(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 436 994 A2**

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
04.04.2012 Bulletin 2012/14

(51) Int Cl.:
F24F 1/00 *(2011.01)* ***F24F 13/20*** *(2006.01)*

(21) Application number: **11182449.6**

(22) Date of filing: **23.09.2011**

(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

(30) Priority: **29.09.2010 JP 2010218481**

(71) Applicant: **Mitsubishi Electric Corporation**
Tokyo 100-8310 (JP)

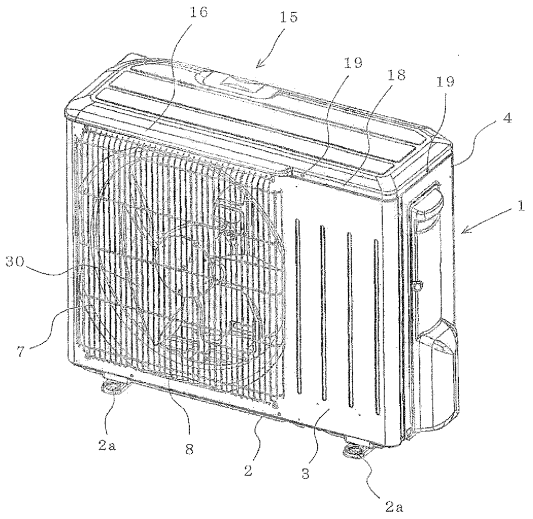
(72) Inventors:
- **Mochizuki, Tatsuya**
  Tokyo, 102-0073 (JP)
- **Kubono, Toshiyuki**
  Tokyo, 102-0073 (JP)
- **Jinnai, Hiroyuki**
  Tokyo, 102-0073 (JP)
- **Yanase, Tomoya**
  Tokyo, 102-0073 (JP)

(74) Representative: **Ilgart, Jean-Christophe**
BREVALEX
95 rue d'Amsterdam
75378 Paris Cedex 8 (FR)

(54) Outdoor unit and air-conditioning apparatus having the same

(57) In the outdoor unit including: a casing (1) having a substantially parallelepiped shape opened on top; a top panel (15) configured to close the opening on the top of the casing (1); a bell mouth (7) provided at an outlet opening of a propeller fan (30) formed on a front panel (3) which constitutes the casing (1); an outlet grill (8) attached on the front side of the outlet opening; and an appentice (16) provided at an end portion of the top panel (3) at a portion corresponding to the outlet grill (8) on the front side of the top panel (3) so as to be overhung to the front from the edge portion.

FIG. 1



1: CASING
3: FRONT PANEL
4: SIDE PANEL
7: BELL MOUTH
8: OUTLET GRILL
15: TOP PANEL
16: APPENTICE
18: FITTING PORTION
19: SCREW INSERTION HOLE
30: PROPELLER FAN

EP 2 436 994 A2

Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

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

2. Description of the Related Art

[0002] In the outdoor unit of the air-conditioning apparatus, water droplets adhered to a front panel by rain or snow during a heating operation or water droplets generated by melting snow accumulated on the outdoor unit drop along a surface of the front panel and enter between a bell mouth and a fan.

[0003] Then, when the outside temperature is low, the temperature of air blown out by the fan may drop to or below freezing. In such a case, the water droplets that entered between the bell mouth and the fan freeze and, if the quantity of the water droplets is large, ice grows and comes into contact with the fan. Accordingly, there arise problems such as generation of abnormal sounds, or abnormal stop of the outdoor unit due to hindrance of rotation.

[0004] In order to solve the problems as described above, an outdoor unit for an air-conditioning unit in which a bell mouth having an outlet opening for a fan is formed on a casing, an outlet grill is provided on the front side of the bell mouth, and a seal member having a width larger than the diameter of the outlet opening is provided above the outlet opening for sealing a portion between the casing and the outlet opening is proposed (for example, see Japanese Registered Utility Model No. 2510078 (p.2, Fig. 1)).

[0005] In the outdoor unit for the air-conditioning unit disclosed in Japanese Registered Utility Model No. 2510078 (p.2, Fig. 1), when sealing the portion between the casing and the top portion of the outlet grill with the sealing member, a frame-shaped rim is required on an outer periphery, or at least an upper side of the outlet grill formed by welding steel wires, so that the appearance design is not impaired and, in addition, it is necessary to combine a plate-shaped component to the steel wire portion. Therefore, there arise problems of complicated manufacture and increase in the cost.

In addition, since it is difficult to close a gap at a center portion with the sealing member only by fixing the same at both end portions of the outlet grill, fixing screws are added. This, however, aggravates the appearance and workability.

[0006] In addition, only both end portions of the seal member are fixed in order to reduce the number of spots where the above-described seal member is fixed, while rattling or vibration is restrained by pushing an intermediate portion against the casing using the resiliency of the outlet grill. However, in such a case, since the both end portions are fixed in a state of being bent by the resiliency of the outlet grill itself, the seal member that seals the portion between the casing and the outlet grill is bent in a curve, so that it is difficult to ensure the sealing.

