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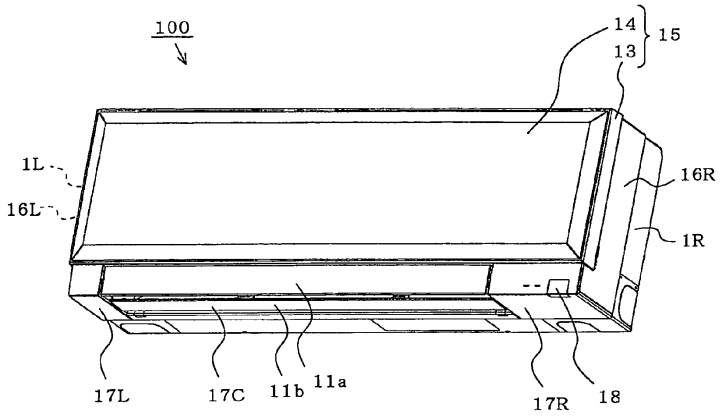
(54) Indoor unit of air-conditioning apparatus

(57) An indoor unit (100) of an air-conditioning apparatus includes a left side panel (16L) on a left body surface (1L), a right side panel (16R) on a right body surface (1 R), a front opening-and-closing panel (15) on a body front opening (5) formed on a body front surface (1 F), a left L-shaped panel (17L) and a right L-shaped panel (17R) extending so as to straddle an area below the front opening-and-closing panel (15) and an area of a body bottom surface (1 B) near the body front surface (1 F) and near the left side panel (16L and the right side panel (16R), respectively, the body bottom surface (1B) between the left L-shaped panel (17L) and the right L-shaped panel (17R) formed respectively on a frame body (the same as a framework) (1). The front opening-and-closing panel (15) is formed of a panel frame body (13) and a panel design surface (14) attached to the panel frame body (13) having a substantially rectangular flat surface, and the panel design surface (14) is molded by heat and cool molding.

FIG. 1



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to an indoor unit of an air-conditioning apparatus and, more specifically, to an indoor unit of an air-conditioning apparatus mounted on a wall surface.

2. Description of the Related Art

[0002] In the related art, an indoor unit of an air-conditioning apparatus (hereinafter, referred to as "indoor unit") includes a fan having a body formed of a housing and an air course formed therein, and a heat exchanger arranged in the air course accommodated therein. There is disclosed an invention in which a gloss coating is applied on the surface of an opening-and-closing panel (the same as a front grill) to be arranged in the front, and a transparent decorative panel applied with texturing is provided in the front of the coated surface in order to enhance the design characteristics (for example, Patent Literature 1).

[0003] Patent Literature 1: JP2004-257619A (P4, Fig. 2)

[0004] However, the invention described in Patent Literature 1 has a problem such that the design characteristics cannot be enhanced satisfactorily as described below.

(a) Since a rib and a catch fixing portion projecting to the back side are formed on the back surface of the transparent decorative panel, a cavity of die for molding the transparent decorative panel requires a draft angle and may become complicated. Therefore, molding by heat and cold molding (weldless molding) described later cannot be performed, and hence injection-molding is performed in the method of the related art, so that the high-gloss surface cannot be obtained.

(b) Although side surfaces or a bottom surface of the housing are exposed and are visible by the user, since they have complex shapes, molding by the heat and cool molding (weldless molding) described later cannot be employed in the same manner as described above. Therefore, they are molded by the injection molding in a manner of the related art, and hence the high-gloss surface cannot be obtained.

(c) Even when the transparent decorative panel applied with texturing is arranged in the front to add a high-quality appearance thereto, since the side surfaces and the bottom surface of the housing do not have high gloss, the integral design characteristics are not sufficiently improved.

SUMMARY OF THE INVENTION

[0005] In order to solve the problem as described above, the invention is intended to provide an indoor unit of an air-conditioning apparatus having improved design characteristics.

[0006] An indoor unit of an air-conditioning apparatus according to the invention including: a frame body as a framework; side panels mounted respectively on both side surfaces of the frame body; a front opening-and-closing panel mounted in the front of the frame body so as to be openable and closable; L-shaped panels mounted respectively near the side panels so as to straddle a lower area of the front of the frame body below the front opening-and-closing panel and a front-side area of a bottom surface; and a bottom panel mounted between the L-shaped panels on the bottom surface of the frame body.

