in the first heat exchanger P11.

[0202] Specifically, the first heat exchanger P11, the second heat exchanger P22, the third heat exchanger P33, and the fourth heat exchanger P44 are arranged on a path through which outside air flows, and the outside air is firstly heat exchanged with the fourth heat exchanger P44, secondly heat exchanged with the third heat exchanger P33, thirdly heat exchanged with the second heat exchanger P22, and fourthly heat exchanged with the first heat exchanger P11.

[0203] More specifically, the refrigerant discharged from the first heat exchanger P11 is supplied to the upper portion of the second heat exchanger P22, the refrigerant heat-exchanged in the second heat exchanger P22 is discharged to the lower portion of the second heat exchanger P22, the refrigerant discharged from the second heat exchanger P22 is supplied to the lower portion of the third heat exchanger P33, the refrigerant heat-exchanged in the third heat exchanger P33 is discharged to the upper portion of the third heat exchanger P33, the refrigerant discharged from the third heat exchanger P33 is supplied to the upper portion of the fourth heat exchanger P44, and the refrigerant heat-exchanged in the fourth heat exchanger P44 is discharged to the lower portion of the fourth heat exchanger P44.

[0204] The fourth heat exchanger P44 may be located upstream in the air flow direction than the third heat exchanger P33, the third heat exchanger P33 may be located upstream in the air flow direction than the second heat exchanger P22, and the second heat exchanger P22 may be located upstream in the air flow direction than the first heat exchanger P11.

[0205] Specifically, the fourth heat exchanger P44 may be located closer to the suction path 151 through which air is flowed in than the third heat exchanger P33, the third heat exchanger P33 may be located closer to the suction path 151 through which air is flowed in than the second heat exchanger P22, and the first heat exchanger P11 may be located closer to the exhaust path 152 through which air is discharged than the second heat exchanger P22.

[0206] Since the heat exchange efficiency decreases when the temperature difference between the refrigerant and the air is too large, the heat exchange efficiency is improved by appropriately maintaining the temperature difference between the refrigerant and the air. The first heat exchanger P1 through which the high-temperature refrigerant flows is disposed in an area where the temperature of the outside air is high, and the third heat exchanger P3 through which the low-temperature refrigerant flows is disposed in an area where the temperature of the outside air is low, so that the temperature of the refrigerant in each heat exchanger and the temperature of the outside air are appropriately different, thereby improving the heat exchange efficiency of the condenser 400.

[0207] The first heat exchanger P11, the second heat exchanger P22, the third heat exchanger P33, and the fourth heat exchanger P44 may include a condensation fin 520 located between a plurality of condensation refrigerant tubes 510 and the condensation refrigerant tubes 510 adjacent to each other to conduct heat.

[0208] The first heat exchanger P11, the second heat exchanger P22, the third heat exchanger P33, and the fourth heat exchanger P44 are manufactured by stacking a plurality of condensation refrigerant tubes 510. Each condensation refrigerant tube 510 extends in a horizontal direction (left-right direction LeRi) so that the refrigerant moves horizontally.

[0209] Specifically, the condensation refrigerant tube 510 of the first heat exchanger P11, the second heat exchanger P22, the third heat exchanger P33, and the fourth heat exchanger P44 are arranged horizontally (transverse direction) long when the air flow direction is a forward-rearward direction, and the plurality of condensation refrigerant tubes 510 can be stacked vertically. As air passes through a space between the plurality of condensation refrigerant tubes 510 stacked vertically (longitudinal direction), heat is exchanged with the refrigerant inside the condensation refrigerant tube 510. A plurality of vertically stacked condensation refrigerant tubes 510 define a heat exchange surface together with the condensation fin 520 described below.

[0210] The first heat exchanger P11 may include a first condensation refrigerant tube 411, a first left header 531, a first right header 541, and a first condensation fin 521. Specifically, the first heat exchanger P11 includes a plurality of first condensation refrigerant tubes 411 having a plurality of flow paths (channels) formed therein, a first condensation fin 521 that connects the first condensation refrigerant tube 411 and conducts heat, a first left header 531 that is coupled to one side of the plurality of first condensation refrigerant tubes 411 and communicates with one side of the plurality of first condensation refrigerant tubes 411 so that refrigerant flows, and a first right header 541 that is coupled to the other side of the plurality of first condensation refrigerant tubes 411 and communicates with the other side of the plurality of first condensation refrigerant tubes 411 so that refrigerant flows.

[0211] The first condensation refrigerant tube 411 is arranged horizontally, and a plurality of first condensation refrigerant tubes 411 are stacked in an up-down direction. A plurality of channels 410a may be formed inside the first condensation refrigerant tube 411.

[0212] The first left header 531 is connected to one side of a plurality of first condensation refrigerant tubes 411. The first left header 531 is arranged to be extended in the up-down direction and connected to the condensation inlet pipe 591. The inside of the first left header 531 is formed as a single space, and the refrigerant flowed in through the condensation inlet pipe 591 is distributed and supplied to the plurality of first condensation refrigerant tubes 411.

[0213] The first right header 541 is connected to the other side of the plurality of first condensation refrigerant tubes 411. The first left header 531 is arranged to be extended in the up-down direction and connected to a first connection pipe 593. The inside of the first right header 541 is formed as a single space, and the refrigerant discharged to the other side of the plurality of first condensation refrigerant tubes 411 is guided to the first connection pipe 593.

[0214] Preferably, the first connection pipe 593 may be connected to the upper end of the first right header 541, and the condensation inlet pipe 591 may be connected to the lower end of the first left header 531. The first connection pipe 593 may be located higher than the condensation inlet pipe 591.

[0215] One side of the first connection pipe 593 is connected to the first right header 541 of the first heat exchanger P11, and the other side of the first connection pipe 593 is connected to the second right header 542 of the second heat exchanger P22.

[0216] The refrigerant flowed in through the condensation inlet pipe 591 is supplied to each of the first condensation refrigerant tubes 411 through the first left header 531, and the refrigerant passing through the first condensation refrigerant tube 411 is heat-exchanged with air and supplied to the first connection pipe 593 through the first right header 541. The condensation inlet pipe 591 is connected to the compressor 163(10) and supplies high-temperature and high-pressure refrigerant to the first heat exchanger P11.

[0217] The second heat exchanger P22 may include a second condensation refrigerant tube 512, a second left header 532, a second right header 542, and a second condensation fin 522. Specifically, the second heat exchanger P22 includes a plurality of second condensation refrigerant tubes 512 having a plurality of flow paths formed therein, a second condensation fin 522 that connects the second condensation refrigerant tube 512 to conduct heat, a second left header 532 that is coupled to one side of the plurality of second condensation refrigerant tubes 512 and communicates with one side of the plurality of second condensation refrigerant tubes 512 so that refrigerant flows, and a second right header 542 that is coupled to the other side of the plurality of second condensation refrigerant tubes 512 and communicates with the other side of the plurality of second condensation refrigerant tubes 512 so that refrigerant flows.

[0218] The second condensation refrigerant tube 512 is arranged horizontally, and a plurality of second condensation refrigerant tubes 512 are stacked in the up-down direction. A plurality of channels 410a may be formed inside the second condensation refrigerant tube 512.

[0219] The second right header 542 is connected to the other side of the plurality of second condensation refrigerant tubes 512. The second right header 542 is arranged to be extended in the up-down direction, and is connected to the first connection pipe 593. The inside of the second right header 542 is formed as a single space, so that the refrigerant flowed in through the condensing inlet pipe 591 may be distributed and supplied to the plurality of second condensation refrigerant tubes 512.

[0220] Preferably, the inside of the second right header 542 is formed into two spaces, so that the refrigerant flowed in through the first connection pipe 593 can change a direction several times while flowing through the plurality of second condensation refrigerant tubes 512.

[0221] Specifically, the inside of the second right header 542 may include a first baffle 542a that divides the internal space of the second right header 542 into two areas in the up-down direction. The first baffle 542a may be located offset from the center of the second right header 542 toward the lower end. The first connection pipe 593 is connected to the upper space of the second right header 542 located above the first baffle 542a.