[0007] In addition, since the sealing member requires a width substantially as large as the thickness thereof, a wall is formed at a position at least 10 mm below an upper surface of the outlet grill. Therefore, in order to decrease in the product size and improve the performance, the seal member is obliged to project toward an air course and hence impair the blowing operation of the fan specifically in the vicinity of the center portion on the upper side of the outlet grill because of the product design which requires maximizing of the fan diameter, which causes generation of noise and impairment of aerodynamic performance.

SUMMARY OF THE INVENTION

[0008] In order to solve the above-described problem, it is an object to the invention to provide an outdoor unit which is capable of reliably preventing water droplets from being frozen between a bell mouth and a propeller fan in a simple structure, and an air-conditioning apparatus having this outdoor unit.

[0009] An outdoor unit according to the invention includes: a casing having a substantially parallelepiped shape opened on top; a top panel configured to close an opening on the top of the casing; a bell mouth provided at an outlet opening of a propeller fan formed on a front panel which constitutes the casing; and an outlet grill attached on the front side of the outlet opening; and an appentice provided at an edge portion of the top panel at a portion corresponding to the outlet grill on the front side of the top panel so as to be overhung forward from the edge portion.

[0010] The air-conditioning apparatus according to the invention includes the outdoor unit described above.

[0011] According to the invention, an outdoor unit which is capable of reliably preventing water droplets from being frozen between a bell mouth and a propeller fan in a simple structure without impairing the appearance, and an air-conditioning apparatus having this outdoor unit can be obtained.

In an embodiment instead of the appentice, another appentice is provided over the entire edge portion on the front side of the top panel so as to be overhung to the front from the edge portion.

Advantageously the appentice is overhung from the edge portion on the front side of the top panel on the order of 10 to 20 mm.

Advantageously the lower portion of the front end portion of the appentice is bent inward to form a bent portion.

In an embodiment the overhung portion overhung on the order of several mm to 10 mm is formed on one of the side edge portions continuing to the appentice of the top panel via a shoulder and the side surface of the casing

is formed into a shape corresponding to the overhung portion of the front panel.

6. In an embodiment screw insertion holes are formed at a plurality of positions, which includes positions in the vicinity of the apprentice, in a fitting portion provided on an outer periphery of the top panel, and screws inserted into the screw insertion holes are screwed into screw holes (10) provided on an engaging portion on a peripheral edge of an opening on the top of the casing, so that the top panel and the casing are integrally fixed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012]

Fig. 1 is an external perspective view illustrating an outdoor unit of an air-conditioning apparatus according to Embodiment 1 of the invention;
Fig. 2 is a perspective view illustrating a state in which a top panel in Fig. 1 is removed;
Fig. 3 is a perspective view when viewed from the obliquely opposite side from Fig. 2;
Fig. 4 is a top view of Fig. 1;
Fig. 5 is a front view of Fig. 2;
Fig. 6A is a cross-sectional view taken along the line X-X in Fig. 5;
Fig. 6B is an enlarged view of a portion A in Fig. 6A; and
Fig. 7 is a perspective view illustrating a state in which the top panel of the air-conditioning apparatus according to Embodiment 2 of the invention is removed.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Embodiment 1

[0013] Fig. 1 is an external perspective view of an outdoor unit of an air-conditioning apparatus according to Embodiment 1 of the invention, Fig. 2 is a perspective view illustrating a state in which a top panel in Fig. 1 is removed, Fig. 3 is a perspective view when viewed from an obliquely opposite side of Fig. 2, and Fig. 4 is a top view of Fig. 1. In the description given below, the near side of the drawing is referred to as the front side, the far side of the drawing is referred to as the back side, the left side of the drawing is referred to as a left side surface and a right side of the drawing is referred to as the right side surface.

[0014] In Fig. 1 to Fig. 4, reference numeral 1 designates a casing of the outdoor unit formed to have a parallelepiped shape opened on top by a bottom plate having legs 2a on a lower surface thereof, a substantially L-shaped front panel 3 mounted from the front side to the left side surface, a side panel 4 mounted from the right side surface to part of the back side, and a substantially L-shaped heat exchanger 5 mounted from the back side through the left side surface to the inside of the front panel 3. An opening on the top is closed with a top panel 15. Although a partitioning panel, a compressor, refrigerant piping, and electric components are mounted in the casing 1, these components are not illustrated.

[0015] Reference numeral 30 designates a propeller fan whose driving motor (not illustrated) is attached to a motor mounting panel 6 extending upright from the bottom plate 2 in the casing 1, a bell mouth 7 is provided at an outlet opening of the propeller fan 30 provided on the front panel 3, and an outlet grill 8 is attached to the outside of the outlet opening so as to cover the outlet opening. Formed on upper end portions of the front panel 3 and the side panel 4 is an engaging portion 9 slightly reduced in thickness via a shoulder 9a, and screw holes 10 are provided on the engaging portion 9 corresponding to screw insertion holes 19 formed on a fitting portion 18 of the top panel 15, described later.

