

(19)



(11)

EP 3 015 783 A2

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
04.05.2016 Bulletin 2016/18

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

(21) Application number: **15189303.9**

(22) Date of filing: **12.10.2015**

(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
Designated Validation States:
MA

(72) Inventors:
• **Nunome, Yoshinori**
Tokyo (JP)
• **Ito, Shingo**
Tokyo (JP)

(74) Representative: **Henkel, Breuer & Partner**
Patentanwälte
Maximiliansplatz 21
80333 München (DE)

(30) Priority: **28.10.2014 JP 2014219437**

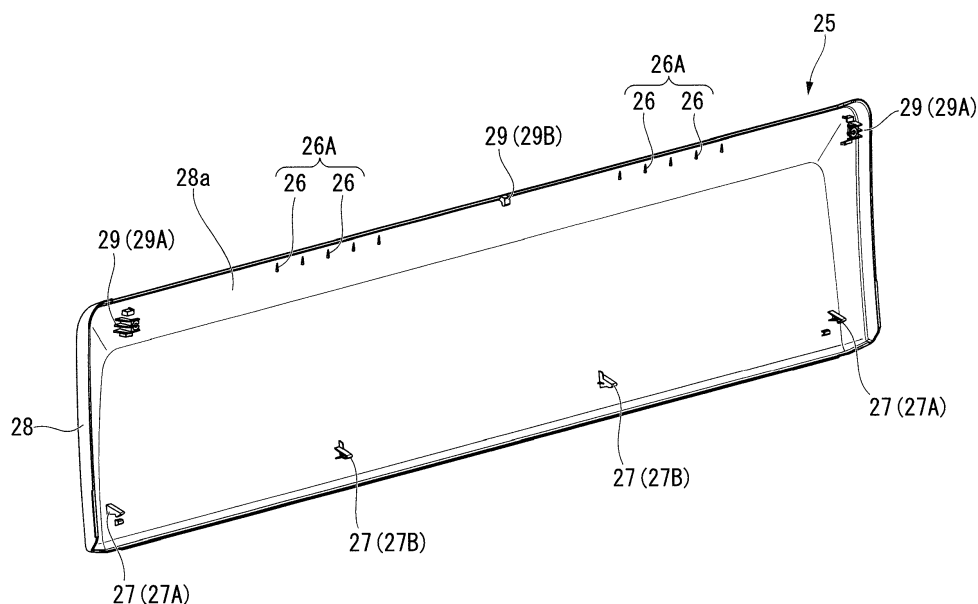
(71) Applicant: **MITSUBISHI HEAVY INDUSTRIES, LTD.**
Tokyo 108-8215 (JP)

(54) **AIR CONDITIONER**

(57) An air conditioner (1) includes a front panel (16) formed on a front side of a front opening section (OP1) of a housing (2) in a horizontal direction when the air conditioner (1) is installed, and having a crosspiece formed therein; a suction panel (25) disposed opposite to the crosspiece (18) to cover the front opening section (OP1) and the front panel (16) and provided to allow opening and closing of the front opening section (OP1);

and a plurality of ribs (26) formed at intervals on back surfaces (28a) of the suction panel (25), which face each other, in a direction serving as the horizontal direction when the air conditioner (1) is installed, projecting toward a facing surface (18a) to the suction panel (25) in the crosspiece (18), and having tips coming into contact with the facing surface (18a).

FIG. 2



EP 3 015 783 A2

Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to an indoor unit of an air conditioner.

Description of Related Art

[0002] Conventionally, an air conditioner which accommodates a blower, a heat exchanger or the like inside a housing, and performs the indoor air-conditioning by ejecting the indoor air after sucking the air to perform the adjustment of the temperature and the humidity is known. An example of such an air conditioner is disclosed in

[0003] Patent Literature 1.

[0004] Here, in the housing of the air conditioner disclosed in Patent Literature 1, a front panel and a suction panel are provided to cover the front surface. A suction port is provided above the suction panel and the front panel, and the air is sucked into the housing via the suction port.

[Prior Art]

[Patent Literature]

[0005] Japanese Unexamined Patent Application, First Publication No. 2010-112628

[0006] However, in the conventional air conditioner as disclosed in Patent Literature 1, a gap is formed between the front panel and the suction panel. Thus, for example, when stacking a plurality of air conditioners during transportation or the like, there is a possibility that the suction panel may be deformed by being pressed from the front side. Therefore, in order to avoid deformation of the suction panel, there is a need for treatment such as interposing a separate member such as a spacer between the front panel and the suction panel. Thus, there is a problem that the labor may be increased.

