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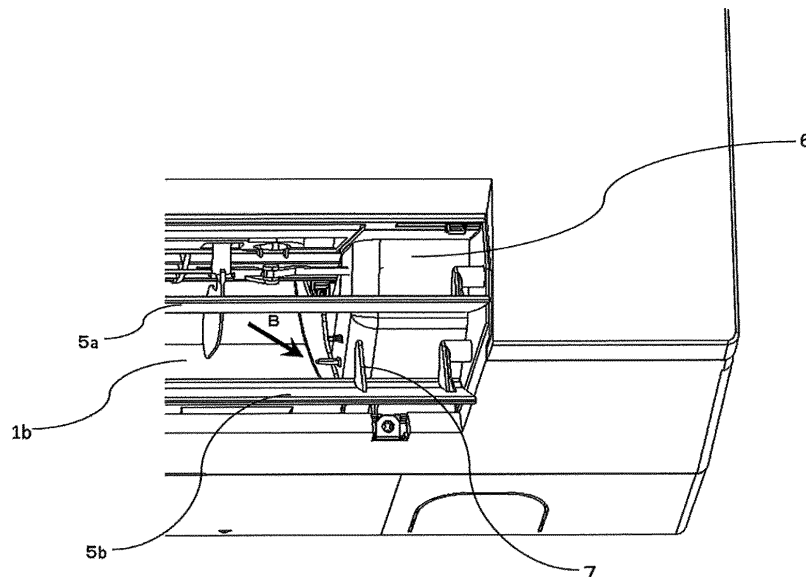
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(54) **INDOOR UNIT AND AIR CONDITIONER**

(57) An indoor unit includes a housing including an air outlet in a lower portion of the housing; an up-down airflow deflector located at the air outlet, the up-down airflow deflector being configured to adjust a direction of air blown from an air path inside the housing; and a pseudo air path part adjacent to the air path, the pseudo air path part including a pseudo air path through which the air inside the housing does not pass. The air outlet and

the up-down airflow deflector extend over the air path and the pseudo air path part in a width direction of the housing, and the up-down airflow deflector includes a shielding plate at an end portion of the up-down airflow deflector that is close to the pseudo air path part, the shielding plate including a plate face extending along a direction in which the air is blown from the air path.

FIG. 3



Description

Technical Field

[0001] The present disclosure relates to an indoor unit and an air-conditioning apparatus, and more particularly to an airflow deflector.

Background Art

[0002] Some indoor unit of an air-conditioning apparatus includes an air inlet in an upper portion of an indoor unit body and an air outlet in a lower portion of the indoor unit body. Inside the indoor unit body, a fan and a heat exchanger are disposed in an air passage from the air inlet to the air outlet. An air outlet path leading to the air outlet is formed downstream of the fan. An up-down airflow deflector for changing an up-down airflow direction is disposed close to the air outlet. Electric components are disposed either at the left or right portion inside the indoor unit body.

[0003] As the electric components are disposed either at the left or right portion inside the indoor unit body, an air outlet width is reduced. This leads to poor distribution of airflow in the left-right direction. Additionally, as the air outlet is close either to the left or to the right, an appearance of the indoor unit is asymmetrical in the left-right direction. To remedy these problems, a pseudo air path part is provided at an end portion of the air outlet so that a lateral width of the up-down airflow deflector is greater than an air path width of the air outlet.

[0004] However, air is not blown from the pseudo air path part. For this reason, airflow speed is reduced at the pseudo air path part. This generates dew condensation on a guiding surface of the up-down airflow deflector caused by backflow of high temperature indoor air containing moisture and contact with the up-down airflow deflector cooled by blown air during a cooling operation. Thus, to prevent indoor air backflow and prevent dew condensation, the up-down airflow deflector is disposed on an upper air path where air outlet speed is high.

[0005] Another proposed solution to preventing dew condensation during a cooling operation is to use an indoor unit that includes an air outlet direction guide on a guiding surface of an up-down airflow deflector so that blown air is guided further outward to prevent indoor air from being drawn in (for example, see Patent Literature 1).

Citation List

Patent Literature

[0006] Patent Literature 1: Japanese Unexamined Patent Application Publication No. 6-288605

Summary of Invention

Technical Problem

[0007] However, the effect of providing the air outlet direction guide is obtained only at a location where an air outlet speed is at a certain rate. The air outlet speed may be low depending on factors such as height positions of the pseudo air path part and the up-down airflow deflector, so that a problem lies in that providing the air outlet direction guide is less effective in preventing indoor air from being drawn in.

[0008] To solve the above problem, the present disclosure aims to provide an indoor unit and an air-conditioning apparatus capable of preventing dew condensation on the up-down airflow deflector.

Solution to Problem

[0009] With the above aim in view, an indoor unit according to an embodiment of the present disclosure includes a housing including an air outlet in a lower portion of the housing; an up-down airflow deflector located at the air outlet, the up-down airflow deflector being configured to adjust a direction of air blown from an air path inside the housing; and a pseudo air path part adjacent to the air path, the pseudo air path part including a pseudo air path through which the air inside the housing does not pass. The air outlet and the up-down airflow deflector extend over the air path and the pseudo air path part in a width direction of the housing, and the up-down airflow deflector includes a shielding plate at an end portion of the up-down airflow deflector that is close to the pseudo air path part, the shielding plate including a plate face extending along a direction in which the air is blown from the air path.

