

(19)



(11)

EP 2 584 276 A2

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:

24.04.2013 Bulletin 2013/17

(51) Int Cl.:

F24F 1/56 ^(2011.01)**F24F 1/16** ^(2011.01)**F24F 1/46** ^(2011.01)(21) Application number: **12182869.3**(22) Date of filing: **04.09.2012**

(84) Designated Contracting States:

**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**

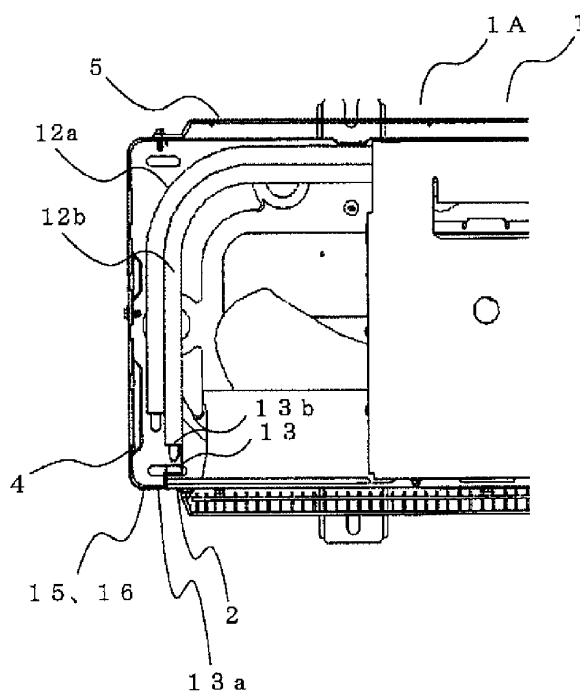
Designated Extension States:

BA ME(71) Applicant: **Mitsubishi Electric Corporation****Chiyoda-ku****Tokyo 100-8310 (JP)**(72) Inventor: **Miwa, Masaharu****Tokyo, 102-0073 (JP)**(30) Priority: **20.10.2011 JP 2011230850**(74) Representative: **Pfenning, Meinig & Partner GbR****Theresienhöhe 13****80339 München (DE)**(54) **Outdoor unit of air-conditioning apparatus**

(57) [Object] An object is to provide an outdoor unit of an air-conditioning apparatus, which has high heat exchange efficiency.

[Solution] An outdoor unit 1 includes a left side panel 4 configured to form a left side of a housing 1A and to partially extend to the front of the housing 1A, and a front left panel 2 configured to form the front of the housing 1A together with the part of the left side panel 4. An end

portion of the front left panel 2 is connected, at the front of the housing 1A, to an end portion of the left side panel 4. The left side panel 4 is provided with air inlets 11a in an area that forms the left side of the housing 1A. A metal sheet 13 is interposed between a front end portion of a heat exchanger 12b and the connection between the end portion of the front left panel 2 and the end portion of the left side panel 4. Thus, the metal sheet 13 secures the heat exchanger 12b to the front left panel 2.

FIG. 3

Description**[Solution to Problem]**

[Technical Field]

[0001] The present invention relates to an outdoor unit of an air-conditioning apparatus.

[Background Art]

[0002] In recent years, high-performance and high-capacity separate-type air-conditioning apparatuses have become widespread significantly. For effective use of installation space, an outdoor unit of such a separate-type air-conditioning apparatus includes a heat exchanger formed into an L-shape to fit the housing. Conventionally, in an outdoor unit of this type, for example, a raised piece on the left side of the housing of the outdoor unit is engaged with a notch in an end plate at the front of an L-shaped heat exchanger, and thus the heat exchanger is secured on the left side of the housing (see, e.g., Patent Literature 1).

[Citation List]

[Patent Literature]

[0003]

[Patent Literature 1] Japanese Unexamined Utility Model Registration Application Publication No. 5-3822 (Abstract, Fig. 2)

[Summary of Invention]

[Technical Problem]

[0004] An outdoor unit described in Patent Literature 1 has a configuration in which a raised piece on the left side of the housing of the outdoor unit is engaged with a notch in an end plate at the front of an L-shaped heat exchanger, and thus the heat exchanger is secured on the left side of the housing. In this configuration, the left side of the housing needs to have, for example, a circular hole for securing the end plate of the heat exchanger. Since this requires an area for forming the circular hole on the left side of the housing, it is difficult to provide ventilation slots in the vicinity of this area. In the entire area of the left side of the housing, an area available for forming ventilation slots (air inlets) is limited. This results in degradation of heat exchange efficiency.