[0007] The present invention provides an air conditioner which can limit the deformation of the suction panel when the suction panel is pressed using a simple structure.

SUMMARY OF THE INVENTION

[0008] An air conditioner according to a first aspect of the invention includes a front panel in which a crosspiece is provided on a front side of a front opening section of a housing in a horizontal direction when the air conditioner is installed in a intersecting direction intersecting with a penetrating direction in which the front opening section penetrate; a suction panel disposed opposite to the crosspiece to cover the front opening section and the front panel and provided to allow opening and closing of

the front opening section; and a plurality of ribs provided at intervals in the intersecting direction on one of a back surfaces of the suction panel and a facing surface to the suction panel of the crosspiece which face each other, projecting toward the other, and having tips coming into contact with the other.

[0009] An air conditioner according to a second aspect of the invention includes a front panel in which a crosspiece is provided on a front side of a front opening section of a housing in a horizontal direction when the air conditioner is installed in a intersecting direction intersecting with a penetrating direction in which the front opening section penetrate; a suction panel disposed opposite to the crosspiece to cover the front opening section and the front panel, and provided to allow opening and closing of the front opening section; and a plurality of ribs provided at intervals in the intersecting direction on a back surfaces of the suction panel and a facing surface to the suction panel of the crosspiece which face each other, wherein the ribs provided on the back surface of the suction panel protrude toward the facing surface of the crosspiece, tips thereof come into contact with the facing surface of the crosspiece, the ribs formed on the facing surface of the crosspiece protrude toward the back surface of the suction panel, and the tips thereof come into contact with the back surface of the suction panel.

[0010] According to such an air conditioner, the crosspiece is provided on the front panel, and the crosspiece and the suction panel come into contact with each other via the ribs. Therefore, when the suction panel is pressed, it is not bent due to the gap between the suction panel and the crosspiece. Moreover, even if the suction panel is relatively moved so as to be shifted with respect to the crosspiece, since the suction panel and the crosspiece come into contact with each other via the ribs, it is possible to reduce the contact area between the suction panel and the crosspiece. Therefore, it is possible to limit the rubbing sound generated during the relative movement, and the damage of the suction panel and the crosspiece.

[0011] In the air conditioner according to a third aspect of the present invention, the air conditioner in the first or second aspect may further include a top panel configured to cover a top opening section of the housing and provided continuously on the front panel, wherein the top panel has a plurality of horizontal frames extending in the intersecting direction and a plurality of vertical frames intersecting with the horizontal frames and has a grid shape, and the plurality of vertical frames are connected to the crosspiece.

[0012] Thus, since the vertical frames of the top panel assembled in a grid shape by the horizontal frames and the vertical frames are connected to the crosspiece, when a pressing force is applied to the crosspiece from the suction panel via the ribs, the pressing force is transmitted to the vertical frames of the top panel, and thus, it is possible to limit the deformation of the crosspiece. Therefore, it is possible to further limit the flexure of the suction panel when the suction panel is pressed.

[0013] Further, in the air conditioner according to a fourth aspect of the present invention, the ribs of the third aspect may be provided at positions corresponding to positions at which the vertical frames are connected to the crosspiece.

[0014] Since the ribs are formed at such positions, when the pressing force is applied to the crosspiece from the suction panel via the ribs, the pressing force is directly transmitted to the vertical frame of the top panel, and thus, it is possible to further limit the deformation of the crosspiece. Therefore, it is possible to further limit the flexure of the suction panel when the suction panel is pressed.

[0015] In the air conditioner according to a fifth aspect of the present invention, the suction panel of the first to fourth aspects may have a panel main body which covers the front opening section, and a plurality of support sections which are provided at an upper end portion of the panel main body to be spaced apart from each other in the intersecting direction, and fix the panel main body with respect to the front panel, wherein the ribs are disposed at least in a region separated farthest from the plurality of support sections in the intersecting direction.

[0016] According to such an air conditioner, since the ribs are disposed in a region spaced farthest from the support sections provided on the suction panel and located between the support sections, when there is no rib, the ribs are disposed in a region in which the flexure deformation is the most likely to occur in the suction panel. Therefore, it is possible to effectively limit the flexure of the suction panel when the suction panel is pressed.

Effect of the Invention

[0017] According to the air conditioner, it is possible to limit the deformation of the suction panel when the suction panel is pressed, by a simple structure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018]

Fig. 1A is an external perspective view showing an air conditioner according to an embodiment of the present invention and showing a state in which the suction panel is removed.

