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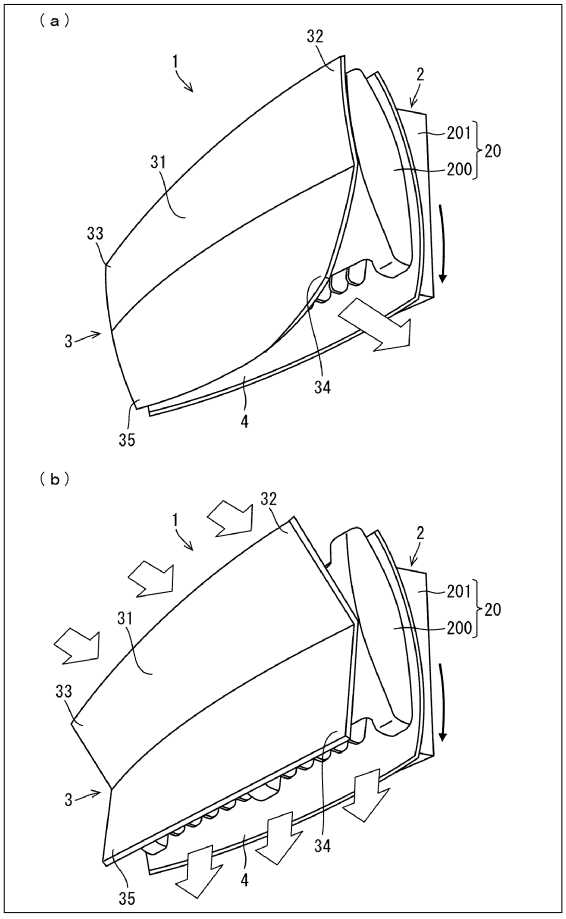
(54) AIR CONDITIONER

(57) Provided is a novel appearance of a front panel which maintains a function of the front panel. A flexible front panel (3) which covers a front part (200) of a main body (2) has a flexibility. A driving section causes a corner part (34) of the front panel (3) to move forward so that the corner part (34) and the main body (2) are away from each other.

FIG. 6



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Description

Technical Field

[0001] The present invention relates to an air conditioner which conditions indoor air.

Background Art

[0002] As disclosed in, for example, Patent Literature 1, a typical air conditioner includes (i) a main body which includes a heat exchanger for warming or cooling air, and an air blowing fan which sends the air which has passed through the heat exchanger and (ii) a front panel which covers the main body.

[0003] Typically, the front panel has a front part and an upper part each of which has an air inlet through which the main body sucks indoor air. The front panel further has a lower part having an air outlet through which the main body sends out air indoors. The air outlet is provided with a louver for controlling a direction in which the main body sends out the air. That is, the front panel functions as a vent via which the main body and the outside (indoor) communicate with each other as well as protects the main body.

Citation List

[Patent Literature]

[0004] [Patent Literature 1] Japanese Patent Application Publication, *Tokukai* No. 2006-162216 (Publication date: June 22, 2006)

Summary of Invention

Technical Problem

[0005] Conventional air conditioners, which are even manufactured by any manufacturers, have appearances which are much of a muchness, and look identical to each other.

[0006] The present invention was made in view of the problem, and an object of the present invention is to provide a novel appearance of a front panel which maintains a function of the front panel.

Solution to Problem

[0007] In order to address the problem, an air conditioner in accordance with an aspect of the present invention is configured to be an air conditioner including: a main body; a front panel, having a flexibility, which covers the main body; and a driving section configured to cause at least a portion of an end part of the front panel to move forward so that the at least the portion and the main body are away from each other.

Advantageous Effects of Invention

[0008] The aspect of the present invention brings about an effect of providing a novel appearance of a front panel which maintains a function of the front panel.

Brief Description of Drawings

[0009]

Fig. 1 is a perspective view illustrating an appearance of an indoor unit of an air conditioner in accordance with an Embodiment of the present invention.

Fig. 2 is a front view illustrating the appearance of the indoor unit.

Fig. 3 is a perspective view illustrating a state where a cover of a front panel is removed from the indoor unit.

Fig. 4 is a front view illustrating a main body of and a back panel of the indoor unit.

Fig. 5 is a perspective view illustrating a state of a frame shown in a case where a servomotor is driven to rotate in the indoor unit.

Fig. 6 is a perspective view illustrating an operation of the indoor unit.

Fig. 7 is a perspective view illustrating an operation of the indoor unit.

Fig. 8 is an end view illustrating an operation of the indoor unit.

Fig. 9 is a perspective view illustrating an appearance of an indoor unit of an air conditioner in accordance with another Embodiment of the present invention.

Fig. 10 is a perspective view illustrating a state where a cover of a front panel is removed from the indoor unit.

Fig. 11 is a perspective view illustrating an operation of the indoor unit.

Fig. 12 is a perspective view illustrating an operation of the indoor unit.

Fig. 13 is an end view illustrating a structure of an indoor unit of an air conditioner in accordance with yet another Embodiment of the present invention.

Fig. 14 is an end view illustrating a structure of an indoor unit of an air conditioner in accordance with yet another Embodiment of the present invention.

Description of Embodiments

[0010] The following description will discuss Embodiments of the present invention in detail. Note that, for convenience, identical reference signs are given to members having respective functions identical to those of members illustrated in each Embodiment, and descriptions of such members are omitted as appropriate.

[Embodiment 1]

[0011] The following description will discuss Embodiment 1 of the present invention with reference to Figs. 1 through 7.

(Overview of indoor unit)

[0012] Figs. 1 and 2 are a perspective view and a front view, respectively, each illustrating an appearance of an indoor unit of an air conditioner in accordance with Embodiment 1. Fig. 3 is a perspective view illustrating a state where a cover of a front panel is removed from the indoor unit. Fig. 4 is a front view illustrating a main body of and a back panel of the indoor unit. Note that Embodiment 1 omits description of an outdoor unit of the air conditioner. This is because Embodiment 1 can employ a well-known outdoor unit as the outdoor unit of the air conditioner.

[0013] As illustrated in Figs. 1 through 4, an indoor unit 1 of the air conditioner is configured to include a main body 2, a front panel 3, and a back panel 4.

[0014] The main body 2 includes a housing 20 in which the heat exchanger (not illustrated) and an air blowing fan 21 (see Fig. 8) are provided in respective appropriate locations. The housing 20 is made of plastic, and is attached to an indoor side wall W. Note that Embodiment 1 omits descriptions of the heat exchanger and the air blowing fan 21. This is because Embodiment 1 can employ well-known heat exchanger and air blowing fan as the heat exchanger and the air blowing fan 21, respectively.

[0015] The front panel 3 is provided on a front surface of the main body 2 so as to cover a front part of the main body 2. According to Embodiment 1, the front panel 3 is configured to include a frame 30 and a cover 31 which covers the frame 30. The frame 30 is made of, for example, plastic or rubber so as to have a flexibility. According to Embodiment 1, the frame 30 is provided so that an upper frame 30a and a lower frame 30b are separately provided. The cover 31 is a cloth-like member made of, for example, fabric, nonwoven fabric, or silicone rubber. Note that the cover 31 is desirably stretchy. In a case where the cover 31 is thus stretchy, it is possible to restrain the cover 31 from wrinkling and/or breaking even in a case where the frame 30 bends.