[0222] The second right header 542 is connected to the second connection pipe 594. The second connection pipe 594 is connected to a lower space of the second right header 542 located below the first baffle 542a. The first connection pipe 593 is connected to the upper end of the second right header 542 located above the first baffle 542a, and the second connection pipe 594 is connected to the lower end of the second right header 542 located below the first baffle 542a.

[0223] The second left header 532 is arranged to be extended in the up-down direction, and the inside of the second left header 532 is formed as a single space.

[0224] The refrigerant discharged to one side of the plurality of second condensation refrigerant tubes 512 can be guided to the second connection pipe 594.

[0225] The second heat exchanger P22 includes a second-first path (P22-1) for allowing the refrigerant discharged from the first heat exchanger P11 to flow in the first direction, and a second-second path (P22-2) that is located below the second-first path (P22-1) and allows the refrigerant discharged from the second-first path (P22-1) to flow in the opposite direction to the first direction.

[0226] The second-first path (P22-1) allows the refrigerant discharged from the first heat exchanger P11 to flow in the right-left direction. The second-first path (P22-1) is a partial area of the second heat exchanger P22 from the upper end of the second heat exchanger P22 to the first baffle 542a. The second-first path (P22-1) includes seven second condensation refrigerant tubes 512.

[0227] The second-second path (P22-2) is located below the second-first path (P22-1) and allows the refrigerant discharged from the second-first path (P22-1) to flow in the left-right direction. The second-second path (P22-2) is a partial area of the second heat exchanger P22 from the first baffle 542a of the second heat exchanger P22 to the lower end of the second heat exchanger P22. The second-second path (P22-2) includes five second condensation refrigerant tubes 512.

[0228] The second-second path (P22-2) has a wider width than the second-first path (P22-1). The number of second condensation refrigerant tubes 512 of the second-second path (P22-2) is greater than the number of second condensation refrigerant tubes 512 of the second-first path (P22-1).

[0229] The third heat exchanger P33 may include a third condensation refrigerant tube 513, a third left header 533, a third right header 543, and a third condensation fin 523. Specifically, the third heat exchanger P33 includes a plurality of third condensation refrigerant tubes 513 having a plurality of flow paths formed therein, a third condensation fin 523 that connects the third condensation refrigerant tube 513 to conduct heat, a third left header 533 that is coupled to one side of the plurality of third condensation refrigerant tubes 513 and communicates with one side of the plurality of third condensation refrigerant tubes 513 so that refrigerant flows, and a third right header 543 that is coupled to the other side of the plurality of third condensation refrigerant tubes 513 and communicates with the other side of the plurality of third condensation refrigerant tubes 513 so that refrigerant flows.

[0230] The third condensation refrigerant tube 513 is arranged horizontally, and a plurality of third condensation refrigerant tubes 513 are stacked in the up-down direction. A plurality of channels 410a may be formed inside the third condensation refrigerant tube 513.

[0231] The third right header 543 is communicated with the other side of the plurality of third condensation refrigerant tubes 513. The third right header 543 is arranged to be extended in the up-down direction, and is connected to the second connection pipe 594.

[0232] The inside of the third right header 543 is formed into two spaces, so that the refrigerant flowed in through the second connection pipe 594 can change a direction several times while flowing through the plurality of third condensation refrigerant tubes 513.

[0233] Specifically, the inside of the third right header 543 may include a second baffle 543a that divides the internal space of the third right header 543 into two areas in the up-down direction. The second baffle 543a may be located offset from the center of the third right header 543 toward the lower end. The second connection pipe 594 is connected to the lower space of the third right header 543 located above the second baffle 543a.

[0234] The third right header 543 is connected to the second connection pipe 594. The second connection pipe 594 is connected to the lower space of the third right header 543 located below the second baffle 543a. The second connection pipe 594 is connected to the lower end of the third right header 543 located below the second baffle 543a.

[0235] The third left header 533 is connected to one side of a plurality of third condensation refrigerant tubes 513. The third left header 533 is arranged to extend vertically and is connected to the third connection pipe 595.

[0236] The inside of the third left header 533 is formed into two spaces, so that the refrigerant flowed in through the third condensation refrigerant tube 513 can change a direction several times while flowing through the plurality of third condensation refrigerant tubes 513.

[0237] Specifically, the inside of the third left header 533 may include a third baffle 533a that divides the internal space of the third left header 533 into two areas in the up-down direction. The third baffle 533a may be located at the center of the third left header 533. The third connection pipe 594 is connected to the upper space of the third left header 533 located above the third baffle 533a.

[0238] The third baffle 533a may be located higher than the second baffle 543a. Therefore, the third heat exchanger P33 (P3) may allow the refrigerant flowing in the right-left direction to flow in the left-right direction again, and allow it to flow in the right-left direction again through the two baffles.

[0239] The third heat exchanger P33 includes a third-first path (P33-1) that allows the refrigerant discharged from the second heat exchanger P22 to flow in the right-left direction, a third-second path (P33-2) that is located above the third-first path (P33-1) and allows the refrigerant discharged from the third-first path (P33-1) to flow in the left-right direction, and a third-second path (P33-2) that is located above the third-second path (P33-2) and allows the refrigerant discharged from the third-second path (P33-2) to flow in the right-left direction.

[0240] The third-first path (P33-1) is a partial area of the third heat exchanger P33 from the lower end of the third heat exchanger P33 to the second baffle 543a. The third-first path (P33-1) includes three third condensation refrigerant tubes 513.

[0241] The third-second path (P33-2) is an area between the second baffle 543a and the third baffle 533a of the third heat exchanger P33. The third-second path (P33-2) includes four third condensation refrigerant tubes 513.

[0242] The third-third path (P33-3) is an area between the third baffle 533a of the third heat exchanger P33 and the upper end of the third heat exchanger P33. The third-third path (P33-3) includes six third condensation refrigerant tubes 513.

[0243] The third-third path (P33-3) has a wider width than the third-second path (P33-2), and the third-second path (P33-2) has a wider width than the third-first path (P33-1).

[0244] The number of third condensation refrigerant tubes 513 of the third-third path (P33-3) is larger than the number of third condensation refrigerant tubes 513 of the third-second path (P33-2), and the number of third condensation refrigerant tubes 513 of the third-second path (P33-2) is larger than the number of third condensation refrigerant tubes 513 of the third-first path (P33-1).

[0245] The fourth heat exchanger P44 may include a fourth condensation refrigerant tube 514, a fourth left header 534, a fourth right header 544, and a fourth condensation fin 524. Specifically, the fourth heat exchanger P44 (P34) includes a plurality of fourth condensation refrigerant tubes 514 having a plurality of flow paths formed therein, a fourth condensation fin 524 that connects the fourth condensation refrigerant tube 514 to conduct heat, a fourth left header 534 that is coupled to one side of the plurality of fourth condensation refrigerant tubes 514 and communicates with one side of the plurality of fourth condensation refrigerant tubes 514 so that refrigerant flows, and a fourth right header 544 that is coupled to the other side of the plurality of fourth condensation refrigerant tubes 514 and communicates with the other side of the plurality of fourth condensation refrigerant tubes 514 so that refrigerant flows.

[0246] The fourth condensation refrigerant tube 514 is arranged horizontally, and a plurality of fourth condensation refrigerant tubes 514 are stacked in the up-down direction. A plurality of channels 410a may be formed inside the fourth condensation refrigerant tube 514.

[0247] The fourth left header 534 is connected to one side of the plurality of fourth condensation refrigerant tubes 514. The fourth left header 534 is arranged to be extended in the up-down direction, and is connected to the third connection pipe 595 and the condensation outlet pipe 592.

[0248] The condensation outlet pipe 592 may be arranged in the fourth left header 534 so as to overlap with the first left header 591 in the forward-rearward direction.

[0249] The inside of the fourth left header 534 is formed as three spaces, so that the refrigerant flowed in through the third connection pipe 595 can change a direction several times while flowing through the plurality of fourth condensation refrigerant tubes 514.

[0250] Specifically, the inside of the fourth left header 534 may include a fourth baffle 534a and a fifth baffle 534b that divide the internal space of the fourth left header 534 into three areas in the up-down direction. The fourth baffle 534a may be located higher than the fifth baffle 534b.

