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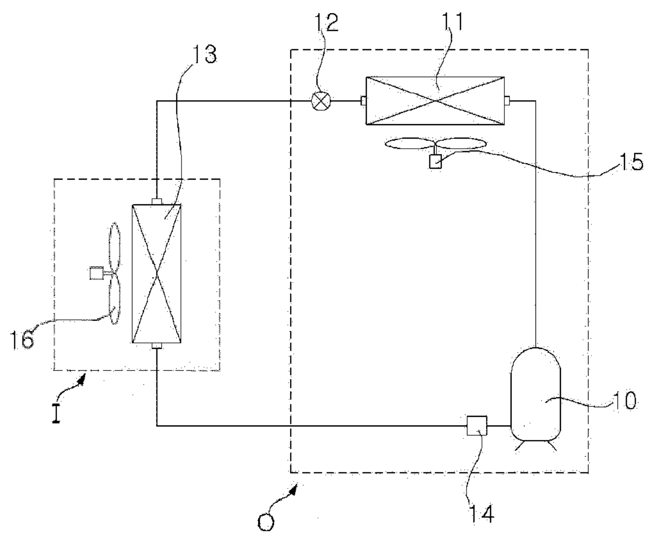
(54) ## HEAT EXCHANGER

(57) A heat exchanger is disclosed. The heat exchanger includes a main heat exchange unit configured to perform heat exchange between refrigerant and air and to define a first heat exchange surface and an auxiliary heat exchange unit configured to perform heat exchange between refrigerant discharged from the main heat exchange unit and air and to define a second heat exchange surface. The first heat exchange surface has an area larger than the area of the second heat exchange surface.

Fig. 1



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Description

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims the priority benefit of Korean Patent Application No. 10-2023-0002329 filed on 06 01 2023, in the Korean Intellectual Property Office, the disclosure of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0002] The present disclosure relates to a heat exchanger capable of reducing air-blowing resistance and improving heat exchange efficiency.

2. Description of the Related Art

[0003] FIG. 8 is a perspective view schematically showing the external appearance of a conventional heat exchanger, FIG. 9 is an exploded view showing the coupling relationship between components of the conventional heat exchanger, and FIG. 10 is a view showing the cross-section of a tube shown in FIG. 9.

[0004] Referring to these drawings, the conventional heat exchanger includes an upper header 2 located above a lower header 1 so as to correspond thereto, a plurality of tubes 3 located between the upper header 2 and the lower header 1, and fins 6 located between the tubes 3. The lower header 1 is formed in the shape of a cylinder having a cavity formed therein, and a plurality of header holes 4, into which the tubes 3 are fixedly inserted, is formed in one side of the outer circumferential portion of the lower header 1, which defines the external appearance of the lower header 1, in the longitudinal direction of the lower header 1 so as to be spaced apart from each other at regular intervals.

[0005] Here, the upper header 2, which is located above the lower header 1 so as to correspond thereto, has the same shape as the lower header 1. The tubes 3 are arranged parallel to each other in the longitudinal direction of the headers 1 and 2 in such a manner that both end portions of each of the tubes 3 in the longitudinal direction are fixed to the respective header holes 4.

[0006] Meanwhile, air passes between the tubes 3 and the two headers 1 and 2 while flowing at a predetermined incline toward a plane connecting the longitudinal axes of the two headers 1 and 2. The tube 3 has a length corresponding to a distance between both end portions thereof fixed to the two headers 1 and 2, a thickness corresponding to a distance perpendicular to the flow direction of air, and a width corresponding to a distance parallel to the flow direction of air. The tube 3 is formed in the shape of a rectangular plate having a width and a thickness small enough to be received in the two headers 1 and 2, and includes a plurality of hollow channels 5 formed therein.

[0007] Each of the fins 6 is formed in the shape of a plate that has a small thickness and is bent several times in a zigzag pattern, and is mounted between the tubes 3. The fins 6 may be fixed in any of various shapes. However, it is preferable to secure a space so as to minimize air flow resistance.

[0008] In general, the tubes and the fins are provided in multiple rows. However, as the number of rows of the tubes and the fins increases, air resistance increases, and heat exchange efficiency decreases.

[Related Art Document]

[0009] (Patent Document 1) Korean Patent Laid-Open Publication No. 10-2004-0053551

SUMMARY OF THE INVENTION

[0010] It is an object of the present disclosure to provide a heat exchanger including a plurality of heat exchange units and capable of obtaining an additional amount of heat.

[0011] It is another object of the present disclosure to provide a heat exchanger capable of reducing air-blowing resistance while obtaining an additional amount of heat.

[0012] It is still another object of the present disclosure to provide a heat exchanger capable of being disposed in a narrow space.

[0013] The objects of the present disclosure are not limited to the above-described objects, and other objects not mentioned herein may be clearly understood by those skilled in the art from the following description.

[0014] In order to accomplish the above and other objects, a heat exchanger according to the present disclosure includes a main heat exchange unit configured to perform heat exchange between refrigerant and air and to define a first heat exchange surface and an auxiliary heat exchange unit configured to perform heat exchange between refrigerant discharged from the main heat exchange unit and air and to define a second heat exchange surface, wherein the first heat exchange surface has an area larger than the area of the second heat exchange surface.

[0015] The area of the second heat exchange surface may be 40% to 60% of the area of the first heat exchange surface.

[0016] The second heat exchange surface may have a width identical to the width of the first heat exchange surface and may have a height different from the height of the first heat exchange surface.

[0017] A portion of the main heat exchange unit may be located so as to overlap the auxiliary heat exchange unit in a first direction, and the upper end of the auxiliary heat exchange unit may be located at a lower height than the upper end of the main heat exchange unit.

[0018] In addition, the heat exchanger may further include an air introduction hole formed to allow air to be introduced thereinto, and the auxiliary heat exchange unit may be located closer to the air introduction hole than the main heat exchange unit.

[0019] The first heat exchange surface of the main heat exchange unit may be disposed in multiple rows in the first direction.