[0016] The back panel 4 is a curved plate member, which is provided so as to change a wind direction of air in a vertical direction which air is sent out from the main body 2. The back panel 4 is provided, behind the front panel 3 and in a center part of the main body 2, so as to slide in the vertical direction. Note that Embodiment 1 omits description of a driving mechanism (not illustrated) of the back panel 4. This is because Embodiment 1 can employ, as the driving mechanism of the back panel 4, a well-known driving mechanism such as a combination of a rack and a pinion.

[0017] The indoor unit 1 includes various sensors and various electric circuits. However, note that Embodiment 1 omits descriptions of such sensors and electric circuits. This is because Embodiment 1 can employ, as the sensors and the electric circuits of the indoor unit 1, well-known sensors and electric circuits, respectively.

(Details of indoor unit)

[0018] As is illustrated in Figs. 1 through 4, the housing 20 of the main body 2 is provided so that a front part 200 projects outwards in a lateral direction (in a horizontal direction), as compared with a back part 201. According to Embodiment 1, there are provided, at the front of the housing 20, protruding members 22 and 23 in a center part of an upper end and a center part of a lower end, respectively. The protruding members 22 and 23 are configured to support the upper frame 30a and the lower frame 30b, respectively, while the front panel 3 is being closed.

[0019] There is provided, at the front of the housing 20, a projecting member 25 between a center part of a left end and a center part of a right end. The projecting member 24 (i) has a crescent shape so that its center part projects more forward than both end parts of the projecting member 24 and (ii) is provided so as to be in contact with the cover 31 of the front panel 3. This causes, in the cover 31 of the front panel 3, (i) an appropriate tension to be secured and (ii) its center part to project so as to form a ridgeline.

[0020] A lower end part of the upper frame 30a is attached to the both end parts of the projecting member 24 via respective hinge members 25 and 26. Similarly, an upper end part of the lower frame 30b is attached to the both end parts of the projecting member 24 via respective hinge members 27 and 28.

[0021] Servomotors 50 through 53 (driving sections) are provided more inward than the hinge members 25 through 28 and on axes of the hinge members 25 through 28. Base ends of driving arms 54 through 57 (driving sections) are pivotally attached to the respective servomotors 50 through 53. Leading ends of the driving arms 54 and 55 are in contact with respective corner parts 300 and 301 of the upper frame 30a, and leading ends of the driving arms 56 and 57 are in contact with respective corner parts 302 and 303 of the lower frame 30b.

[0022] Fig. 5 is a perspective view illustrating a state of the frame 30 shown in a case where the servomotor 52 is driven to rotate. As illustrated in Fig. 5, when the servomotor 52 is driven to rotate in one direction, a forward driving force is transmitted from a leading end of the driving arm 56 to the corner part 302 of the lower frame 30b. This causes the corner part 302 to move forward. This ultimately causes the lower frame 30b to (i) incline more forward as a distance from an upper part of a left end toward a lower end of the lower frame 30b is longer and (ii) curve forward as a distance from a center part of the lower end to a left end of the lower frame 30b is longer.

[0023] When the servomotor 52 is driven to rotate in a

reverse direction, the leading end of the driving arm 56 returns to its original position. This causes the corner part 302 of the lower frame 30b to return to its original position due to a resilience of the lower frame 30b.

[0024] Note that Fig. 5 illustrates a case where the servomotor 52 is driven to rotate but the same applies to a case where each of the servomotors 50, 51 and 53 is driven to rotate. Note also that the hinge members 25 through 27 each desirably have a rotational axis which is inclined with respect to a direction (horizontal direction) along the projecting member 24 (see Fig. 5). In this case, it is possible to make the utmost use of a torque of the servomotor 52 for curving the lower frame 30b.

[0025] As illustrated in Figs. 1 through 4, there are provided, at the front of the housing 20, (i) an upper-end opening 202 between the center part of the upper end and an upper-left corner part, (ii) an upper-end opening 203 between the center part of the upper end and an upper-right corner part, (iii) a lower-end opening 204 between the center part of the lower end and a lower-left corner part and (iv) a lower-end opening 205 between the center part of the lower end and a lower-right corner part. The openings 202 through 205 each function as a flow path through which air flows inside of and outside of the main body 2. That is, the openings 202 through 205 each function as a vent.

[0026] In each of the lower-end openings 204 and 205, there are provided a plurality of longitudinal louvers 60 each controlling a wind direction of air in the lateral direction which air is sent out from the inside of the main body 2 to the outside of the main body 2. Note that, in each of the upper-end openings 202 and 203, there can also be similarly provided a plurality of longitudinal louvers. Note also that Embodiment 1 omits description of a driving mechanism (not illustrated) of the plurality of longitudinal louvers 60. This is because Embodiment 1 can employ a well-known driving mechanism as the driving mechanism of the plurality of longitudinal louvers 60.

[0027] There are provided linear light sources 61 through 64 (informing light sources) in respective front inner parts of the upper-end openings 202 and 203 and the lower-end openings 204 and 205. In each of the linear light sources 61 through 64, a plurality of light emitting diodes (LEDs) are linearly arranged. According to Embodiment 1, the linear light sources 63 and 64, which are provided below the respective linear light sources 61 and 62, emit light of a warm color. Meanwhile, the linear light sources 61 and 62, which are provided above the respective linear light sources 63 and 64, emit light of a cold color. Note, however, that the color of the light emitted by each of the linear light sources 61 through 64 is not limited as such. The linear light sources 61 through 64 can each emit light of a different color. The linear light sources 61 through 64 can alternatively be provided in front end parts or rear end parts of the respective openings 202 through 205. Note that control of light emissions of the linear light sources 61 through 64 will be later described.

[0028] As illustrated in Fig. 4, there is provided, at the front of the housing 20, a projector 65 (light source for a visual effect) in a bit of underside of a center part. According to Embodiment 1, the projector 65 is configured to provide a light visual effect in the indoor unit 1. The projector 65 projects light on a predetermined display region A1 (region) of the cover 31 of the front panel 3. The light thus projected diffuses in the display region A1, and the display region A1 transmits the light thus diffused. This allows a gentle and peaceful image to be displayed in the display region A1. It is therefore possible to provide a gentle and peaceful light visual effect. Note that the light visual effect will be later described in detail.

(Operation of indoor unit)

[0029] Figs. 6 through 8 are views each illustrating an operation of the indoor unit 1 configured as above. Figs. 6 and 7 are perspective views each illustrating the indoor unit 1. (a) of Fig. 8 is an end view taken along by a line A-A of Fig. 4. (b) and (c) of Fig. 8 are end views each taken along by a line B-B of Fig. 4. Note that in Figs. 6 and 7, an arrow which is longer than is wide indicates a direction in which the back panel 4 moves, and a hollow arrow wider than the arrow indicates a direction in which air flows.

