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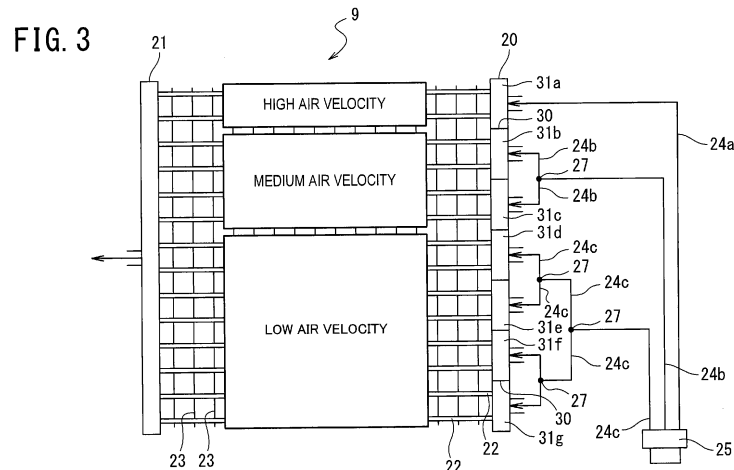
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(54) **HEAT EXCHANGER, AND OUTDOOR UNIT COMPRISING SAID HEAT EXCHANGER**

(57) There is provided a heat exchanger capable of suppressing a decrease in the amount of heat exchange due to the nonuniform air velocity distribution. The heat exchanger includes an inlet header (20), an outlet header (21), a plurality of rooms (31) partitioned by partition plates (30) inside the inlet header (20), a plurality of flat tubes (22) arranged in parallel and connected to each room (31) and the outlet header (21), a distributor (25) provided in a refrigerant pipe (10), and a plurality of branch pipes (24) connected to each room (31) and the

distributor (25), in which depending on an air velocity distribution, the branch pipe (24) has a branch portion (27) provided between the room (31) and the distributor (25), and the number of the branch portions (27) of the branch pipe (24) connected to the room (31), to which the flat tubes (22) located in a part having a high air velocity are connected, is less than the number of the branch portions (27) of the branch pipe (24) connected to the room (31), to which the flat tubes (22) passing through a part having a low air velocity, are connected.



Description

Technical Field

[0001] The present invention relates to, for example, a heat exchanger used in an upward-blowing type outdoor unit in an air conditioner, and an outdoor unit including the heat exchanger.

Background Art

[0002] In the upward-blowing type outdoor unit of the air conditioner, a blower fan is provided at an upper portion, a vertically long heat exchanger is provided below the blower fan, and outdoor air is sucked in by the blower fan. As a result, the outdoor air passes through the heat exchanger and exchanges heat with the refrigerant flowing through the heat exchanger. In this case, since the blower fan is provided at the upper portion, the air velocity of the air passing through the heat exchanger due to the suction of the outdoor air by the blower fan is fast on the upper portion side close to the blower fan and slow on the lower portion side far from the blower fan. Therefore, an air velocity distribution of the air passing through the heat exchanger becomes nonuniform. As a result, since the ability of the heat exchanger cannot be used effectively, there is a problem which is causing a decrease in the amount of heat exchange and a decrease in blowing performance.

[0003] In order to solve this problem, PTL 1 discloses an invention that includes a heat exchanger that causes a refrigerant to flow through a plurality of heat transfer pipes arranged in parallel, a refrigerant distributor including a header and a distributor and a capillary tube, the header that is connected to one end of the plurality of heat transfer pipes and is installed in a vertical direction with the inside separated by partition plates, the distributor for distributing and inflowing the refrigerant to each of the rooms in the header separated by the partition plates and the capillary tube connected to each of the rooms from the distributor, in which a length and an inner diameter of the capillary tube is set depending on an air velocity distribution in the heat exchanger.

[0004] In the heat exchanger and the refrigerant distributor disclosed in PTL 1, since the length and the inner diameter of the capillary tube is set depending on the air velocity distribution in the heat exchanger, a decrease in the amount of heat exchange due to the nonuniform air velocity distribution of the air passing through the heat exchanger in the upward-blowing type outdoor unit can be suppressed.

Citation List

Patent Literature

[0005] PTL 1: WO2013/160952 A1

Summary of Invention

Technical Problem

[0006] However, there is a problem, in the heat exchanger and the refrigerant distributor disclosed in PTL 1, in that a length and an inner diameter of the capillary tube are set depending on the air velocity distribution in the heat exchanger, but since the flow rate is adjusted by increasing the flow path resistance using a capillary tube, the pressure loss increases and the air conditioning capacity decreases.

[0007] Further, the length and the inner diameter of the capillary tube are set depending on the air velocity distribution in the heat exchanger, but in order to lengthen the capillary tube or reduce the inner diameter of the capillary tube, it is necessary to prepare several types of capillary tubes with different lengths and inner diameters according to the specifications of the heat exchanger, which causes a cost increase.

[0008] In view of the above problems, the present invention provides a heat exchanger that can suppress a decrease in the amount of heat exchange due to the non-uniform air velocity distribution.