Fig. 1B is an external perspective view showing an air conditioner according to the embodiment of the present invention and showing a state in which the suction panel is attached.

Fig. 2 is a perspective view in which the suction panel of the air conditioner according to the embodiment of the present invention is viewed from the back side.

Fig. 3 is a cross-sectional view showing a contact state between the suction panel of the air conditioner and the front panel according to the embodiment of the present invention taken from a line A-A of Fig. 1B.

DETAILED DESCRIPTION OF THE INVENTION

[0019] Hereinafter, an air conditioner 1 according to the embodiment of the present invention will be described.

[0020] The air conditioner 1 is an indoor unit provided indoors, and is a device that discharges an air A after sucking the air A and adjusting the temperature and humidity to perform the air-conditioning of the room.

[0021] As shown in Figs. 1A and 1B, the air conditioner 1 is equipped with a housing 2 which has an oblong rectangular parallelepiped shape in a direction which is a horizontal direction when the air conditioner 1 is installed, and an air conditioning device 5 accommodated in the housing 2.

[0022] Hereinafter, a direction as the horizontal direction when the air conditioner 1 is installed is set as a lateral direction, a direction as the vertical direction when the air conditioner 1 is installed is simply set as a vertical direction, and a direction perpendicular to the lateral direction and the vertical direction is set as a longitudinal direction. A front side of the air conditioner 1 when the air conditioner 1 is installed is a longitudinal front side.

[0023] As the air conditioning device 5, a heat exchanger 6, a blower fan 7 provided so as to be covered by the heat exchanger 6, a filter 8 provided in the suction port for sucking an air A, a control box 9 provided on one end side in the lateral direction to control the air-conditioning are mainly provided (see Fig. 3).

[0024] The housing 2 is equipped with a front panel 16 disposed on the front side as the front side of the air conditioner 1 when the air conditioner 1 is installed, a top panel 20 integrally connected to the front panel 16 and disposed at the top when the air conditioner is installed, and a housing main body 10 which defines a space S (see Fig. 3) which accommodates the air conditioning device 5 in the interior thereof along with the front panel 16 and the top panel 20.

[0025] Furthermore, the housing 2 is equipped with a suction panel 25 which covers the front panel 16 from the front, and ribs 26 formed on the suction panel 25.

[0026] The housing main body 10 has a pair of side panels 12 disposed in the lateral direction, a back panel 11 integrally connected to the pair of side panels 12 to face the installation surface, and a bottom panel 13 which supports the pair of side panels 12 and the back panel 11 and is disposed at the bottom.

[0027] In this way, the housing main body 10 defines a space S which accommodates the air conditioning device 5 surrounded by the pair of side panels 12, the back panel 11 and the bottom panel 13. Thus, the space S is opened forward and upward. That is, the housing main body 10 is formed with a front opening section OP1 that laterally penetrates through the housing 2, and a top opening section OP2 that vertically penetrates through the housing 2.

[0028] The front panel 16 is provided integrally with the housing main body 10 on the front side of the front open-

ing section OP1.

[0029] In this embodiment, the front panel 16 has a plurality of front vertical frames 17 which extend upward from the bottom panel 13 to be spaced apart from each other in the lateral direction, a crosspiece 18 which is connected to the front vertical frames 17 on the upper side of the front opening section OP1, is formed to extend in the lateral direction (a direction intersecting with the penetrating direction of the front opening section OP1) and is connected to the pair of side panels 12, and a front horizontal frame 19 which laterally connects the front vertical frames 17 below the crosspiece 18.

[0030] Thus, the front panel 16 has a grid shape.

[0031] Further, the front vertical frame 17 located substantially at the center in the lateral direction is a front vertical frame 17A which is formed to have a larger lateral width dimension than the other front vertical frames 17.

[0032] The top panel 20 is provided integrally with the housing main body 10 on the upper surface side of the top opening section OP2, has a plurality of longitudinally extending vertical frames 21, and a plurality of horizontal frames 22 extending in the lateral direction to intersect with the vertical frames 21, and has a grid shape.

[0033] Each of the vertical frames 21 is disposed spaced apart from each other in the lateral direction, and each of the vertical frames 21 is connected to the crosspiece 18 of the front panel 16 and the back panel 11.

[0034] Further, each of the horizontal frames 22 is disposed to be parallel to the crosspiece 18 to be spaced apart from each other in the longitudinal direction, and is connected to the pair of side panels 12.

[0035] The air A is taken into the space S of the housing 2 from the top opening section OP2.