[0251] The third connection pipe 595 is connected to the upper space of the fourth left header 534 located above the fourth baffle 534a, and the condensation outlet pipe 592 is connected to the lower space of the fourth left header 534 located below the fifth baffle 534b. The third connection pipe 595 is located higher than the condensation outlet pipe 592. The third connection pipe 595 may be arranged higher than the second connection pipe 594.

[0252] The central space of the fourth left header 534 may be located between the fourth baffle 534a and the fifth baffle 534b.

[0253] The fourth right header 544 is connected to the other side of the plurality of fourth condensation refrigerant tubes 514. The fourth right header 544 is arranged to extend in the up-down direction.

[0254] The inside of the fourth right header 544 is formed into two spaces, so that the refrigerant flowed in through the fourth condensation refrigerant tube 514 can change a direction several times while flowing through the plurality of fourth condensation refrigerant tubes 514.

[0255] Specifically, the inside of the fourth right header 544 may include a sixth baffle 544a that divides the internal space of the fourth right header 544 into two areas in the up-down direction. The sixth baffle 544a may be located at the center of the fourth right header 544.

[0256] The sixth baffle 544a may be located higher than the fifth baffle 534b and lower than the fourth baffle 534a. Therefore, through the three baffles, the fourth heat exchanger P44 (P34) may allow the refrigerant flowed in the left-right direction to flow again in the right-left direction, and then allow it to flow in the left-right direction again.

[0257] The fourth heat exchanger P44 includes a fourth-first path (P44-1) for allowing the refrigerant discharged from the third heat exchanger P33 to flow in the left-right direction, a fourth-second path (P44-2) that is located below the fourth-first path (P44-1) and allows the refrigerant discharged from the fourth-first path (P44-1) to flow in the right-left direction, a fourth-third path (P44-3) that is located below the fourth-second path (P44-2) and allows the refrigerant discharged from the fourth-second path (P44-2) to flow in the left-right direction, and a fourth-fourth path (P44-4) that is located below the fourth-third path (P44-3) and allows the refrigerant discharged from the fourth-third path (P44-3) to flow in the right-left direction.

[0258] The fourth-first path (P44-1) is a partial area of the fourth heat exchanger P44 from the upper end of the fourth heat exchanger P44 to the fourth baffle 534a. The fourth-first path (P44-1) includes four fourth condensation refrigerant tubes 514.

[0259] The fourth-second path (P44-2) is a partial area of the fourth heat exchanger P44 between the fourth baffle 534a to the sixth baffle 544a of the fourth heat exchanger P44. The fourth-second path (P44-2) includes four fourth condensation refrigerant tubes 514.

[0260] The fourth-third path (P44-3) is a partial area of the fourth heat exchanger P44 between the sixth baffle 544a and the fifth baffle 534b of the fourth heat exchanger P44. The fourth-third path (P44-3) includes three fourth condensation refrigerant tubes 514.

[0261] The fourth-fourth path (P44-4) is a partial area of the fourth heat exchanger P44 from the fifth baffle 534b of the fourth heat exchanger P44 to the lower end of the fourth heat exchanger P44. The fourth-fourth path (P44-4) includes two fourth condensation refrigerant tubes 514.

[0262] The fourth-first path (P44-1) and the fourth-second path (P44-2) have a wider width than the fourth-third path (P44-3), and the fourth-third path (P44-3) has a wider width than the fourth-fourth path (P44-4). The number of fourth condensation refrigerant tubes 514 of the fourth-first path (P44-1) and the fourth-second path (P44-2) is larger than the number of fourth condensation refrigerant tubes 514 of the fourth-third path (P44-3), and the number of fourth condensation refrigerant tubes 514 of the fourth-third path (P44-3) is larger than the number of fourth condensation refrigerant tubes 514 of the fourth-fourth path (P44-4).

[0263] The fourth heat exchanger P44 is divided into four paths in the vertical direction, and the number of refrigerant tubes becomes smaller as it goes down, so that the refrigerant is sufficiently supercooled.

[0264] The heat exchanger and garment treatment device of the present disclosure have one or more of the following effects.

[0265] First, the present disclosure uses a multi-row microchannel type heat exchanger as a condenser of the clothing processing equipment, and the refrigerant of the second to last row flows from the bottom to the top, and the refrigerant of the last row flows from the top to the bottom, thereby preventing the accumulation of droplets in the header of the microchannel heat exchanger and improving the heat exchange efficiency.

[0266] Second, the present disclosure uses a multi-row microchannel type heat exchanger as a condenser of the clothing processing equipment, and the refrigerant of the second to last row flows from the bottom to the top, and the refrigerant of the last row flows from the top to the bottom, while making the number of paths of the last row to be four or more, and making the number of refrigerant tubes included in each path to be smaller as it goes down, thereby allowing the refrigerant in the last row to be supercooled.

[0267] Third, the present disclosure uses a microchannel for a condenser, which is configured as a multi-row type, that requires a large amount of heat in order to reheat the air in the air flow path and supply it into a tub, so that the temperature of the air supplied into the tub can be easily controlled, and the counterflow can be easily configured, thereby improving the heat exchange performance.

[0268] Fourth, in the present disclosure, when arranging a condenser in a multi-row within a mechanical room having a limited space, the pipe that supplies refrigerant to the condenser and the pipe that discharges refrigerant from the condenser are all arranged in the same direction, and the evaporator also has refrigerant pipes in the same direction as the condenser, thereby minimizing the length of the refrigerant pipe connecting the condenser and evaporator to the compressor and expansion valve, and reducing an increase in flow resistance caused by the refrigerant pipe.

[0269] Fifth, since the present disclosure has the evaporator and the condenser that are made of aluminum, it has the advantage of improving corrosion resistance in the air flow path of the clothing processing equipment having a high moisture content, improving the reliability of the clothing processing equipment, and preventing galvanic corrosion that occurs when copper and aluminum are mixed.

[0270] Sixth, since the present disclosure adjusts the distance between the evaporator and the condenser to an optimal distance in the air flow path of the machine room, it has the advantage of preventing the lowering of the heat exchange efficiency of the evaporator and the lowering of the efficiency of the clothing processing equipment as the condensed water generated in the evaporator is splashed to the evaporator.

[0271] The above described features, configurations, effects, and the like are included in at least one of the embodiments of the present invention, and should not be limited to only one embodiment. In addition, the features, configurations, effects, and the like as illustrated in each embodiment may be implemented with regard to other embodiments as they are combined with one another or modified by those skilled in the art. Thus, content related to these combinations and modifications should be construed as including in the scope of the invention as disclosed in the accompanying claims.

Claims

1. A heat exchanger comprising:

a first heat exchanger (P1) comprising a plurality of refrigerant tubes (411) through which refrigerant flows, and which extends in a first direction, a pair of headers (431, 441) which are connected to both ends of the plurality of refrigerant tubes (411) and extend in a second direction, and a fin (421) which conducts heat of the plurality of refrigerant tubes (411);

a second heat exchanger (P2) comprising a plurality of refrigerant tubes (412) through which refrigerant flows, and which extends in the first direction, a pair of headers (432, 442) which are connected to both ends of the plurality of refrigerant tubes (412) and extend in the second direction, and a fin (422) which conducts heat of the plurality of refrigerant tubes (412), and through which refrigerant discharged from the first heat exchanger (P1) flows; and

a third heat exchanger (P3) comprising a plurality of refrigerant tubes (413) through which refrigerant flows, and which extends in the first direction, a pair of headers (433, 443) which are connected to both ends of the plurality of refrigerant tubes (413) and extend in the second direction, and a fin (423) which conducts heat of the plurality of refrigerant tubes (413), and through which refrigerant discharged from the second heat exchanger (P2) flows,

wherein the refrigerant discharged from the first heat exchanger (P1) is supplied to a lower portion of the second heat exchanger (P2), refrigerant heat-exchanged in the second heat exchanger (P2) is discharged to an upper portion of the second heat exchanger (P2), the refrigerant discharged from the second heat exchanger (P2) is supplied to an upper portion of the third heat exchanger (P3), and refrigerant heat-exchanged in the third heat exchanger (P3) is discharged to a lower portion of the third heat exchanger (P3).