[0020] The main heat exchange unit may include a plurality of main refrigerant tubes formed to allow refrigerant to flow therethrough, a plurality of main fins disposed between the plurality of main refrigerant tubes adjacent to each other in order to conduct heat, a first main header coupled to one side of each of the plurality of main refrigerant tubes and formed to allow refrigerant to flow therethrough, and a second main header coupled to the opposite side of each of the plurality of main refrigerant tubes and formed to allow refrigerant to flow therethrough.

[0021] The first heat exchange surface may be defined by the plurality of main refrigerant tubes and the plurality of main fins.

[0022] The auxiliary heat exchange unit may include a plurality of auxiliary refrigerant tubes formed to allow refrigerant to flow therethrough, a plurality of auxiliary fins disposed between the plurality of auxiliary refrigerant tubes adjacent to each other in order to conduct heat, a first auxiliary header coupled to one side of each of the plurality of auxiliary refrigerant tubes and formed to allow refrigerant to flow therethrough, and a second auxiliary header coupled to the opposite side of each of the plurality of auxiliary refrigerant tubes and formed to allow refrigerant to flow therethrough.

[0023] The second heat exchange surface may be defined by the plurality of auxiliary refrigerant tubes and the plurality of auxiliary fins.

[0024] A spacing distance between the plurality of main refrigerant tubes and the plurality of auxiliary refrigerant tubes may be less than the width of the plurality of main refrigerant tubes.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] The above and other objects, features, and other advantages of the present disclosure will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a block diagram showing a refrigeration cycle device according to an embodiment of the present disclosure;
FIG. 2 is a perspective view showing the interior of an outdoor unit shown in FIG. 1;
FIG. 3 is a perspective view of the outdoor heat exchanger shown in FIG. 2;
FIG. 4 is a plan view of the outdoor heat exchanger shown in FIG. 3;
FIG. 5 is a front view of a main heat exchange unit shown in FIG. 3;
FIG. 6 is a front view of an auxiliary heat exchange unit shown in FIG. 3; and
FIG. 7 is a view showing the flow of refrigerant in the outdoor heat exchanger shown in FIG. 3.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0026] 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.

[0027] 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.

[0028] 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.

[0029] 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.

[0030] 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.

[0031] Hereinafter, exemplary embodiments of the present invention will be described with reference to the accompanying drawings.

[0032] FIG. 1 is a block diagram showing a refrigeration cycle device according to an embodiment of the present disclosure, and FIG. 2 is a perspective view showing the interior of an outdoor unit shown in FIG. 1.

[0033] Referring to FIGs. 1 and 2, a refrigeration cycle device according to an embodiment may include a compressor 10 configured to compress refrigerant, an outdoor heat exchanger 11 configured to perform heat exchange between the refrigerant and outdoor air, an expansion device 12 configured to expand the refrigerant, and an indoor heat exchanger 13 configured to perform heat exchange between the refrigerant and indoor air.

[0034] The refrigerant compressed by the compressor 10 may exchange heat with outdoor air while passing through the outdoor heat exchanger 11, with the result that the refrigerant may be condensed.

[0035] The outdoor heat exchanger 11 may be used as a condenser.

[0036] The refrigerant condensed by the outdoor heat exchanger 11 may flow to the expansion device 12, and may be expanded by the expansion device 12. The refrigerant expanded by the expansion device 12 may exchange heat with indoor air while passing thorough the indoor heat exchanger 13, with the result that the refrigerant may be evaporated.

[0037] The indoor heat exchanger 13 may be used as an evaporator for evaporating the refrigerant.

[0038] The refrigerant evaporated by the indoor heat exchanger 13 may be collected in the compressor 10.

[0039] The refrigerant circulates through a refrigeration cycle constituted by the compressor 10, the outdoor heat exchanger 11, the expansion device 12, and the indoor heat exchanger 13.

[0040] A compressor suction channel may be connected to the compressor 10 in order to guide the refrigerant, having passed through the indoor heat exchanger 13, to the compressor 10. An accumulator 14 configured to accumulate liquid refrigerant may be mounted in the compressor suction channel.

[0041] A refrigerant channel, through which the refrigerant passes, may be formed in the indoor heat exchanger 13.

[0042] The refrigeration cycle device may be a separation-type air conditioner including an indoor unit I and an outdoor unit O, which are provided separately from each other. In this case, the compressor 10 and the outdoor heat exchanger 11 may be mounted in the outdoor unit O. Alternatively, the refrigeration cycle device may be a refrigerator, in which the indoor heat exchanger 13 exchanges heat with air inside a food storage compartment and the outdoor heat exchanger 11 exchanges heat with air outside the food storage compartment. In the case of a refrigerator, both the indoor unit I and the outdoor unit O may be disposed in a main body.

[0043] The expansion device 12 may be mounted in any one of the indoor unit I and the outdoor unit O.

[0044] The indoor heat exchanger 13 may be mounted in the indoor unit I.

[0045] An outdoor fan 15 may be mounted in the outdoor unit O in order to blow outdoor air to the outdoor heat exchanger 11.

[0046] An indoor fan 16 may be mounted in the indoor unit I in order to blow indoor air to the indoor heat exchanger 13.

[0047] FIG. 3 is a perspective view of the outdoor heat exchanger shown in FIG. 2, and FIG. 4 is a plan view of the outdoor heat exchanger shown in FIG. 3.

[0048] A heat exchanger according to an embodiment of the present disclosure will be described with reference to FIGs. 3 and 4. An outdoor heat exchanger will be mainly described with reference to FIGs. 3 and 4. However, the heat exchanger according to the embodiment of the present disclosure may also be used as an indoor heat exchanger.

[0049] The outdoor heat exchanger 11 is a microchannel-type heat exchanger. The outdoor heat exchanger 11 is made of aluminum.

[0050] The outdoor heat exchanger 11 includes a main heat exchange unit 110 and an auxiliary heat exchange unit 120.

[0051] The outdoor heat exchanger 11 includes a main heat exchange unit 110, an auxiliary heat exchange unit 120 stacked on the main heat exchange unit 110, an introduction pipe 22 connected to the main heat exchange unit 110 in order to supply refrigerant thereto, a discharge pipe 24 connected to the auxiliary heat exchange unit 120 in order to discharge refrigerant therefrom, and a connection pipe 26 connecting the main heat exchange unit 110 to the auxiliary heat exchange unit 120 in order to allow refrigerant to flow from the main heat exchange unit 110 to the auxiliary heat exchange unit 120 therethrough.