Solution to Problem

[0009] A first aspect of the present invention is a heat exchanger including an inlet header located on a refrigerant inlet side, an outlet header located on a refrigerant outlet side, a plurality of rooms partitioned by partition plates and provided inside one header of the inlet header or the outlet header, a plurality of flat tubes connected in parallel between each room of the plurality of rooms provided in the one header of the inlet header or the outlet header and the other header of the inlet header or the outlet header, a distributor provided in a refrigerant pipe, a plurality of branch pipes connected to each room and the distributor, in which the branch pipe has a branch portion provided between the room and the distributor depending on an air velocity distribution in the heat exchanger, and the number of the branch portions of the branch pipe connected to the room, to which the flat tubes located in a part having a high air velocity are connected, is less than the number of the branch portions of the branch pipe connected to the room, to which the flat tubes passing through a part having a low air velocity are connected.

[0010] Further, a second aspect of the present invention is an upward-blowing type outdoor unit of an air conditioner in which a blower fan is provided at an upper portion and the heat exchanger according to the first aspect of the present invention is provided below the blower fan.

Advantageous Effects of Invention

[0011] In view of the above problems, the present in-

vention provides a heat exchanger that can suppress a decrease in the amount of heat exchange due to the non-uniform air velocity distribution.

Brief Description of Drawings

[0012]

FIG. 1 is a refrigerant circuit diagram of an air conditioner according to an embodiment of the present invention;

FIG. 2 is a longitudinal cross-sectional view of an outdoor unit of the air conditioner according to the embodiment of the present invention; and

FIG. 3 is a schematic diagram of a heat exchanger of the air conditioner according to the embodiment of the present invention.

Description of Embodiments

[0013] Hereinafter, embodiments of the present invention will be described in detail based on the accompanying drawings. As the embodiment, an air conditioner in which an indoor unit is connected to an outdoor unit and a cooling operation or a heating operation can be performed in the indoor unit will be described by way of an example. The present invention is not limited to the following embodiments, and various modifications can be made without departing from the gist of the present invention.

Examples

[0014] An air conditioner 1 will be described with reference to FIG. 1. FIG. 1 illustrates a refrigerant circuit diagram of the air conditioner 1 according to an embodiment of the present invention. The air conditioner 1 is capable of a cooling operation and a heating operation, and includes an outdoor unit 2 arranged outdoors and an indoor unit 3 arranged indoors. The outdoor unit 2 includes a compressor 4, a four-way valve 5, an outdoor heat exchanger 9, and an outdoor unit-side expansion valve 7, which are connected by a refrigerant pipe 10, and the indoor unit 3 includes an indoor unit-side expansion valve 6 and an indoor heat exchanger 8, which are connected by the refrigerant pipe 10, and a refrigerant circuit 11 is composed of the compressor 4, the four-way valve 5, the outdoor heat exchanger 9, the outdoor unit-side expansion valve 7, the indoor unit-side expansion valve 6, and the indoor heat exchanger 8. The outdoor heat exchanger 9 is the heat exchanger in the present invention. Further, the outdoor unit 2 includes a blower fan 16 for sending outdoor air to the outdoor heat exchanger 12, and the indoor unit 3 includes an indoor fan (not illustrated) for sending indoor air to the indoor heat exchanger 8. The four-way valve 5 is connected to the discharge side of the compressor 4 and is a switching valve that changes a direction of the flow of the refrigerant

that circulates through the refrigerant circuit 11 during the cooling operation and the heating operation. During the cooling operation, the refrigerant discharged from the compressor 4 flows through the four-way valve 5 to the outdoor heat exchanger 9, the outdoor unit-side expansion valve 7, the indoor unit-side expansion valve 6, the indoor heat exchanger 8, the four-way valve 5, and the suction side of the compressor 4, and during the heating operation, the refrigerant discharged from the compressor 4 flows through the four-way valve 5 to the indoor heat exchanger 8, the indoor unit-side expansion valve 6, the outdoor unit-side expansion valve 7, the outdoor heat exchanger 9, the four-way valve 5, and the suction side of the compressor 4. In FIG. 1, the solid line arrow indicates the flow of the refrigerant during the heating operation, and the dashed line arrow indicates the flow of the refrigerant during the cooling operation.

[0015] The flow of the refrigerant in the refrigerant circuit 11 during the heating operation will be described. During the heating operation, the refrigerant that is compressed by the compressor 4 and becomes high-temperature and high-pressure flows through the four-way valve 5 to the indoor heat exchanger 8. The high-temperature and high-pressure refrigerant that flows through the indoor heat exchanger 8 dissipates heat by exchanging heat with the indoor air sent by the indoor fan, and warms the indoor air that exchanged heat with the high-temperature and high-pressure refrigerant. The refrigerant that dissipates heat when passing through the indoor heat exchanger 8 is depressurized by the outdoor unit-side expansion valve 7 after passing through the indoor unit-side expansion valve 6, resulting in a two-phase refrigerant state in which gas refrigerant and liquid refrigerant are mixed. The refrigerant in the two-phase refrigerant state flows through the outdoor heat exchanger 9 and absorbs heat by heat exchange with the outdoor air sent by the blower fan 16 when passing through the outdoor heat exchanger 9 and becomes a gas refrigerant. The refrigerant that has absorbed heat and became a gas refrigerant returns to the compressor 4 through the four-way valve 5 and is compressed again at a high temperature and high pressure.