[0005] The present invention has been made to solve the problems describe above. An object of the present invention is to provide an outdoor unit of an air-conditioning apparatus, which includes a heat exchanger having high heat exchange efficiency.

[0006] An outdoor unit of an air-conditioning apparatus according to the present invention includes a housing having a substantially rectangular parallelepiped shape; at least one heat exchanger formed into a substantially L-shape, the heat exchanger being disposed along the inside of one side of the housing and along the inside of the rear of the housing; and a securing member configured to secure the heat exchanger to the housing. The housing includes a side panel configured to form the one side of the housing and to partially extend to the front of the housing, and a front panel configured to form the front of the housing together with the part of the side panel. An end portion of the front panel is connected, at the front of the housing, to an end portion of the side panel. The side panel is provided with a plurality of air inlets in an area that forms the one side of the housing. The securing member is interposed between a front end portion of the heat exchanger and the connection between the end portion of the front panel and the end portion of the side panel, and thereby secures the heat exchanger to the front panel.

[Advantageous Effects of Invention]

[0007] In the outdoor unit of the air-conditioning apparatus according to the present invention, an end portion of the front panel is connected, at the front of the housing, to an end portion of the side panel. The securing member is interposed between a front end portion of the heat exchanger and the connection between the end portion of the front panel and the end portion of the side panel, and thereby secures the heat exchanger to the front panel. Therefore, it is possible to provide a larger area for air inlets in the side panel and achieve higher heat exchange efficiency than before.

[Brief Description of Drawings]

[0008]

[Fig. 1] Fig. 1 is a perspective view of an outdoor unit of an air-conditioning apparatus according to Embodiment 1 of the present invention, as viewed from the front left of the outdoor unit.

[Fig. 2] Fig. 2 is a perspective view of the outdoor unit of the air-conditioning apparatus according to Embodiment 1 of the present invention, as viewed from the rear left of the outdoor unit.

[Fig. 3] Fig. 3 is a plan view of a housing according to Embodiment 1 of the present invention, with a top panel of the housing removed.

[Fig. 4] Fig. 4 is a plan view of a housing according to a modification of Embodiment 1 of the present invention illustrated in Fig. 3, with a top panel of the housing removed.

[Fig. 5] Fig. 5 is a perspective view of an outdoor unit

of an air-conditioning apparatus according to Embodiment 2 of the present invention, as viewed from the front left of the outdoor unit.

[Fig. 6] Fig. 6 is a plan view of a housing according to Embodiment 2 of the present invention, with a top panel of the housing removed.

[Description of Embodiments]

Embodiment 1

[0009] Fig. 1 is a perspective view of an outdoor unit of an air-conditioning apparatus according to Embodiment 1 of the present invention, as viewed from the front left of the outdoor unit. Fig. 2 is a perspective view of the outdoor unit of the air-conditioning apparatus according to Embodiment 1 of the present invention, as viewed from the rear left of the outdoor unit.

As illustrated in Fig. 1 and Fig. 2, a housing 1A of an outdoor unit 1 includes a front left panel 2, a front right panel 3, a left side panel 4, a rear left panel 5, a rear right panel 6, a top panel 7, and a bottom panel (not shown). The left side panel 4 forms a left side of the housing 1A and extends partially to the front of the housing 1A. The front left panel 2 forms the front of the housing 1A together with the part of the left side panel 4. An end portion of the front left panel 2 is connected, at the front of the housing 1A, to an end portion of the left side panel 4 (described in detail below with reference to Fig. 3). The left side panel 4 is provided with a plurality of air inlets 11a in an area that forms the left side of the housing 1A. The rear left panel 5 and the rear right panel 6 form the rear of the housing 1A. The rear right panel 6 forms a part of the rear of the housing 1A and a right side of the housing 1A.

[0010] Fig. 3 is a plan view of a housing according to Embodiment 1 of the present invention, with a top panel of the housing removed.

As illustrated in Fig. 3, the housing 1A includes a heat exchanger 12a and a heat exchanger 12b. The heat exchangers 12a and 12b are formed into a substantially L-shape and disposed along the rear and the left side of the housing 1A. The heat exchangers 12a and 12b are secured to each other, for example, with a band. An end portion of the heat exchanger 12b (adjacent to the front of the housing 1A) is located closer to the front of the housing 1A than an end portion of the heat exchanger 12a (adjacent to the front of the housing 1A) is.