[0030] Fig. 1 and (a) of Fig. 8 each illustrate that the indoor unit 1 is in a stand-by state. In the stand-by state, an upper end part and a lower end part of the front panel 3 exist in respective backward reference positions, and the back panel 4 faces the front panel 3. This causes the openings 202 through 205 of the main body 2 to be closed by the front panel 3 and the back panel 4.

[0031] (a) of Fig. 6 and (b) of Fig. 8 each illustrate a state where the indoor unit 1 is conducting a warm-up operation in a spot mode in which the indoor unit 1 sends out a small amount of wind from a (left) part of the indoor unit 1. In such a state, the servomotor 52, located in a lower left part of the main body 2, is driven (see Fig. 5) so that a lower-left corner part 34 (end part) of the front panel 3 moves forward. This causes a lower left part of the front panel 3 to (i) incline more forward as a distance, in the vertical direction, from a lower end of the front panel 3 is shorter and (ii) curve forward as a distance, in the lateral direction, from a left end of the front panel 3 is shorter. The back panel 4 moves downwards.

[0032] Hence, the lower-end opening 204 on the left side and the front panel 3 are away from each other so that the main body 2 opens greater as the distance from the left end of the front panel 3 becomes smaller whereas a distance between the back panel 4 and respective of the upper-end openings 202 and 203 is ensured. This causes a small amount of indoor air to be sucked into the main body 2, through the upper-end openings 202 and 203. The air, which is warmed in the main body 2, is sent out in a lower left direction from the lower-end opening 204 (air outlet) on the left side, via the lower-left corner part 34 of the front panel 3.

[0033] In addition, the linear light source 63 on the lower left side emits light of the warm color for a predetermined period of time from a time when a part of the front panel 3 and the back panel 4 start moving. Emitted light is reflected by the back panel 4, and a part of the emitted light leaks outside. This allows a user to pay attention to the movement of the part of the front panel 3 and the back panel 4, and this makes it possible to inform in advance the user that the air which has been warmed is sent out from the lower left part.

[0034] (b) of Fig. 6 illustrates a state where the indoor unit 1 is conducting a warm-up operation in a quick mode in which the indoor unit 1 sends out a large amount of wind. In such a state, all of the servomotors 50 through 53 in the main body 2 are driven so that corner parts 32 through 35 (end parts) of the front panel 3 move forward. This causes a lower part of the front panel 3 to incline more forward as a distance, in the vertical direction, from the lower end of the front panel 3 is shorter. This also causes an upper part of the front panel 3 to incline more forward as a distance, in the vertical direction, from an upper end of the front panel 3 is shorter. Consequently, a center part of the front panel 3 forms a shape of a valley. The back panel 4 moves downwards.

[0035] Hence, all of the openings 202 through 205 and the front panel 3 are away from each other so that the main body 2 opens greater. This causes a large amount of indoor air to be sucked into the main body 2, through the upper-end openings 202 and 203. The large amount of indoor air, which is warmed in the main body 2, is sent out downwards from the lower-end openings 204 and 205 (air outlets), via the lower end part of the front panel 3.

[0036] In addition, the linear light sources 63 and 64 on the lower side emit light of the warm color for a predetermined period of time from a time when the front panel 3 and the back panel 4 start moving. Emitted light is reflected by the back panel 4, and a part of the emitted light leaks outside. This allow a user to pay attention to the movement of the front panel 3 and the back panel 4, and this makes it possible to inform in advance the user that the large amount of indoor air which has been warmed is sent out from below.

[0037] (a) of Fig. 7 and (c) of Fig. 8 each illustrate a state where the indoor unit 1 is conducting a cooling operation in the spot mode. In such a state, the servomotor 50, located in an upper left part of the main body 2, is driven so that the upper-left corner part 32 (end part) of the front panel 3 moves forward. This causes an upper left part of the front panel 3 to (i) incline more forward as a distance, in the vertical direction, from the upper end of the front panel 3 is shorter and (ii) be twisted more as a distance, in the lateral direction, from the left end of the front panel 3 is shorter. The back panel 4 moves upwards.

[0038] Hence, the upper-end opening 202 on the left side and the front panel 3 are away from each other so that the main body 2 opens greater as the distance, in the lateral direction, from the left end of the front panel 3 becomes shorter whereas a distance between the back panel 4 and respective of the lower-end openings 204 and 205 is ensured. This causes a small amount of indoor air to be sucked into the main body 2, through the lower-end openings 204 and 205. The air, which is cooled in the main body 2, is sent out, in an upper left direction, from the upper-end opening 202 (air outlet) on the left side via the upper-left corner part 32 of the front panel 3.

[0039] In addition, the linear light source 61 on the upper left side emits light of the cold color for a predetermined period of time from a time when a part of the front panel 3 and the back panel 4 start moving. Emitted light is reflected by the back panel 4, and a part of the emitted light leaks outside. This allows a user to pay attention to the movement of the part of the front panel 3 and the back panel 4, and this makes it possible to inform in advance the user that the air which has been cooled is sent out from the upper left part.

[0040] (b) of Fig. 7 illustrates a state where the indoor unit 1 is conducting a cooling operation in the quick mode. In such a state, all of the servomotors 50 through 53 in the main body 2 are driven so that the corner parts 32 through 35 (end parts) of the front panel 3 move forward. This causes the front panel 3 to become a state identical to that illustrated in (b) of Fig. 6. Meanwhile, the back panel 4 moves upwards.

[0041] Hence, all of the openings 202 through 205 and the front panel 3 are away from each other so that the main body 2 opens greater. This causes a large amount of indoor air to be sucked into the main body 2, through the lower-end openings 204 and 205. The large amount of indoor air, which is cooled in the main body 2, is sent out, upwards, from the upper-end openings 202 and 203 (air outlets) via the upper end part of the front panel 3.

[0042] In addition, the linear light sources 61 and 62 on the upper side emit light of the cold color for a predetermined period of time from a time when the front panel 3 and the back panel 4 start moving. Emitted light is reflected by the back panel 4, and a part of the emitted light leaks outside. This allow a user to pay attention to the movement of the front panel 3 and the back panel 4, and this makes it possible to inform in advance the user that the large amount of indoor air which has been cooled is sent out from above.

[0043] The above description has discussed the operations of the indoor unit 1 with reference to Figs. 6 through 8. However, note that the operations of the indoor unit 1 are not limited as such. Various operations can be selected as appropriate. For example, the indoor unit 1 can conduct (i) the operations illustrated in Fig. 6 and (b) of Fig. 8 in the cooling operation and (ii) the operations illustrated in Fig. 7 and (c) of Fig. 8 in the warm-up operation. Moreover, (i) a direction in which air is sucked and (ii) a direction in which air is sent out, can be reversed, each of which directions is indicated by the hollow arrow wider than the arrow in each of (b) of Fig. 6 and (b) of Fig. 7.