[0016] Next, the flow of the refrigerant in the refrigerant circuit 11 during the cooling operation will be described. The switching from the heating operation to the cooling operation is performed by changing the direction of the flow of the refrigerant which circulates through the refrigerant circuit 11 using the four-way valve 5. During the cooling operation, the refrigerant that is compressed by the compressor 4 and becomes high-temperature and high-pressure flows through the four-way valve 5 to the outdoor heat exchanger 9. The high-temperature and high-pressure refrigerant that flows through the outdoor heat exchanger 9 dissipates heat by exchanging heat with the outdoor air sent by the blower fan 16, and the refrigerant that exchanged heat with the outdoor air becomes a high-temperature and high-pressure liquid refrigerant. The high-temperature and high-pressure liquid

refrigerant passes through the outdoor unit-side expansion valve 7, and then is depressurized by the indoor unit-side expansion valve 6, resulting in a two-phase refrigerant state in which gas refrigerant and liquid refrigerant are mixed. The refrigerant in a two-phase refrigerant state flows through the indoor heat exchanger 8 and absorbs heat by heat exchange with the indoor air sent by the indoor fan when passing through the indoor heat exchanger 8 and becomes a gas refrigerant. The refrigerant that has absorbed heat and became a gas refrigerant returns to the compressor 4 through the four-way valve 5 and is compressed again at a high temperature and high pressure.

[0017] Next, the outdoor unit 2 will be described using FIG. 2. FIG. 2 is a longitudinal cross-sectional view of the outdoor unit 2, and the upper portion side indicates an upward direction, and the lower portion side indicates a downward direction, in a state where the outdoor unit 2 is installed. The outdoor unit 2 is a so-called upward-blowing type outdoor unit, and has a chassis 15 with an opening at an upper portion as a ventilation port 18, and an opening on a side surface as a suction port 17. Inside the chassis, the blower fan 16 is provided close to the ventilation port 18, and a vertically long outdoor heat exchanger 9 is arranged below the blower fan 16, facing the suction port 17. The outdoor air is sucked from the suction port 17 by driving the blower fan 16, the sucked outdoor air passes through the outdoor heat exchanger 9 and exchanges heat with the refrigerant passing through the outdoor heat exchanger 9, and the outdoor air that has passed through the outdoor heat exchanger 9 is blown out of the outdoor unit 2 through the ventilation port 18. The arrows in FIG. 2 indicate the magnitude of air velocity, with the longer arrows indicating higher (faster) air velocity than the shorter arrows. Since the upward-blowing type outdoor unit 2 has the blower fan 16 provided at the upper portion, the air velocity of the air that passes through the outdoor heat exchanger 9 due to the suction of the outdoor air by the blower fan 16 is high (fast) on the upper portion side, which is close to the blower fan 16 and low (slow) on the lower portion side, which is far from the blower fan 16, as indicated by the arrows in FIG. 2. Therefore, the air velocity distribution of the air passing through the outdoor heat exchanger 9 becomes nonuniform.

[0018] Next, the outdoor heat exchanger 9 will be described using FIG. 3. In FIG. 3, the upper portion side indicates an upward direction, and the lower portion side indicates a downward direction, in a state where the outdoor heat exchanger 9 is installed. The outdoor heat exchanger 9 includes an inlet header 20, an outlet header 21, a plurality of flat tubes 22, a plurality of heat transfer fins 23, a plurality of branch pipes 24a to 24c having the same diameter, and a distributor 25. The inlet header 20 and the outlet header 21 are with reference to the flow of the refrigerant in the refrigerant circuit 11 during the heating operation, the refrigerant flows into the inlet header 20 and the refrigerant flows out from the outlet

header 21 during the heating operation, and the refrigerant flows into the outlet header 21 and the refrigerant flows out from the inlet header 20 during the cooling operation. In the present embodiment, the number of the flat tubes 22 is conveniently set to 14.

[0019] Each of the plurality of flat tubes 22 is formed in a linear band shape. The plurality of flat tubes 22 is arranged between the inlet header 20 and the outlet header 21 and is stacked with a predetermined spacing in a vertical direction. One end of the plurality of flat tubes 22 is connected to the inlet header 20 and the other end of the plurality of flat tubes 22 is connected to the outlet header 21. A plurality of through-holes (not illustrated) is formed in the flat tube 22 from one end to the other end, and the refrigerant flows through the through-holes. In FIG. 3, the higher the flat tube 22 is in the upward direction, the higher the air velocity received is, and the lower the flat tube is in the downward direction, the lower the air velocity received is. Therefore, as for the amount of heat exchange between the refrigerant that flows through the flat tube 22 and the outdoor air, the higher the flat tube 22 is in the upward direction, the larger the amount of heat exchange is, and the lower the flat tube 22 is in the downward direction, the smaller the amount of heat exchange is.