The heat exchanger 12b is secured to the front left panel 2, with a metal sheet 13 interposed therebetween. The metal sheet 13 has a first end portion 13a adjacent to the front of the housing 1A, and a second end portion 13b adjacent to the rear of the housing 1A. The first end portion 13a is secured at the front of the housing 1A. The second end portion 13b is secured at the end portion of the heat exchanger 12b (adjacent to the front of the housing 1A).

A first position 15 is a position at which the end portion of the left side panel 4 (i.e., the end portion forming a part

of the front of the housing 1A) is connected to the end portion of the front left panel 2 (i.e., the end portion adjacent to the left side of the housing 1A). A second position 16 is a position at which the first end portion 13a is secured at the front of the housing 1A. The first position 15 and the second position 16 substantially coincide in plan view but differ in height. Note that the end portion of the left side panel 4 and the end portion of the front left panel 2 overlap and are connected to each other in their overlapping region.

[0011] Fig. 4 is a plan view of a housing according to a modification of Embodiment 1 of the present invention illustrated in Fig. 3, with a top panel of the housing removed.

In the housing 1A illustrated in Fig. 4, a heat exchanger 12c is added to the heat exchangers 12a and 12b illustrated in Fig. 3. As illustrated, the heat exchanger 12c is disposed inside the heat exchanger 12b. An end portion of the heat exchanger 12c (adjacent to the front of the housing 1A) is closer to the front of the housing 1A than the end portion of the heat exchanger 12b (adjacent to the front of the housing 1A) is.

As illustrated in Fig. 4, a metal sheet 14 for securing the heat exchanger 12c differs in shape from the metal sheet 13 illustrated in Fig. 3. The heat exchanger 12b is secured to the second end portion 13b of the metal sheet 13 in Fig. 3, whereas the heat exchanger 12c is secured to a second end portion 14b of the metal sheet 14 in Fig. 4. A first end portion 14a of the metal sheet 14 in Fig. 4 is secured at the second position 16, that is, at the same position as the first end portion 13a of the metal sheet 13 in Fig. 3.

[0012] As described above, in the outdoor unit 1 of the air-conditioning apparatus according to Embodiment 1, the front left panel 2 is connected to the left side panel 4 at the first position 15 at the front of the housing 1A. The first end portion 13a (or first end portion 14a) secures the heat exchanger 12b (or heat exchanger 12c) to the front left panel 2 at the second position 16 that coincides with the first position 15 in plan view. That is, the heat exchanger 12b (or heat exchanger 12c) is secured, not on the left side of the housing 1A, but at the point of connection at the front of the housing 1A. Thus, since there are no components etc. that may prevent formation of the air inlets 11a in the left side panel 4, it is possible to provide a larger area for forming air inlets and achieve higher heat exchange efficiency than before. Additionally, since the heat exchanger 12b (or heat exchanger 12c) is configured to be secured at the front of the housing 1A, it is possible to extend the heat exchanger 12b (or heat exchanger 12c) to the front of the outdoor unit 1 and increase the efficiency of heat exchange of the heat exchangers 12a, 12b, and 12c with air drawn through the air inlets 11a in the left side panel 4 into the housing 1A.

[0013] In the outdoor unit 1 of the air-conditioning apparatus according to Embodiment 1 of the present invention, any number of heat exchangers can be secured at the same position at the front of the housing 1A by varying

the shape of the metal sheet 13 (or metal sheet 14). That is, the housing 1A with the same shape can be used regardless of the number of heat exchangers included in the housing 1A.

[0014] Although the housing 1A includes two or three heat exchangers in Embodiment 1 of the present invention, the number of heat exchangers is not limited to this.

[0015] Although Embodiment 1 of the present invention describes the metal sheet 13 (or metal sheet 14) as a securing member of the present invention, the shape of the securing member is not limited to this, and may be modified as necessary.

[0016] In Embodiment 1 of the present invention, the left side panel 4 forms the left side of the housing 1A and partially extends to the front of the housing 1A. However, the present invention is not limited to this. For example, the left side panel 4 may be formed into a substantially U-shape such that it forms the left side of the housing 1A, partially extends to the front of the housing 1A, and forms at least a part of the rear of the housing 1A. This can reduce the number of components and simplify the assembly process.

[0017] In Embodiment 1 of the present invention, the air inlets 11a have the shape illustrated in Fig. 1. However, the shape of the air inlets 11a is not limited to this and may be determined appropriately.