[0052] The main heat exchange unit 110 is disposed so as to exchange heat with air having exchanged heat with the auxiliary heat exchange unit 120. In detail, the main heat exchange unit 110 and the auxiliary heat exchange unit 120 are disposed on a path through which outside air flows, and the outside air primarily exchanges heat with the auxiliary heat exchange unit 120, and secondarily exchanges heat with the main heat exchange unit 110. In more detail, the outdoor unit is provided with an air introduction part H1, through which outside air is introduced, and an air discharge part H2, through which the introduced air having exchanged heat with the heat exchange units is discharged. The auxiliary heat exchange unit 120 is disposed closer to the air introduction part H1 than the main heat exchange unit 110.

[0053] Therefore, the main heat exchange unit 110, through which high-temperature refrigerant flows, is disposed in a region in which the temperature of the outside air is high, and the auxiliary heat exchange unit 120, through which low-temperature refrigerant flows, is disposed in a region in which the temperature of the outside air is low, so that the heat exchange efficiency of the outdoor heat exchanger 11 is improved.

[0054] The main heat exchange unit 110 and the auxiliary heat exchange unit 120 may be disposed so as to define a heat exchange surface P that intersects an air flow direction. The main heat exchange unit 110 may define a first heat exchange surface P1, and the auxiliary heat exchange unit 120 may define a second heat exchange surface P2.

[0055] The main heat exchange unit 110 and the auxiliary heat exchange unit 120 form heat exchange surfaces that intersect an air flow direction and allow air to pass therethrough while exchanging heat therewith. The main heat exchange unit 110 and the auxiliary heat exchange unit 120 may be stacked in the air flow direction (forward-backward direction).

[0056] The main heat exchange unit 110 and the auxiliary heat exchange unit 120 are manufactured by stacking a plurality of refrigerant tubes. The main heat exchange unit 110 and the auxiliary heat exchange unit 120 are formed such that the refrigerant tubes are disposed horizontally in order to allow the refrigerant to move horizontally.

[0057] In detail, when the air flow direction is the forward-backward direction, the refrigerant tubes of the main heat exchange unit 110 and the auxiliary heat exchange unit 120 may be disposed so as to be elongated in the horizontal (lateral) direction, and may be stacked in the vertical direction. Air exchanges heat with refrigerant in the refrigerant tubes while passing through spaces between the plurality of refrigerant tubes stacked in the vertical (longitudinal) direction. The plurality of refrigerant tubes stacked vertically defines heat exchange surfaces together with fins to be described later.

[0058] The main heat exchange unit 110 may include main refrigerant tubes 51, a first main header 111, a second main header 112, and main fins 61. In detail, the main heat exchange unit 110 includes a plurality of main refrigerant tubes 51 in which a plurality of channels is formed, main fins 61 interconnecting the main refrigerant tubes 51 in order to conduct heat, a first main header 111 coupled to one side of each of the plurality of main refrigerant tubes 51 and communicating with one side of each of the plurality of main refrigerant tubes 51 in order to allow the refrigerant to flow therethrough, and a second main header 112 coupled to the other side of each of the plurality of main refrigerant tubes 51 and communicating with the other side of each of the plurality of main refrigerant tubes 51 in order to allow the refrigerant to flow therethrough.

[0059] The main refrigerant tubes 51 are disposed so as to be elongated in the lateral direction. Channels, through which the refrigerant flows, are formed in the main refrigerant tubes 51.

[0060] The main refrigerant tubes 51 are disposed horizontally, and the plurality of main refrigerant tubes 51 is stacked in the upward-downward direction. A plurality of channels may be formed in the main refrigerant tubes 51.

[0061] The right sides of the main refrigerant tubes 51 communicate with the first main header 111, and the left sides thereof communicate with the second main header 112.

[0062] The main fins 61 are formed so as to be bent in the upward-downward direction. Each of the main fins 61 interconnects two adjacent ones of the main refrigerant tubes 51, which are stacked in the upward-downward direction, to conduct heat.

[0063] The first main header 111 communicates with one side of each of the plurality of main refrigerant tubes 51. The first main header 111 is disposed so as to be elongated in the upward-downward direction and is connected to the introduction pipe 22. The first main header 111 has a single space defined therein to distribute the refrigerant introduced through the introduction pipe 22 to the plurality of main refrigerant tubes 51.

[0064] One introduction pipe 22 or a plurality of introduction pipes 22 may be connected to the first main header 111.

[0065] The second main header 112 communicates with the other side of each of the plurality of main refrigerant tubes 51. The second main header 112 is disposed so as to be elongated in the upward-downward direction. The second main header 112 has a single space defined therein to guide the refrigerant discharged from the other side of each of the plurality of main refrigerant tubes 51 to the connection pipe 26.

[0066] That is, the refrigerant that has passed through the first main header 111 flows to the second main header 112 via the main refrigerant tubes 51, and the refrigerant introduced into the second main header 112 is supplied to the auxiliary heat exchange unit 120 through the connection pipe 26.

[0067] In detail, one side of the connection pipe 26 is connected to the second main header 112 of the main heat exchange unit 110, and the other side thereof is connected to a second auxiliary header 122 of the auxiliary heat exchange unit 120.

[0068] The refrigerant introduced through the introduction pipe 22 is supplied to the respective main refrigerant tubes 51 through the first main header 111, and exchanges heat with air while passing through the main refrigerant tubes 51. Thereafter, the refrigerant is supplied to the connection pipe 26 through the second main header 112. The introduction pipe 22 is connected to the compressor 10 to supply high-temperature and high-pressure refrigerant to the main heat exchange unit 110.

[0069] Although the main heat exchange unit 110 has been described above as being disposed in a single row, the main heat exchange unit 110 may be disposed in multiple rows in the forward-backward direction, which is a first direction, as shown in FIG. 3.

[0070] In detail, the main heat exchange unit 110 may include a first main heat exchange unit 110a, a second main heat exchange unit 110b disposed in front of the first main heat exchange unit 110a, and a third main heat exchange unit 110c disposed in front of the second main heat exchange unit 110b. The first main heat exchange unit 110a to the third main heat exchange unit 110c have the same structure.