[0020] The plurality of heat transfer fins 23 is stacked spaced from each other between the inlet header 20 and the outlet header 21, having a plate-shape through which air passes, and the heat transfer fins 23 are thermally connected to the plurality of flat tubes 22 that penetrates the heat transfer fins 23.

[0021] The inlet header 20 and the outlet header 21 are formed in a tubular shape, the refrigerant pipe 10 is connected to the outlet header 21 and a plurality of branch pipes 24a to 24c is connected to the inlet header 20. The inside of the inlet header 20 is partitioned by partition plates 30, and forms a plurality of rooms 31a to 31g. The partition plates 30 are arranged such that the height of each room of the rooms 31a to 31g is the same, and the size of each room of the rooms 31a to 31g is the same. In the present embodiment, the inside of the inlet header 20 is partitioned by six partition plates 30, and seven rooms 31a to 31g are formed vertically. The plurality of flat tubes 22 connected to the inlet header 20 is connected to each room of the rooms 31a to 31g with two tubes.

[0022] The distributor 25 is connected to the refrigerant pipe 10 extending from the outdoor unit-side expansion valve 7 and the three branch pipes 24a to 24c extending from the inlet header 20. The branch pipe 24a, which is one of the three branch pipes 24a to 24c, connected to the distributor 25 is connected to the room 31a located at the highest height in a height direction of the outdoor heat exchanger 9. The branch pipe 24b, which is one of the three branch pipes 24a to 24c, is divided into two branch pipes 24b by the branch portion 27, and one of the two branch pipes 24b is connected to the room 31b located at the second height, and the other one of the

two branch pipes 24b is connected to the room 31c located at the third height. Therefore, one branch pipe 24b connected to the distributor 25 is divided into two by one branch portion 27 and is connected to the two rooms 31b and 31c, respectively. The branch pipe 24c, which is one of the three branch pipes 24a to 24c, is divided into two branch pipes 24c by the branch portion 27, and one of the two branch pipes 24c is further divided into two by the branch portion 27, and then one of the two branch pipes 24c is connected to the room 31d located at the fourth height, and the other one of the two branch pipes 24c is connected to the room 31e located at the fifth height. Similarly, the other one of the two branch pipes 24c is further divided into two branch pipes 24c by the branch portion 27, and then one of the two branch pipes 24c is connected to the room 31f located at the sixth height, and the other one of the two branch pipes 24 is connected to room 31g located at the seventh height. Therefore, one branch pipe 24c connected to the distributor 25 is first divided into two by the first branch portion 27, and further divided into two by the second branch portion 27, and the divided branch pipes are connected to the rooms 31d to 31g, respectively.

[0023] As for the amount of refrigerant flowing into each room of the rooms 31a to 31g of the outdoor heat exchanger 9, since in a case where the amount of refrigerant flowing from the outdoor unit-side expansion valve 7 to the distributor 25 during the heating operation is 1, the three branch pipes 24a to 24c formed of the same diameter are connected to the distributor 25, and the branch pipe 24a does not have the branch portion 27, the refrigerant in an amount of 1/3 flows into the room 31a located at the highest height. Since there is one branch portion 27 in the middle of the branch pipe 24b, the refrigerant in an amount of 1/6 flows into each room of the rooms 31b and 31c located at the second height and the third height. Similarly, since the two branch portions 27 are in the middle of the branch pipe 24c, the refrigerant in an amount of 1/12 flows into each room of the rooms 31d to 31g. Therefore, since the distribution amount of refrigerant flowing into the room 31a, to which the flat tubes 22 located in a range where the air velocity is high are connected, is set to be increased, the distribution amount of refrigerant flowing into the rooms 31b and 31c, to which the flat tubes 22 located in a range where the air velocity is medium are connected, is set to be medium, and the distribution amount of refrigerant flowing into the rooms 31d to 31g, to which the flat tubes 22 located in a range where the air velocity is low are connected, is set to be decrease, the refrigerant flow rate can be adjusted according to the airflow rate. Therefore, the ability of the heat exchanger to make the state of the refrigerant uniform at the outlet side of the flat tubes can be fully exhibited. That is, since the flowing amount of the refrigerant in the upper portion where a large amount of heat exchange can be expected increases and the flowing amount of the refrigerant in the lower portion where the amount of heat exchange is small decreases,

the entire heat exchanger can function without waste.

[0024] In the embodiment of the present invention, in the three branch pipes 24a to 24c connected to each room of the rooms 31a to 31g, which are arranged in the vertical direction of the inlet header 20, and the distributor 25, the branch portions 27 are provided depending on the air velocity distribution in the outdoor heat exchanger 9. In other words, in the branch pipe 24a connected to the room 31a, which is located in a range where the air velocity is high, and the distributor 25, the branch portion 27 is not provided between the distributor 25 and the room 31a. In the branch pipe 24b connected to the rooms 31b to 31e, which are located in a range where the air velocity is medium, and the distributor 25, one branch portion 27 is provided between the distributor 25 and the rooms 31b to 31e. In the branch pipe 24c connected to the rooms 31d to 31g, which are located in a range where the air velocity is low, and the distributor 25, two branch portions 27 are provided between the distributor 25 and the rooms 31b to 31e. As a result, the larger the number of the branch portions 27 provided between the distributor 25 and each room 31, the smaller the amount of the refrigerant that flows into the room 31.