[0007] As described above, the invention includes the frame body which is the framework of the body of the indoor unit, the side panels, the front opening-and-closing panel, the L-shaped panels, and the bottom panel mounted respectively on the surfaces of the frame body. Therefore, since the respective panels can be formed into simple shapes apart from the shape of the frame body, a molding method which improves design characteristics (for example, heat and cool molding) can be employed, and hence the surfaces of these panels can be formed into high-gloss weldless surfaces.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008]

Fig. 1 is a perspective view illustrating an indoor unit of an air-conditioning apparatus according to Embodiment 1 of the invention;

Fig. 2 is a cross-sectional view illustrating a cross section of the entire indoor unit shown in Fig. 1 viewed from the side;

Fig. 3A is a plan view illustrating the entire indoor unit shown in Fig. 1;

Fig. 3B is a front view illustrating the entire indoor unit shown in Fig. 1;

Fig. 3C is a side view illustrating the entire indoor unit shown in Fig. 1;

Fig. 4A is a perspective view illustrating a panel frame body of the indoor unit shown in Fig. 1;

Fig. 4B is a perspective view illustrating a panel design surface of the indoor unit shown in Fig. 1;

Fig. 5A is a perspective view illustrating a front opening-and-closing panel of the indoor unit shown in Fig. 1;

Fig. 5B is a perspective view illustrating a frame body of the indoor unit shown in Fig. 1;

Fig. 5C is a perspective view illustrating a left side panel of the indoor unit shown in Fig. 1;

Fig. 5D is a perspective view illustrating a right side panel of the indoor unit shown in Fig. 1;

Fig. 6A is a perspective view illustrating a left L-shaped panel of the indoor unit shown in Fig. 1;
Fig. 6B is a perspective view illustrating a right L-shaped panel of the indoor unit shown in Fig. 1;
Fig. 6C is a perspective view illustrating a bottom panel of the indoor unit shown in Fig. 1;
Fig. 7A is a perspective view illustrating a remote control receiving window of the indoor unit shown in Fig. 1; and
Fig. 7B is an exploded perspective view illustrating the remote control receiving window of the indoor unit shown in Fig. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Embodiment 1

[0009] Fig. 1 to Fig. 7B are drawings for explaining an indoor unit of an air-conditioning apparatus according to Embodiment 1 of the invention. Fig. 1 is a diagrammatic perspective view illustrating the entire part of the indoor unit, Fig. 2 is a cross-sectional view illustrating a cross section viewed from the side, Fig. 3A is a plan view illustrating the entire part, Fig. 3B is a front view illustrating the entire part, Fig. 3C is a side view illustrating the entire part, Fig. 4A is a perspective view illustrating a panel frame body, Fig. 4B is a perspective view illustrating a panel design surface, Fig. 5A is a perspective view illustrating a front opening-and-closing panel, Fig. 5B is a perspective view illustrating a frame body; Fig. 5C is a perspective view illustrating a left side panel, Fig. 5D is a perspective view illustrating a right side panel, Fig. 6A is a perspective view illustrating a left L-shaped panel, Fig. 6B is a perspective view illustrating a right L-shaped panel, Fig. 6C is a perspective view illustrating a bottom panel, Fig. 7A is a perspective view illustrating a remote control receiving window 18, and Fig. 7B is a perspective view illustrating the remote control receiving window 18. The respective drawings are diagrammatically illustrated, and the shapes and the sizes of the respective members are not limited to those illustrated in the drawings. The same parts or corresponding parts of the respective drawings are designated by the same reference numerals and parts of the description may be omitted.

(Indoor Unit of Air-conditioning apparatus)

[0010] In Fig. 1 to Fig. 4, an indoor unit of an air-conditioning apparatus (hereinafter, referred to as "indoor unit") 100 is configured to cause indoor air taken from an inlet opening 2 formed on an upper surface of a frame body (the same as a "framework") 1 to pass through a heat exchanger 6 and to be heat-exchanged (conditioned), and deliver the air after being heat-exchanged (conditioned) (hereinafter, referred to as "conditioned air") indoors from an outlet opening 3 formed on the frame body 1 so as to extend to a substantially bottom surface via an air course 4 by the rotation of a fan 7.

The air course 4 is defined by a front air course member 8 on the front (left) side of the body and a back air course member 9 on the back (right) side of the body, and the front air course member 8 is provided with a horizontal wind-direction control panel 10. The outlet opening 3 is provided with a front vertical wind-direction control panel 11a and a bottom vertical wind-direction control panel 11b, which are configured to close the outlet opening 3 in an area on the front side of the body and an area on the lower side of the body, respectively.

[0011] The frame body 1 is the frame body (framework) of a rectangular parallelepiped shape, and is formed with the inlet opening 2 over part of a body top surface 1A having a rectangular flat surface and the outlet opening 3 extending so as to straddle part of a body bottom surface 1 B having a rectangular flat surface and part of a body front surface 1 F having a rectangular flat surface. Then, a left L-shaped panel 17L and a right L-shaped panel 17R having an L-shaped cross section (formed by a pair of rectangular flat surfaces orthogonal to each other) are attached so as to straddle part of the body bottom surface 1 B and part of the body front surface 1 F on opposite sides of the outlet opening 3 when viewed from the front, and a center bottom panel 17C having a rectangular flat surface is mounted to the back side of the outlet opening 3 of the body bottom surface 1 B.
Mounted to an area close to the body front surface 1 F of a left body surface 1 L is a left side panel 16L having a rectangular flat surface, and mounted to an area close to the body front surface 1 F of a right body surface 1 R is a right side panel 16R having a rectangular flat surface. At this time, the left side panel 16L projects leftward by an amount corresponding to a difference in level g16 with respect to the left body surface 1 L, and the right side panel 16R projects rightward by an amount corresponding to the difference in level g16 with respect to the right body surface 1 R. The center bottom panel 17C projects downward and rightward from the body bottom surface 1 B by an amount corresponding to a difference in level g17 (see Figs. 3A, 3B, and 3C).
In addition, a front opening-and-closing panel 15 (the same as a grill) is attached to a body front opening 5 formed on the body front surface 1 F of the frame body 1 so as to be openable and closable.