[0036] As shown in Fig. 2, the suction panel 25 is disposed on the further front side of the front panel 16 to cover the front opening section OP1 and the front panel 16, and is disposed to face the crosspiece 18. The suction panel 25 is able to open and close the front opening section OP1 by being attachable to and detachable from the housing main body 10.

[0037] More specifically, the suction panel 25 of this embodiment has a panel main body 28 which covers the front opening section OP1 and the front panel 16, and a plurality of support sections 29 which are provided on the upper end portion of the panel main body 28 to be spaced apart from each other in the lateral direction, and fix the panel main body 28 to the front panel 16.

[0038] The panel main body 28 has a plate shape in which a back surface 28a is disposed to face the crosspiece 18 of the front panel 16.

[0039] The support sections 29 are protrusions provided at both lateral end portions and the center portion at the upper end portion of the back surface 28a of the panel main body 28. In a state in which the suction panel 25 is attached to the housing main body 10, the support sections 29A provided at the both end portions are inserted into receiving holes 12a formed in each of the pair of side panels 12 so as to be recessed rearward from the front.

Further, the support section 29B provided in the center portion comes into contact with the front vertical frame 17A located substantially at the center in the lateral direction.

[0040] Here, a plurality of protrusions 27 are formed at the lower end portion of the panel main body 28 to be spaced apart from each other in the lateral direction. In the state in which the suction panel 25 is attached to the housing main body 10, the protrusions 27 are engaged with the lower end portion of the front panel 16 to fix the suction panel 25. In this embodiment, as the protrusions 27, each protrusion 27A at both lateral end portions, and two protrusions 27B spaced apart in the lateral direction between the protrusions 27A are provided. The protrusions 27 are disposed at equal intervals in the lateral direction.

[0041] As shown in Fig. 3, a plurality of the ribs 26 are formed to protrude toward the crosspiece 18 on the back surface 28a of the panel main body 28 of the suction panel 25 to be spaced from each other in the lateral direction, at a position facing the crosspiece 18, in a state in which the suction panel 25 is attached to the housing main body 10 to cover the front opening section OP 1.

[0042] In this embodiment, the ribs 26 are formed in a vertically long rod shape in the vertical direction of the suction panel 25.

[0043] Furthermore, in this embodiment, some ribs 26 among the plurality of ribs 26 are formed at the lateral positions corresponding to the position at which the vertical frames 21 of the top panel 20 are connected to the crosspiece 18. Furthermore, in this embodiment, the ribs 26 are disposed in regions which include exactly intermediate positions between the support sections 29. That is, rib groups 26A in which the plurality of the ribs 26 are formed are provided in two regions spaced apart from each other in the lateral direction. In other words, the ribs 26 are disposed in the regions spaced farthest from the support section 29 in the lateral direction.

[0044] Here, in a state in which the suction panel 25 is attached, a gap is formed between the back surface 28a of the panel main body 28 and a facing surface 18a of the crosspiece 18 facing the back surface 28a, and the surface (tip) of the rib 26 comes into contact with the facing surface 18a of the crosspiece 18.

[0045] The rib 26 may not completely come into contact with the facing surface 18a of the crosspiece 18 in a state in which no external force from the front is applied to the suction panel 25, and a minute gap may be formed between the surface of the ribs 26 and the facing surface 18a of the crosspiece 18 in such a state.

[0046] According to the air conditioner 1 as described above, in a state in which the crosspiece 18 is formed on the front panel 16, and the suction panel 25 is attached, the crosspiece 18 and the suction panel 25 come into contact with each other via the ribs 26.

[0047] Here, for example, a plurality of air conditioners 1 are stacked so that the suction panel 25 in one air conditioner 1 faces the back panel 11 in another air condi-

tioner 1 during transportation or the like in some cases.

[0048] In this state, the pressing force acts on the suction panel 25 from the front. However, when the suction panel 25 is pressed in this way, since the surface of the rib 26 comes into contact with the facing surface 18a of crosspiece 18, it is possible to limit the flexure of the suction panel 25 caused by the gap existing between the suction panel 25 and the crosspiece 18.

[0049] Also, even when the suction panel 25 relatively moves to be shifted with respect to the crosspiece 18 in the lateral direction and the vertical direction, since the suction panel 25 and the crosspiece 18 are in contact with each other via the ribs 26, it is possible to reduce the contact area between the suction panel 25 and the crosspiece 18. Therefore, it is possible to limit the rubbing sound generated during the relative movement and the damage of the suction panel 25 and the crosspiece 18.