[0071] In this case, a second main header 112a of the first main heat exchange unit 110a and a second main header 112b of the second main heat exchange unit 110b may be connected to each other via a first main connection pipe 25-1, a first main header 111b of the second main heat exchange unit 110b and a first main header 111c of the third main heat exchange unit 110c may be connected to each other via a second main connection pipe 25-2, and a second main header 112c of the third main heat exchange unit 110c and the second auxiliary header 122 may be connected to each other via the connection pipe 26. A first main header 111a of the first main heat exchange unit 110a is connected to the introduction pipe 22.

[0072] Similar to the main heat exchange unit 110, the auxiliary heat exchange unit 120 may include a plurality of auxiliary refrigerant tubes 52, auxiliary fins 62, a first auxiliary header 121, and a second auxiliary header 122.

[0073] The auxiliary heat exchange unit 120 includes a plurality of auxiliary refrigerant tubes 52 having a plurality of channels formed therein, auxiliary fins 62 interconnecting the auxiliary refrigerant tubes 52 in order to conduct heat, a first auxiliary header 121 coupled to one side of each of the plurality of auxiliary refrigerant tubes 52 and communicating with one side of each of the plurality of auxiliary refrigerant tubes 52 in order to allow the refrigerant to flow therethrough, and a second auxiliary header 122 coupled to the other side of each of the plurality of auxiliary refrigerant tubes 52 and communicating with the other side of each of the plurality of auxiliary refrigerant tubes 52 in order to allow the refrigerant to flow therethrough.

[0074] The auxiliary refrigerant tubes 52 are disposed so as to be elongated in the lateral direction. Channels, through which the refrigerant flows, are formed in the auxiliary refrigerant tubes 52.

[0075] The auxiliary refrigerant tubes 52 are disposed horizontally, and the plurality of auxiliary refrigerant tubes 52 is stacked in the upward-downward direction. A plurality of channels may be formed in the auxiliary refrigerant tubes 52.

[0076] The right sides of the auxiliary refrigerant tubes 52 communicate with the first auxiliary header 121, and the left sides thereof communicate with the second auxiliary header 122.

[0077] The auxiliary fins 62 are formed so as to be bent in the upward-downward direction. Each of the auxiliary fins 62 interconnects two adjacent ones of the auxiliary refrigerant tubes 52, which are stacked in the upward-downward direction, to conduct heat.

[0078] The first auxiliary header 121 communicates with one side of each of the plurality of auxiliary refrigerant tubes 52. The first auxiliary header 121 is disposed so as to be elongated in the upward-downward direction and is connected to the discharge pipe 24. The first auxiliary header 121 has a single space defined therein to distribute the refrigerant discharged from the plurality of auxiliary refrigerant tubes 52 to the discharge pipe 24.

[0079] One discharge pipe 24 or a plurality of discharge pipes 24 may be connected to the first auxiliary header 121.

[0080] The second auxiliary header 122 communicates with the other side of each of the plurality of auxiliary refrigerant tubes 52. The second auxiliary header 122 is disposed so as to be elongated in the upward-downward direction and is connected to the connection pipe 26. The second auxiliary header 122 has a single space defined therein to supply the refrigerant supplied through the connection pipe 26 to the plurality of auxiliary refrigerant tubes 52.

[0081] One connection pipe 26 or a plurality of connection pipes 26 may be connected to the second auxiliary header 122.

[0082] The refrigerant that is discharged from the compressor 10 and is heat-exchanged in the main heat exchange unit 110 is in a high-temperature and high-pressure gaseous state, and thus has a large specific volume. The refrigerant that is heat-exchanged in the auxiliary heat exchange unit 120 after being heat-exchanged in the main heat exchange unit 110 is in a gaseous or gas-liquid mixed state, the temperature of which is lower than that of the refrigerant in the main heat exchange unit 110. Therefore, the specific volume of the refrigerant that is heat-exchanged in the auxiliary heat exchange unit 120 is smaller than that of the refrigerant that is heat-exchanged in the main heat exchange unit 110.

[0083] In this case, if the heat-exchange area of the main heat exchange unit 110 and the heat-exchange area of the auxiliary heat exchange unit 120 are identical, the heat exchange amount and heat exchange efficiency in the main heat exchange unit 110 is greatly reduced due to the large specific volume of the refrigerant in the main heat exchange unit 110.

[0084] Therefore, in the embodiment, the sum of the cross-sectional areas of the refrigerant tubes of the main heat exchange unit 110 is set to be larger than the sum of the cross-sectional areas of the refrigerant tubes of the auxiliary heat exchange unit 120, so that the heat exchange amount in the main heat exchange unit 110 may be improved.

[0085] FIG. 5 is a front view of the main heat exchange unit 110 shown in FIG. 3, and FIG. 6 is a front view of the auxiliary heat exchange unit 120 shown in FIG. 3.

[0086] The main heat exchange unit 110 may define a first heat exchange surface P1, and the auxiliary heat exchange unit 120 may define a second heat exchange surface P2. In particular, referring to FIGs. 5 and 6, when viewed from the front, the first heat exchange surface P1 may refer to an area defined by the main refrigerant tubes

51 and the main fins 61. The first heat exchange surface P1 may have a first height H1 and a first width L1.

[0087] The second heat exchange surface P2 may refer to an area defined by the auxiliary refrigerant tubes 52 and the auxiliary fins 62. The second heat exchange surface P2 may have a second height H2 and a second width L2.

[0088] The area of the first heat exchange surface P1 may be larger than the area of the second heat exchange surface P2. When the area of the second heat exchange surface P2 is smaller than the area of the first heat exchange surface P1, there is an advantage in that the flow resistance of the introduced air is reduced in the second heat exchange surface P2 having a smaller area. In addition, it is possible to sufficiently supercool the refrigerant in the auxiliary heat exchange unit 120, whereby the efficiency of the air conditioner is improved.

[0089] Preferably, the area of the second heat exchange surface P2 may be 40% to 60% of the area of the first heat exchange surface P1.

[0090] The second width L2 of the second heat exchange surface P2 may be equal to the first width L1 of the first heat exchange surface P1, and the second height H2 of the second heat exchange surface P2 may be different from the first height H1 of the first heat exchange surface P1. Therefore, the positions of the headers of the main heat exchange unit 110 and the auxiliary heat exchange unit 120 may be shared, whereby manufacture thereof is facilitated.