[0018] In Embodiment 1 of the present invention, the front end portions of air inlets 11a closest to the front of the housing 1A may be closer to the front of the housing 1A, in side view, than the end portion of the heat exchanger 12b (or heat exchanger 12c) adjacent to the front of the housing 1A is. With this configuration, it is possible to further increase the heat exchange efficiency of the heat exchangers 12a, 12b, and 12c.

Embodiment 2

[0019] Fig. 5 is a perspective view of an outdoor unit of an air-conditioning apparatus according to Embodiment 2 of the present invention, as viewed from the front left of the outdoor unit. In Embodiment 2, unlike in Embodiment 1, there are a left-side front panel 8 and a left-side rear panel 9 spaced apart on the left side of the housing 1A. The left-side front panel 8 corresponds to a first side panel of the present invention, and the left-side rear panel 9 corresponds to a second side panel of the present invention.

The left-side front panel 8 forms a part of the left side of the housing 1A and partially extends to the front of the housing 1A. The left-side rear panel 9 is disposed closer to the rear of the housing 1A than the left-side front panel 8 is, and forms a part of the left side of the housing 1A. The end portion of the front left panel 2 is connected at the front of the housing 1A to an end portion of the left-side front panel 8, in the same manner as that in the example illustrated in Fig. 4. Each of the left-side front panel 8 and the left-side rear panel 9 is provided with a plurality of air inlets 11a. There is an opening between

the left-side front panel 8 and the left-side rear panel 9. This opening serves as an air inlet 11b.

[0020] Fig. 6 is a plan view of the outdoor unit 1 of Fig. 5, with a top panel removed. Although the left side of the housing 1A in Fig. 4 is formed by the left side panel 4, the left side of the housing 1A in Fig. 6 is formed by two components, the left-side front panel 8 and the left-side rear panel 9. The other configurations illustrated in Fig. 6 are the same as those illustrated in Fig. 4.

[0021] As described above, in the outdoor unit 1 of the air-conditioning apparatus according to Embodiment 2, the left-side front panel 8 and the left-side rear panel 9 are disposed on the left side of the housing 1A. Each of the left-side front panel 8 and the left-side rear panel 9 is provided with air inlets 11a. There is the air inlet 11b between the left-side front panel 8 and the left-side rear panel 9. Therefore, in the outdoor unit 1 of the air-conditioning apparatus according to Embodiment 2, as compared to the outdoor unit 1 of the air-conditioning apparatus according to Embodiment 1, a larger amount of air flows into the housing 1A from the left side of the housing 1A and higher heat exchange efficiency can be achieved.

[Reference Signs List]

[0022] 1: outdoor unit, 1A: housing, 2: front left panel, 3: front right panel, 4: left side panel, 5: rear left panel, 6: rear right panel, 7: top panel, 8: left-side front panel, 9: left-side rear panel, 11a, 11b: air inlet, 12a, 12b, 12c: heat exchanger, 13, 14: metal sheet, 13a, 14a: first end portion, 13b, 14b: second end portion, 15: first position, 16: second position

Claims

1. An outdoor unit (1) of an air-conditioning apparatus, comprising:

a housing (1A) having a substantially rectangular parallelepiped shape;
at least one heat exchanger (12) formed into a substantially L-shape, the heat exchanger (12) being disposed along the inside of one side of the housing (1A) and along the inside of the rear of the housing (1A); and
a securing member (13, 14) configured to secure the heat exchanger (12) to the housing (1A), wherein the housing (1A) includes
a side panel configured to form the one side of the housing (1A) and to partially extend to the front of the housing (1A), and
a front panel configured to form the front of the housing (1A) together with the part of the side panel;
an end portion (13a, 14a) of the front panel is connected, at the front of the housing (1A), to an end portion (13b, 14b) of the side panel;

the side panel is provided with a plurality of air inlets (11) in an area that forms the one side of the housing (1A); and

the securing member (13, 14) is interposed between a front end portion (13b, 14b) of the heat exchanger (12) and the connection between the end portion (13a, 14a) of the front panel and the end portion (13a, 14a) of the side panel, and thereby secures the heat exchanger (12) to the front panel.