[0044] As has been described, the front panel 3 of the indoor unit 1 of Embodiment 1 can provide a novel ap-

pearance in which the front panel 3 partially curves while maintaining a function as a vent via which the main body 2 and the outside communicate with each other. Moreover, the front panel 3 is configured to be flexible enough to gradually curve, and is therefore employed as a member which partially constitutes the vent. The front panel 3 is thus unlikely to interfere with a flow of air to be sent out. This brings about an excellent effect of improving a visual effect of the air conditioner. Note that a direction of wind in the vertical direction is adjustable in accordance with how much the front panel 3 and the back panel 4 move. Note also that a direction of wind in the lateral direction is adjustable by use of the plurality of longitudinal louvers 60.

(Light visual effect)

[0045] According to Embodiment 1, the projector 65 projects an image, in which an operating state of the indoor unit 1 is illustrated by light, on the display region A1 of the cover 31 of the front panel 3. Note that the projector 65 can alternatively output, via a speaker (not illustrated), a sound which matches the image.

[0046] For example, in a case where the indoor unit 1 is in a state illustrated in Fig. 1, i.e., in a state where the indoor unit 1 is not conducting an air-conditioning operation, such as a stand-by state or an operation suspending state, the indoor unit 1 is regarded as being in a power saving mode, and is therefore regarded as being operating less and slowly. In view of the circumstances, examples of the image include (i) an image whose color and light quantity give a relatively less active impression and (ii) an image which heavily uses slow blinking of or slow movement of light.

[0047] Alternatively, in a case where the indoor unit 1 accepts various instructions or requests (i) from a user via a remote controller or via a microphone and a speech recognizing device or (ii) from an external server via a communication network, an image indicative of the acceptance is displayed in the display region A1 by use of light. Examples of the image include an image which heavily uses light which is brighter and broader than that used in the state where the indoor unit 1 is not conducting the air-conditioning operation. Examples of a sound which matches the image include (i) a sound which is lower and smaller than one-time alarm whistle such as a horn and (ii) a voice which repeats an instruction which the indoor unit 1 has accepted from a user.

[0048] In a case where the indoor unit 1 starts conducting the warm-up operation (illustrated in Fig. 6) in response to a user's instruction or a user's request, an image, indicative of a warm-up state, is displayed in the display region A1 by use of light. Examples of the image include a warm-color image, such as a sunny place in winter. Examples of a sound, which matches the image, include music of a little bird. Depending on a user's instruction, providing a user with a piece of music, which causes the user to recall spring, also brings about an effect of amplifying the effect of the air-conditioning operation (the warm-up operation in this case).

[0049] In a case where the indoor unit 1 starts conducting the cooling operation (illustrated in Fig. 7) in accordance with a user's instruction or a user's request, an image, which indicates a cooling state, is displayed in the display region A1 by use of light. Examples of the image include a cold-color image which indicates a gust of cool wind blows through a summer forest. Examples of a sound, which matches the image, include a sound of the gust of cool wind. Depending on a user's instruction, providing a user with a piece of music, which causes the user to recall a waterfront of, for example, a waterfall, also brings about an effect of amplifying the effect of the air-conditioning operation (the cooling operation in this case).

[0050] Note that an image displayed in the quick mode illustrated in (b) of Fig. 6 and (b) of Fig. 7 can be larger in size than that displayed in the spot mode illustrated in (a) of Fig. 6 and (a) of Fig. 7. Note also that, during the warm-up operation or the cooling operation, a corresponding image can keep being displayed. An object of the examples of the light visual effect is to more strengthen an impression which the indoor unit 1 wants to make on a user even in any of the warm-up state and the cooling state of the air-conditioning operation. It therefore goes without saying that (i) a visual effect other than the examples of the light visual effect can be provided and (ii) various visual effects can be alternatively provided in accordance with, for example, the seasons, the calendar, or a time of day provided that the visual effects meet the object.

[Additional description]

[0051] According to Embodiment 1, the linear light sources 61 through 64 are provided in the front inner parts of the respective openings 202 through 205. Note, however, that the linear light sources 61 through 64 can alternatively be provided in front outer parts of the respective openings 202 through 205. In a case where the linear light sources 61 through 64 are provided in the front outer parts of the respective openings 202 through 205, the cover 31 is irradiated with light emitted from the linear light sources 61 through 64. It is therefore possible to inform in advance a user that air is sent out from a bright part of the cover 31. As such, the linear light sources 61 through 64 need only be provided in the vicinity of the respective openings 202 through 205.

[0052] In a case where the cover 31 of the front panel 3 has an air permeability, a filter can be detachably provided on a back surface of the front panel 3.

[Embodiment 2]

[0053] The following description will discuss Embodiment 2 of the present invention with reference to Figs. 9 through 12.

(Overview of indoor unit)

[0054] Fig. 9 is a perspective view illustrating an appearance of an indoor unit of an air conditioner in accordance with Embodiment 2. Fig. 10 is a perspective view illustrating a state where a cover of a front panel is removed from the indoor unit.

[0055] As illustrated in Fig. 10, an indoor unit 1 of Embodiment 2 is identical in configuration to that illustrated in Figs. 1 through 8, except that a frame 30 of a front panel 3 of the indoor unit 1 of Embodiment 2 is not provided so that an upper frame 30a and a lower frame 30b are separately provided. Namely, the frame 30 is monolithically provided. Since the frame 30 is monolithically provided, the frame 30 is attached to both end parts of a projecting member 24, and the hinge members 25 through 28 illustrated in Fig. 3 are not provided. Note that the servomotors 50 through 53 and the driving arms 54 through 57, which are illustrated in Fig. 3, are provided in respective appropriate locations of a housing 20, though not illustrated in Fig. 10.

(Operation of indoor unit)

[0056] Figs. 11 and 12 each are a perspective view illustrating an operation of the indoor unit 1 which has the above configuration. The operations of the indoor unit 1 illustrated in Figs. 9, 11 and 12 are identical to those of the indoor unit illustrated in Figs. 1, 6 and 7, except for a shape which the front panel 3 has in a case where the front panel 3 partially moves forward.

[0057] Fig. 9 illustrates that the indoor unit 1 is in a stand-by state. Such a state is identical to that of the indoor unit 1 illustrated in Fig. 1, and therefore detailed description of this stand-by state is omitted.

[0058] (a) of Fig. 11 illustrates a state where the indoor unit 1 is conducting a warm-up operation in the spot mode. In such a state, the servomotor 52, located in a lower left part of a main body 2, is driven so that a lower-left corner part 34 of the front panel 3 moves forward. This causes a lower left part of the front panel 3 to curve forward (i) as a distance, in the vertical direction, from a lower end of the front panel 3 is shorter and (ii) as a distance, in the lateral direction, from a left end of the front panel 3 is shorter.