[0091] A portion of the main heat exchange unit 110 may be located so as to overlap the auxiliary heat exchange unit 120 in the first direction (forward-backward direction), and the upper end of the auxiliary heat exchange unit 120 may be located at a lower height than the upper end of the main heat exchange unit 110. In this case, the lower end of the auxiliary heat exchange unit 120 and the lower end of the main heat exchange unit 110 may be located at the same height.

[0092] The number of first heat exchange surfaces may be greater than the number of second heat exchange surfaces. The first heat exchange surfaces may be disposed in multiple rows, and the second heat exchange surfaces may be disposed in a single row.

[0093] Therefore, the auxiliary heat exchange unit 120 does not shield the middle and upper portions of the main heat exchange unit 110, in which an air flow amount is relatively large, and thus air resistance is reduced.

[0094] A spacing distance between the main refrigerant tubes 51 and the auxiliary refrigerant tubes 52 may be less than the width of the main refrigerant tubes 51.

[0095] The plurality of auxiliary fins may be located so as to overlap the plurality of main fins in the first direction. The plurality of auxiliary refrigerant tubes may be located so as to overlap the plurality of main refrigerant tubes in the first direction. Due to such placement, air flow resistance is reduced, and heat exchange efficiency is improved.

[0096] FIG. 7 is a view showing the flow of refrigerant in the outdoor heat exchanger shown in FIG. 3.

[0097] Referring to FIG. 7, the refrigerant compressed in the compressor 10 flows to the first main heat exchange unit 1 10a, the refrigerant in the first main heat exchange unit 110a flows to the second main heat exchange unit 110b, the refrigerant in the second main heat exchange unit 110b flows to the third main heat exchange unit 110c, the refrigerant in the third main heat exchange unit 110c flows to the auxiliary heat exchange unit 120, and the refrigerant in the auxiliary heat exchange unit 120 is discharged outside through the discharge pipe 24.

[0098] As is apparent from the above description, the heat exchanger of the present disclosure has one or more effects as follows.

[0099] First, since an auxiliary heat exchange unit is disposed separately from a main heat exchange unit and the area of the heat exchange surface of the auxiliary heat exchange unit is set to be smaller than the area of the heat exchange surface of the main heat exchange unit, air resistance increases little while air passes through the auxiliary heat exchange unit having a relatively small area, the flow amount of air that has passed through the auxiliary heat exchange unit is increased, and the flow amount of air to be supplied to the main heat exchange unit is increased.

[0100] Second, since the refrigerant condensed in the main heat exchange unit is supercooled in the auxiliary heat exchange unit, the efficiency of the air conditioner is improved.

[0101] Third, since the refrigerant that has passed through the main heat exchange unit is supplied to the auxiliary heat exchange unit and the auxiliary heat exchange unit is disposed closer to an air introduction hole than the main heat exchange unit, outside air having a relatively low temperature and refrigerant having a relatively low temperature exchange heat with each other in the auxiliary heat exchange unit, whereby heat exchange efficiency is increased.

[0102] 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 main heat exchange unit (110) performing heat exchange between refrigerant and air and defining a first heat exchange surface (P1); and

an auxiliary heat exchange unit (120) performing heat exchange between refrigerant discharged from the main heat exchange unit (110) and air and defining a second heat exchange surface (P2),
wherein the first heat exchange surface (P1) has an area larger than an area of the second heat exchange surface (P2).

2. The heat exchanger according to claim 1, wherein the area of the second heat exchange (P2) surface is 40% to 60% of the area of the first heat exchange surface (P1).

3. The heat exchanger according to claims 1 or 2, wherein the second heat exchange surface (P2) has a width (L2) identical to a width (L1) of the first heat exchange surface (P1) and has a height (H2) different from a height (H1) of the first heat exchange surface (P1).

4. The heat exchanger according to any one of claims 1 to 3, wherein a portion of the main heat exchange unit (110) is located so as to overlap the auxiliary heat exchange unit (120) in a first direction, and wherein an upper end of the auxiliary heat exchange unit (120) is located at a lower height than an upper end of the main heat exchange unit (110).

5. The heat exchanger according to any one of claims 1 to 4, further comprising an air introduction hole (H1) formed to allow air to be introduced thereinto, wherein the auxiliary heat exchange unit (120) is located closer to the air introduction hole (H1) than the main heat exchange unit (110).

6. The heat exchanger according to any one of claims 1 to 5, wherein the first heat exchange surface (P1) of the main heat exchange unit (110) is disposed in multiple rows in a first direction.

7. The heat exchanger according to any one of claims 1 to 6, wherein the number of first heat exchange surfaces (P1) is greater than the number of second heat exchange surfaces (P2).

8. The heat exchanger according to any one of claims 1 to 7, wherein the first heat exchange surfaces (P1) are arranged in multiple rows, and the second heat exchange surfaces (P2) are arranged in a single row.

9. The heat exchanger according to any one of claims 1 to 8, wherein the main heat exchange unit (110) comprises:

a plurality of main refrigerant tubes (51) formed to allow refrigerant to flow therethrough;
a plurality of main fins (61) disposed between the plurality of main refrigerant tubes (51) adjacent to each other in order to conduct heat;
a first main header (111) coupled to one side of each of the plurality of main refrigerant tubes (51) and formed to allow refrigerant to flow therethrough; and
a second main header (112) coupled to an opposite side of each of the plurality of main refrigerant tubes (51) and formed to allow refrigerant to flow therethrough.

10. The heat exchanger according to claim 9, wherein the first heat exchange surface (P1) is defined by the plurality of main refrigerant tubes (51) and the plurality of main fins (61).

11. The heat exchanger according to claim 10, wherein the auxiliary heat exchange unit (120) comprises:

a plurality of auxiliary refrigerant tubes (52) formed to allow refrigerant to flow therethrough;
a plurality of auxiliary fins (62) disposed between the plurality of auxiliary refrigerant tubes (52) adjacent to each other in order to conduct heat;
a first auxiliary header (121) coupled to one side of each of the plurality of auxiliary refrigerant tubes (52) and formed to allow refrigerant to flow therethrough; and
a second auxiliary header (122) coupled to an opposite side of each of the plurality of auxiliary refrigerant tubes (52) and formed to allow refrigerant to flow therethrough.