[0025] In the embodiment of the present invention, in the three branch pipes 24a to 24c connected to each room of the rooms 31a to 31g, which are arranged in the vertical direction of the inlet header 20, and the distributor 25, the branch portions 27 are provided depending on the air velocity distribution in the outdoor heat exchanger 9. Therefore, the substantial amount of heat exchange becomes approximately the same in the vertical direction of the outdoor heat exchanger 9, and the refrigerant state of the outlet header 21 can be aligned. Compared with a case where the flow rate is adjusted by increasing the flow path resistance using a conventional capillary tube, since the refrigerant state of the outlet header 21 can be aligned without increasing the pressure loss of the refrigerant passing through the heat exchanger, a decrease in the cooling and heating capacity of the air conditioner due to the increased pressure loss can be suppressed. In addition, the embodiments of the present invention have the following effects in addition to the present effects.

[0026] The inside of the inlet header 20 is partitioned by the partition plates 30, and the partition plates 30 are arranged such that the height of each room of the rooms 31a to 31g is the same, and the size (volume) of each room of the rooms 31a to 31g is the same. Therefore, since it is not necessary to adjust the height of each room of the rooms 31a to 31g according to the air velocity distribution in the outdoor heat exchanger 9 and the specifications of the outdoor heat exchanger, it is possible to reduce the manufacturing cost.

[0027] The three branch pipes 24a to 24c connected to each room of the rooms 31a to 31g, which are arranged in the vertical direction of the inlet header 20, and the distributor 25 are branch pipes having the same diameter. Therefore, since it is not necessary to adjust the di-

ameters of each of the branch pipes 24a to 24c according to the air velocity distribution in the outdoor heat exchanger 9 and the specifications of the outdoor heat exchanger, it is possible to reduce the manufacturing cost. Further, only by setting the number of the branch portions 27 provided between the distributor 25 and each room 31 according to the air velocity distribution in the outdoor heat exchanger 9 and the specifications of the outdoor heat exchanger, the amount of refrigerant flowing into each room of the rooms 31a to 31g can be adjusted. Therefore, it is possible to reduce the manufacturing cost.

[0028] In the present embodiment, with reference to the flow of the refrigerant in the refrigerant circuit 11 during the heating operation, the refrigerant flows into the inlet header 20 during the heating operation, in a case where the refrigerant flows out from the outlet header 21, the distributor 25 is arranged on an inflow side, the inside of the inlet header 20 on the inflow side is partitioned by the partition plates 30, and forms the rooms 31a to 31g having the same height, the three branch pipes 24a to 24c connect each room of the rooms 31a to 31g and the distributor 25, the branch portions 27 are provided in the three branch pipes 24a to 24c depending on the air velocity distribution in the outdoor heat exchanger 9, but the reverse configuration is also acceptable. That is, with reference to the flow of the refrigerant in the refrigerant circuit 11 during the heating operation, the refrigerant may flow into the inlet header 20 during the heating operation, in a case where the refrigerant flows out from the outlet header 21, the refrigerant may flow into the inlet header 20 on the inflow side through the outdoor unit-side expansion valve 7, the distributor 25 may be arranged on an outflow side, the inside of the outlet header 21 on the outflow side may be partitioned by the partition plates 30, forming the rooms 31a to 31g having the same height, the three branch pipes 24a to 24c may connect each room of the rooms 31a to 31g and the distributor 25, the branch portions 27 may be provided in the three branch pipes 24a to 24c depending on the air velocity distribution in the outdoor heat exchanger 9. Even in this case, the same effect can be obtained. In addition, although the air conditioner 1 of the present embodiment is an air conditioner capable of a cooling operation and a heating operation, it may be an air conditioner capable of either a cooling operation or a heating operation.

[0029] Although the present invention has been described with reference to the definite number of embodiments, the scope of the present invention is not limited thereto and modifications of the embodiments based on the above disclosure are obvious to those skilled in the art.

Reference Signs List

[0030]

- | | |
|---|-----------------|
| 1 | air conditioner |
| 2 | outdoor unit |

- | | |
|------------|-----------------------------------|
| 3 | indoor unit |
| 4 | compressor |
| 5 | four-way valve |
| 6 | indoor unit-side expansion valve |
| 5 7 | outdoor unit-side expansion valve |
| 8 | indoor heat exchanger |
| 9 | outdoor heat exchanger |
| 10 | refrigerant pipe |
| 11 | refrigerant circuit |
| 10 15 | chassis |
| 16 | blower fan |
| 17 | suction port |
| 18 | ventilation port |
| 20 | inlet header |
| 15 21 | outlet header |
| 22 | flat tube |
| 23 | heat transfer fin |
| 24a to 24c | branch pipe |
| 25 | distributor |
| 20 27 | branch portion |
| 30 | partition plate |
| 31a to 31g | room |