[0016] The top panel 15 is formed to have a size substantially the same as the outline of the casing 1, and is provided with the fitting portion 18 configured to be fitted to the engaging portion 9 of the casing 1 along the peripheral edge thereof except for an appentice 16 described below, a portion on the front side corresponding to the outlet grill 8 is provided with an appentice 16 overhung outward (to the front) from an edge portion. Although the amount of protrusion of the appentice 16 is described to be on the order of 10 to 20 mm from an edge portion in the embodiment, the invention is not limited thereto. Then, the fitting portion 18 is formed with a plurality of the screw insertion holes 19 including a portion near the appentice 16.

[0017] The appentice 16 is bent or curled inward into a substantially U-shape at a lower portion at a front end portion as shown in Figs. 6A and 6B, which are cross-sectional views taken along the line X-X in Fig. 5 (hereinafter, this part is referred to as a bent portion 17). Also, as shown in Fig. 3 and Fig. 4, an edge portion on the left side surface of the top panel 15 continuing from the appentice 16 is overhung slightly (for example, on the order of several mm to 10 mm) from the surface of the appentice 16 on the left end portion thereof via a shoulder 21 to form an overhung portion 20. A side surface portion 3a of the front panel 3 of the casing 1 also has a shape corresponding to the overhung portion 20 of the top panel 15 via a shoulder 11.

[0018] The top panel 15 configured in this manner is fitted at the fitting portion 18 thereof to the engaging portion 9 of the casing 1 and closes the opening on the top of the casing 1, then is fixed integrally therewith by screwing screws inserted into the plurality of screw insertion holes 19 formed on the fitting portion 18 of the top panel 15 respectively into the screw holes 10 formed on the engaging portion 9 of the casing 1 corresponding to the screw insertion holes 19. At this time, the appentice 16 provided on the top panel 15 above the outlet grill 8 projects from the surface of the front panel 3 to the front

surface side until a position in the vicinity of a front edge portion of the outlet grill 8.

[0019] In this case, since the outlet grill 8 is positioned on the left side of the casing 1, if the left edge portion and the left end surface of the appentice 16 of the top pane 15 are flush with each other and this part is formed to be linear, the top panel 15 may be displaced in the fore-and-aft direction at the time of assembly of the product and hence the screw insertion holes 19 are not aligned with the screw holes 10, whereby workability may be deteriorated.

[0020] In this embodiment, the left edge portion of the top panel 15 is formed with the overhung portion 20 overhung slightly from the left end surface of the appentice 16 via the shoulder 21 provided therebetween and the side surface 3a of the front panel 3 of the casing 1 is formed into a shape corresponding to the overhung portion 20 via the shoulder 11. Therefore, positioning in the fore-and-aft direction of the top panel 15 at the time of assembly is ensured, so that workability can be improved.

[0021] In the outdoor unit according to this embodiment having the configuration as described above, when water droplets adhered on the top panel 15 or melted snow accumulated on the top panel 15 flows out toward the front surface, the water droplets flow along the front panel 3 on the right side in the drawing but, on the side of the outlet grill 8 (the left side), water droplets drop at positions away from the surface of the front panel 3, come into contact with the lower portion of the front panel 3 or bridges of the outlet grill 8, and drop along the bridges because the top panel 15 is provided with the appentice 16. Therefore, icicles generated by freezing grow on the bridges of the outlet grill 8 and enter neither the front panel 3 nor the bell mouth 7.

[0022] Therefore, even when the outside air temperature is low and the blown air temperature from the propeller fan 30 drops to or below freezing, no freezing occurs between the bell mouth 7 and the propeller fan 30, and generation of abnormal sound of the propeller fan 30 due to the freezing can be prevented.

[0023] Also, since the front end portion of the appentice 16 of the top panel 15 is located at a position away (protruded) from the front panel 3, the user often places his or her finger on the appentice 16. Since the bent portion 17 formed by being bent inward is provided at the lower portion of the distal edge portion of the appentice 16, injury of a finger is prevented and safety can be secured. The top panel 15 is fixed by the screws inserted into the screw insertion holes 19 provided at a plurality of points on the fitting portion 18 including the positions in the vicinity of the appentice 16 screwed into the screw holes 10 formed correspondingly on the engaging portion 9 of the casing 1. Therefore, even when a force in the direction of lifting the appentice 16 with the hand thereon is applied, deformation of the appentice 16 can be prevented.

Embodiment 2

[0024] Fig. 7 is a perspective view illustrating a state in which the top panel of the outdoor unit of the air-conditioning apparatus according to Embodiment 2 of the invention is removed. The identical or same functional portions as in Embodiment 1 are designated by the same reference numerals.

In Embodiment 1, the case where the appentice 16 is provided on the edge portion of the portion of the top panel 15 corresponding to the outlet grill 8 on the front side has been described. However, in this embodiment, the appentice 16 is provided over the entire edge portion on the front side of the top panel 15.