2. The heat exchanger of claim 1, further comprising:

an inlet pipe (491) for supplying refrigerant to the first heat exchanger (P1); and

an outlet pipe (492) through which the refrigerant of the third heat exchanger (P3) is discharged.

3. The heat exchanger of claim 2, wherein the inlet pipe (491) is connected to a header (431, 441) of the first heat exchanger (P1), and

the outlet pipe (492) is connected to a header (433, 443) of the third heat exchanger (P3) which is located to overlap the header (431, 441) of the first heat exchanger (P1) to which the inlet pipe (491) is connected in a third direction.

4. The heat exchanger of claims 2 or 3, wherein the inlet pipe (491) is located higher than the outlet pipe (492).

5. The heat exchanger according to any one of the claims 2 to 4, wherein a first connection pipe (493) through which the refrigerant discharged from the first heat exchanger (P1) flows into the second heat exchanger (P2) is located lower than the inlet pipe (491).

6. The heat exchanger according to any one of the claims 2 to 5, wherein a second connection pipe (494) through which the refrigerant heat-exchanged in the second heat exchanger (P2) is discharged is located higher than the outlet pipe (492).

7. The heat exchanger of claim 5, wherein a second connection pipe (494) through which the refrigerant heat-exchanged in the second heat exchanger (P2) is discharged is located higher than the first connection pipe (493).

8. The heat exchanger of claim 7, wherein the first connection pipe (493) is connected to any one header (432, 442) of the second heat exchanger (P2), and the second connection pipe (494) is connected to the other header (432, 442) of the second heat exchanger (P2).

9. The heat exchanger of claim 6, wherein the second connection pipe (494) and the outlet pipe (492) are located in the same header (433, 443) of the third heat exchanger (P3).

10. The heat exchanger according to any one of the claims 1 to 9, wherein the third heat exchanger (P3) is located upstream in an air flow direction than the second heat exchanger (P2), and the second heat exchanger (P2) is located upstream in an air flow direction than the first heat exchanger (P1).

11. The heat exchanger according to any one of the claims 1 to 10, wherein the first heat exchanger (P1), the second heat exchanger (P2), and the third heat exchanger (P3) are located to overlap with each other in an air flow direction.

12. The heat exchanger according to any one of the claims 1 to 11, wherein the second heat exchanger (P2) comprises:

   a second-first path (P2-1) which allows the refrigerant discharged from the first heat exchanger (P1) to flow in the first direction;
   a second-second path (P2-2) which is located above the second-first path (P2-1), and allows the refrigerant discharged from the second-first path (P2-1) to flow in a direction opposite to the first direction; and
   a second-third path (P2-3) which is located above the second-second path, and allows the refrigerant discharged from the second-second path to flow in the first direction.

13. The heat exchanger of any one of the claims 1 to 12, wherein the third heat exchanger (P3) comprises:

   a third-first path (P3-1) which allows the refrigerant discharged from the second heat exchanger (P2) to flow in the first direction;
   a third-second path (P3-2) which is located below the third-first path (P3-1), and allows refrigerant discharged from the third-first path (P3-1) to flow in a direction opposite to the first direction;
   a third-third path (P3-3) which is located below the third-second path (P3-2), and allows refrigerant discharged from the third-second path (P3-2) to flow in the first direction; and
   a third-fourth path (P3-4) which is located below the third-third path (P3-3), and allows refrigerant discharged from the third-third path (P3-3) to flow in a direction opposite to the first direction.

14. The heat exchanger of claim 12, wherein a number of refrigerant tubes (412) in the second-third path (P2-3) is greater than a number of refrigerant tubes (412) in the above second-first path (P2-1).

15. The heat exchanger of claim 12, wherein a number of refrigerant tubes (412) in the second-third path (P2-3) is greater than a number of refrigerant tubes (412) in the above second-second path (P2-2).

Fig. 1

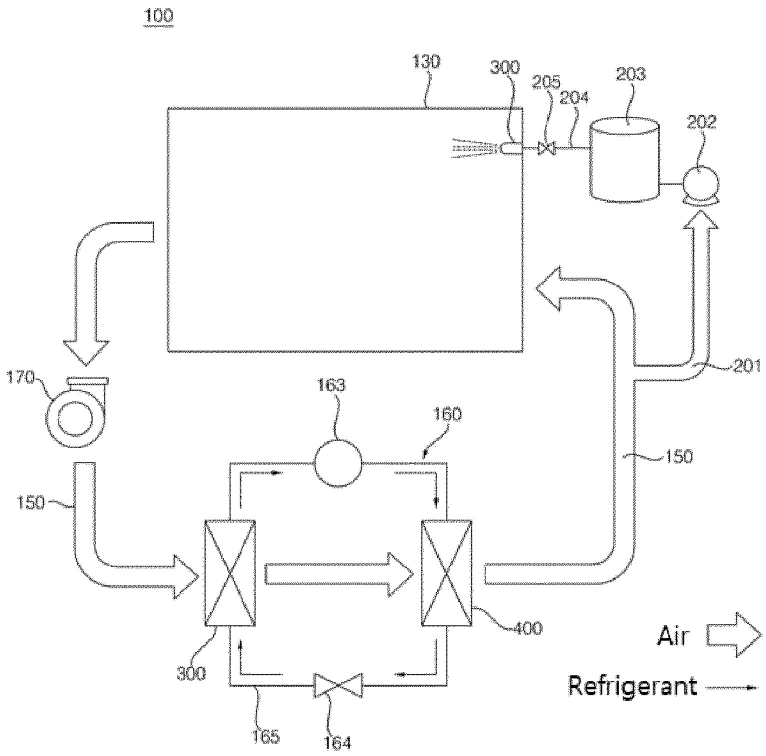

100
130
300
205
204
203
202
201
150
170
163
160
150
300
400
165
164
Air
Refrigerant