[0059] (b) of Fig. 11 illustrates a state where the indoor unit 1 is conducting a warm-up operation in the quick mode. In such a state, all of the servomotors 50 through 53 in the main body 2 are driven so that corner parts 32 through 35 of the front panel 3 move forward. This causes a lower part of the front panel 3 to curve forward as a distance, in the vertical direction, from the lower end of the front panel 3 is shorter. This also causes an upper part of the front panel 3 to curve forward as a distance, in the vertical direction, from an upper end of the front panel 3 is shorter. Since the front panel 3 of Embodiment 2 is attached to the both end parts of the projecting member 24 of the main body 2, the front panel 3 has a center part which keeps projecting, similar to a case illustrated in Fig. 9.

[0060] (a) of Fig. 12 illustrates a state where the indoor unit 1 is conducting a cooling operation in the spot mode. In such a state, the servomotor 50, located in an upper left part of the main body 2, is driven so that the upper-left corner part 32 of the front panel 3 moves forward. This causes an upper left part of the front panel 3 to curve forward (i) as a distance, in the vertical direction, from the upper end of the front panel 3 is shorter and (ii) as a distance, in the lateral direction, from the left end of the front panel 3 is shorter.

[0061] (b) of Fig. 12 illustrates a state where the indoor unit 1 is conducting a cooling operation in the quick mode. In such a state, the front panel 3 has a shape which is similar to that of the front panel 3 illustrated in (b) of Fig. 11.

[0062] As is described above, the front panel 3 of Embodiment 2 differs in curve state from the front panel 3 illustrated in Figs. 1 through 8. It is therefore possible to provide a further novel appearance.

[Embodiment 3]

[0063] The following description will discuss Embodiment 3 of the present invention with reference to Fig. 13.

[0064] Fig. 13 is an end view illustrating a structure of an indoor unit of an air conditioner of Embodiment 3. The end view is similar to the end view illustrated in (a) of Fig. 8. As illustrated in Fig. 13, an indoor unit 1 of Embodiment 3 is identical to the indoor unit 1 illustrated in Figs. 1 through 8, except that there are provided, in respective appropriate locations of a housing 20 of a main body 2 of the indoor unit 1 of Embodiment 3, a point light source 66, such as an LED, and a reflective plate 67 which reflects light emitted from the point light source 66, instead of a projector 65.

[0065] According to Embodiment 3, the reflective plate 67 has a reflective surface which has been processed so as to have various shapes so that light reflected from the reflective surface has a complicated pattern. This causes indirect light, having the complicated pattern, to be projected onto a cover 31 of a front panel 3.

[0066] Even though the point light source 66 and the reflective plate 67 are used, it is therefore possible that the indoor unit 1 provides a light visual effect. Note that the number of point light sources 66 can be one or more. Note also that the number of a combination of the point light source 66 and the reflective plate 67 can be one or more.

[Embodiment 4]

[0067] The following description will discuss Embodiment 4 of the present invention with reference to Fig. 14.

[0068] Fig. 14 is an end view, similarly to Fig. 13, illustrating a structure of an indoor unit of an air conditioner of Embodiment 4. As illustrated in Fig. 14, an indoor unit

1 of Embodiment 4 is identical to the indoor unit 1 illustrated in Fig. 13, except that there is provided, in an appropriate location of a housing 20, a transmission plate 68 which transmits light emitted from a point light source 66, instead of a reflective plate 67.

[0069] According to Embodiment 4, the transmission plate 68 has a surface which has been processed so as to have various shapes so that light transmitted by the transmission plate 68 has a complicated pattern. This causes indirect light, having the complicated pattern, to be projected onto a cover 31 of a front panel 3. The indoor unit 1 of Embodiment 4 can therefore bring about an effect identical to that brought about by the indoor unit 1 illustrated in Fig. 13.

[Additional description]

[0070] According to each of Embodiments 1 through 4, the servomotors 50 through 53 and the driving arms 54 through 57 drive the corner parts 32 through 34 of the front panel 3 to move forward. Note, however, that the present invention is not limited to this. For example, the center part of the upper end of and the center part of the lower end of the front panel 3 can alternatively be driven to move forward. It is also possible to utilize a given driving mechanism for driving a part of the front panel 3 to move forward.

[Recap]

[0071] An air conditioner (indoor unit 1) in accordance with Aspect 1 of the present invention is configured to be an air conditioner including: a main body 2; a front panel 3, having a flexibility, which covers a front part of the main body; and a driving section (servomotors 50 through 53 and driving arms 54 through 57) configured to cause at least a portion of an end part of the front panel to move forward so that the at least the portion and the main body are away from each other.

[0072] According to the configuration, the front panel has the flexibility. The driving section can therefore cause the at least the portion of the end part of the front panel to move forward so that the at least the portion and the main body are away from each other. This causes the at least the portion to serve as a vent via which the main body and the outside communicate with each other. This also causes the front panel to bend and curve in the vicinity of the at least the portion.

[0073] The front panel can therefore provide a novel appearance in which the front panel partially curves while maintaining a function as a vent via which the main body and the outside communicate with each other. Moreover, the front panel is configured to be flexible enough to gradually curve, and is therefore employed as a member which partially constitutes the vent. The front panel is thus unlikely to interfere with a flow of air to be sent out. This brings about an excellent effect of improving a visual effect of the air conditioner. Note that the vent can be the aforementioned air inlet or air outlet.

[0074] In Aspect 2 of the present invention, an air conditioner is arranged such that, in Aspect 1 of the present invention, the front panel includes (i) a flexible frame 30 and (ii) a cloth-like member (cover 31) which covers the flexible frame. In this case, the driving section causes the flexible frame to move forward. This causes the flexible frame to curve. Note that examples of the cloth-like member include fabric, nonwoven fabric, and membranous rubber.

[0075] An air conditioner in accordance with Aspect 3 of the present invention is preferably arranged such that, in Aspect 2 of the present invention, the cloth-like member is stretchy. In a case where the cloth-like member is stretchy, curve of the flexible frame makes it possible to restrain the cloth-like member from wrinkling.

[0076] In Aspect 4 of the present invention, an air conditioner is arranged such that, in Aspects 1 through 3 of the present invention, the air conditioner further includes a back panel 4 which is provided behind the front panel so as to change a direction in which the main body sends air outside, the back panel being provided so as to be slidable in a vertical direction, the driving section sliding the back panel toward an air outlet (openings 202 through 205) via which air is sent outside from the main body.

[0077] In this case, the back panel can change a wind direction of air in the vertical direction which air is sent out from the air outlet. For example, in a case where the back panel slightly slides downwards, air is sent out directly below the main body from the air outlet (openings 204 and 205). Meanwhile, in a case where the back panel considerably slides downwards, air is sent out forward rather than directly below the main body from the air outlet. That is, the back panel functions in the same manner as a louver.

[0078] In Aspect 5 of the present invention, an air conditioner is arranged such that, in Aspects 1 through 4 of the present invention, the air conditioner further includes a light source (linear light sources 61 through 64), provided in a vicinity of an air outlet via which air is sent outside from the main body, for informing that the air is sent outside from the main body. In this case, driving of the driving section causes the light source to emit light. This makes it possible to inform a user of a part corresponding to the air outlet. Note that examples of the light source include an LED. Note also that the light source can be provided on a front or back surface of the front panel, or can be provided in the main body.