12. The heat exchanger according to claim 11, wherein the second heat exchange surface (P2) is defined by the plurality of auxiliary refrigerant tubes (52) and the plurality of auxiliary fins (62).

13. The heat exchanger according to claim 11 or 12, wherein a spacing distance between the plurality of main refrigerant tubes (51) and the plurality of auxiliary refrigerant tubes (52) is less than a width of the plurality of main refrigerant tubes (51).

14. The heat exchanger according to any one of claims 11 to 13, wherein a plurality of auxiliary fins (62) are positioned to overlap the plurality of main fins (61) in a first direction.

15. The heat exchanger according to any one of claims 11 to 14, wherein a plurality of auxiliary refrigerant tubes (52) are positioned to overlap the plurality of main refrigerant tubes (51) in a first direction.

Fig. 1

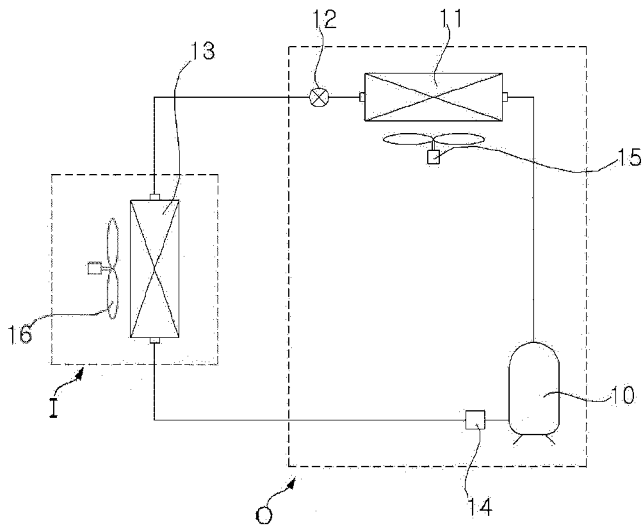


Fig. 2

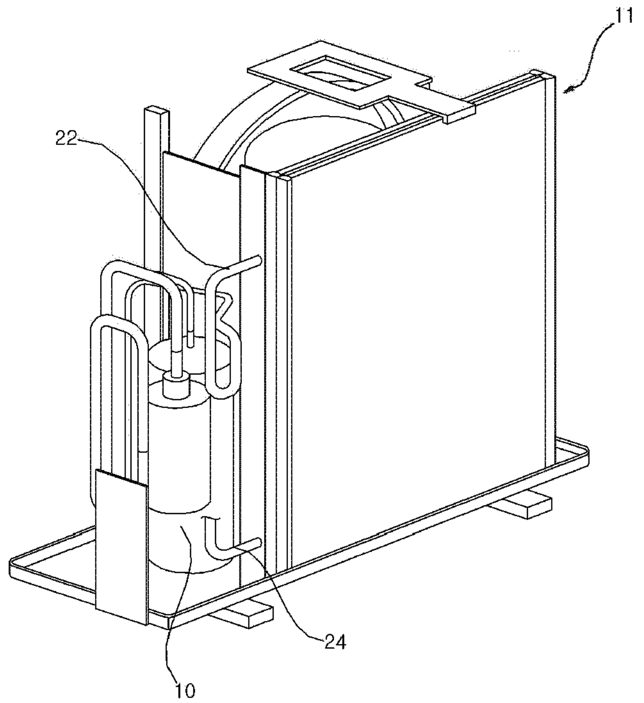


Fig. 3

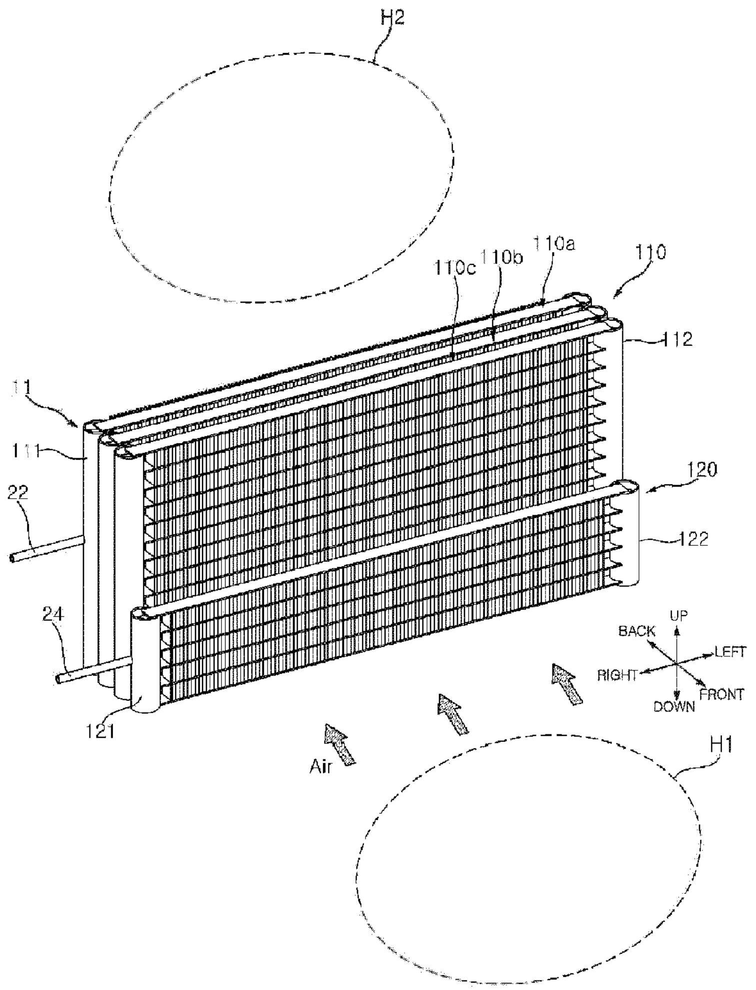

H2
110c
110b
110a
110
112
11
111
22
120
122
24
BACK
UP
LEFT
RIGHT
FRONT
DOWN
121
Air
H1

Fig. 4

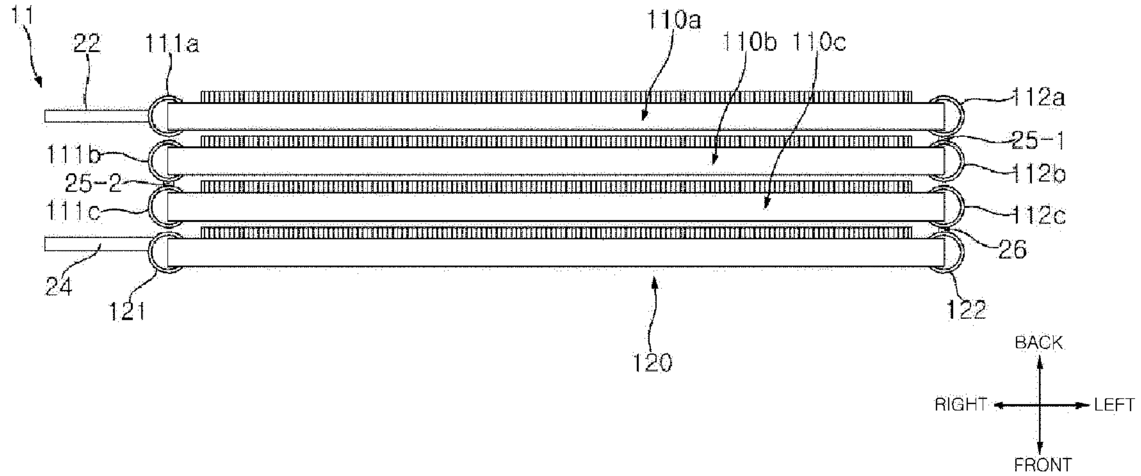

11
22
111a
110a
110b 110c
112a
25-1
111b
112b
25-2
111c
112c
26
24
121
122
120
BACK
RIGHT
LEFT
FRONT