Fig. 2

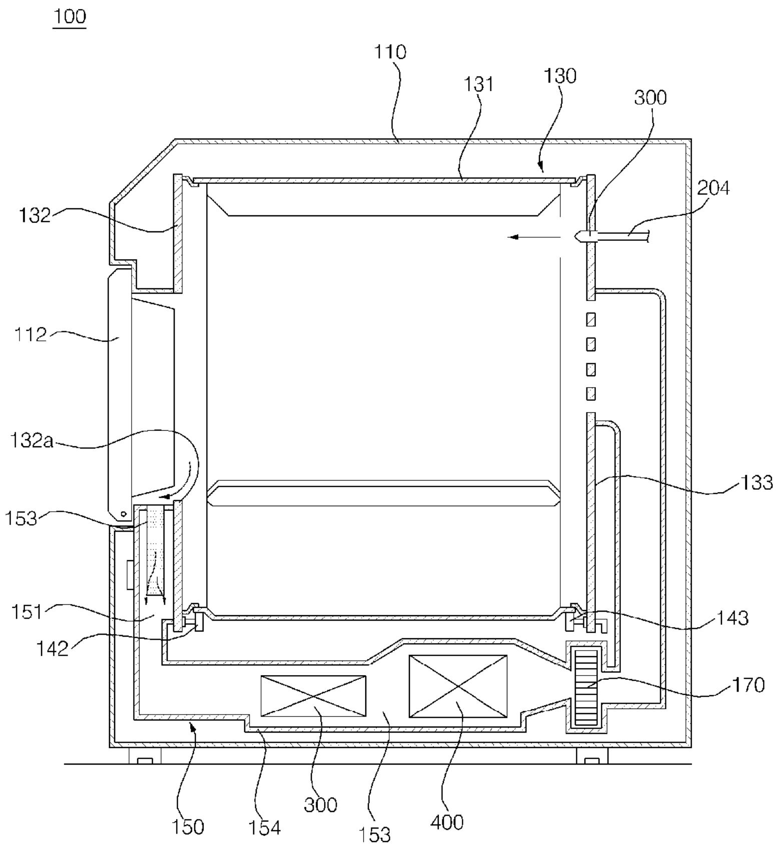
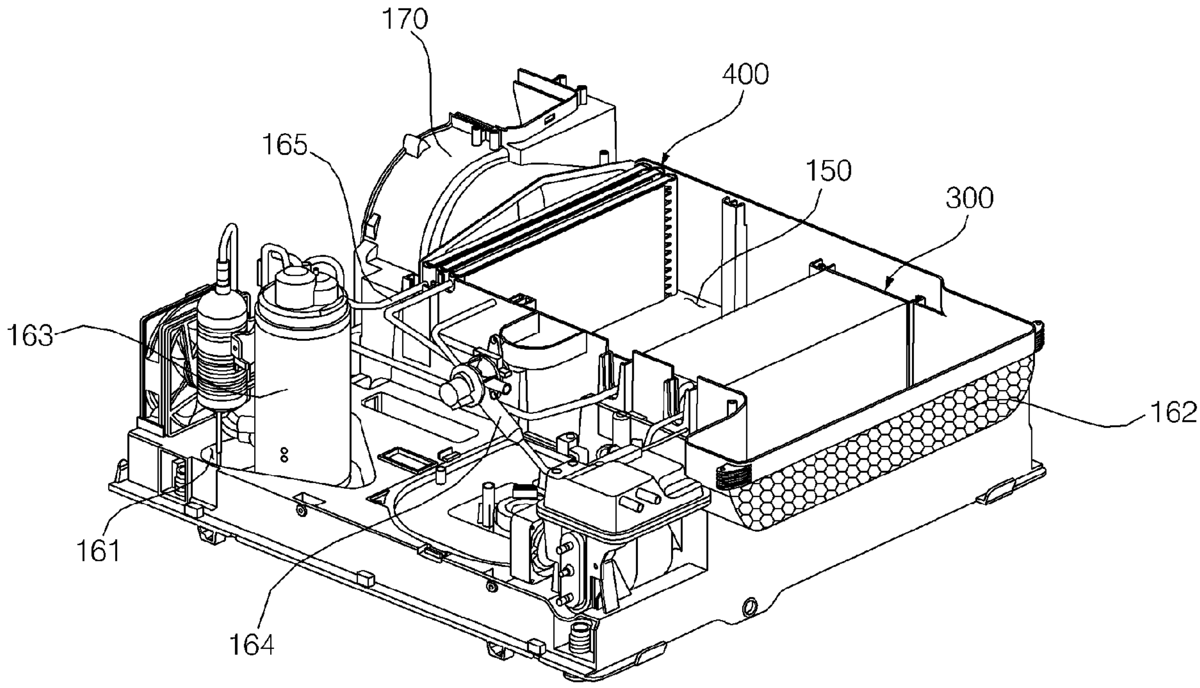

100
110
131
130
300
204
132
112
132a
153
151
142
133
143
170
150
154
300
153
400

Fig. 3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400
165
150
300
163
162
161
164