25 Claims

1. A heat exchanger comprising:

- | | |
|----|--|
| 30 | an inlet header located on a refrigerant inlet side;
an outlet header located on a refrigerant outlet side;
a plurality of rooms partitioned by partition plates and provided inside one header of the inlet header or the outlet header; |
| 35 | a plurality of flat tubes connected in parallel between each room of the plurality of rooms provided in the one header of the inlet header or the outlet header and the other header of the inlet header or the outlet header; |
| 40 | a distributor provided in a refrigerant pipe;
a plurality of branch pipes connected to each room and the distributor,
wherein the branch pipe has a branch portion provided between the room and the distributor depending on an air velocity distribution in the heat exchanger, and |
| 45 | the number of the branch portions of the branch pipe connected to the room, to which the flat tubes located in a part having a high air velocity are connected, is less than the number of the branch portions of the branch pipe connected to the room, to which the flat tubes passing through a part having a low air velocity are connected. |

- | | |
|----|--|
| 55 | 2. The heat exchanger according to claim 1, wherein a length of each room in a direction in which the flat tubes connected in parallel are arranged is the same. |
|----|--|

3. The heat exchanger according to claim 1 or 2, wherein the one header is the inlet header and the other header is the outlet header.

4. An upward-blowing type outdoor unit of an air conditioner, comprising: 5

a blower fan provided at an upper portion;
the heat exchanger according to any one of
claims 1 to 3 provided below the blower fan, 10
wherein, in the heat exchanger, a parallel direction of the plurality of flat tubes is a vertical direction, and the inlet header and the outlet header are installed upright in the vertical direction. 15