Advantageous Effects of Invention

[0010] The indoor unit according to an embodiment of the present disclosure includes a shielding plate on an up-down airflow deflector. This allows to block the flow of high temperature indoor air containing moisture and to thus prevent its entry into the air outlet. This, in turn, allows to avoid collision with air blown from inside the housing of the indoor unit, helping prevent the backflow of air around the pseudo air path part and prevent dew condensation.

Brief Description of Drawings

[0011]

[Fig. 1] Fig. 1 shows an exterior of an indoor unit 100 of an air-conditioning apparatus according to Embodiment 1 of the present disclosure.

[Fig. 2] Fig. 2 shows an internal structure of the indoor unit 100 of the air-conditioning apparatus in Embodiment 1 of the present disclosure.

[Fig. 3] Fig. 3 shows an air outlet 1b of the indoor unit 100 according to Embodiment 1 of the present

disclosure and a structure around a portion of the air outlet 1 b that is beside a location inside which an electric component box is located.

[Fig. 4] Fig. 4 illustrates a shielding plate 7 provided on a second up-down airflow deflector 5b of the indoor unit 100 according to Embodiment 1 of the present disclosure.

[Fig. 5] Fig. 5 illustrates airflow around the portion of the air outlet 1b of the indoor unit 100 according to Embodiment 1 of the present disclosure that is beside the location inside which the electric component box is located.

[Fig. 6] Fig. 6 shows an exemplary configuration of an air-conditioning apparatus according to Embodiment 2 of the present disclosure. Description of Embodiments

[0012] An indoor unit and other devices according to embodiments of the present disclosure will be described below with reference to the drawings. In the drawings, reference signs refer to identical or corresponding elements. This applied to all embodiments described below. Forms of components described in the entire specification are merely examples and not construed to be limited to the forms described in the specification. In particular, combinations of the elements are not limited to those given in each embodiment, and the elements described in one embodiment may be applicable to another embodiment. In the following description, an "upper side" refers to an upper portion in the drawings, and a "lower side" refers to a lower portion in the drawings. Terms indicating directions (for example, "right", "left", "front", and "rear") that may be used when necessary to help understanding are for explanatory purposes only and not intended to limit the present disclosure according to the present application. From the perspective of a viewer looking at a front side of the indoor unit of an air-conditioning apparatus, an up-down direction is defined as a vertical direction (height direction), and a left-right direction is defined as a horizontal direction (width direction). When pressure or temperature is described to be high or low, it is not defined by an absolute value but relatively determined on a basis of factors such as a state and operation of a device. Relative sizes of components in the drawings may differ from actual ones.

[0013] Fig. 1 shows an exterior of an indoor unit 100 of an air-conditioning apparatus according to Embodiment 1 of the present disclosure. Fig. 2 shows an internal structure of the indoor unit 100 of the air-conditioning apparatus in Embodiment 1 of the present disclosure. The indoor unit 100 of the air-conditioning apparatus in Embodiment 1 is shown to be a wall-mounted indoor unit installed on a wall, although the indoor unit 100 may be of any other type.

[0014] As shown in Figs. 1 and 2, the indoor unit 100 of the air-conditioning apparatus (hereinafter referred to as the "indoor unit 100") includes an indoor unit body 1 and a front panel 2. The indoor unit body 1 and the front

panel 2 form a housing of the indoor unit 100. The indoor unit body 1 includes an air inlet 1a, an air outlet 1b, a front air path surface 1c, and a rear air path surface 1d. The air inlet 1a is an opening port through which air around the indoor unit 100 flows into the indoor unit 100. The air outlet 1b is an opening port located in a lower portion of the indoor unit body 1 and through which air having flowed into the indoor unit 100 is blown to the outside of the indoor unit 100. The front air path surface 1c and the rear air path surface 1d are walls defining an air path from the air inlet 1a to the air outlet 1b inside the housing of the indoor unit 100. The front panel 2 is a design part.

[0015] The indoor unit 100 further includes an indoor heat exchanger 3 and a cross-flow fan 4 in the indoor unit 100. Driving the cross-flow fan 4 causes air around the indoor unit 100 to flow into the indoor unit 100 through the air inlet 1a, pass through the indoor heat exchanger 3 and the cross-flow fan 4, and pass through the air path to flow out from the air outlet 1b. The indoor heat exchanger 3 exchanges heat between air passing through the indoor heat exchanger 3 and refrigerant flowing in a heat transfer tube included in the indoor heat exchanger 3 to heat or cool the air for air-conditioning. The indoor heat exchanger 3 covers the cross-flow fan 4 in a portion of the air path through which the air is suctioned and that is located upstream of the cross-flow fan 4 (that is a portion of the air path through which the air passes before the air reaches the cross-flow fan 4). The air having exchanged heat in the indoor heat exchanger 3 is blown to the outside of the indoor unit 100 so that an air-conditioned space where the indoor unit 100 is installed is air-conditioned.