In this embodiment as well, the substantially same advantages as in Embodiment 1 can be obtained.

Embodiment 3

[0025] In this embodiment, the outdoor unit according to Embodiment 1 or 2 is connected to an indoor unit mounted indoors via refrigerant piping and electric wiring to constitute the air-conditioning apparatus.

In this embodiment as well, the same advantages as in Embodiment 1 can be obtained.

REFERENCE SIGNS LIST

[0026] 1 casing, 3 front panel, 4 side panel, 5 heat exchanger, 7 bell mouth, 8 outlet grill, 9 engaging portion, 10 screw hole, 11 shoulder, 15 top panel, 16 appentice, 17 bent portion, 18 fitting portion, 19 screw insertion hole, 20 overhung portion, 21 shoulder, 30 propeller fan

Claims

1. An outdoor unit comprising:

a casing (1) having a substantially parallelepiped shape opened on top;
a top panel (15) configured to close an opening on the top of the casing (1);
a bell mouth provided at an outlet opening of a propeller fan (30) formed on a front panel (3) which constitutes the casing (1);
an outlet grill attached on the front side of the outlet opening; and
an apprentice (16) provided at an edge portion of the top panel (15) at a portion corresponding to the outlet grill on the front side of the top panel (15) so as to be overhung to the front from the edge portion.

2. The outdoor unit of claim 1, wherein instead of the appentice (16), another appentice (16) is provided over the entire edge portion on the front side of the top panel (15) so as to be overhung to the front from

the edge portion.

3. The outdoor unit of claim 1 or 2, wherein the appentice (16) is overhung from the edge portion on the front side of the top panel (15) on the order of 10 to 20mm.

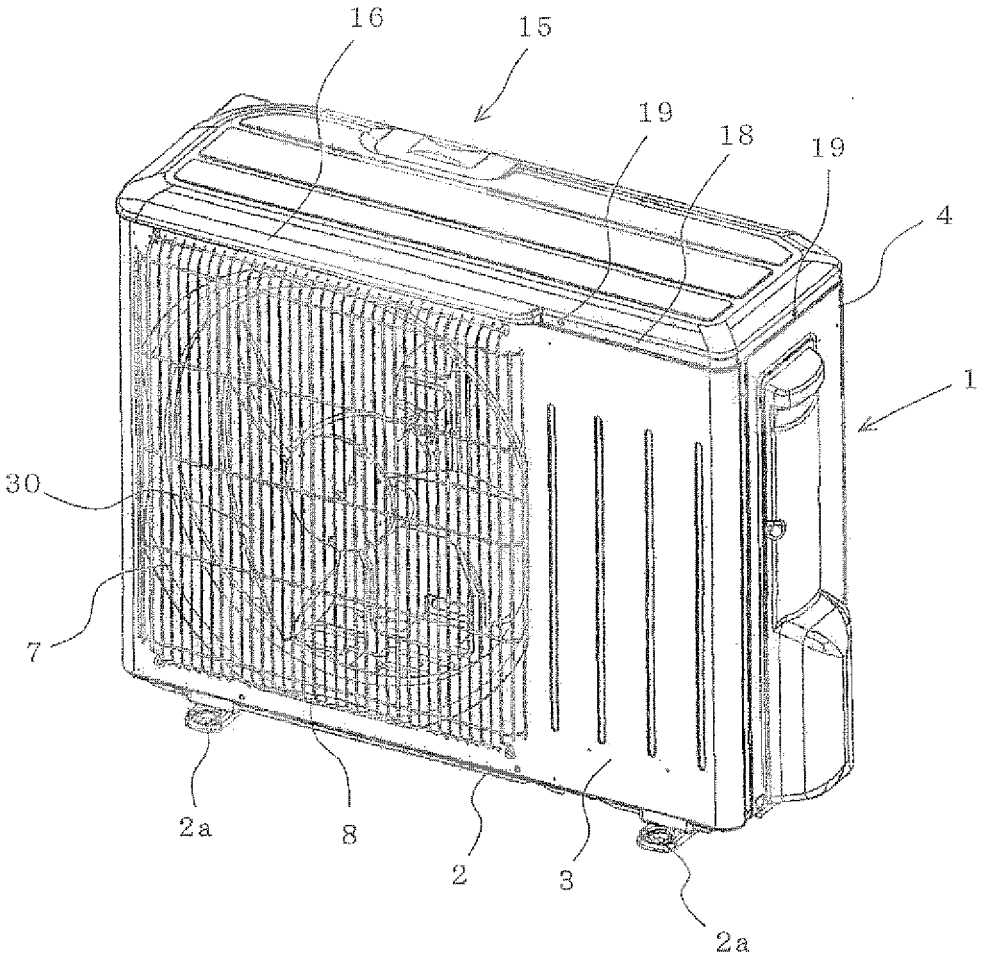
4. The outdoor unit of any one of claims 1 to 3, wherein the lower portion of the front end portion of the appentice (16) is bent inward to form a bent portion.