[0079] In Aspect 6 of the present invention, an air conditioner is arranged such that, in Aspects 1 through 5 of the present invention, the air conditioner further includes a light source (projector 65), provided in front of the main body, for providing a light visual effect, the front panel having at least a region which (i) is irradiated with light emitted from the light source for providing the light visual effect and (ii) diffuses and transmits the light. In this case, it is possible to provide a gentle and peaceful light visual effect in the region. Note that examples of the light source

for providing the light visual effect include a projector, and a combination of (i) one or more LED(s) and (ii) a reflective plate or a transmission plate.

[0080] The present invention is not limited to the embodiments, but can be altered by a skilled person in the art within the scope of the claims. The present invention also encompasses, in its technical scope, any embodiment derived by combining technical means disclosed in differing embodiments. Further, it is possible to form a new technical feature by combining the technical means disclosed in the respective embodiments.

Reference Signs List

[0081]

1: indoor unit (air conditioner)
2: main body
3: front panel
4: back panel
20: housing
21: air blowing fan
24: projecting member
22 and 23: protruding member
25 through 28: hinge member
30: frame
31: cover (cloth-like member)
32 through 35: corner part
50 through 53: servomotor (driving section)
54 through 57: driving arm (driving section)
60: longitudinal louver
61 through 64: linear light source (informing light source)
65: projector (light source for visual effect)
66: point light source
67: reflective plate
68: transmission plate
200: front part
201: back part
202 through 205: opening
300 through 303: corner part

Claims

1. An air conditioner comprising:

a main body;
a front panel, having a flexibility, which covers a front part of the main body; and
a driving section configured to cause at least a portion of an end part of the front panel to move forward so that the at least the portion and the main body are away from each other.

2. The air conditioner as set forth in claim 1, wherein the front panel includes (i) a flexible frame and (ii) a cloth-like member which covers the flexible frame.

3. An air conditioner as set forth in claim 1 or 2, further comprising:

a back panel which is provided behind the front panel so as to change a direction in which the main body sends air outside,
the back panel being provided so as to be slidable in a vertical direction,
the driving section sliding the back panel toward an air outlet via which air is sent outside from the main body.

4. An air conditioner as set forth in any one of claims 1 through 3, further comprising:
a light source, provided in a vicinity of an air outlet via which air is sent outside from the main body, for informing that the air is sent outside from the main body.

5. An air conditioner as set forth in any one of claims 1 through 4, further comprising:

a light source, provided in front of the main body, for providing a light visual effect,
the front panel having at least a region which (i) is irradiated with light emitted from the light source for providing the light visual effect and (ii) diffuses and transmits the light.