(Front Opening-and-Closing Panel)

[0012] In Figs. 4A and 4B, the front opening-and-closing panel 15 includes a panel frame body 13 and a panel design surface 14 integrated into one piece.
The panel frame body 13 includes a front frame body portion 13C as the frame body (framework) having a rectangular flat surface, a left body frame surface 13L having a rectangular flat surface and a right body frame surface 13R having a rectangular flat surface formed respectively on a left edge and a right edge of the front frame body portion 13C and both projecting backward, and has a substantially angular C-shape (substantially a square

bracket shape) in cross section.

The panel design surface 14 has a rectangular shape, and is a substantially flat surface having an inclined rim which improves design characteristics around the periphery thereof.

Formed on the front side (the surface visible from the outside) of the front frame body portion 13C are combining locking portions 13a for combining the panel design surface 14, and tilt centers 13b supported so as to be tiltable. On the other hand, formed on the back side (the surface which is not visible from the outside) of the panel design surface 14 are combining locked portions 14a configured to be locked with the combining locking portions 13a and tilt bearings (not illustrated) which tiltably support the tilt centers 13b so as to be tiltable.

Therefore, the panel frame body 13 and the panel design surface 14 are integrated only by pressing the panel design surface 14 against the front side of the front frame body portion 13C, so that the front opening-and-closing panel 15 is formed.

[0013] When the front opening-and-closing panel 15 is molded integrally, a specific draft angle for plastic molding is necessary, and hence the front opening-and-closing panel 15 cannot be formed into a rectangular parallelepiped, which is a simple shape, (a rectangular parallelepiped, one direction of which is longer, or a quadratic prism). However, according to the invention, the panel design surface 14 of a simple shape is achieved by forming the front opening-and-closing panel by combining two components, namely, the panel frame body 13 and the panel design surface 14 in combination. Therefore, formation by heat and cool molding is enabled as described later and, with such molding, the high-gloss surface with no weld line is obtained.

In addition, in the indoor unit 100 of the invention, the frame body 1 is formed into the framework instead of the housing formed of such face plates, and face plates are mounted to the framework. In other words, since the face plates such as the left side panel 16L, the right side panel 16R, the left L-shaped panel 17L, the center bottom panel 17C, and the right L-shaped panel 17R (hereinafter, these panels may collectively or individually be referred to as "separate-piece design panel") are formed of a rectangular flat surface, formation by the heat and cool molding is enabled as described later and, with such molding, the high-gloss surface with no weld line is obtained.

(Heat and Cool Molding)

[0014] As described above, the panel design surface 14 and the separate-piece design panel, having a simple shape, can be manufactured by the heat and cool molding, and hence are manufactured by the heat and cool molding. Therefore, in the case of general molding, even when the design surface of the die is finished into a mirror surface, there is a limit on gloss of the molded product. In contrast, since the panel frame body 13 and the panel design surface 14 are manufactured by the heat and cool molding, they have high-gloss surfaces.

Since the panel design surface 14, which is easily visible by a user, is formed into a high-gloss surface which adds a high-quality design, the separate-piece design panels (the left side panel 16L, the right side panel 16R, the left L-shaped panel 17L, the center bottom panel 17C, and the right L-shaped panel 17R) as well as the front vertical wind-direction control panel 11a and the bottom vertical wind-direction control panel 11 b adjacent thereto are manufactured by the heat and cool molding, whereby a high-gloss design with a sense of unity is realized in an area easily visible by the user.

[0015] In addition, the left body surface 1 L and the right body surface 1 R of the frame body 1, being not easily visible by the user, are positioned at a level lower than the left side panel 16L and the right side panel 16R respectively by an amount corresponding to the difference in level g16 and, furthermore, are applied with texturing.

Therefore, the left body surface 1 L and the right body surface 1 R being applied with texturing give an impression of being set back and, in contrast, the high-gloss left side panel 16L and right side panel 16R give an impression of protruding to the front, so that the high-gloss is further accentuated.

When performing the heat and cool molding in order to obtain a high-gloss molded product, it is required to arrange steam pipes and cooling pipes for controlling the temperature of the die uniformly on the product surface of the die. Therefore, in the case of the molded product having a complex shape, it is very difficult to arrange the steam pipes and the cooling pipes. In other words, according to the invention, since the shapes of the respective molded products are simplified, arrangement of the steam pipes and the cooling pipes are enabled and hence the heat and cool molding is enabled.