5. The outdoor unit of any one of claims 1 to 4, wherein the overhung portion overhung on the order of several mm to 10 mm is formed on one of the side edge portions continuing to the appentice (16) of the top panel (15) via a shoulder and the side surface of the casing (1) is formed into a shape corresponding to the overhung portion of the front panel (3).

6. The outdoor unit of any one of claims 1 to 5, wherein screw insertion holes (19) are formed at a plurality of positions, which includes positions in the vicinity of the apprentice, in a fitting portion (18) provided on an outer periphery of the top panel (15), and screws inserted into the screw insertion holes (19) are screwed into screw holes (10) provided on an engaging portion (9) on a peripheral edge of an opening on the top of the casing (1), so that the top panel (15) and the casing (1) are integrally fixed.

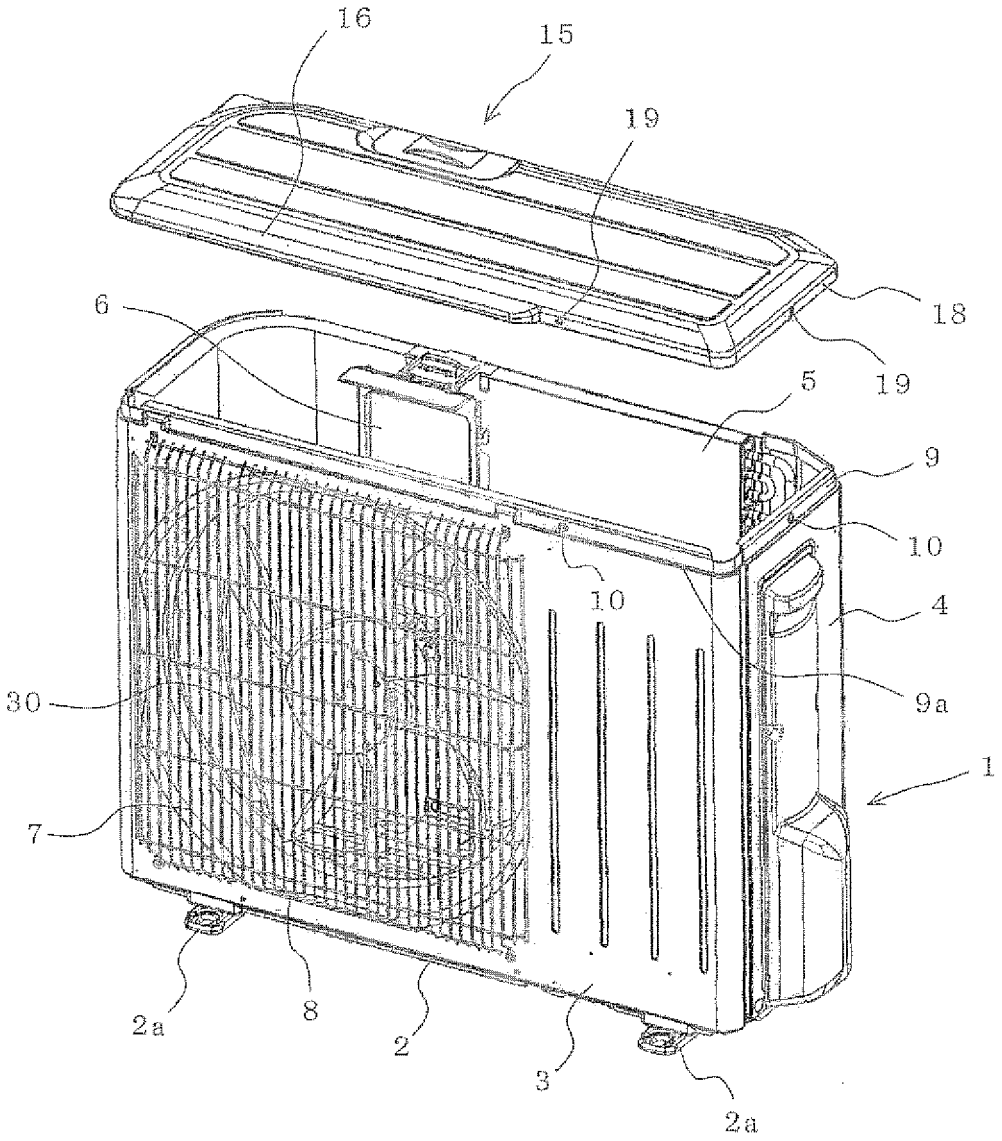
7. An air-conditionning apparatus comprising the outdoor unit of any one of claims 1 to 6.