[0016] The indoor unit 100 also includes, at the air outlet 1b, left-right airflow deflectors 11 and up-down airflow deflectors 5. The left-right airflow deflectors 11 adjust a left-right direction, which is a width direction of the indoor unit 100, of the air blown from the indoor unit 100. The up-down airflow deflectors 5 adjust a vertical direction (up-down direction), which is a height direction of the indoor unit 100, of the air blown from the indoor unit 100. The indoor unit 100 of Embodiment 1 includes two up-down airflow deflectors 5 (a first up-down airflow deflector 5a and a second up-down airflow deflector 5b) arranged in the up-down direction. Each up-down airflow deflector 5 is configured to freely swing in the up-down direction around a pivot. Specifically, a driving motor (not shown) is attached to each of the left and right of the unit, and one of the driving motors is connected to the pivot of the first up-down airflow deflector 5a and the other one of the driving motors is connected to the pivot of the second up-down airflow deflector 5b. Operating of each driving motor causes the corresponding one of the up-down airflow deflectors 5 to freely swing in the up-down direction. This allows the up-down airflow deflectors 5 to each freely adjust, independently from each other, the up-down direction of the air blown from the indoor unit 100.

[0017] The indoor unit 100 further includes an electric

component box (not shown) in the indoor unit 100. The electric component box contains electric components such as a control board to control the cross-flow fan 4 and the aforementioned driving motors to drive the up-down airflow deflectors 5. When viewed from the front, the electric component box is located in an internal space at the right portion inside the indoor unit 100 of Fig. 1.

[0018] Fig. 3 shows the air outlet 1b of the indoor unit 100 according to Embodiment 1 of the present disclosure and a structure around the air outlet 1b that is beside a location inside which the electric component box is located. Fig. 3 is an enlarged view of the part A in Fig. 1. Inside the indoor unit 100, the space accommodating the electric component box is partitioned from the air path through which air passes, and thus no air flows in the space. This decreases the width of the air path relative to the entire width of the indoor unit 100. Also, the internal space accommodating the electric component box is located either at the left or right portion inside the indoor unit 100 (at the right portion inside the indoor unit 100 as viewed in Fig. 1), and this results in uneven airflow. This leads to poor distribution of airflow to the left-right direction. In particular, air hardly flows to the right of the indoor unit 100 of Fig. 1. Further, the appearance of the air outlet 1b is rendered asymmetrical in the left-right direction.

[0019] In view of the above, in the indoor unit 100 of Embodiment 1, an end portion of the air outlet 1b that is beside the location inside which the electric component box is located is formed as a pseudo air path part 6, as shown in Fig. 3. The pseudo air path part 6 is adjacent to the air path and includes a pseudo air path formed to widen the air outlet 1b. The pseudo air path is a dummy part to make the appearance of the air outlet 1b symmetrical in the left-right direction. The air outlet 1b and the up-down airflow deflectors 5 extend over the air path and the pseudo air path part 6. Thus, the width of the air outlet 1b and the widths of the up-down airflow deflectors 5 are larger than the width of the air path, through which air passes, by the width of the pseudo air path part 6.

[0020] As the pseudo air path is not a real air path, air is not blown from the pseudo air path part 6. For this reason, indoor air 8 flows back toward portions of the up-down airflow deflectors 5 that are close to the pseudo air path part 6, at the air outlet 1b, as the indoor air 8 is drawn into the stream of blown air. Hence, during a cooling operation, dew condensation may occur on guiding surfaces of the up-down airflow deflectors 5 if high temperature indoor air 8 containing moisture contacts the up-down airflow deflectors 5 cooled by air-conditioned cold air sent from the indoor unit 100, and thus the indoor air 8 is cooled below the dew point.

[0021] Fig. 4 illustrates a shielding plate 7 provided on the second up-down airflow deflector 5b of the indoor unit 100 according to Embodiment 1 of the present disclosure. Fig. 4 shows a diagram viewed in the direction of an arrow B in Fig. 3. The indoor unit 100 of Embodiment 1 includes the shielding plate 7 on the guiding surface of the second up-down airflow deflector 5b disposed at the

air outlet 1b. The shielding plate 7 is located at the end portion of the second up-down airflow deflector 5b beside which the electric component box is located. The shielding plate 7 is provided close to a boundary between the air path through which air passes and the pseudo air path of the pseudo air path part 6. The shielding plate 7 of the indoor unit 100 of Embodiment 1 is formed integrally with the second up-down airflow deflector 5b.