FIG. 1

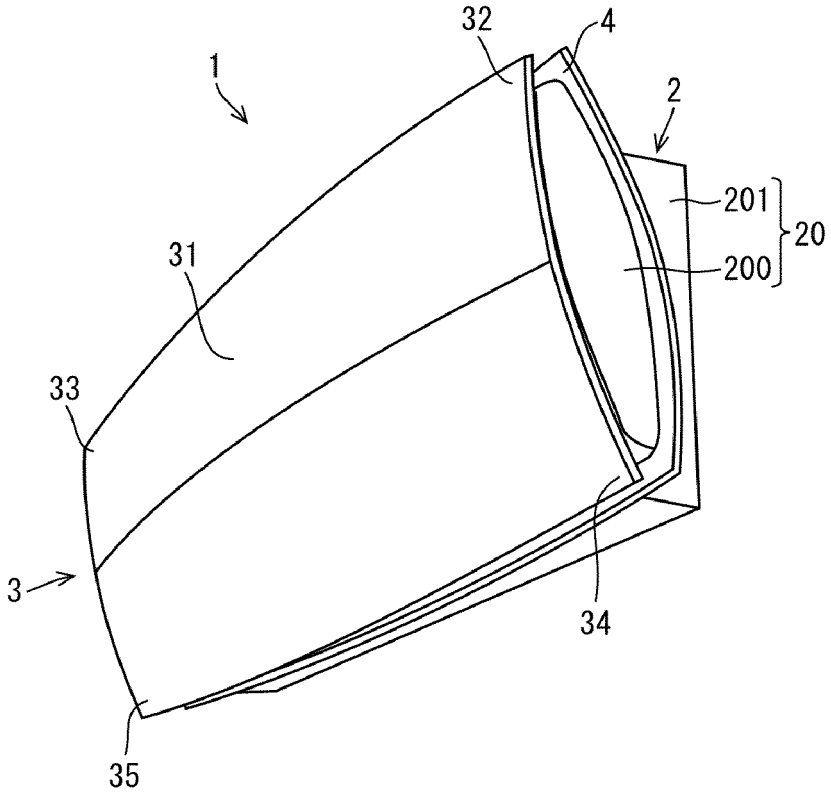


FIG. 2

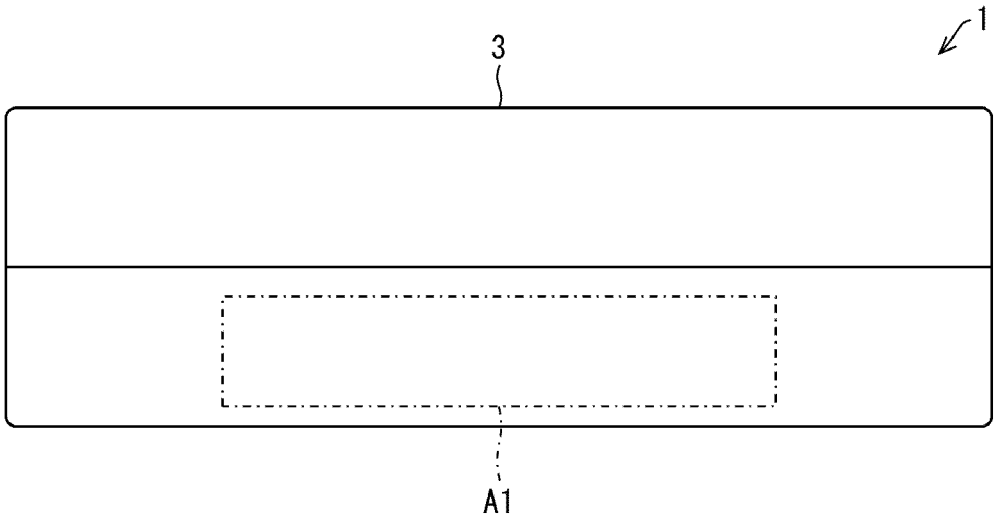
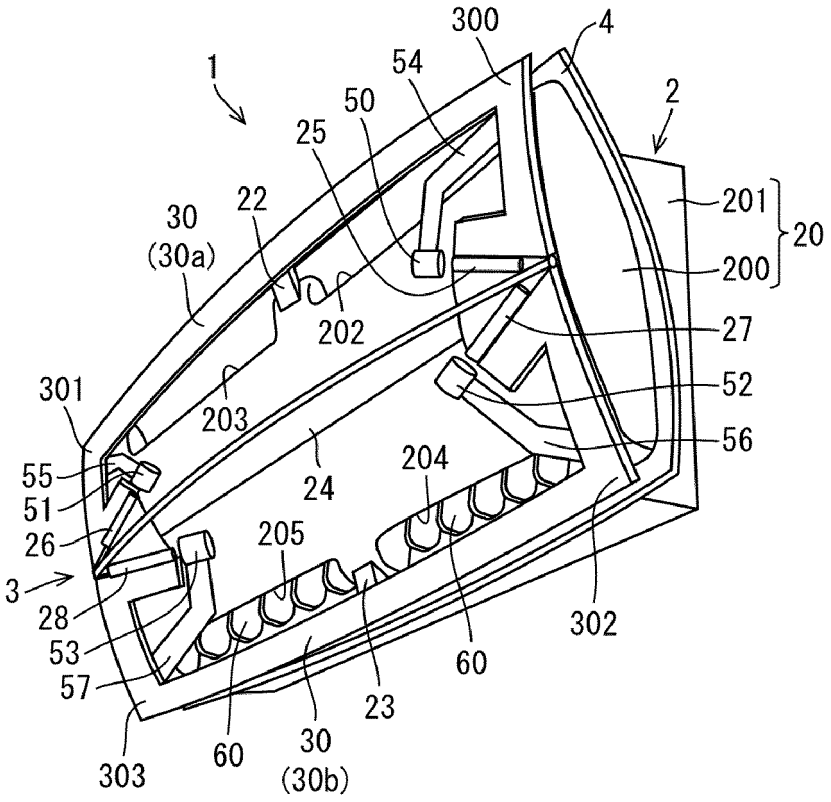


FIG. 3


300
4
1
54
50
2
25
201
20
30
(30a)
22
200
202
27
301
52
203
56
204
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51
205
26
3
28
302
53
60
57
23
303
60
30
(30b)