[0016] The heat and cool molding is also referred to as "weldless molding", and is a molding method used in the injection molding of thermoplastic resin, which heats the surface of the die (hereinafter, referred to as "cavity surface") to temperatures higher than a glass transition temperature (or load-deformation temperature) of the resin to delay cooling and solidifying the injected resin. In other words, when the resin is merged in the die from a plurality of directions, substantially V-shaped spaces are formed between respective parts of resin and the cavity surface, and hence the substantially V-shaped spaces are collapsed while the solidified layer of the resin is still soft to restrict generation of weld lines.

[0017] In addition, by injecting resin in a high-temperature state, transferability from the cavity surface is improved, so that a high-gloss surface without shrinkage or color irregularities is obtained. In particular, by polishing the cavity surface to the order of 10000 to 15000, an injection molded product having a mirror surface can be obtained (the normal cavity surface is on the order of 2000, which does not provide sufficient gloss).

Then, in order to uniformly control the temperature of the

cavity surface, it is necessary to arrange die heating pipes and die cooling pipes uniformly at regular spacings from the cavity surface. Therefore, if the cavity surface is formed into a complex shape, or a sliding structure is employed for molding an overhung portion, the die heating pipes and the die cooling pipes cannot be arranged uniformly at regular spacings.

Therefore, in the invention, the panel design surface 14 and the separate-piece design panels are formed into simple shapes, so that the die heating pipes and the die cooling pipes can be arranged uniformly at regular spacings, and hence the panel design surface 14 and the separate-piece design panels are manufactured by the heat and cool molding.

Although the left side panel 16L and the right side panel 16R both have an L-shape cross section, they have a shape including simple-shaped rectangular flat surfaces orthogonal to each other and not including any hook or wall. Therefore, uniform arrangement at regular spacings of the die heating pipes and the die cooling pipes is enabled.

(Remote-Control Receiving Window)

[0018] The right L-shaped panel 17R having an L-shape cross section is formed with a corner notch 17a at a corner portion thereof, and a remote-control receiving window 18 having an L-shape cross section is mounted to the corner notch 17a. The remote-control receiving window 18 is configured to be fitted from the outside of the right L-shaped panel 17R inward (toward the inside of the frame body 1), and is held from the inside toward the outside by a operation indicator light-window component 19 formed with an corner notch 19a.

In other words, with a two-surface configuration of the remote-control receiving window 18 having the L-shaped cross section, deterioration of receiving performance which may occur when the remote-control receiving window has a single surface configuration resulting from the indoor unit 100 formed into the parallelepiped shape is avoided, and the same receiving performance as the remote-control receiving window having a single surface configuration in the indoor unit having shapes other than the parallelepiped is ensured.

Also, the remote-control receiving window of the related art is fitted from the inside of the product and is fixed by claw shapes formed inside the frame body. However, in order to manufacture the same by the heat and cool molding, it is required to have a simple shape for the mounting of die temperature adjusting pipes. Therefore, since the claw shapes cannot be formed, the remote-control receiving window is configured to be fitted from the outside and held by the operation indicator light-window component 19 from the inside instead of the fixation with the claws.

REFERENCE SIGNS LIST

[0019] 1: frame body, 1A: body top surface, 1 B: body bottom surface, 1 F: body front surface, 1 L: left body surface, 1 R: right body surface, 2: inlet opening, 3: outlet opening, 4: air course, 5: body front opening, 6: heat exchanger, 7: fan, 8: front air course member, 9: back air course member, 10: horizontal wind-direction control panel, 11 a: front vertical wind-direction control panel, 11b: bottom vertical wind-direction control panel, 13: panel frame body, 13C: front frame body portion, 13L: left frame body surface, 13R: right frame body surface, 13a: combining locking portions, 13b: tilt center, 14: panel design surface, 14a: combining locked portion, 15: front opening-and-closing panel, 16L: left side panel, 16R: right side panel, 17C: center bottom panel, 17L: left L-shaped panel, 17R: right L-shaped panel, 17a: corner notch, 18: remote-control receiving window, 19: operation indicator light-window component, 19a: corner notch, 100: indoor unit, g16: difference in level, g17: difference in level.

Claims

1. An indoor unit (100) of an air-conditioning apparatus comprising:

a frame body (1) as a framework;
side panels (16L, 16R) mounted respectively on both side surfaces of the frame body (1);
a front opening-and-closing panel mounted in the front of the frame body (1) so as to be openable and closable;
L-shaped panels (17L, 17R) mounted respectively near the side panels (16L, 16R) so as to straddle a lower area of the front of the frame body (1) below the front opening-and-closing panel and a front-side area of a bottom surface (1 B); and
a bottom panel (17C) mounted between the L-shaped panels (17L, 17R) on the bottom surface (1B) of the frame body (1).

2. The indoor unit (100) of the air-conditioning apparatus of claim 1, wherein the front opening-and-closing panel includes a panel frame body (13) having a substantially flat surface of a rectangular shape and a panel design surface (14) attached to the panel frame body (13).

3. The indoor unit (100) of the air-conditioning apparatus of claim 1 or 2,
wherein the side panels (16L, 16R), the panel design surface (14) which forms the front opening-and-closing panel, the L-shaped panels (17L, 17R), and the bottom panel (17C) are molded by heat and cool molding.