2. The outdoor unit (1) of the air-conditioning apparatus of claim 1, wherein the end portion (13a, 14a) of the front panel is connected to the end portion (13a, 14a) of the side panel, with the end portion (13a, 14a) of the front panel overlapping with the end portion (13a, 14a) of the side panel; and the securing member (13, 14) secures the heat exchanger (12) to the front panel at substantially the same position, in plan view, as the position of the connection between the end portion (13a, 14a) of the front panel and the end portion (13a, 14a) of the side panel.
3. An outdoor unit (1) of an air-conditioning apparatus, comprising:

a housing (1A) having a substantially rectangular parallelepiped shape;

at least one heat exchanger (12) formed into a substantially L-shape, the heat exchanger (12) being disposed along the inside of one side of the housing (1A) and along the inside of the rear of the housing (1A); and

a securing member (13, 14) configured to secure the heat exchanger (12) to the housing (1A), wherein the housing (1A) includes

a first side panel (8) configured to form a part of the one side of the housing (1A) and to partially extend to the front of the housing (1A),

a second side panel (9) disposed closer to the rear of the housing (1A) than the first side panel (8) is, the second side panel (9) being configured to form at least a part of the one side of the housing (1A), and

a front panel configured to form the front of the housing (1A) together with the part of the first side panel (8);

an end portion (14a) of the front panel is connected, at the front of the housing (1A), to an end portion (14a) of the first side panel (8);

an air inlet (11) is formed between the first side panel (8) and the second side panel (9); and

the securing member (13, 14) is interposed between a front end portion (14b) of the heat exchanger (12) and the connection between the end portion (14a) of the front panel and the end portion (14a) of the first side panel (8), and there-

by secures the heat exchanger (12) to the front panel.

4. The outdoor unit (1) of the air-conditioning apparatus of claim 3, wherein the end portion (14a) of the front panel is connected to the end portion (14a) of the first side panel (8), with the end portion (14a) of the front panel overlapping with the end portion (14a) of the first side panel (8); and the securing member (13, 14) secures the heat exchanger (12) to the front panel at substantially the same position, in plan view, as the position of the connection between the end portion (14a) of the front panel and the end portion (14a) of the first side panel (8).
5. The outdoor unit (1) of the air-conditioning apparatus of any one of claims 1 to 4, wherein the heat exchanger (12) is provided in plurality; the plurality of heat exchangers (12) are arranged side by side; the securing member (13, 14) is interposed between the end portion (13a, 14a) of the front panel and a front end portion (13b, 14b) of the heat exchanger (12) closest to the front of the housing (1A), and thereby secures the heat exchanger (12) to the front panel; and the position at which the heat exchanger (12) is secured by the securing member (13, 14) at the front of the housing (1A) is the same regardless of the number of heat exchangers (12).
6. The outdoor unit (1) of the air-conditioning apparatus of any one of claims 1, 2, and 5 when dependent on claim 1 or 2, wherein the side panel is provided with a plurality of air inlets (11); and a front end portion of one air inlet (11) closest to the front of the housing (1A) is closer to the front of the housing (1A), in side view, than a front end portion (13b, 14b) of the heat exchanger (12) closest to the front of the housing (1A) is.
7. The outdoor unit (1) of the air-conditioning apparatus of any one of claims 3, 4, and 5 when dependent on claim 3 or 4, wherein the first side panel (8) is provided with a plurality of air inlets (11); and a front end portion of one air inlet (11) closest to the front of the housing (1A) is closer to the front of the housing (1A), in side view, than a front end portion (14b) of the heat exchanger (12) closest to the front of the housing (1A) is.