[0050] Further, since the vertical frame 21 of the top panel 20 is connected to the crosspiece 18, when the pressing force is applied to the crosspiece 18 from the suction panel 25 via the ribs 26, the pressing force is transmitted to the vertical frame 21 of the top panel 20. Therefore, it is possible to limit the deformation of the crosspiece 18, and it is possible to further limit the flexure of the suction panel 25 when the suction panel 25 is pressed.

[0051] Furthermore, in this embodiment, since the ribs 26 are formed at the positions corresponding to the positions at which the crosspiece 18 and the vertical frames 21 are connected to each other, when the pressing force is applied to the crosspiece 18 from the suction panel 25 via the ribs 26, the pressing force is directly transmitted to the vertical frame 21 of the top panel 20. Therefore, it is possible to further limit the deformation of the crosspiece 18, and it is possible to further limit the flexure of the suction panel 25 when the suction panel 25 is pressed.

[0052] Further, since the ribs 26 are disposed in the regions spaced farthest from the support section 29 and located between the support sections 29 provided on the suction panel 25, when there is no rib 26, the ribs 26 are disposed at positions at which the flexure deformation is most likely to occur in the suction panels 25. Therefore, it is possible to effectively limit the flexure of the suction panel 25 when the suction panel 25 is pressed.

[0053] According to the air conditioner 1 of this embodiment, by forming the ribs 26 facing the crosspiece 18 in the suction panel 25, it is possible to limit the deformation of the suction panel 25 when the suction panel 25 is pressed, by a simple structure.

[0054] While the embodiments of the present invention have been described in detail, slight design changes are possible within the scope that does not depart from the technical idea of the present invention.

[0055] For example, the ribs 26 may be formed on the crosspiece 18, and may be formed on both the suction panel 25 and the crosspiece 18.

[0056] Furthermore, the ribs 26 may be formed over

the entire region in the lateral direction between the support sections 29 and may be formed only in parts of the region in the lateral direction.

5 [Industrial Applicability]

[0057] According to the air conditioner, it is possible to limit the deformation of the suction panel when the suction panel is pressed, by a simple structure.

10

[Description of Reference Numeral]

[0058]

15

1	Air conditioner
2	Housing
5	Air-conditioning device
6	Heat exchanger
7	Blower fan
20 8	Filter
9	Control box
10	Housing main body
11	Back panel
12	Side panel
25 12a	Receiving hole
13	Bottom panel
16	Front panel
17, 17A	Front vertical frame
18	Crosspiece
30 18a	Facing surface
19	Front horizontal frame
20	Top panel
21	Vertical frame
22	Horizontal frame
35 25	Suction panel
26	Rib
26A	Rib group
27, 27A, 27B	protrusion
28	Panel main body
40 28a	Back surface
29, 29A, 29B	Support section
S	Space
OP1	Front opening section
OP2	Top opening section
45 A	Air

Claims

50 1. An air conditioner comprising:

a front panel disposed in which a crosspiece is provided on a front side of a front opening section of a housing in a horizontal direction when the air conditioner is installed in a intersecting direction intersecting with a penetrating direction in which the front opening section penetrates;

55

a suction panel disposed opposite to the crosspiece to cover the front opening section and the front panel and provided to allow opening and closing of the front opening section; and
 a plurality of ribs provided at intervals in the intersecting direction on one of a back surfaces of the suction panel and a facing surface to the suction panel of the crosspiece which face each other, projecting toward the other, and having tips coming into contact with the other.

5

10

a panel main body configured to cover the front opening section; and
 a plurality of support sections provided at an upper end portion of the panel main body to be spaced apart from each other in the intersecting direction, and configured to fix the panel main body to the front panel, wherein the ribs are disposed at least in a region spaced farthest from the plurality of support sections in the intersecting direction.

2. An air conditioner comprising:

a front panel disposed in which a crosspiece is provided on a front side of a front opening section of a housing in a horizontal direction when the air conditioner is installed in a intersecting direction intersecting with a penetrating direction in which the front opening section penetrates;
 a suction panel disposed opposite to the crosspiece to cover the front opening section and the front panel, and provided to allow opening and closing of the front opening section; and
 a plurality of ribs provided at intervals in the intersecting direction on a back surfaces of the suction panel and a facing surface to the suction panel of the crosspiece which face each other, wherein the ribs provided on the back surface of the suction panel protrude toward the facing surface of the crosspiece, tips thereof come into contact with the facing surface of the crosspiece, the ribs formed on the facing surface of the crosspiece protrude toward the back surface of the suction panel, and the tips thereof come into contact with the back surface of the suction panel.