Fig. 4

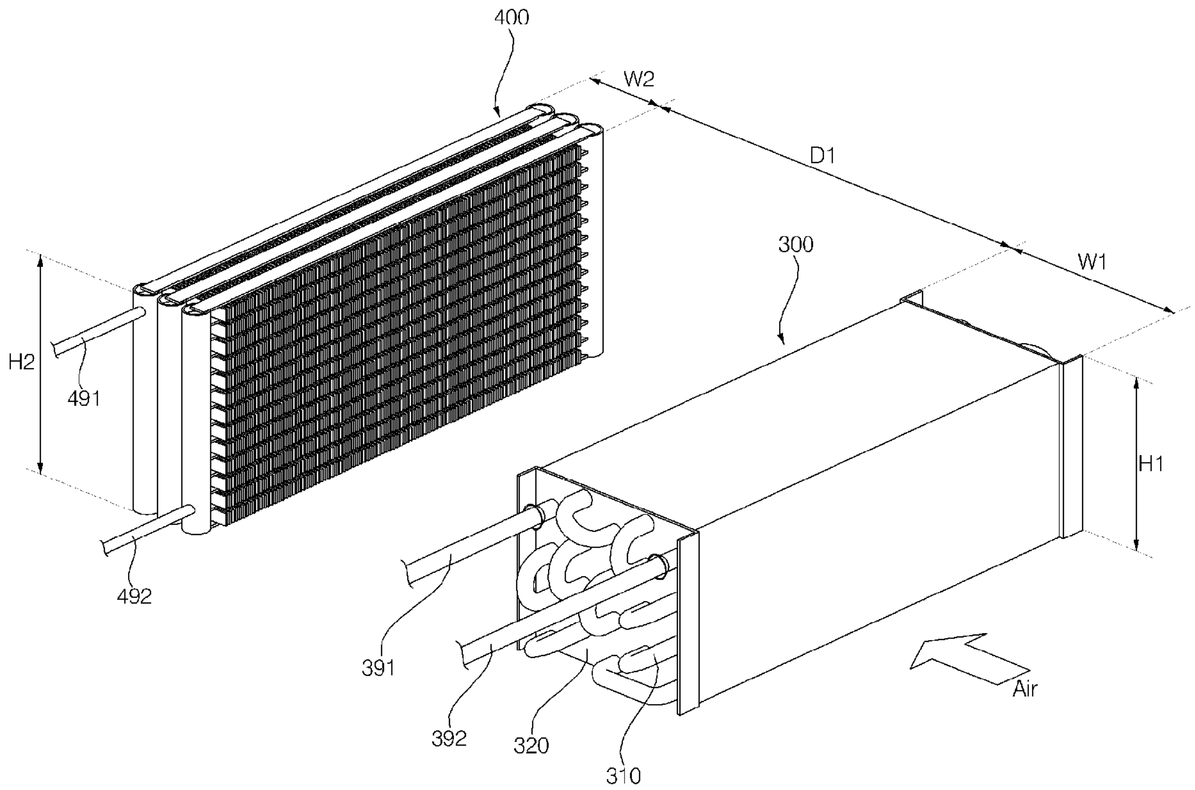

400
W2
D1
300
W1
H2
491
H1
492
391
Air
392
320
310

Fig. 5

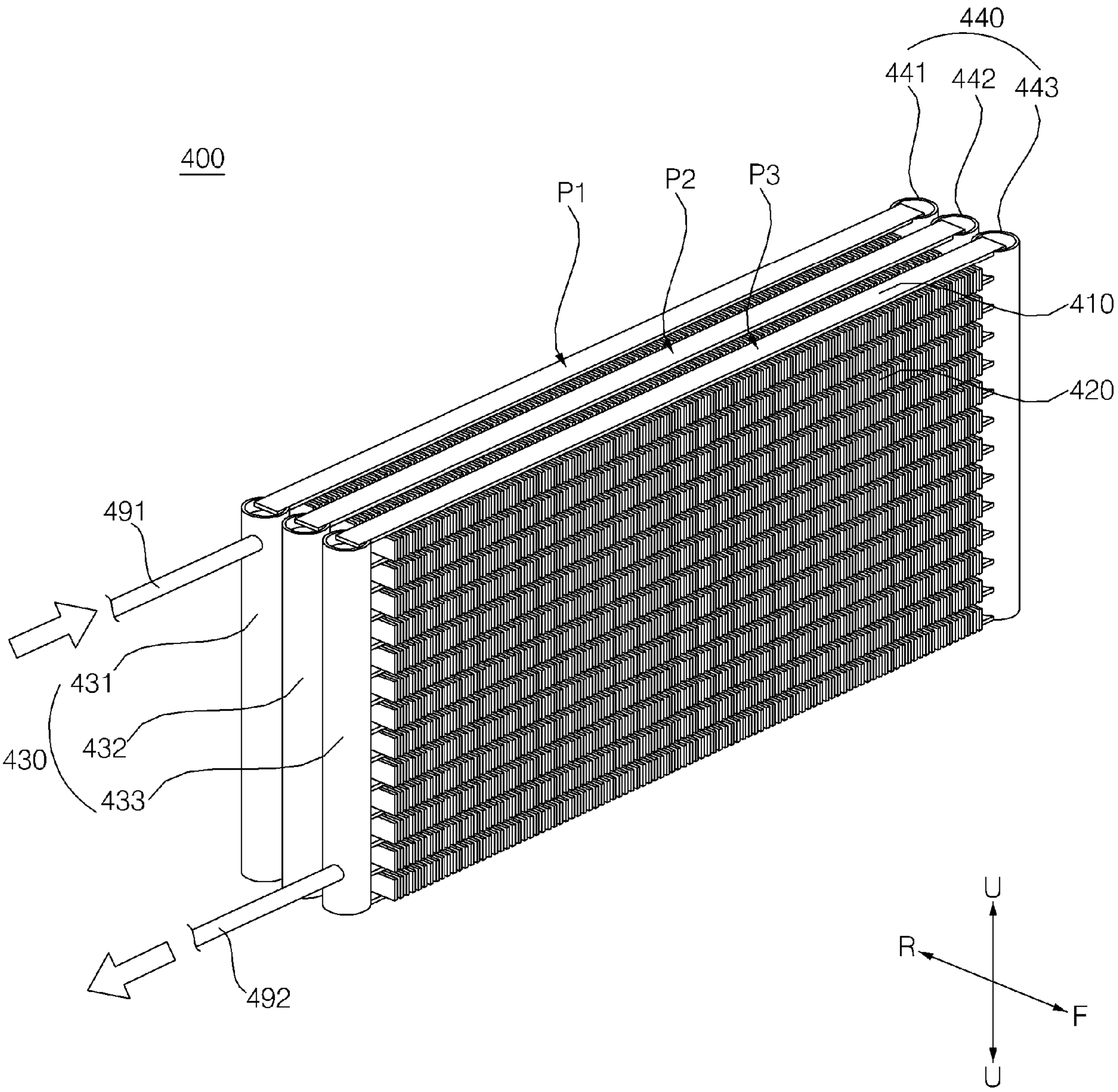


Fig. 6

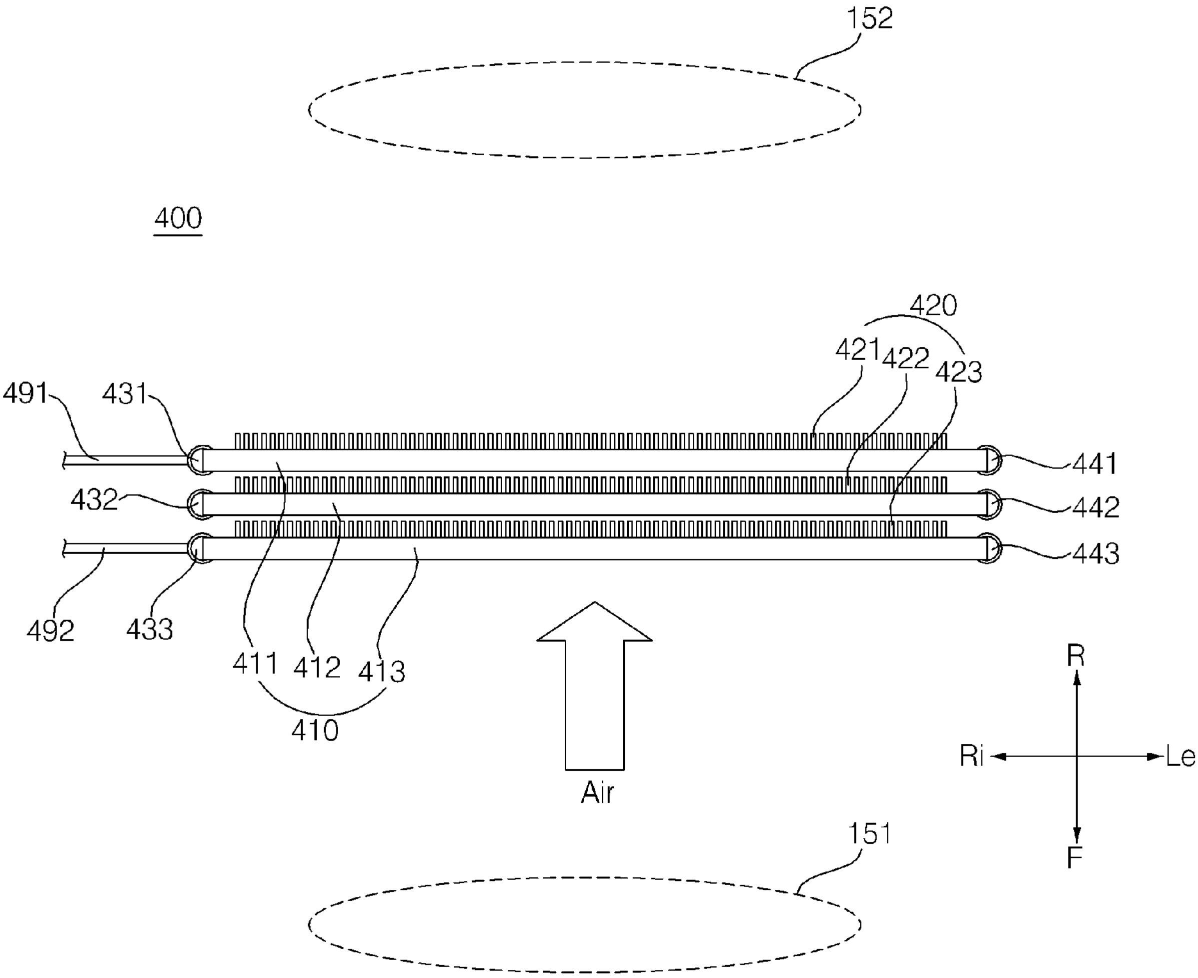

152
400
420
421
422
423
491
431
441
432
442
443
492
433
411
412
413
410
Air
R
Ri
Le
F
151