4. The indoor unit (100) of the air-conditioning apparatus of any one of claims 1 to 3, comprising a front vertical wind-direction control panel (11 a) mounted in an area between the L-shaped panels (17L, 17R) below the front opening-and-closing panel so as to be tiltable and a bottom vertical wind-direction control panel (11 b) mounted in a front-side area of the bottom panel (17C) between the L-shaped panels (17L, 17R) so as to be tiltable, wherein the front vertical wind-direction control panel (11a) and the bottom vertical wind-direction control panel (11b) are molded by heat and cool molding.

5. The indoor unit (100) of the air-conditioning apparatus of claim 4, wherein the side panels (16L, 16R), the panel design surface (14) which forms the front opening-and-closing panel, the L-shaped panels (17L, 17R), the bottom panel (17C), the front vertical wind-direction control panel (11a), and the bottom vertical wind-direction control panel (11 b) are molded from the same type of thermoplastic resin.

6. The indoor unit (100) of the air-conditioning apparatus of any one of claims 1 to 5, wherein the frame body (1) is a parallelepiped,
the side panels (16L, 16R), the panel design surface (14) forming the front opening-and-closing panel, and the bottom panel (17C) are each formed of a rectangular single flat surface, and
each of the L-shaped panels (17L, 17R) is formed of a pair of rectangular flat surfaces orthogonal to each other.

7. The indoor unit (100) of the air-conditioning apparatus of any one of claims 1 to 6, wherein the side panels (16L, 16R) project sideward with respect to the side surfaces of the frame body (1), and
the bottom panel (17C) projects downward with respect to the bottom surface of the frame body (1).

8. The indoor unit (100) of the air-conditioning apparatus of any one of claims 1 to 7, wherein a remote-control receiving window (18) is formed in at least one of the L-shaped panels (17L, 17R), including a pair of flat-surface-shaped receiving surfaces orthogonal to each other.