FIG. 1

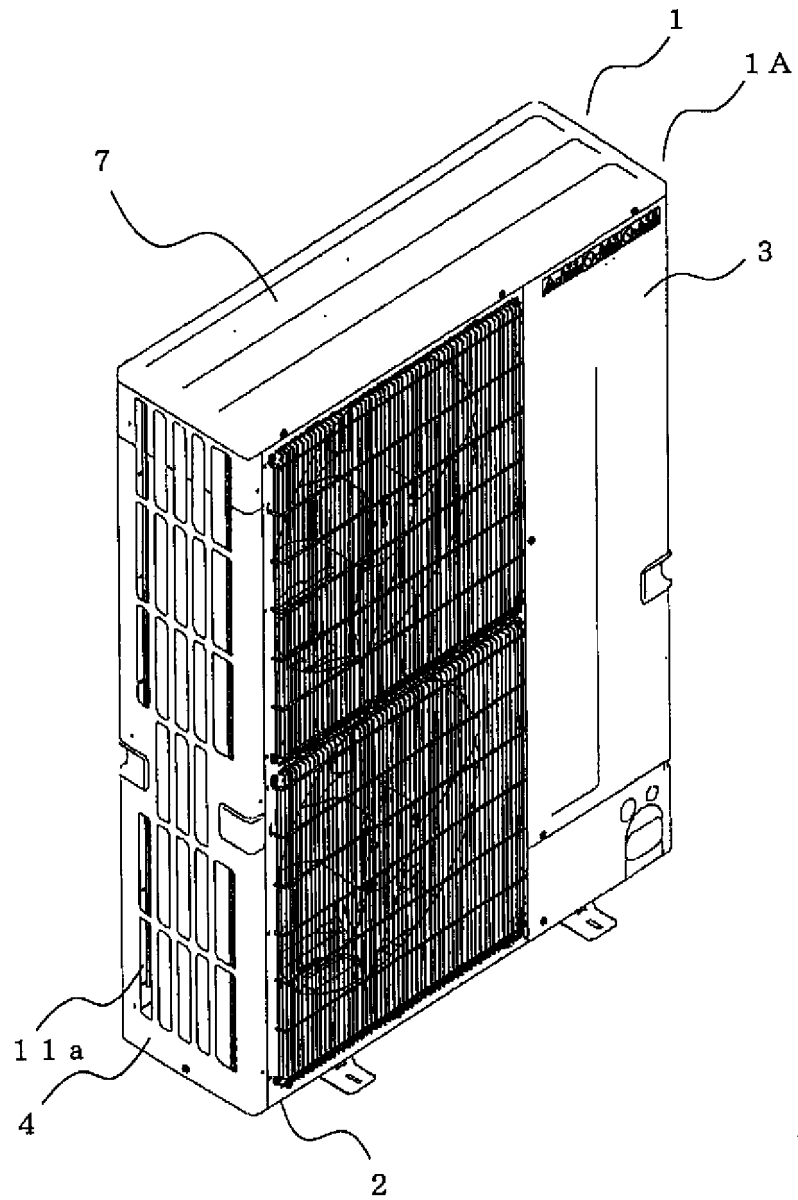


FIG. 2

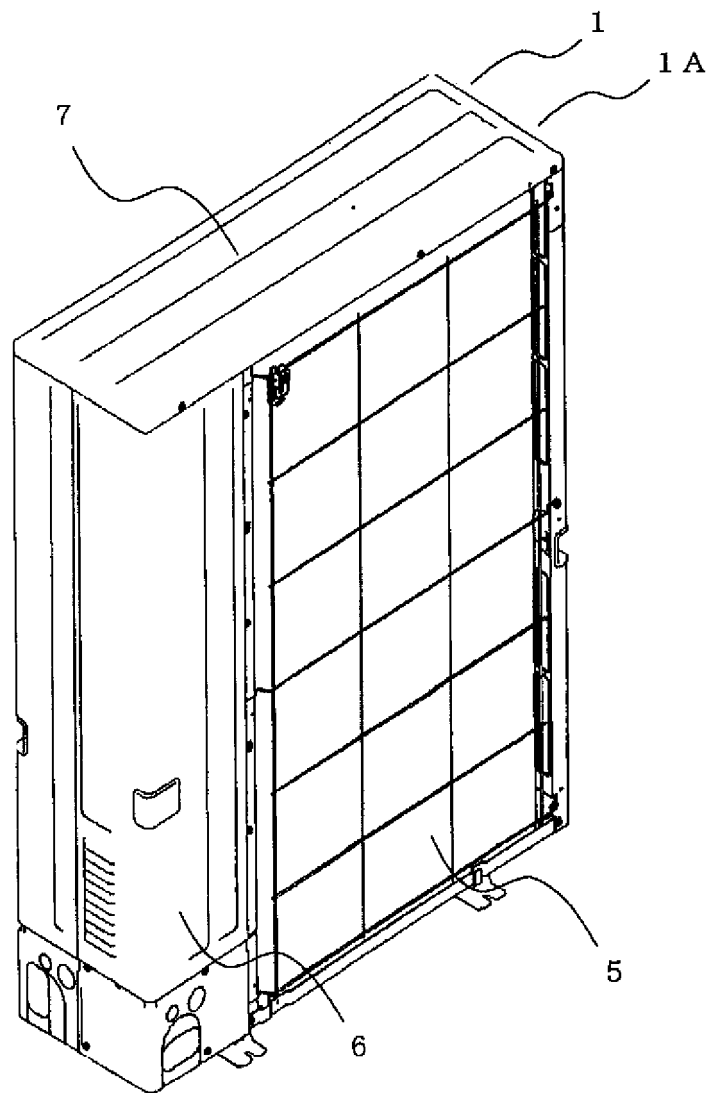


FIG. 3

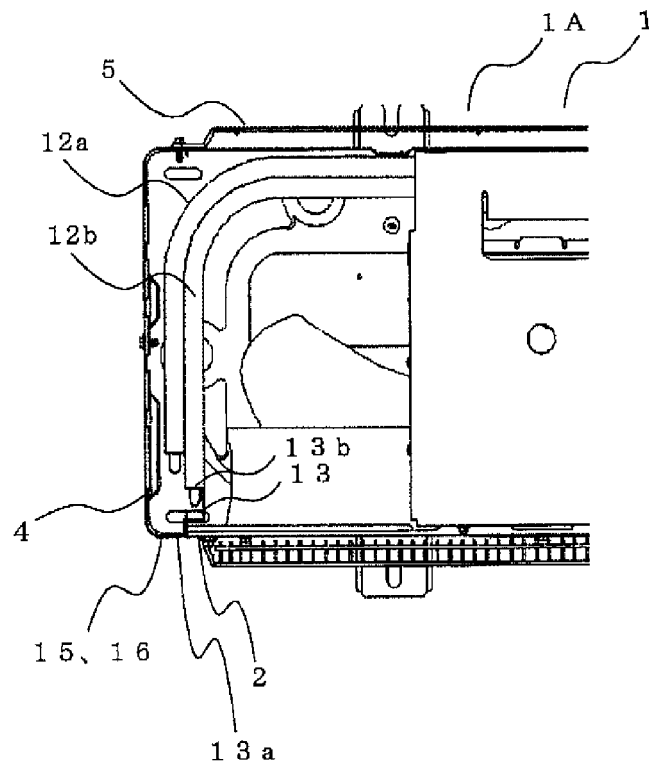