15

20

25

30

35

3. The air conditioner according to claim 1 or 2, further comprising:

40

a top panel configured to cover a top opening section of the housing and provided continuously on the front panel,
 wherein the top panel has a plurality of horizontal frames extending in the intersecting direction and a plurality of vertical frames intersecting with the horizontal frames and has a grid shape, and the plurality of vertical frames are connected to the crosspiece.

45

50

4. The air conditioner according to claim 3, wherein the ribs are provided at positions corresponding to positions at which the vertical frames are connected to the crosspiece.

55

5. The air conditioner according to any one of claims 1 to 4, wherein the suction panel has:

FIG. 1A

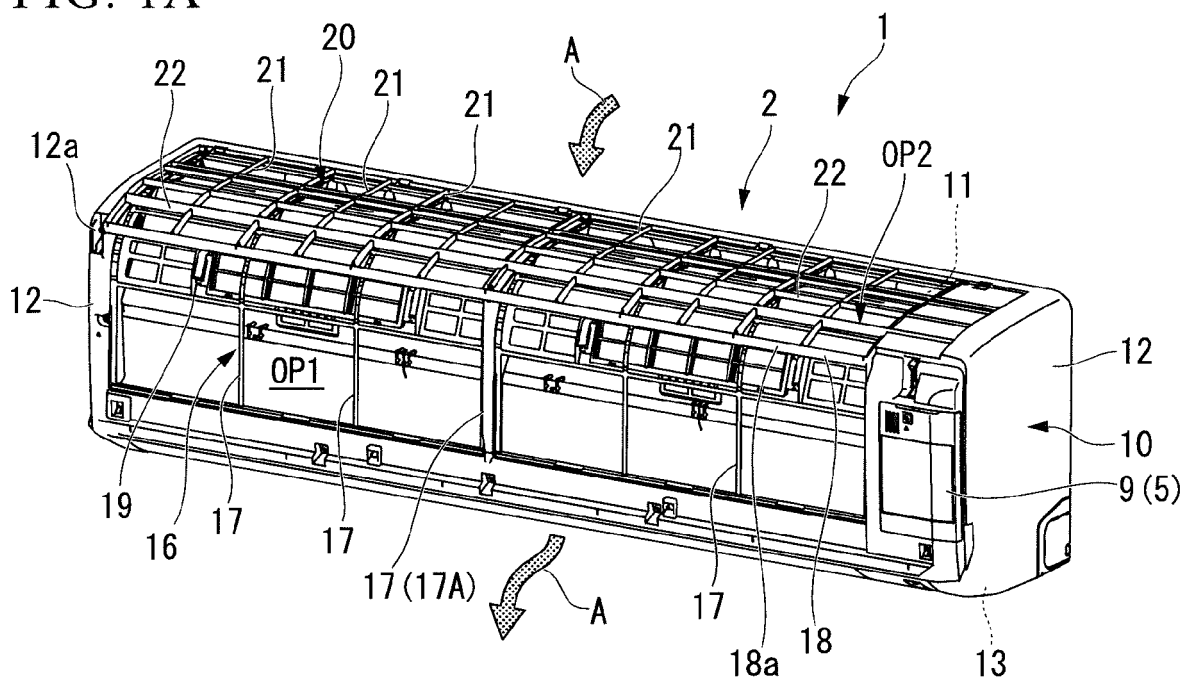


FIG. 1B

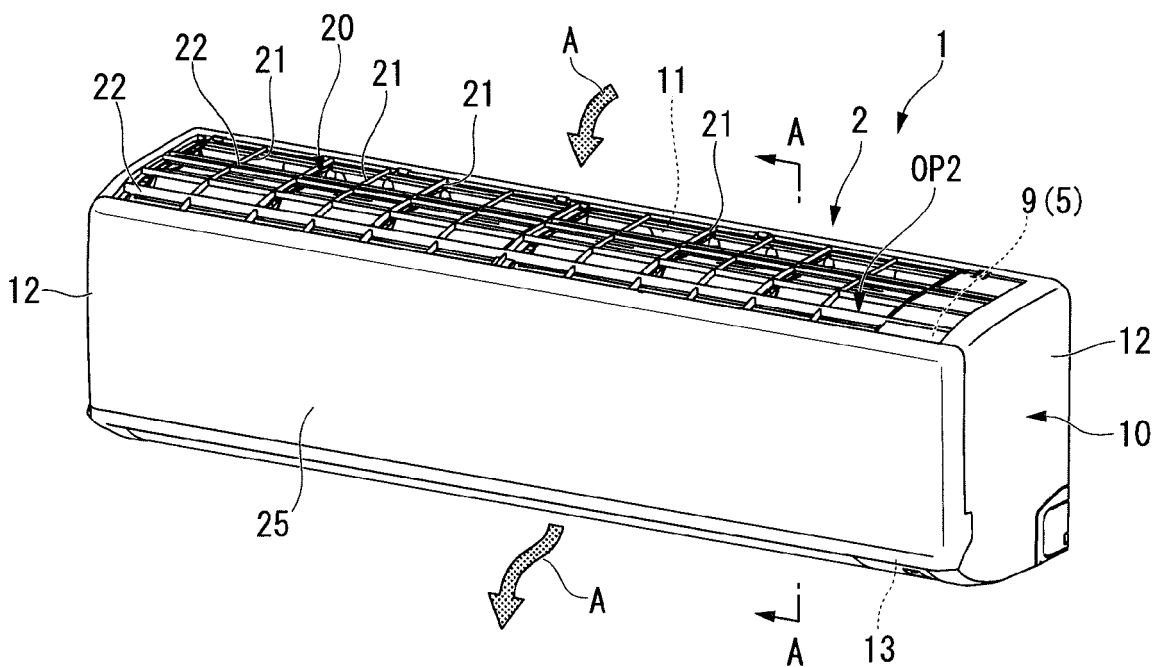


FIG. 2

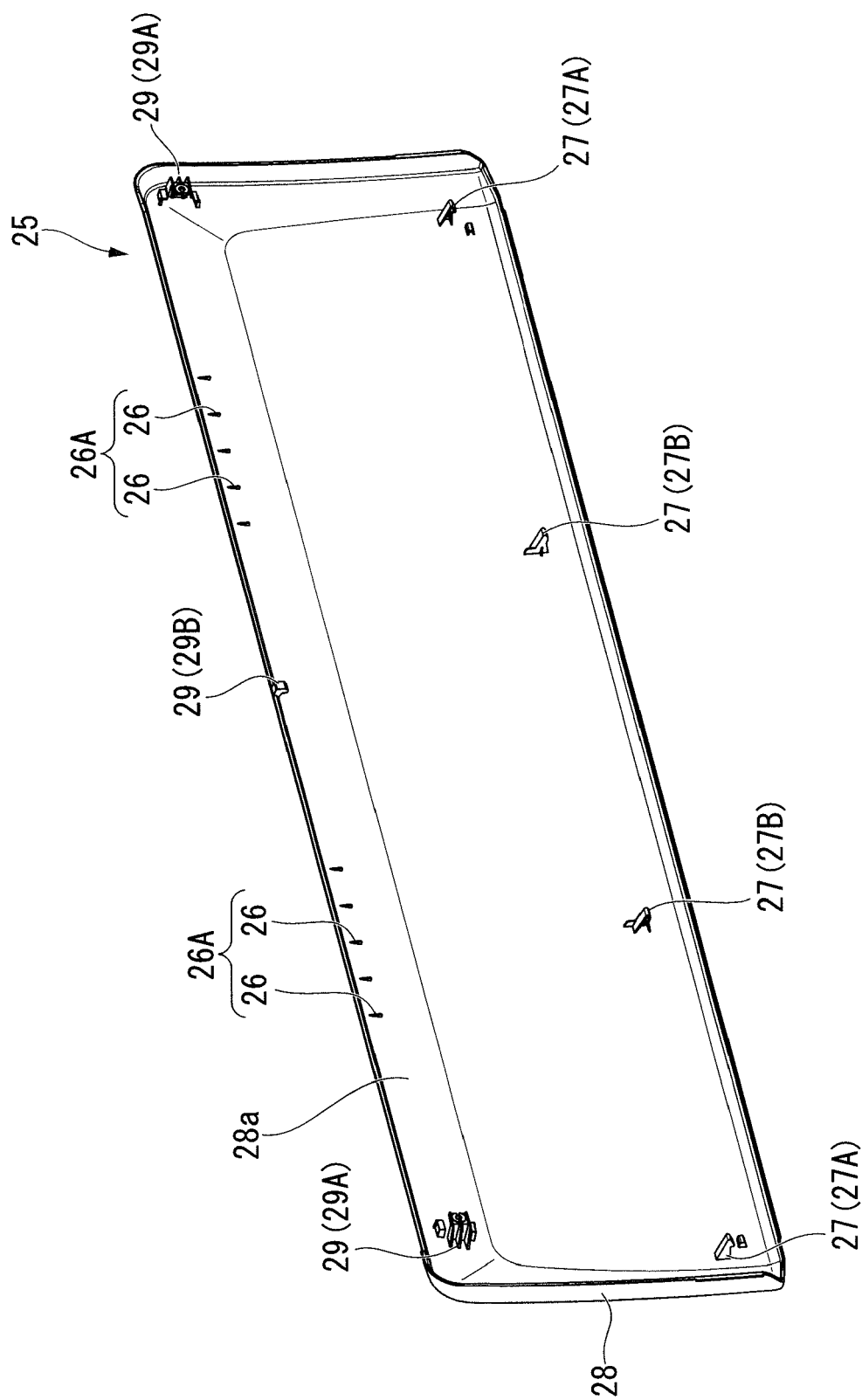
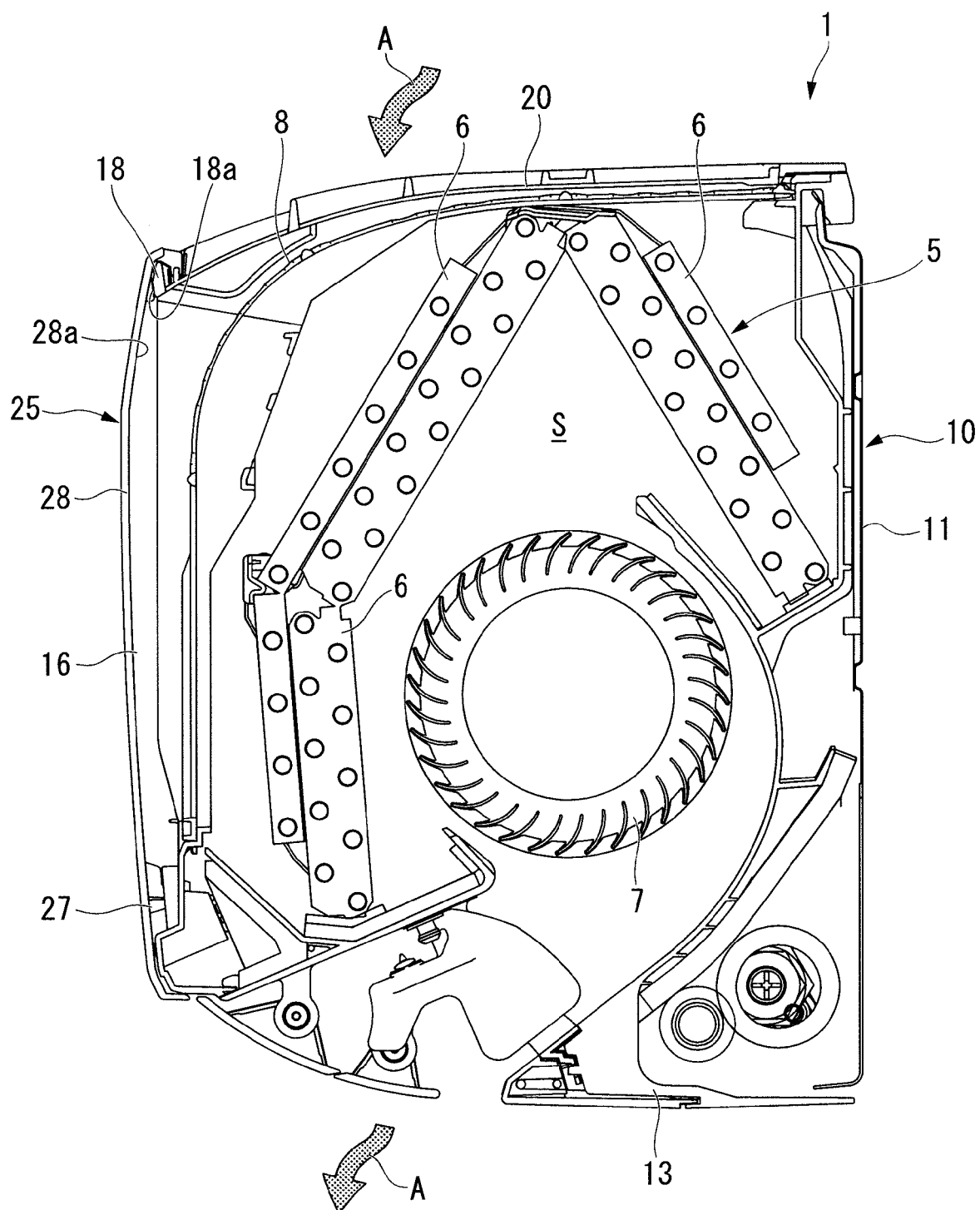


FIG. 3



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 2010112628 A [0005]