FIG. 1

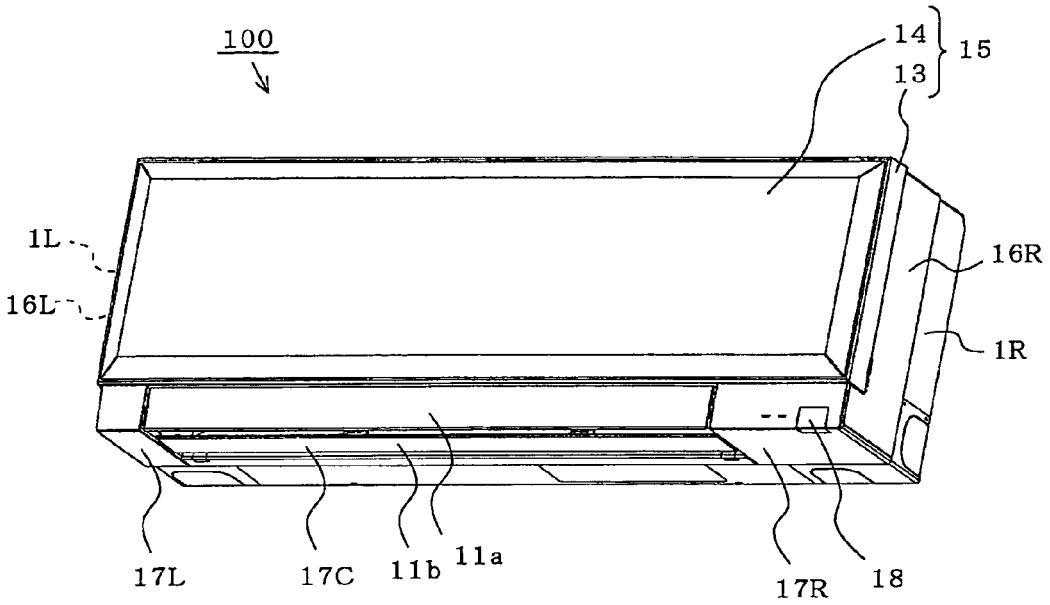


FIG. 2

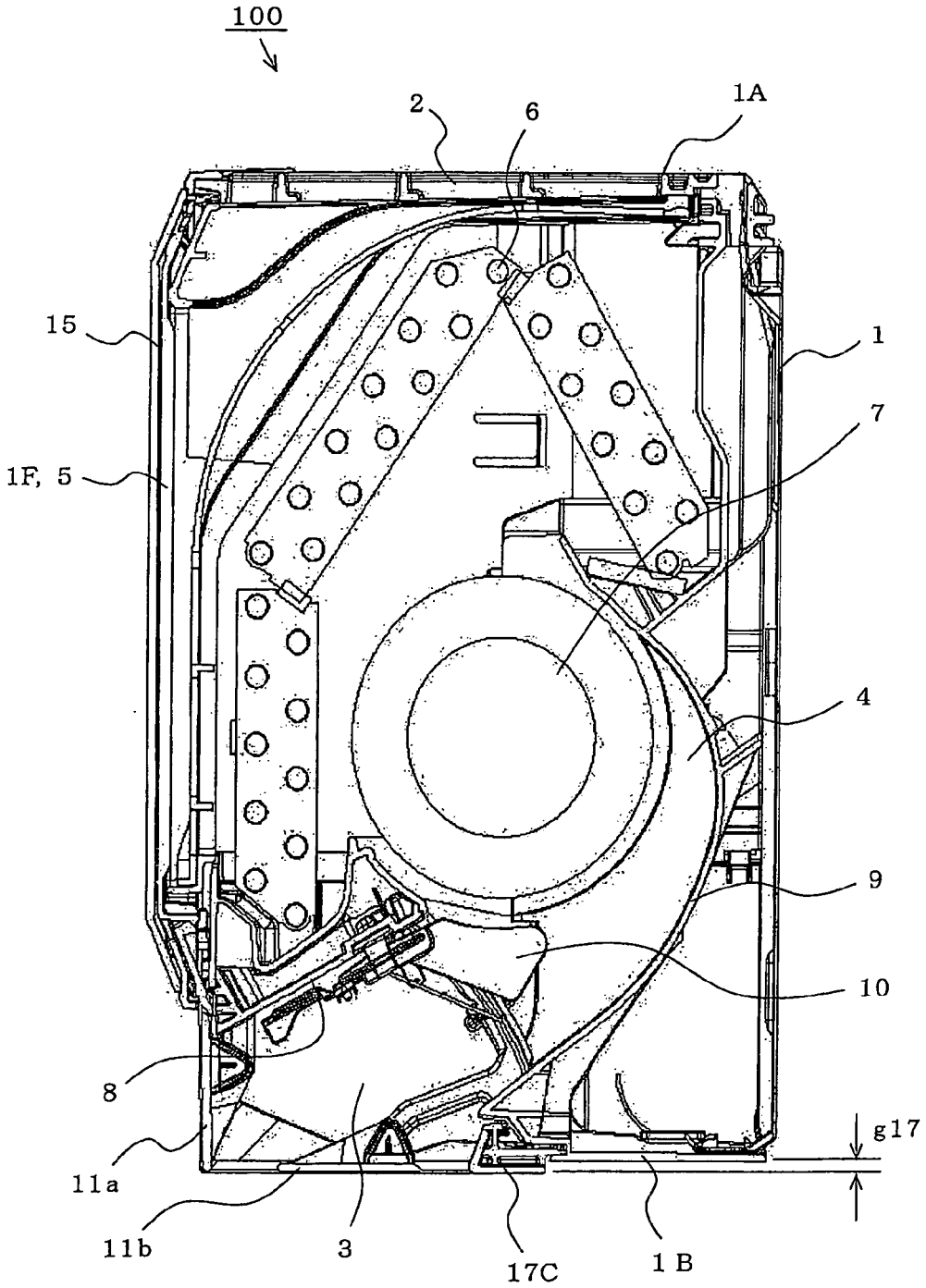


Fig. 3A

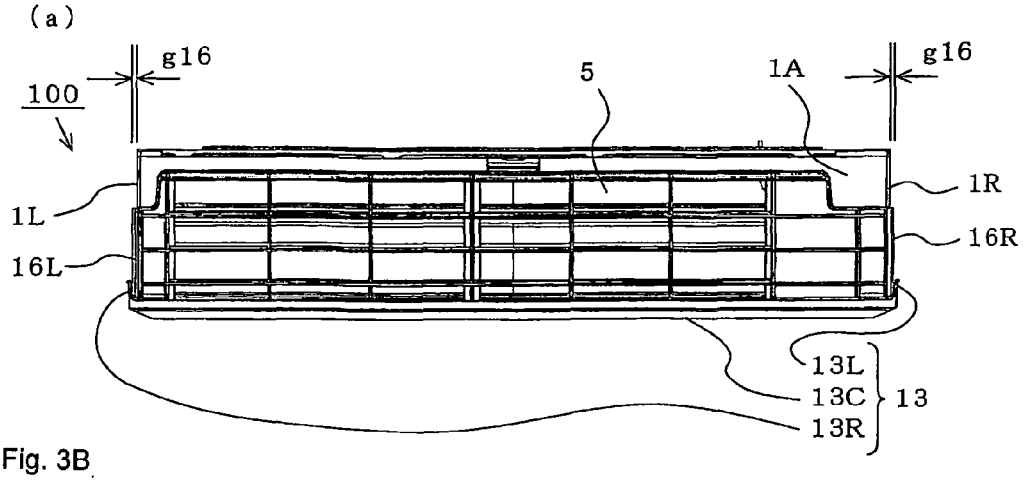


Fig. 3B

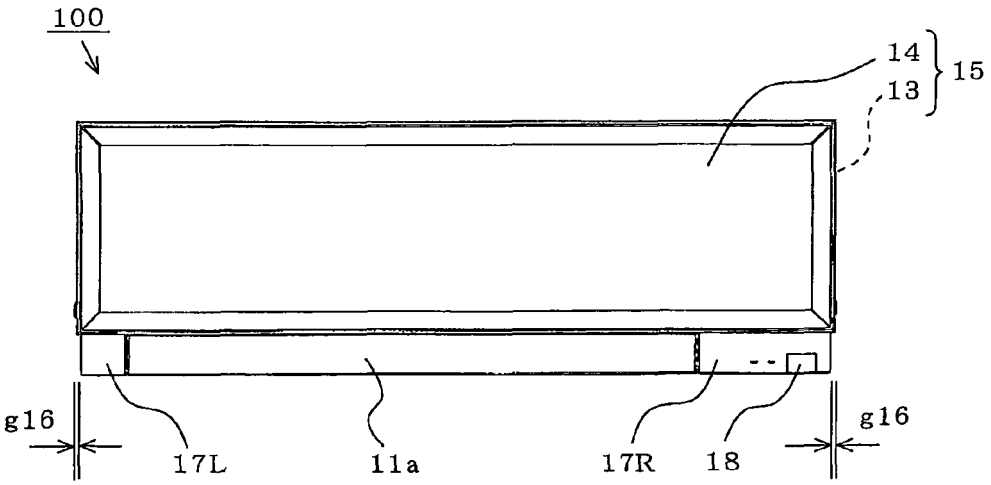


Fig. 3C

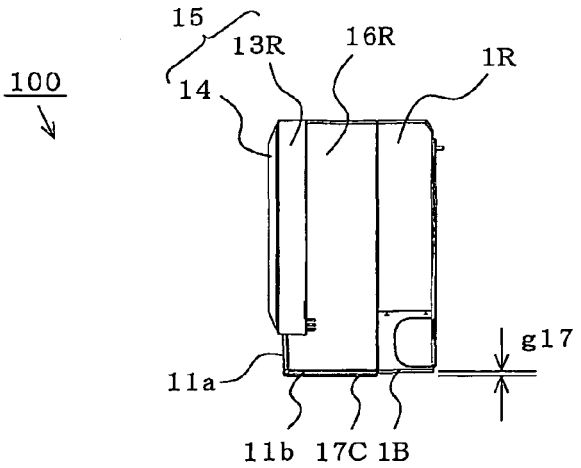


Fig. 4A

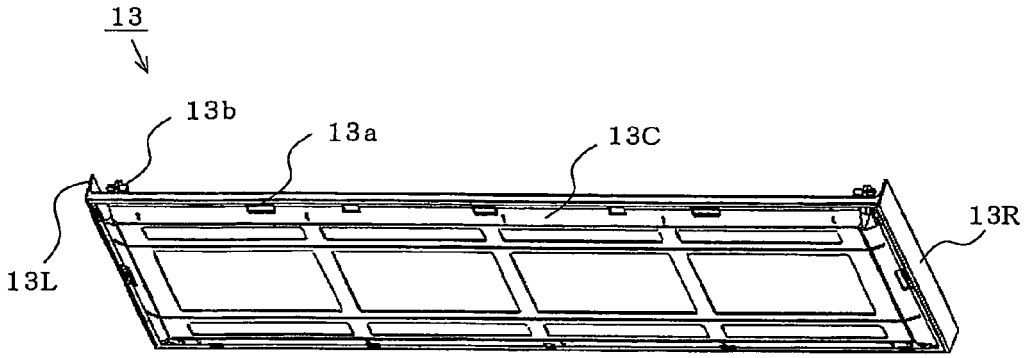


Fig. 4B