FIG. 1



1: CASING
3: FRONT PANEL
4: SIDE PANEL
7: BELL MOUTH
8: OUTLET GRILL
15: TOP PANEL
16: APPENTICE
18: FITTING PORTION
19: SCREW INSERTION HOLE
30: PROPELLER FAN

FIG. 2



5: HEAT EXCHANGER
9: ENGAGING PORTION
10: SCREW HOLE

FIG. 3

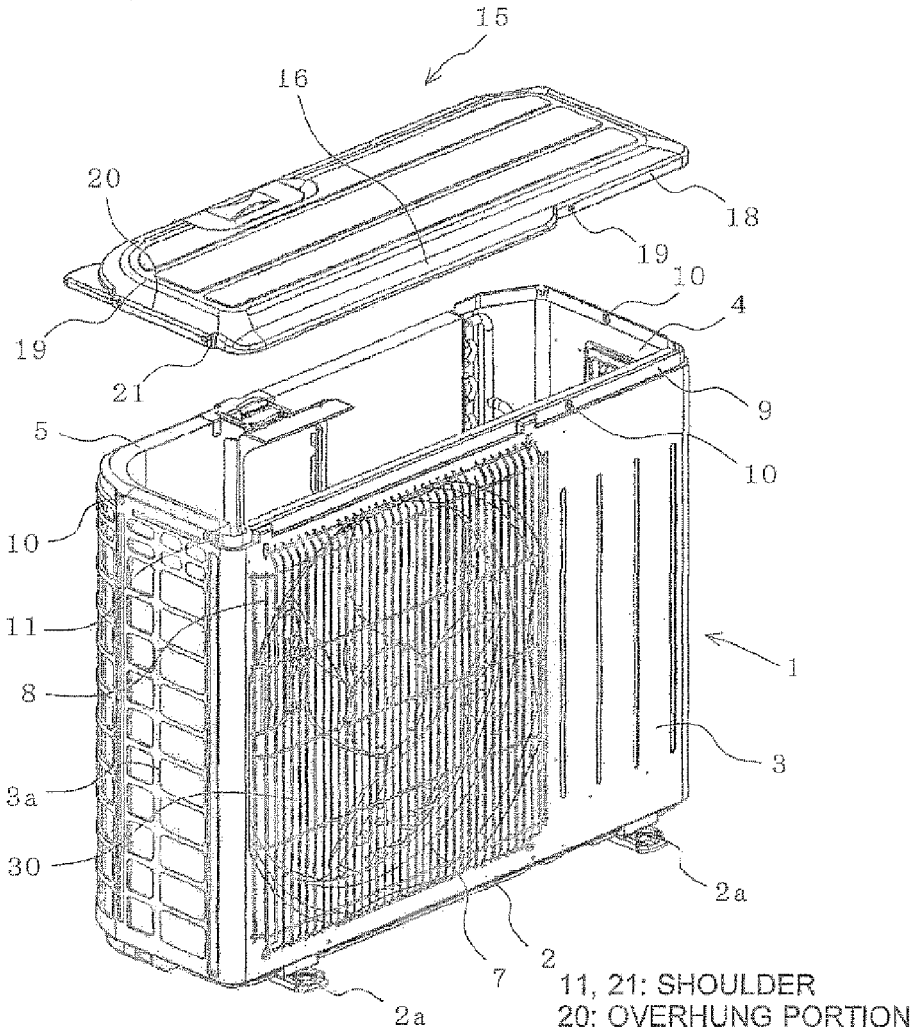

15
16
20
18
19
10
4
19
21
9
5
10
10
11
1
8
3
3a
30
2a
2
7
2a
11, 21: SHOULDER
20: OVERHUNG PORTION

FIG. 4

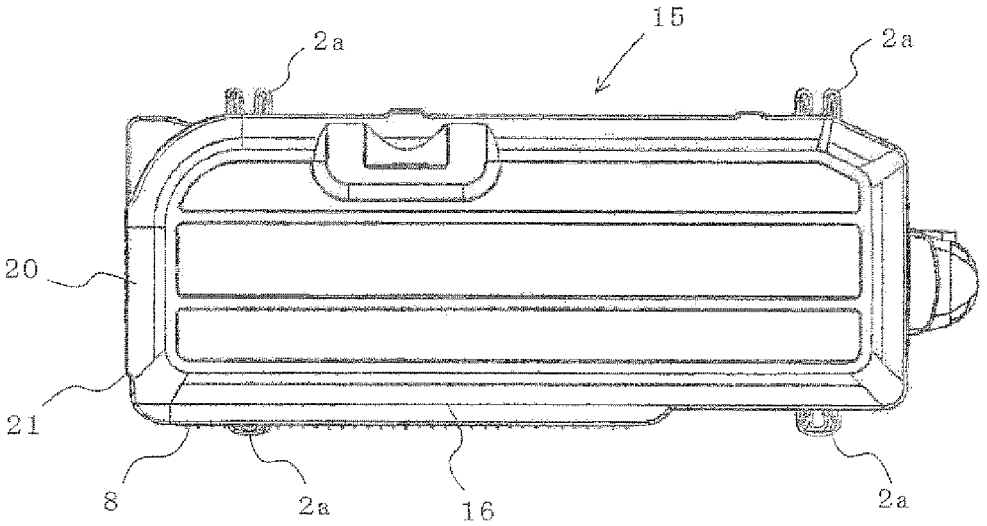

15
2a
2a
20
21
8
2a
16
2a