[0022] Fig. 5 illustrates airflow around the portion of the air outlet 1b of the indoor unit 100 according to Embodiment 1 of the present disclosure that is beside the location inside which the electric component box is located. Fig. 5 shows a diagram viewed in the direction of an arrow C in Fig. 4. As shown in Figs. 4 and 5, the shielding plate 7 is disposed on the guiding surface of the second up-down airflow deflector 5b in such a manner that a plate end 10 that is the windward end in the airflow from the air path is positioned windward of a pivot center 9 of the second up-down airflow deflector 5b. Also, the shielding plate 7 is disposed in such a manner that its plate face is parallel to an air outlet direction 1e of air-conditioned air blown from the air path in the indoor unit 100. Positioning the shielding plate 7 on the second up-down airflow deflector 5b in the manner described above helps effectively prevent collision between the air-conditioned air sent from the air path and the indoor air 8.

[0023] Additionally, as shown in Fig. 5, the shielding plate 7 is disposed within a range corresponding to the pseudo air path part 6 so that the shielding plate 7 does not stand in the air path of air blown from the air outlet 1b. Disposing the shielding plate 7 within the range corresponding to the pseudo air path part 6 helps reduce airflow resistance and prevent dew condensation caused by backflow of the indoor air 8 during a cooling operation, without increasing in outlet pressure loss. The shielding plate 7 has a triangular cross-section. This ensures that even when the first up-down airflow deflector 5a swings, the first up-down airflow deflector 5a does not contact the shielding plate 7, preventing interference between the first up-down airflow deflector 5a and the shielding plate 7. The shape of the shielding plate 7 is not limited to a triangle and may be of any other shape that allows to avoid contact between the first up-down airflow deflector 5a and the shielding plate 7. The shielding plate 7 is described to be provided only on the second up-down airflow deflector 5b, but the location to which the shielding plate 7 is provided is not limited. The first up-down airflow deflector 5a may also include the shielding plate 7.

[0024] As described above, in the indoor unit 100 according to Embodiment 1, the shielding plate 7 is disposed on the guiding surface of the second up-down airflow deflector 5b and disposed at the end portion of the second up-down airflow deflector 5b that is close to the pseudo air path part 6, where airflow speed is low. This allows to block the backflow of the indoor air 8 and prevent dew condensation on the second up-down airflow deflector 5b. Further, in the indoor unit 100, the up-down airflow deflectors 5 can be located also at portions where air

outlet speed is low. Enlarging the air outlet 1b allows to increase recovery of static pressure and to leads to improve fan performance.

Embodiment 2

[0025] Fig. 6 shows an exemplary configuration of an air-conditioning apparatus according to Embodiment 2 of the present disclosure. The air-conditioning apparatus shown in Fig. 6 is an example of a refrigeration cycle apparatus. In Fig. 6, components already described with reference to Fig. 1 and other drawings are defined to operate in a similar manner to the above. The air-conditioning apparatus of Fig. 6 includes an outdoor unit 200, the indoor unit 100 described in Embodiment 1, a gas refrigerant pipe 300, and a liquid refrigerant pipe 400. The outdoor unit 200 and the indoor unit 100 are connected by the gas refrigerant pipe 300 and the liquid refrigerant pipe 400 to form a refrigerant circuit circulating refrigerant. The outdoor unit 200 includes a compressor 210, a four-way valve 220, an outdoor heat exchanger 230, and an expansion valve 240.

[0026] The compressor 210 compresses refrigerant suctioned into the compressor 210 and discharges it. The compressor 210 may be one that is capable of changing its capacity (refrigerant discharge amount per unit time) by having its operating frequency changed optionally by, for example, an inverter circuit, although the compressor 210 is not limited to a particular type of compressor. The four-way valve 220 is, for example, a valve configured to switch flow directions of refrigerant depending on which of a cooling operation and a heating operation is performed.

[0027] The outdoor heat exchanger 230 of the present embodiment exchanges heat between refrigerant and air (outdoor air). For example, the outdoor heat exchanger 230 is used as an evaporator during a heating operation to evaporate and gasify the refrigerant. During a cooling operation, the outdoor heat exchanger 230 is used as a condenser to condense and liquefy the refrigerant.

[0028] The expansion valve 240, which is a device such as an expansion device (flow rate control unit), reduces pressure of the refrigerant to expand the refrigerant. When the expansion valve 240 is, for example, an electronic expansion valve, its opening degree is regulated under the control of a controller (not shown) or similar devices.

[0029] The indoor heat exchanger 3 described in Embodiment 1 exchanges heat between, for example, air to be air-conditioned and the refrigerant. During a heating operation, the indoor heat exchanger 3 is used as a condenser to condense and liquefy the refrigerant. During a cooling operation, the indoor heat exchanger 3 is used as an evaporator to evaporate and gasify the refrigerant. The cross-flow fan 4 allows air to pass through the indoor unit 100 for conditioning of the air and sends it to the air-conditioned space, as described above.

[0030] The air-conditioning apparatus configured as

described above is capable of performing a heating operation and a cooling operation by switching flow directions of the refrigerant by the four-way valve 220 in the outdoor unit 200. The air-conditioning apparatus of Embodiment 2 includes the shielding plate 7. This allows to avoid contact between cold air blown from the indoor unit 100 and warm indoor air during a cooling operation, helping prevent dew condensation.