Fig. 7a

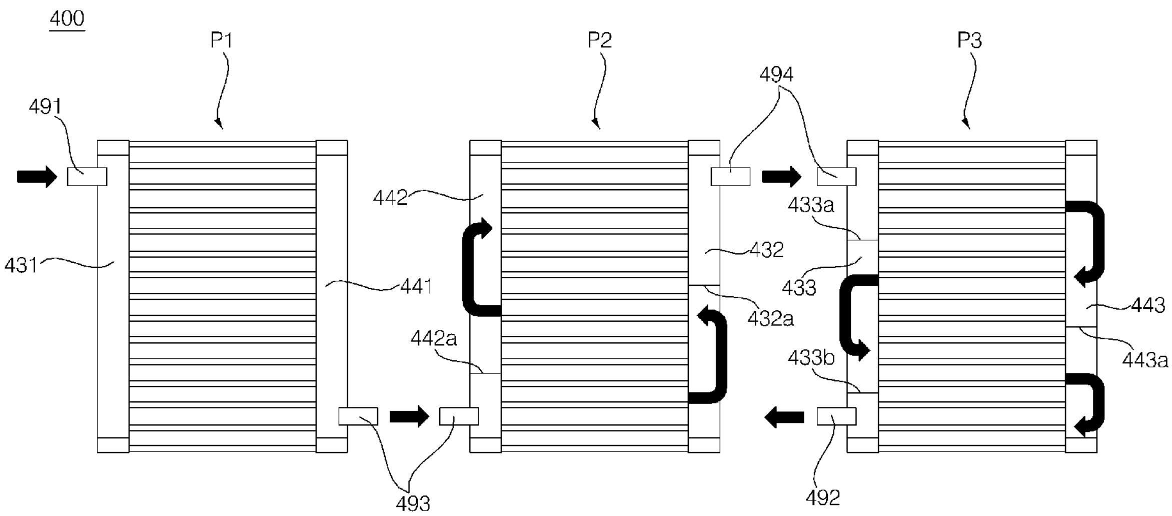

400
P1
P2
P3
494
491
442
433a
432
431
441
433
443
432a
442a
433b
443a
493
492

Fig. 7b

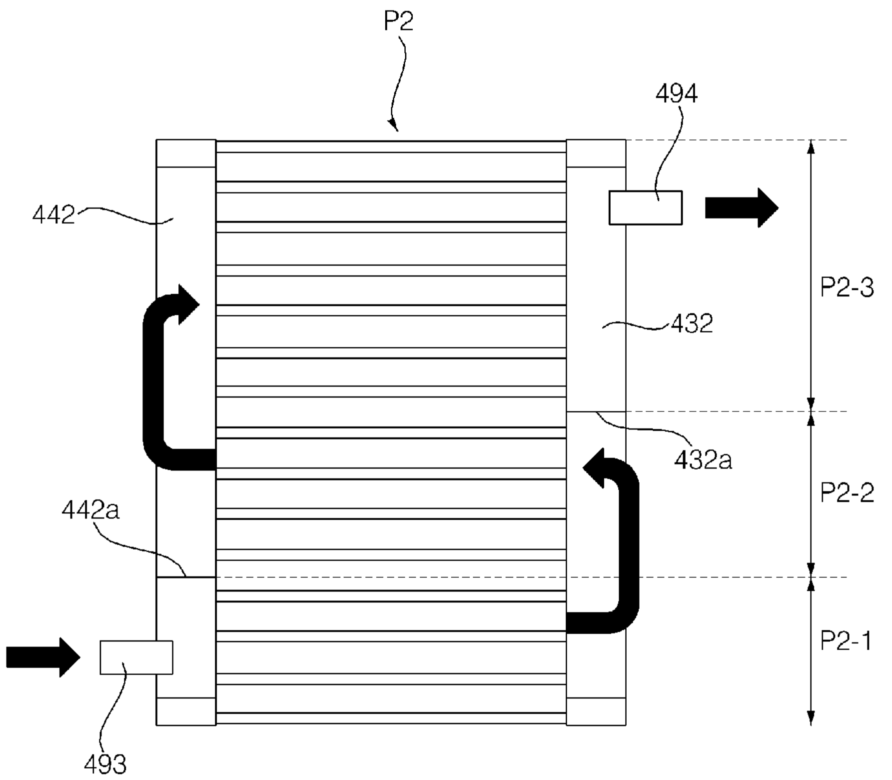
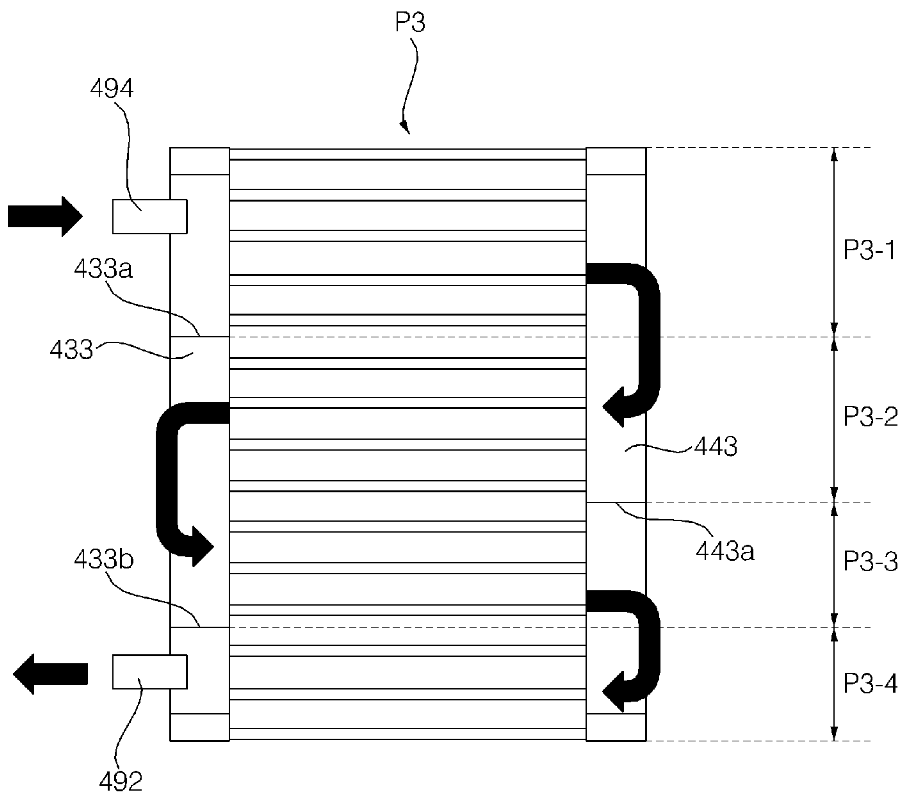

P2
494
442
P2-3
432
432a
P2-2
442a
P2-1
493

Fig. 7c


P3
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P3-1
433a
433
P3-2
443
443a
P3-3
433b
P3-4
492