FIG. 5

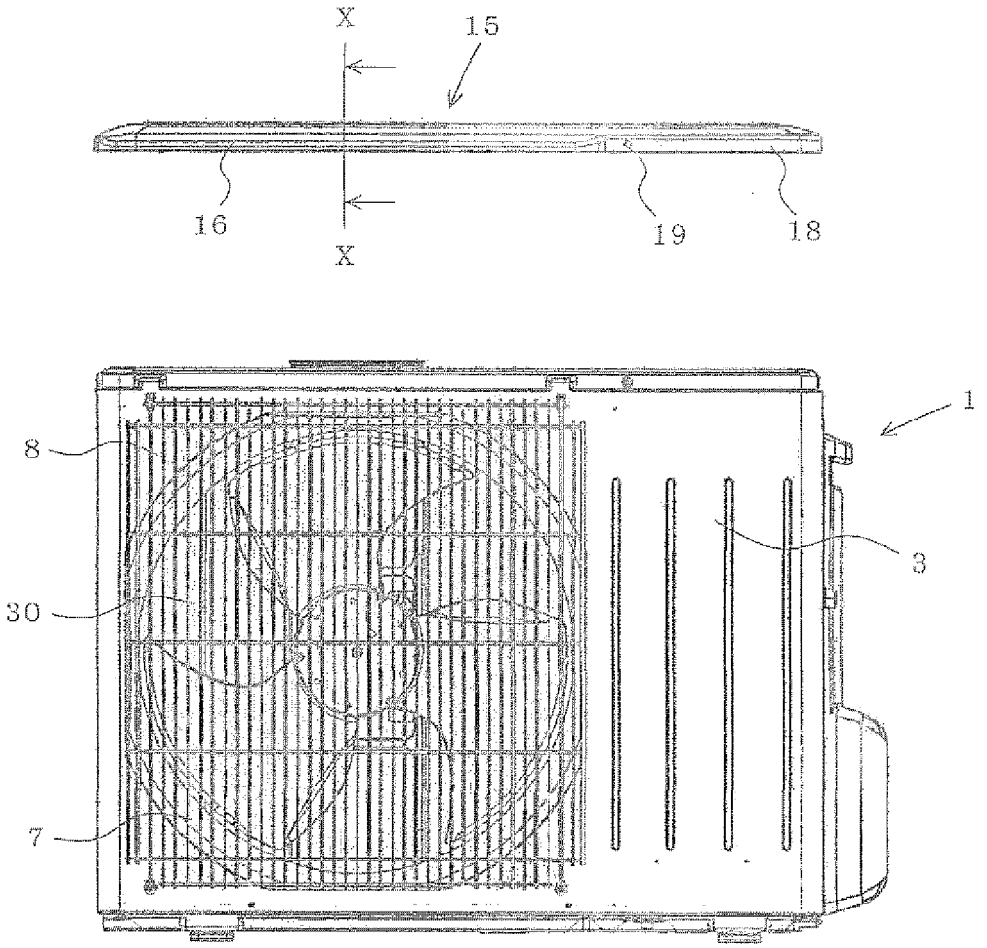


FIG. 6

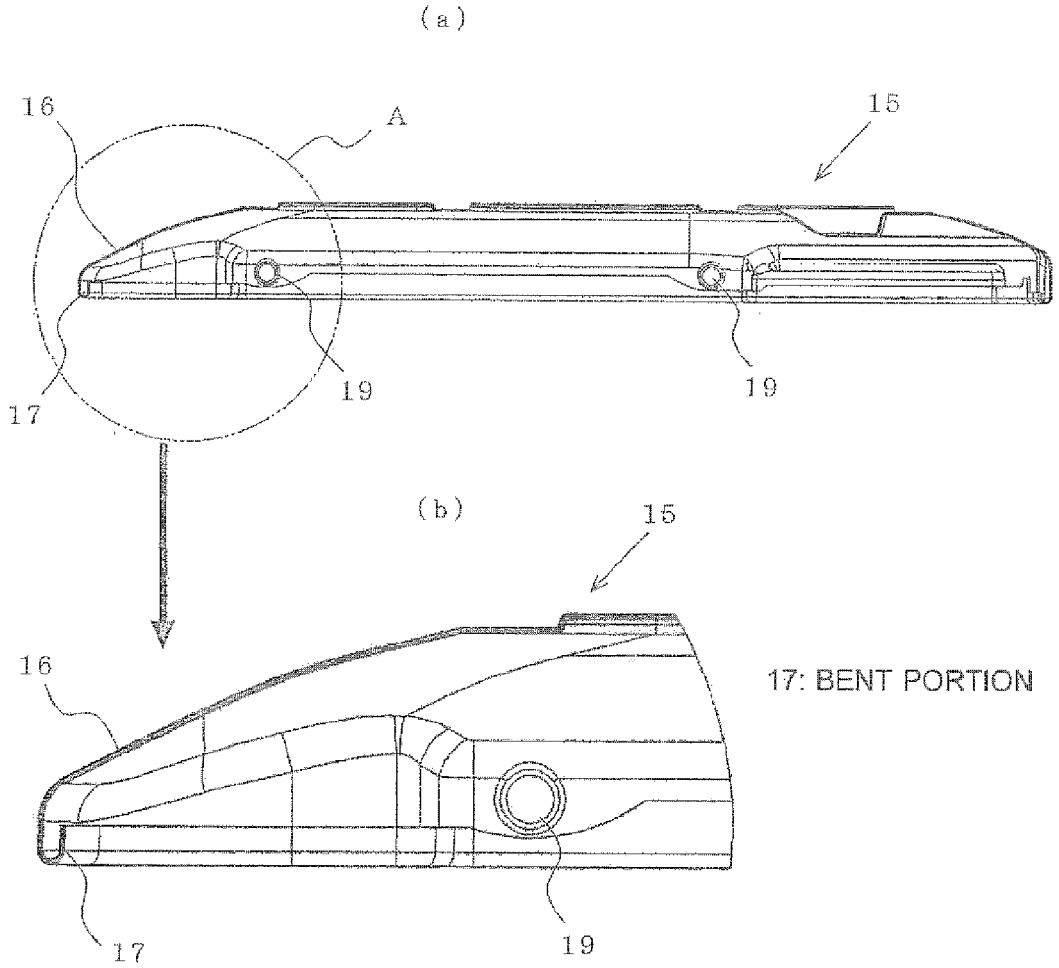
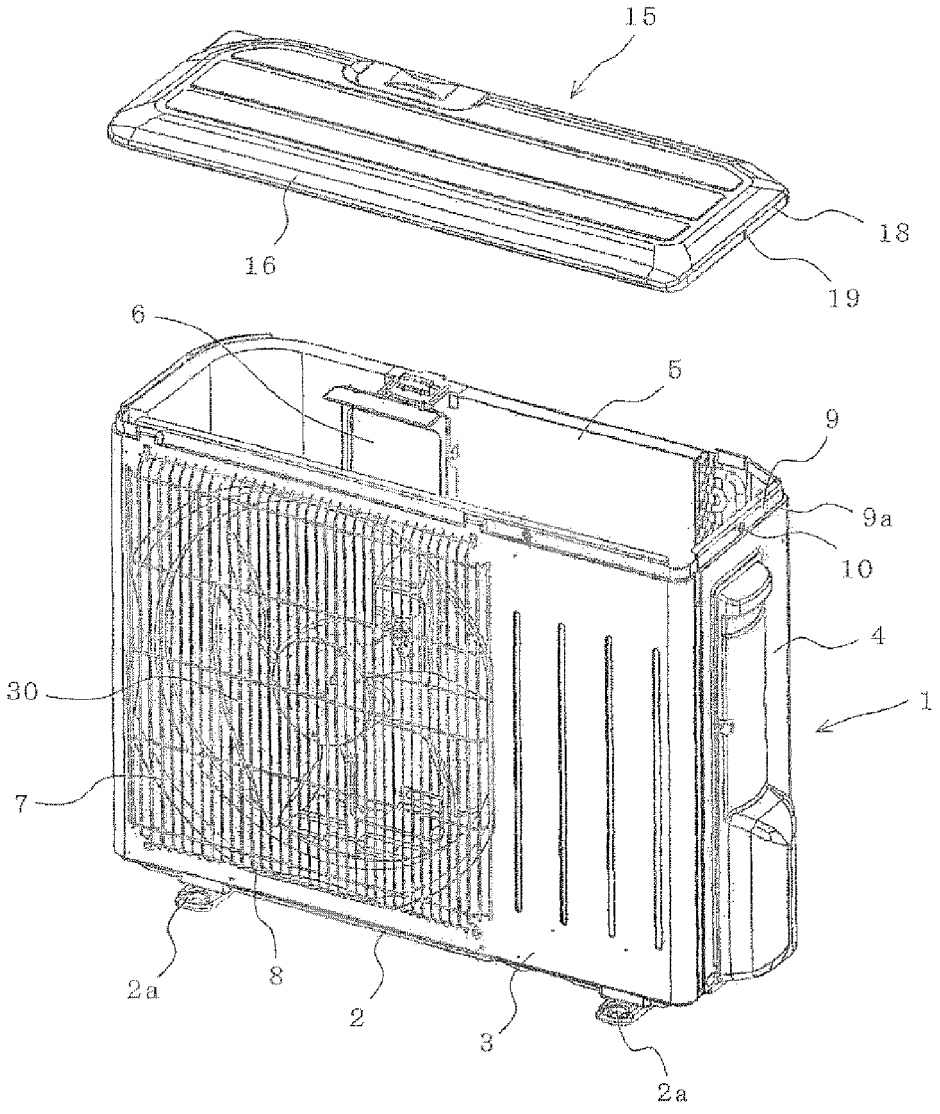


FIG. 7



REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 2510078 B **[0004] [0005]**