FIG. 4

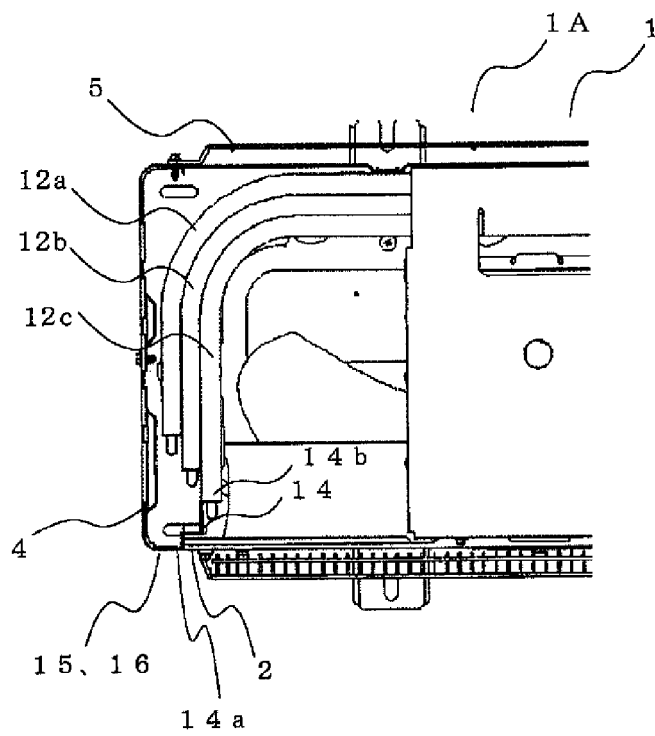


FIG. 5

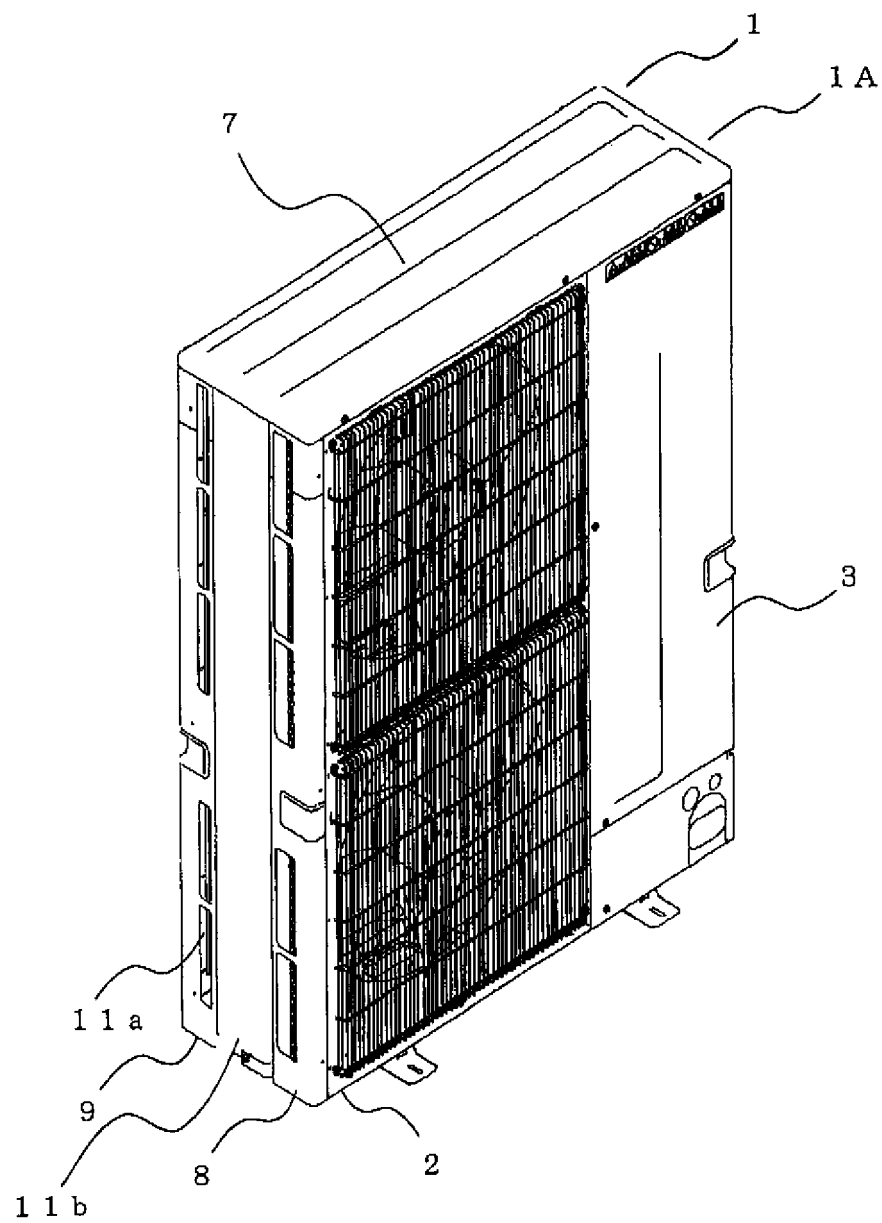
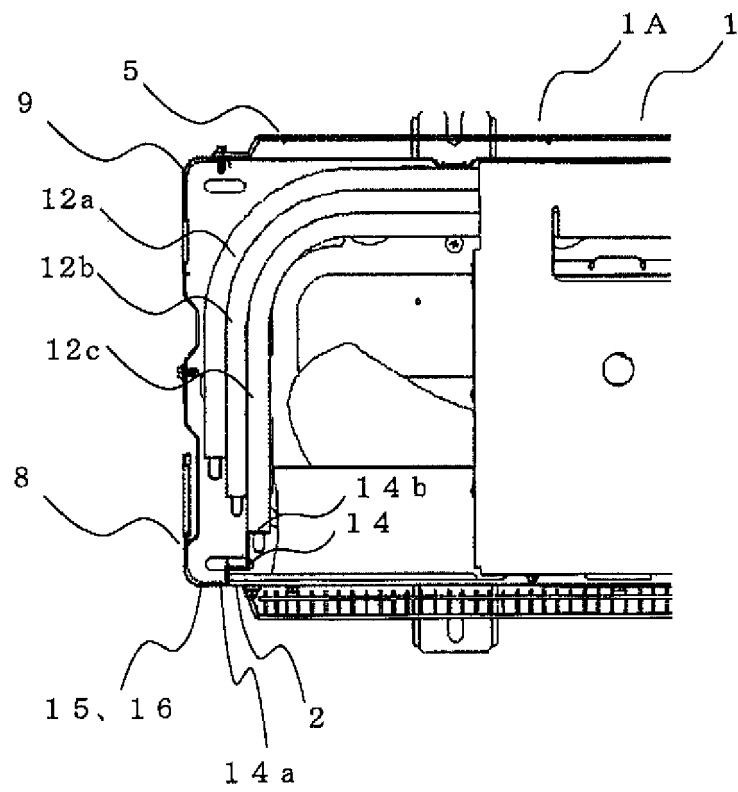


FIG. 6



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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