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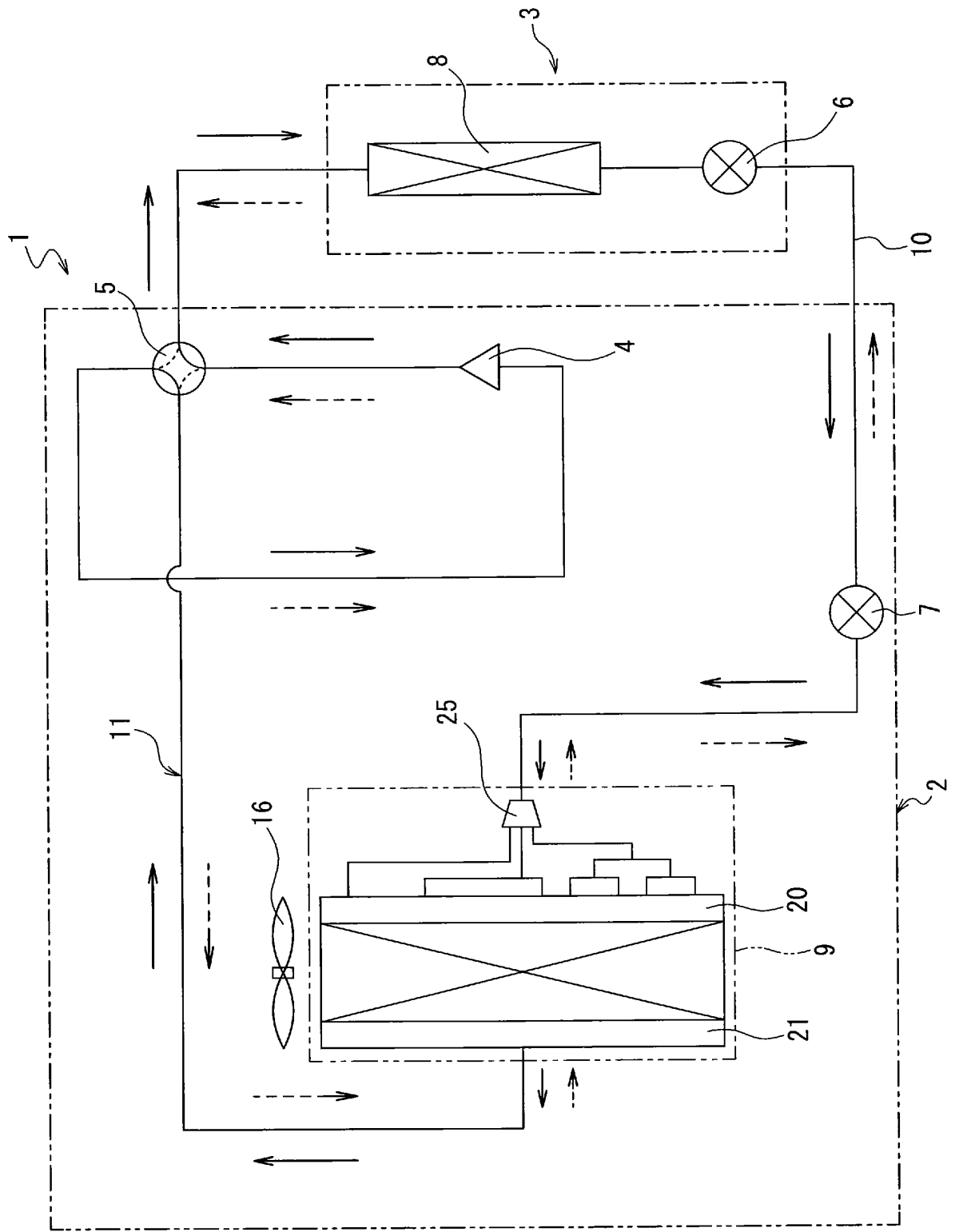
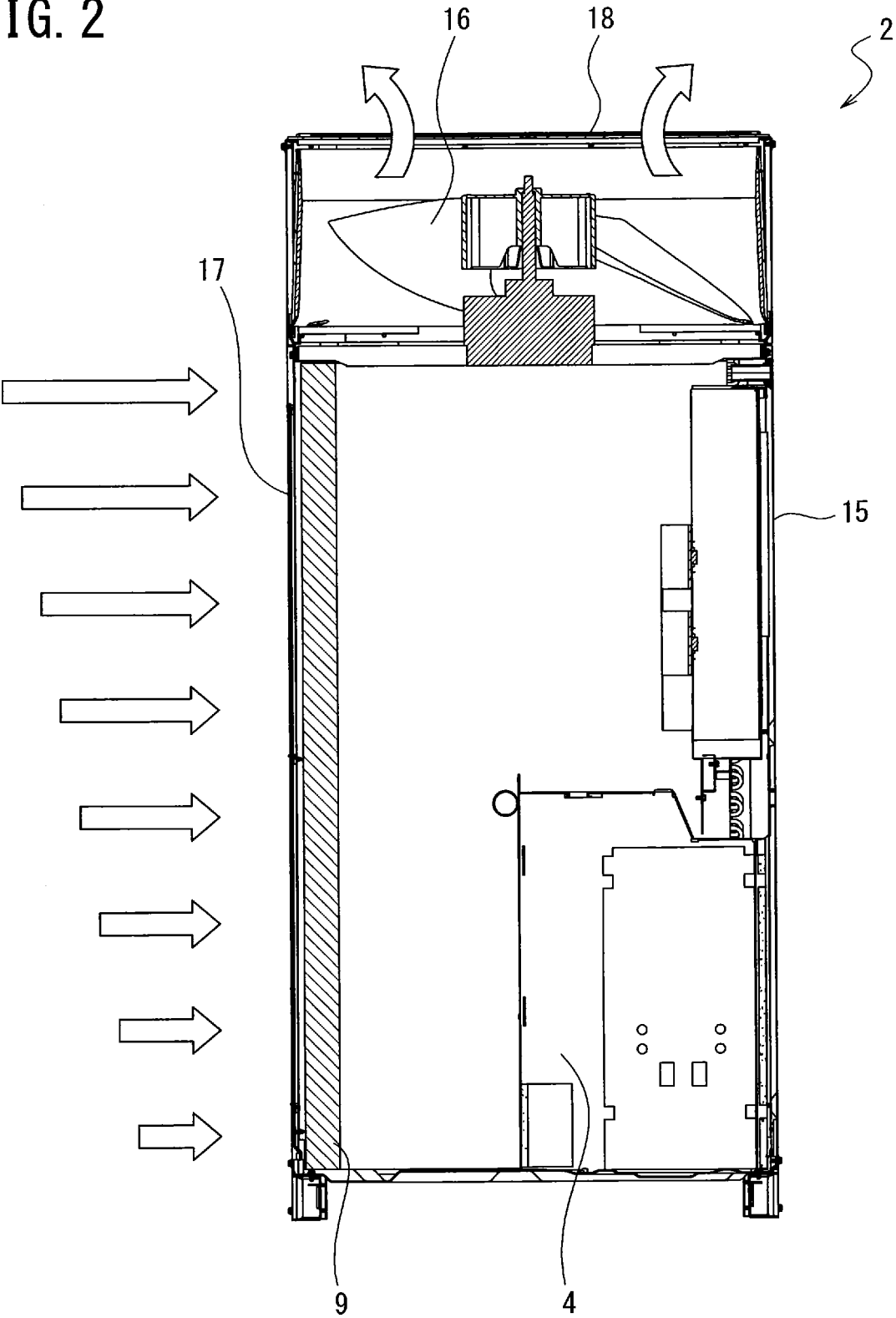