Fig. 8

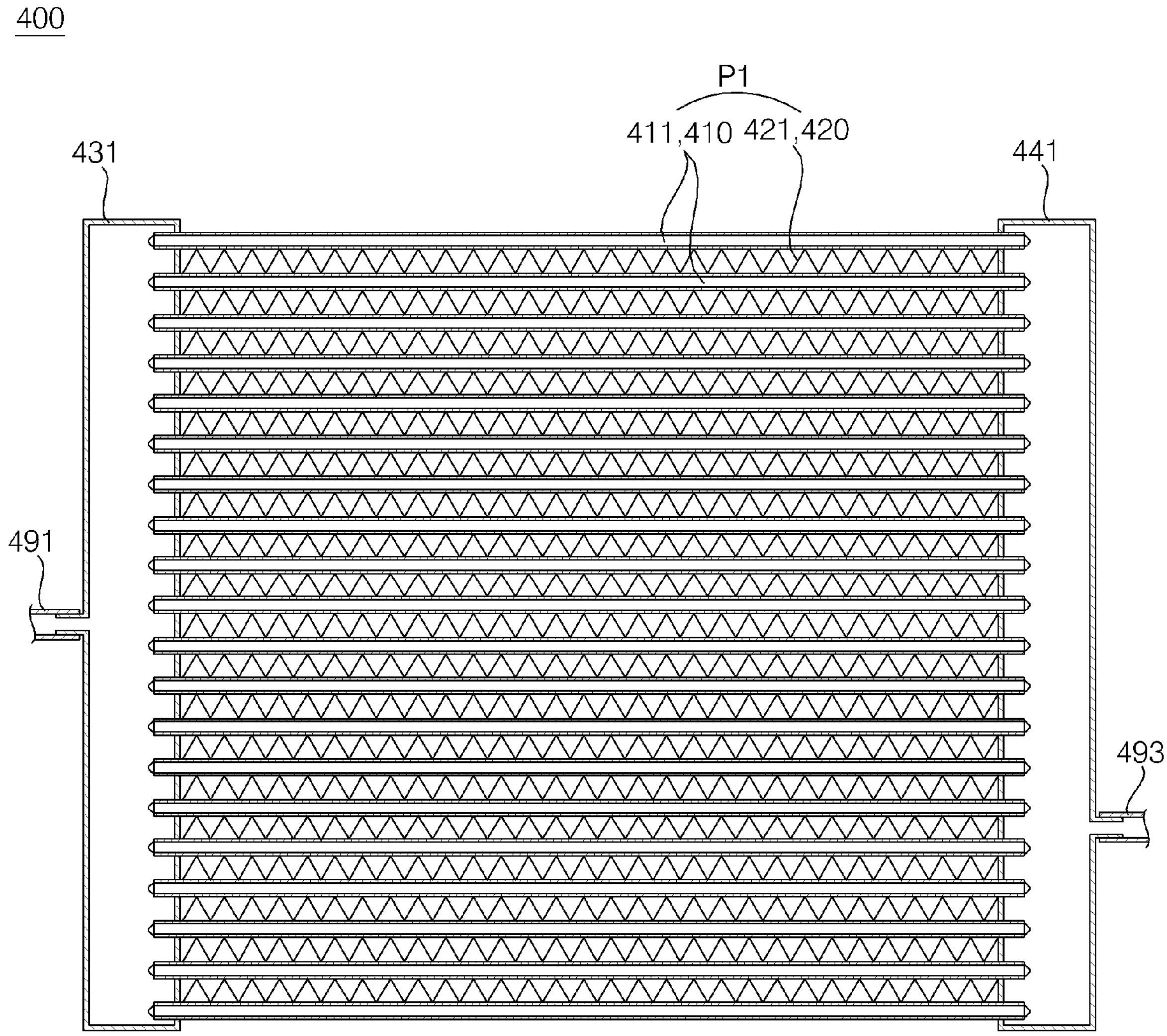


Fig. 9

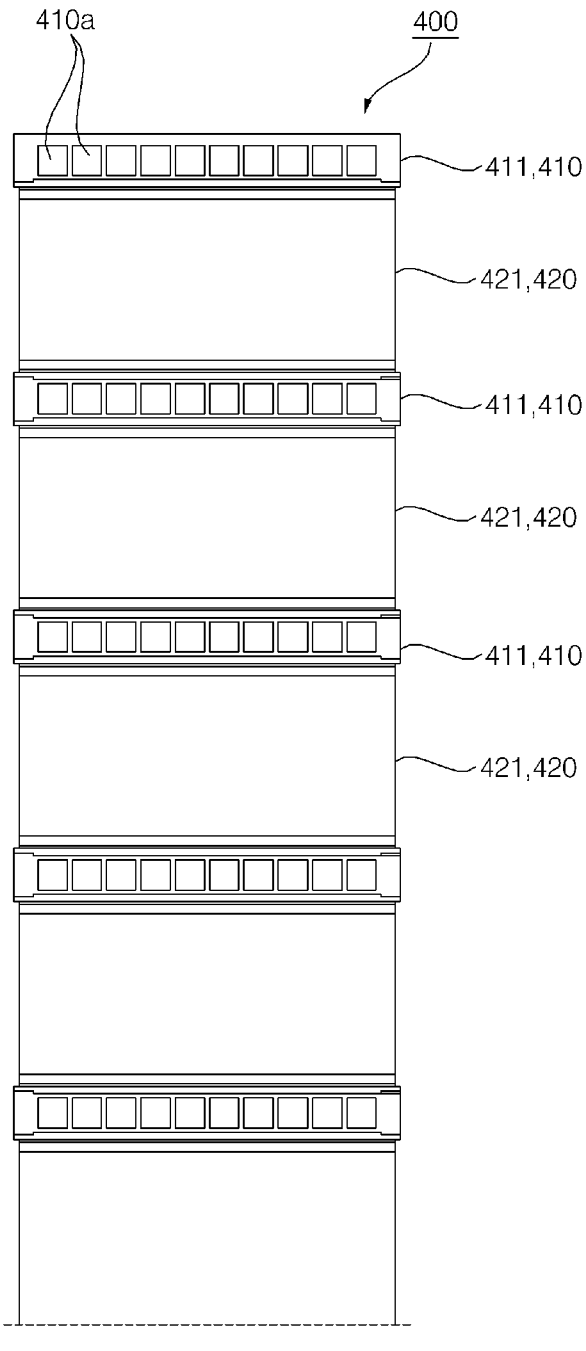


Fig. 10

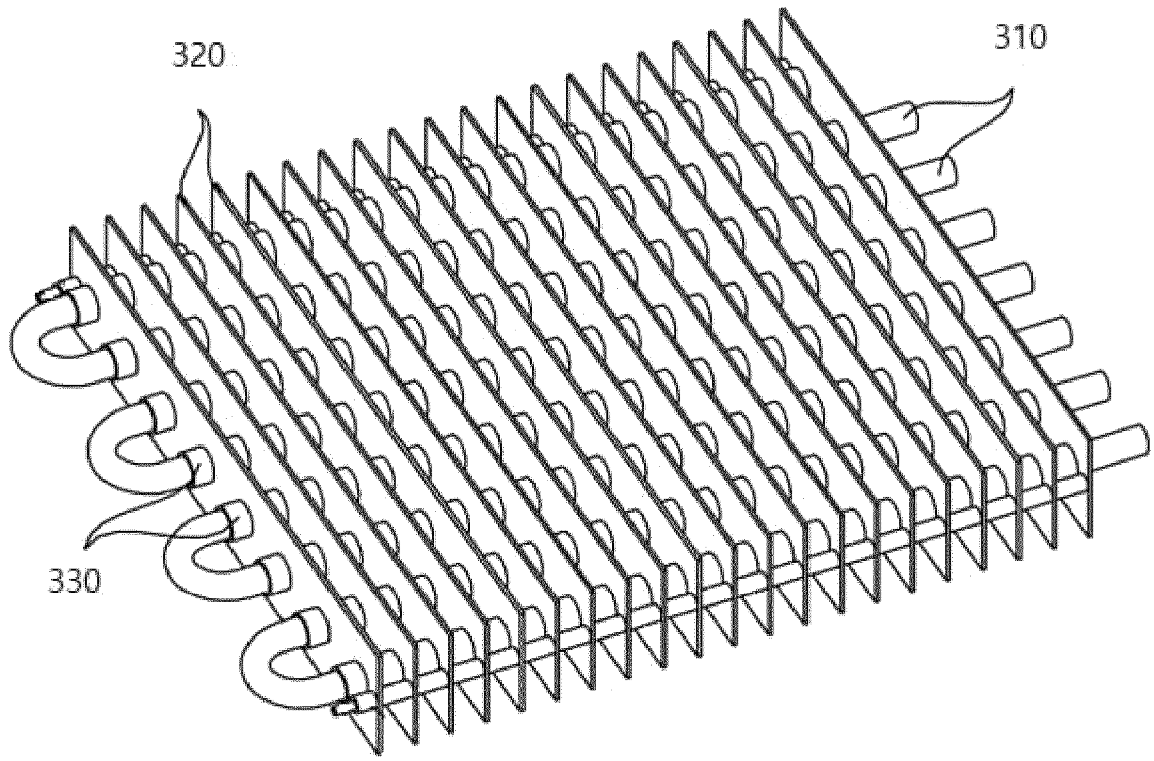
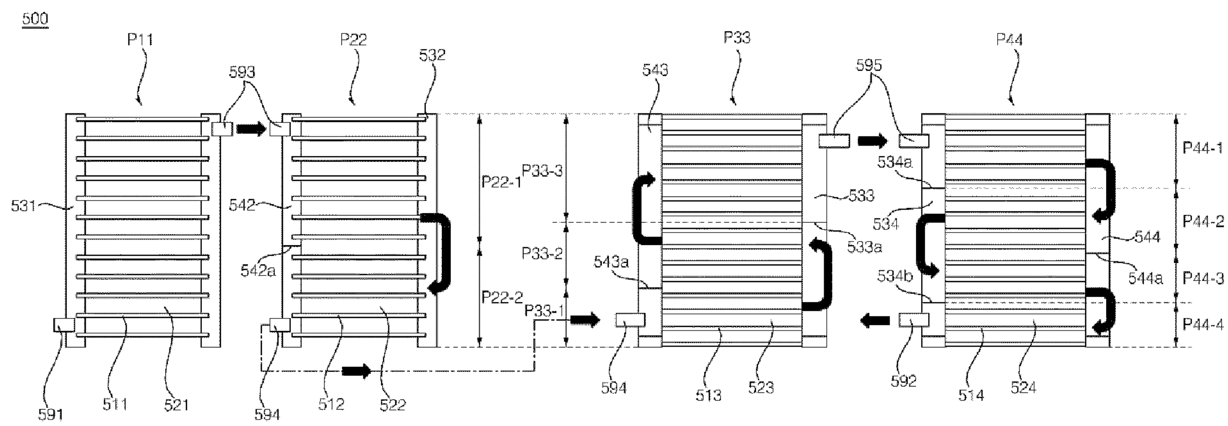

320
310
330

Fig. 11


500
P11
P22
P33
P44
593
532
543
595
531
542
542a
534a
533
534
533a
544
544a
534b
543a
P22-1
P33-3
P33-2
P22-2
P33-1
P44-1
P44-2
P44-3
P44-4
591
511
521
594
512
522
594
513
523
592
514
524

REFERENCES CITED IN THE DESCRIPTION

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- KR 20180040330 **[0016] [0017]**