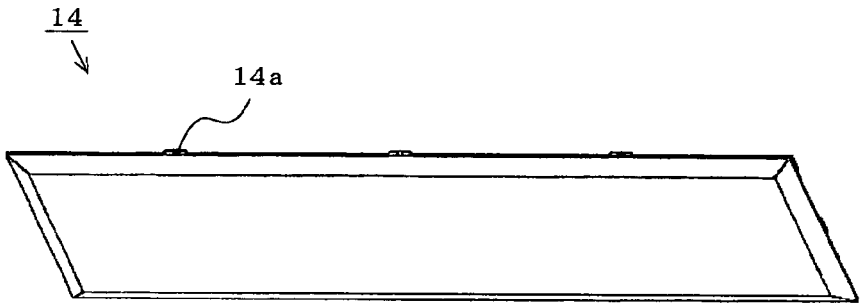


Fig. 5A

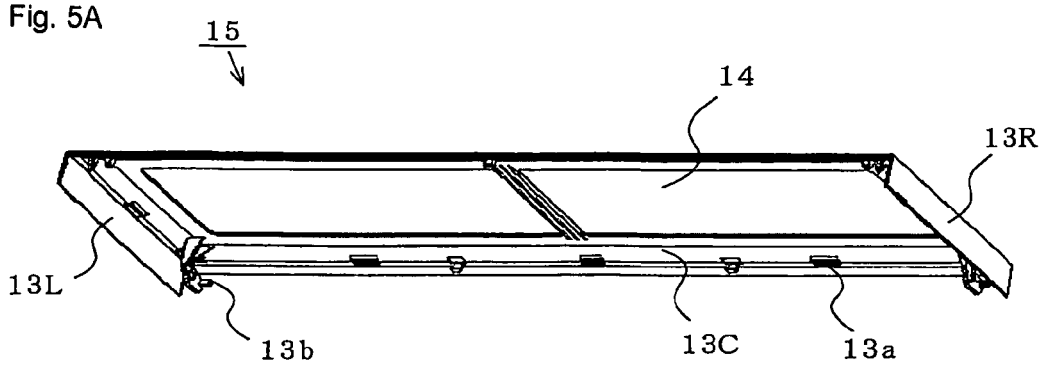


Fig. 5B

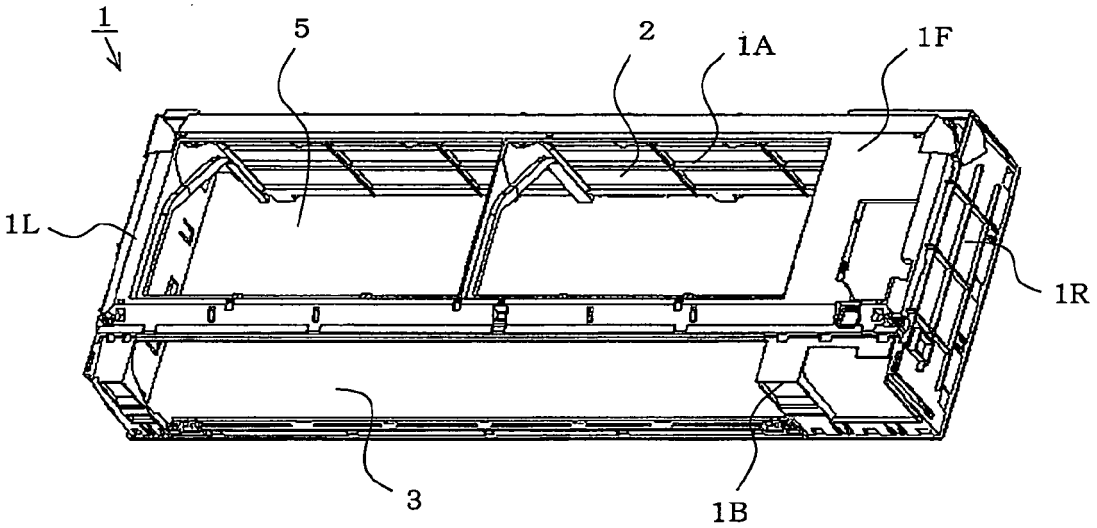


Fig. 5C

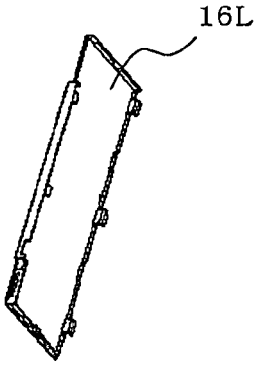


Fig. 5D

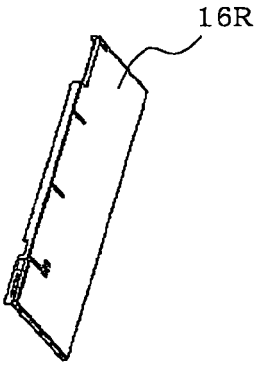


Fig. 6A

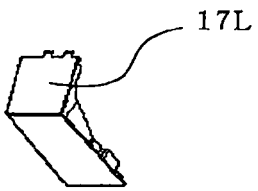


Fig. 6B