10 Industrial Applicability

[0031] Besides the air-conditioning apparatus described in Embodiment 2 above, the configuration described above is also applicable to other refrigeration cycle apparatuses, such as an indoor unit of refrigerating apparatuses and freezing apparatuses.

Reference Signs List

20 [0032]

1 indoor unit body 1a air inlet 1b air outlet 1c front air path surface 1d rear air path surface 1e air outlet direction 2 front panel 3 indoor heat exchanger 4 cross-flow fan 5 up-down airflow deflector 5a first up-down airflow deflector 5b second up-down airflow deflector 6 pseudo air path part 7 shielding plate 8 indoor air 9 pivot center 10 plate end 11 left-right airflow deflector 100 indoor unit 200 outdoor unit 210 compressor 220 four-way valve 230 outdoor heat exchanger 240 expansion valve 300 gas refrigerant pipe 400 liquid refrigerant pipe

35 Claims

1. An indoor unit, comprising:

a housing including an air outlet in a lower portion of the housing;
an up-down airflow deflector located at the air outlet, the up-down airflow deflector being configured to adjust a direction of air blown from an air path inside the housing; and
a pseudo air path part adjacent to the air path, the pseudo air path part including a pseudo air path through which the air inside the housing does not pass,
the air outlet and the up-down airflow deflector extending over the air path and the pseudo air path part in a width direction of the housing, the up-down airflow deflector including a shielding plate at an end portion of the up-down airflow deflector that is close to the pseudo air path part, the shielding plate including a plate face extending along a direction in which the air is blown from the air path.

2. The indoor unit of claim 1, wherein a plate end of the shielding plate that is a windward end in a flow direction of the air blown from inside the housing is located windward of a pivot center of the up-down airflow deflector, and is located in the pseudo air path defined by a boundary between the air path and the pseudo air path. 5
3. The indoor unit of claim 1 or 2, further comprising a plurality of the up-down airflow deflectors arranged in a height direction of the housing, wherein the plate face of the shielding plate disposed on a lower one of the plurality of the up-down airflow deflectors is shaped in a triangle shape. 10
15
4. The indoor unit of any one of claims 1 to 3, further comprising:
a cross-flow fan installed inside the housing; and
a heat exchanger configured to heat or cool the air flowing inside the housing. 20
5. An air-conditioning apparatus, comprising:
the indoor unit of any one of claims 1 to 4; and
an outdoor unit connected by piping to the indoor unit to form a refrigerant circuit configured to circulate refrigerant. 25
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FIG. 1