Fig. 5

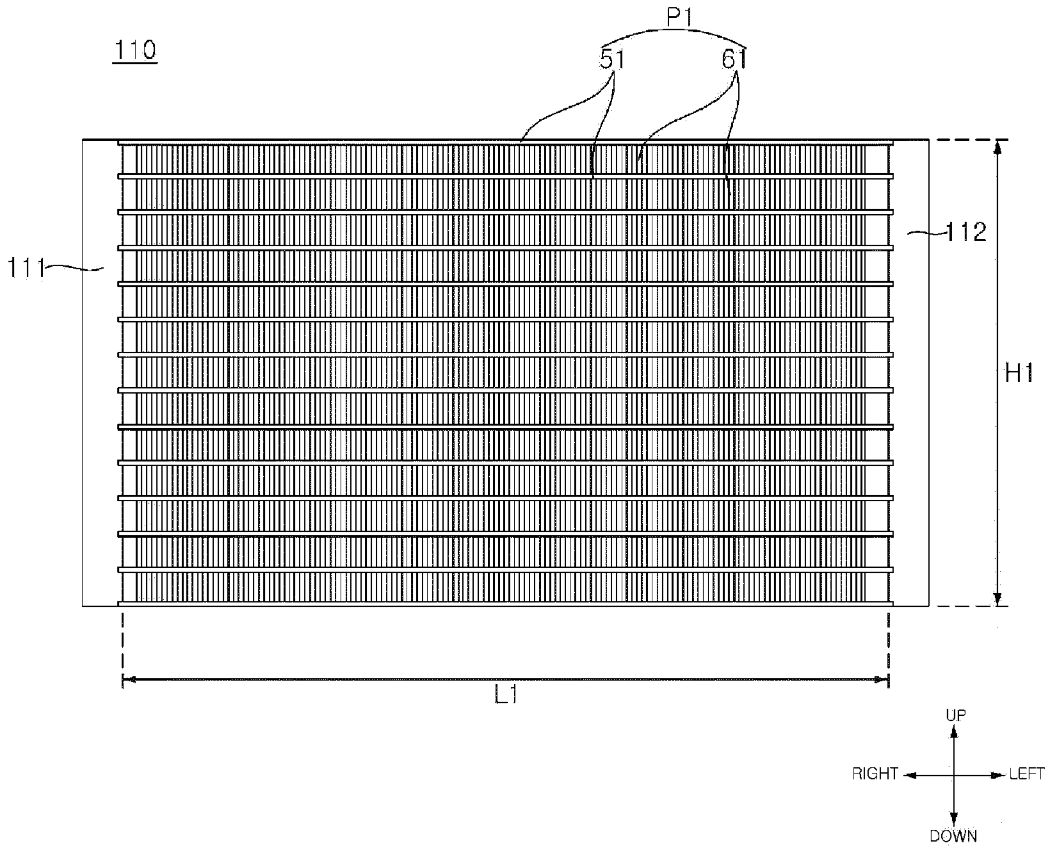

110
P1
51
61
111
112
H1
L1
UP
RIGHT
LEFT
DOWN

Fig. 6

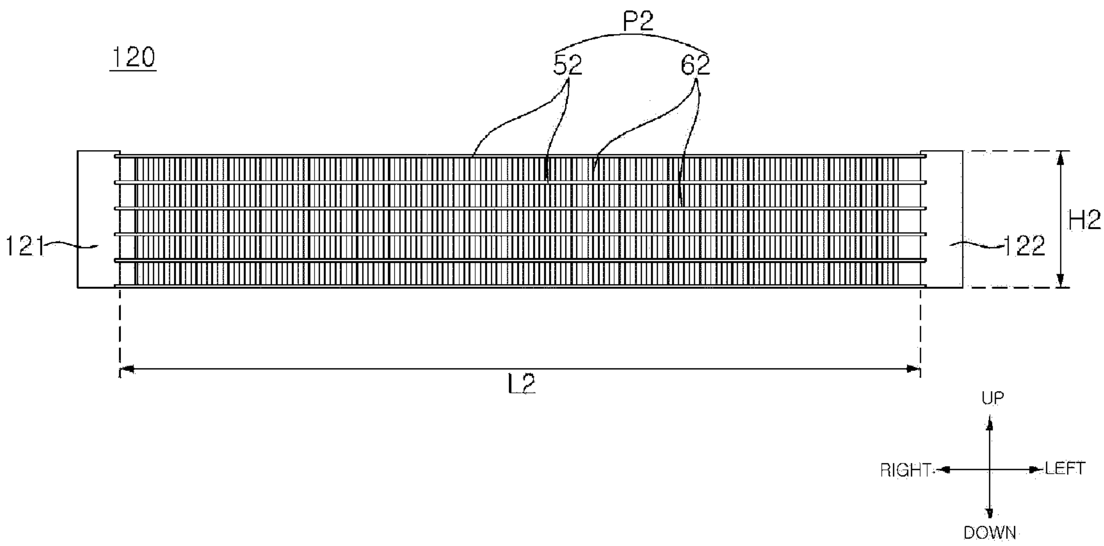

120
P2
52
62
121
122
H2
L2
UP
RIGHT
LEFT
DOWN

Fig. 7

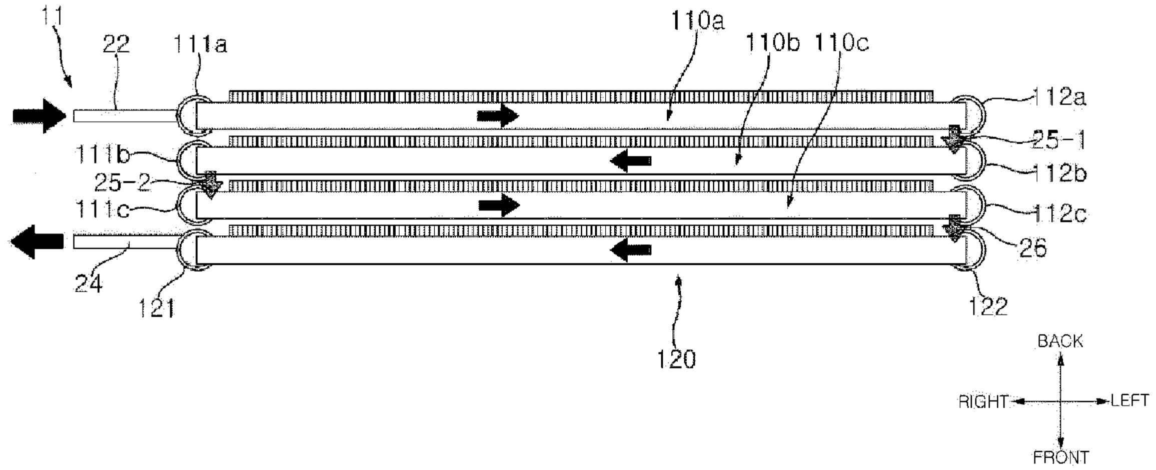

11
22
111a
110a
110b
110c
112a
25-1
111b
112b
25-2
111c
112c
26
24
121
122
120
BACK
RIGHT
LEFT
FRONT

Fig. 8

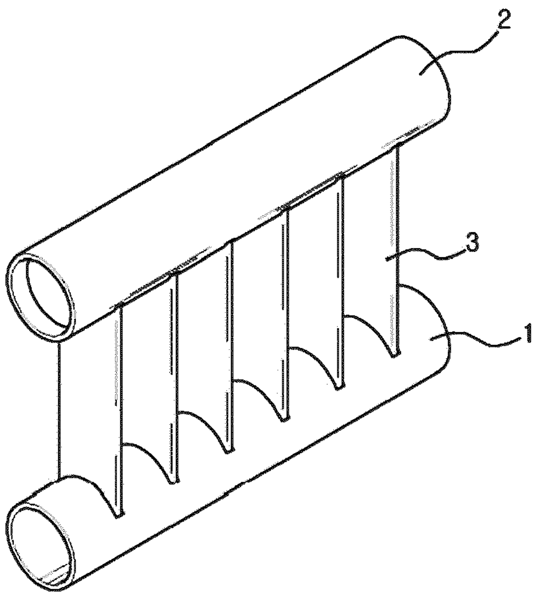

2
3
1

Fig. 9

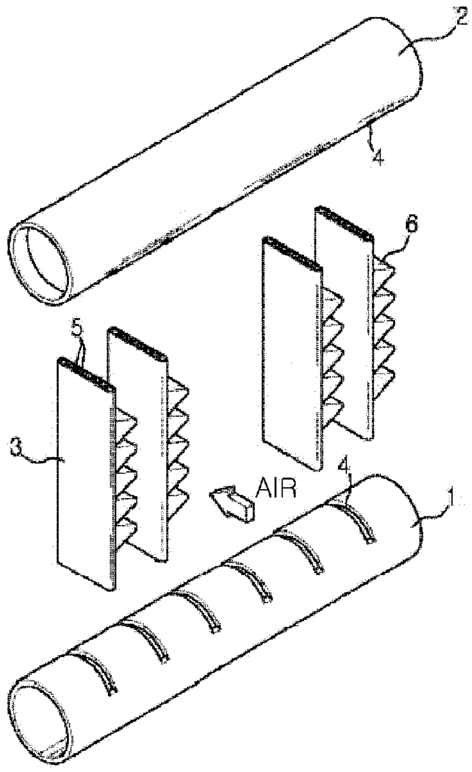
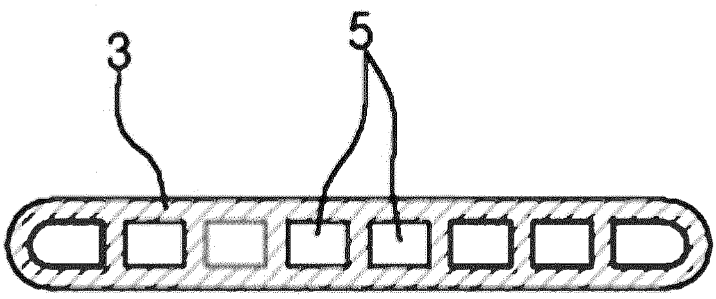


Fig. 10



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EUROPEAN SEARCH REPORT

Application Number
EP 24 15 0443

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The present search report has been drawn up for all claims

2

Place of search	Date of completion of the search	Examiner
Munich	9 April 2024	Bain, David

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