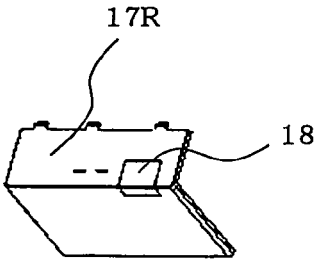


Fig. 6C

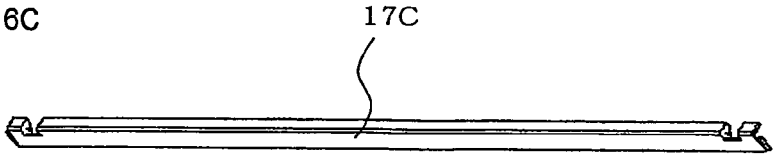


Fig. 7A

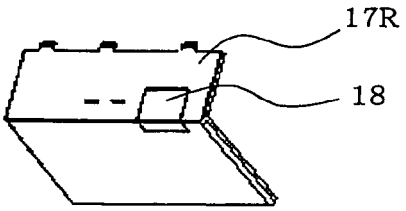
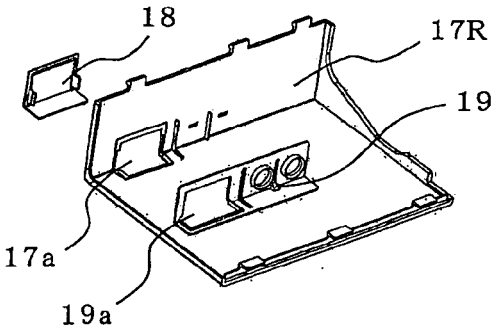


Fig. 7B



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Patent documents cited in the description

- JP 2004257619 A **[0003]**