FIG. 1

FIG. 2



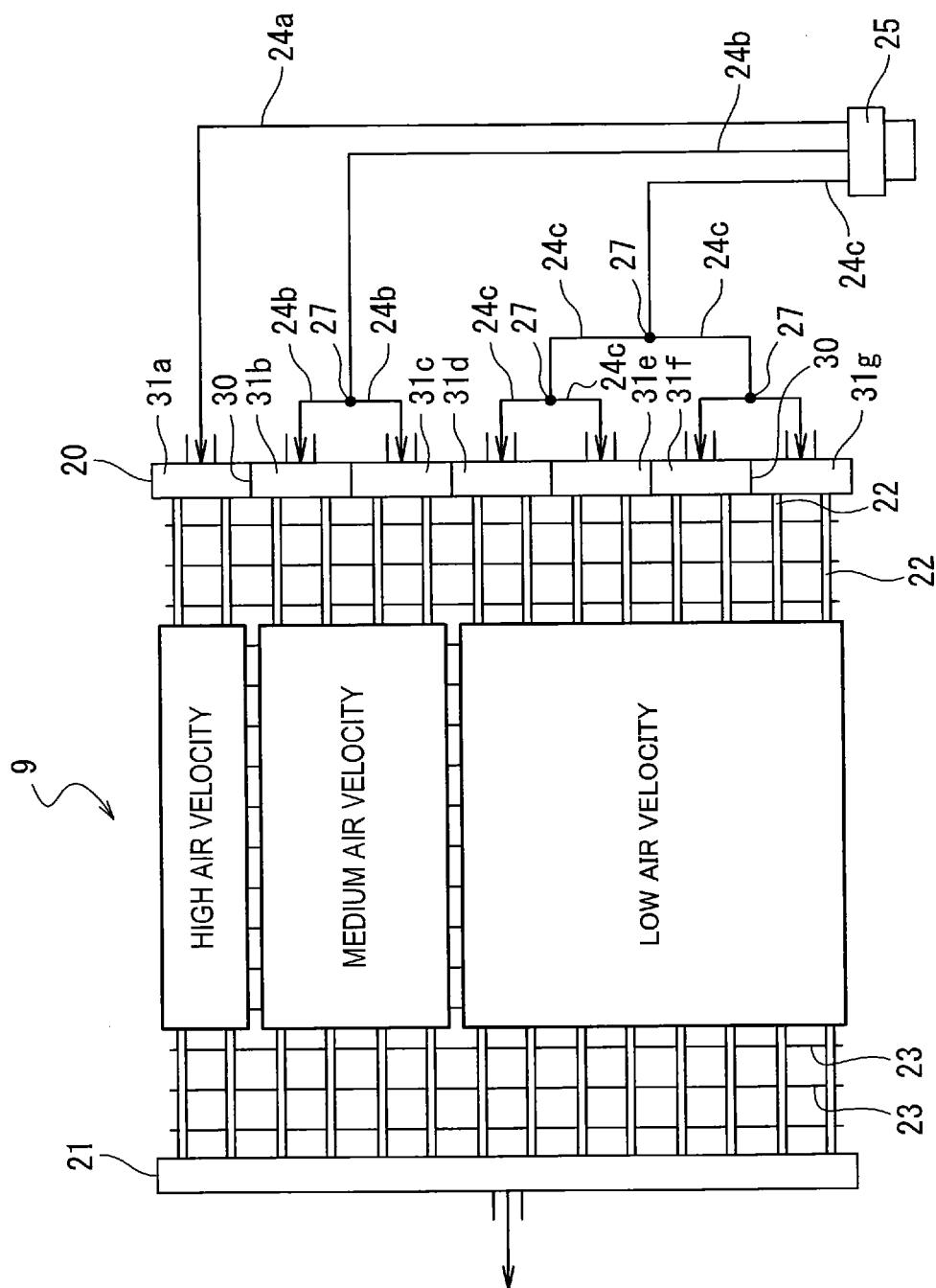


FIG. 3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2022/012064

A. CLASSIFICATION OF SUBJECT MATTER <i>F24F 1/18</i> (2011.01)i; <i>F24F 1/50</i> (2011.01)i FI: F24F1/18; F24F1/50 According to International Patent Classification (IPC) or to both national classification and IPC												
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) F24F1/18; F24F1/50 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Published examined utility model applications of Japan 1922-1996 Published unexamined utility model applications of Japan 1971-2022 Registered utility model specifications of Japan 1996-2022 Published registered utility model applications of Japan 1994-2022 Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)												
C. DOCUMENTS CONSIDERED TO BE RELEVANT <table border="1"> <thead> <tr> <th>Category*</th> <th>Citation of document, with indication, where appropriate, of the relevant passages</th> <th>Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td>Y</td> <td>WO 2013/160952 A1 (MITSUBISHI ELECTRIC CORPORATION) 31 October 2013 (2013-10-31) paragraphs [0012]-[0034]</td> <td>1-4</td> </tr> <tr> <td>Y</td> <td>JP 2010-127601 A (FUJITSU GENERAL LTD) 10 June 2010 (2010-06-10) paragraphs [0027]-[0032]</td> <td>1-4</td> </tr> <tr> <td>Y</td> <td>Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 197487/1985 (Laid-open No. 107262/1987) (NIPPON SPINDLE MFG CO LTD) 09 July 1987 (1987-07-09), p. 5, line 20 to p. 6, line 7</td> <td>4</td> </tr> </tbody> </table>	Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	Y	WO 2013/160952 A1 (MITSUBISHI ELECTRIC CORPORATION) 31 October 2013 (2013-10-31) paragraphs [0012]-[0034]	1-4	Y	JP 2010-127601 A (FUJITSU GENERAL LTD) 10 June 2010 (2010-06-10) paragraphs [0027]-[0032]	1-4	Y	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 197487/1985 (Laid-open No. 107262/1987) (NIPPON SPINDLE MFG CO LTD) 09 July 1987 (1987-07-09), p. 5, line 20 to p. 6, line 7	4
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.										
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☐ Further documents are listed in the continuation of Box C.	☒ See patent family annex.											
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INTERNATIONAL SEARCH REPORT
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