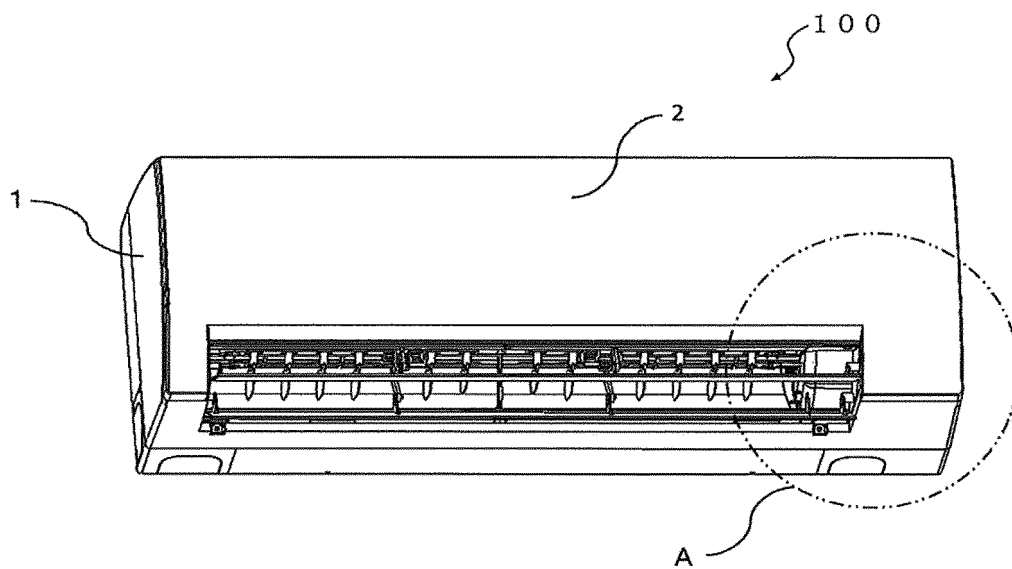


FIG. 2

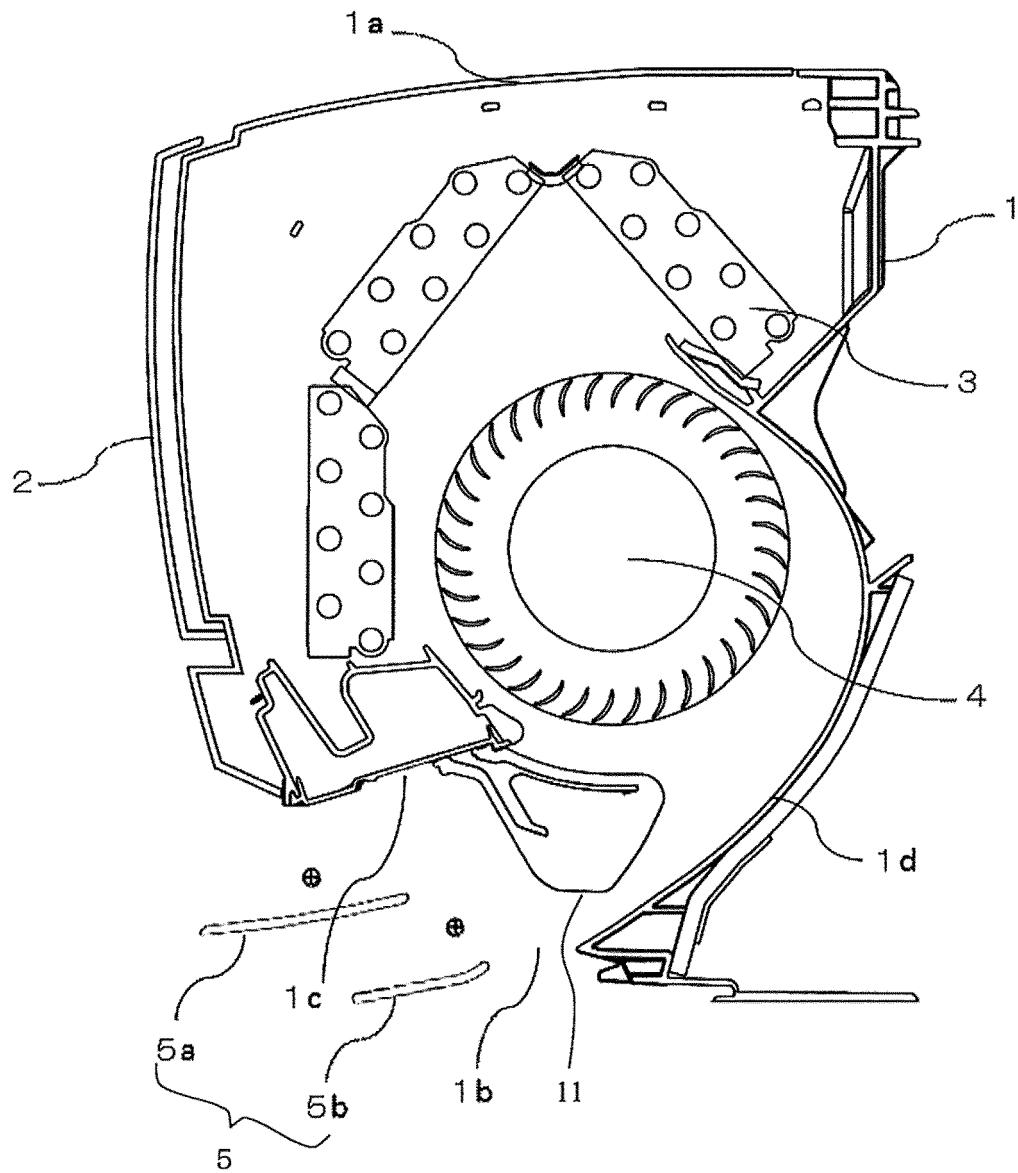


FIG. 3

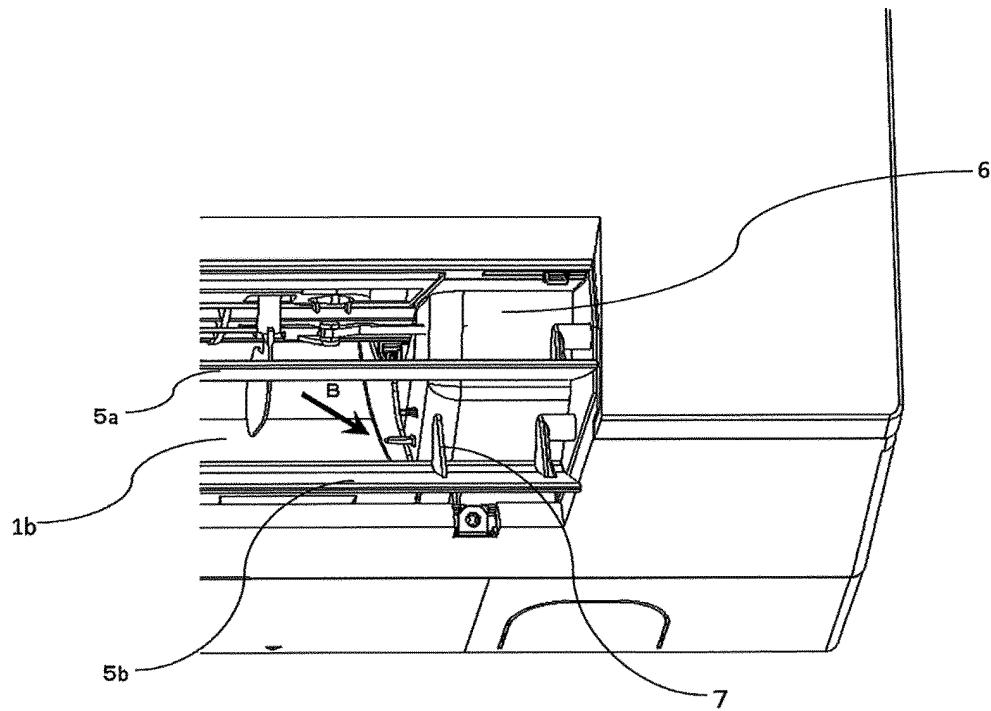


FIG. 4

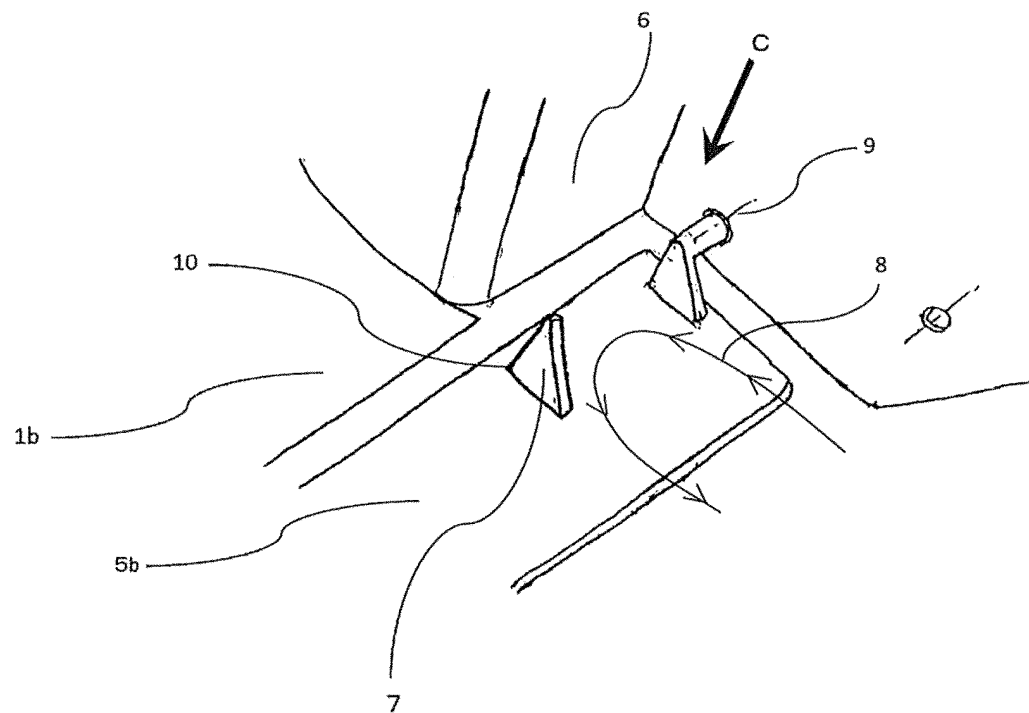


FIG. 5

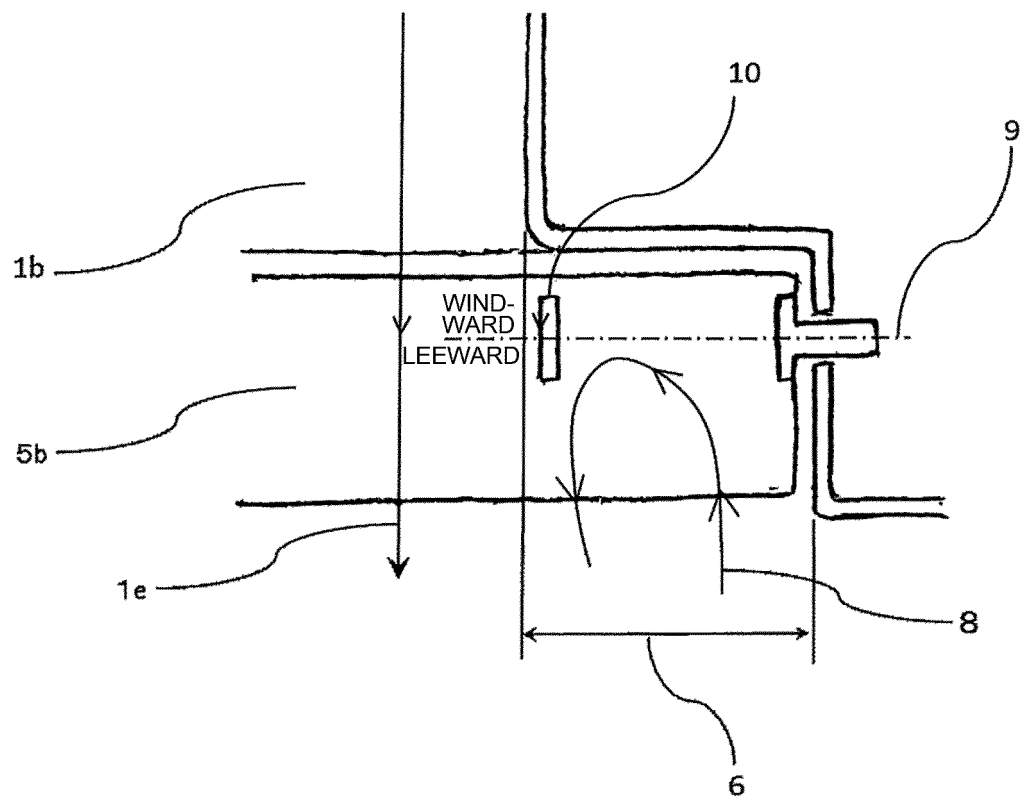
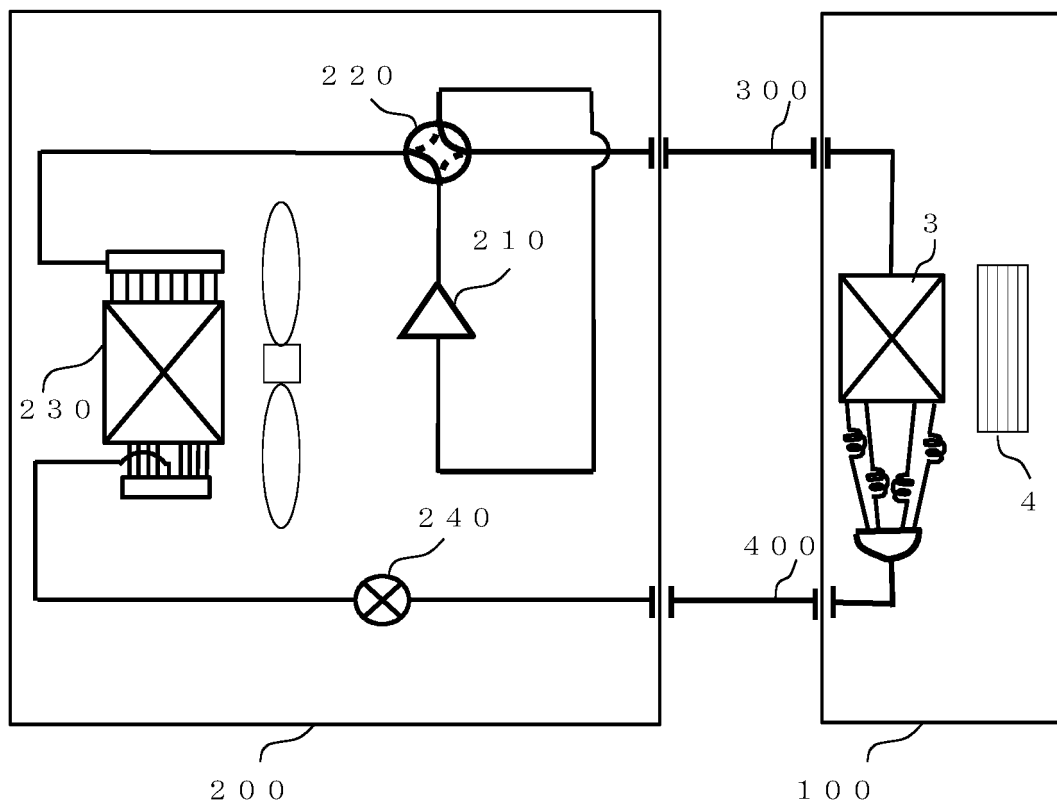


FIG. 6



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2018/008537

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl. F24F13/22 (2006.01) i, F24F13/15 (2006.01) i, F24F13/20 (2006.01) i

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)

Int. Cl. F24F13/22, F24F13/15, F24F13/20

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 1971-2018

Registered utility model specifications of Japan 1996-2018

Published registered utility model applications of Japan 1994-2018

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2016/139729 A1 (MITSUBISHI ELECTRIC CORP.) 09	1-2
Y	September 2016, paragraphs [0010]-[0039], [0042], [0043], fig. 1-10, 12 & US 2017/0336083 A1, paragraphs [0024]-[0073], [0079]-[0083], fig. 1-10, 12 & EP 3104092 A1 & CN 107250682 A	3-5
Y	JP 2010-164268 A (MITSUBISHI ELECTRIC CORP.) 29 July 2010, paragraphs [0011]-[0109], fig. 1, 2 (Family: none)	3-5
Y	JP 2012-42208 A (SHARP CORP.) 01 March 2012, paragraphs [0029]-[0078], fig. 1, 2 (Family: none)	3-5



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

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Date of the actual completion of the international search
17.05.2018Date of mailing of the international search report
29.05.2018Name and mailing address of the ISA/
Japan Patent Office
3-4-3, Kasumigaseki, Chiyoda-ku,
Tokyo 100-8915, Japan

Authorized officer

Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT

International application No. PCT/JP2018/008537
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 51534/1991 (Laid-open No. 136424/1992) (FUJITSU GENERAL LTD.) 18 December 1992, entire text, all drawings (Family: none)	1-5

Form PCT/ISA/210 (continuation of second sheet) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 6288605 A [0006]