FIG. 4

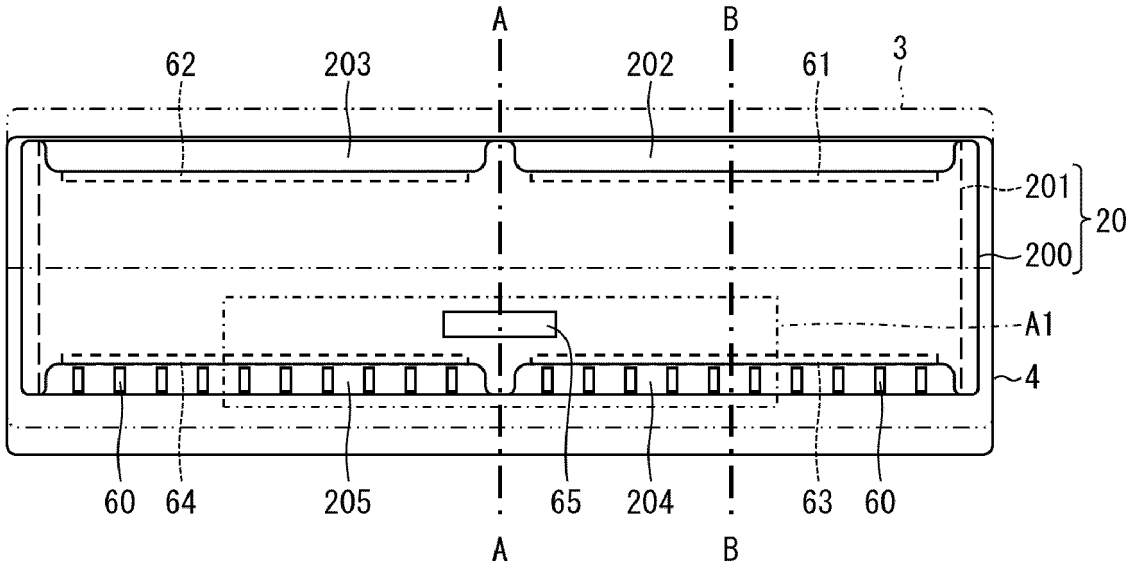

A
B
62
203
202
61
3
201
20
200
A1
4
60
64
205
65
204
63
60
A
B

FIG. 5

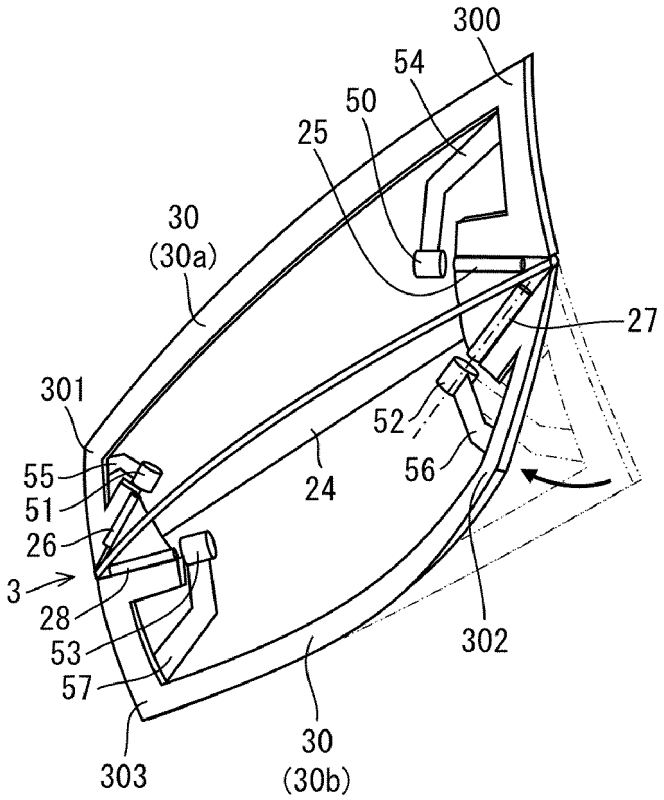


FIG. 6

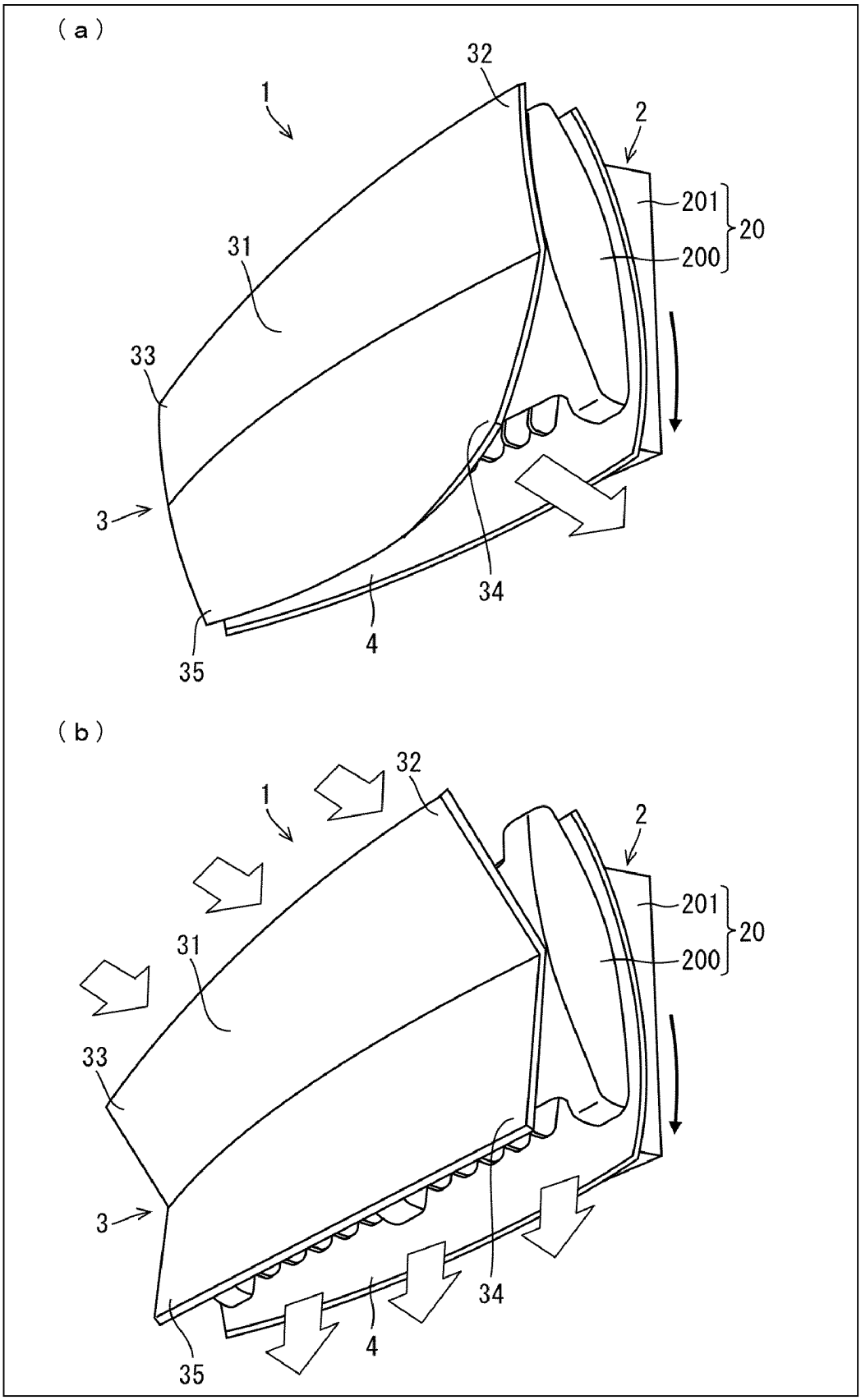


FIG. 7

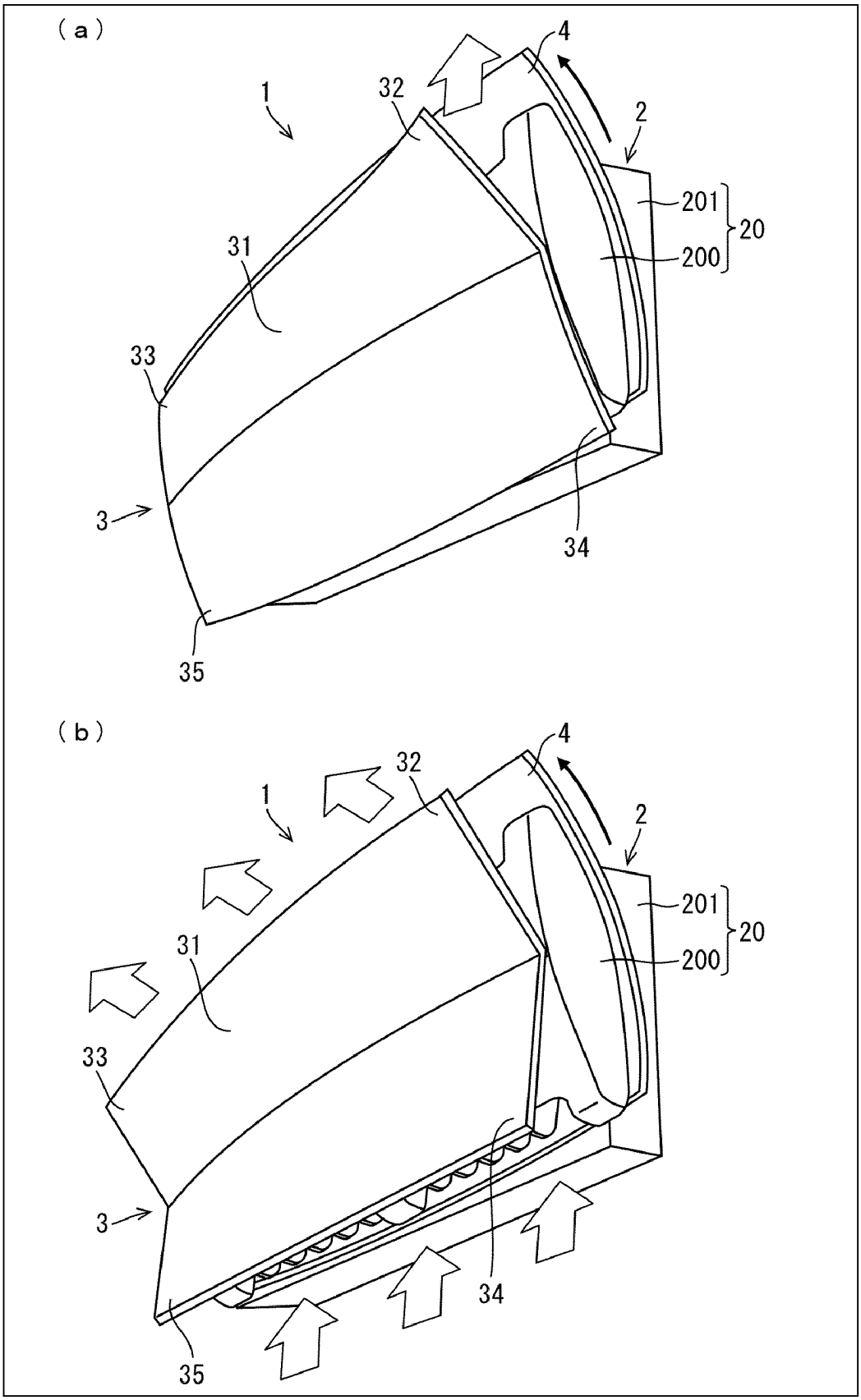
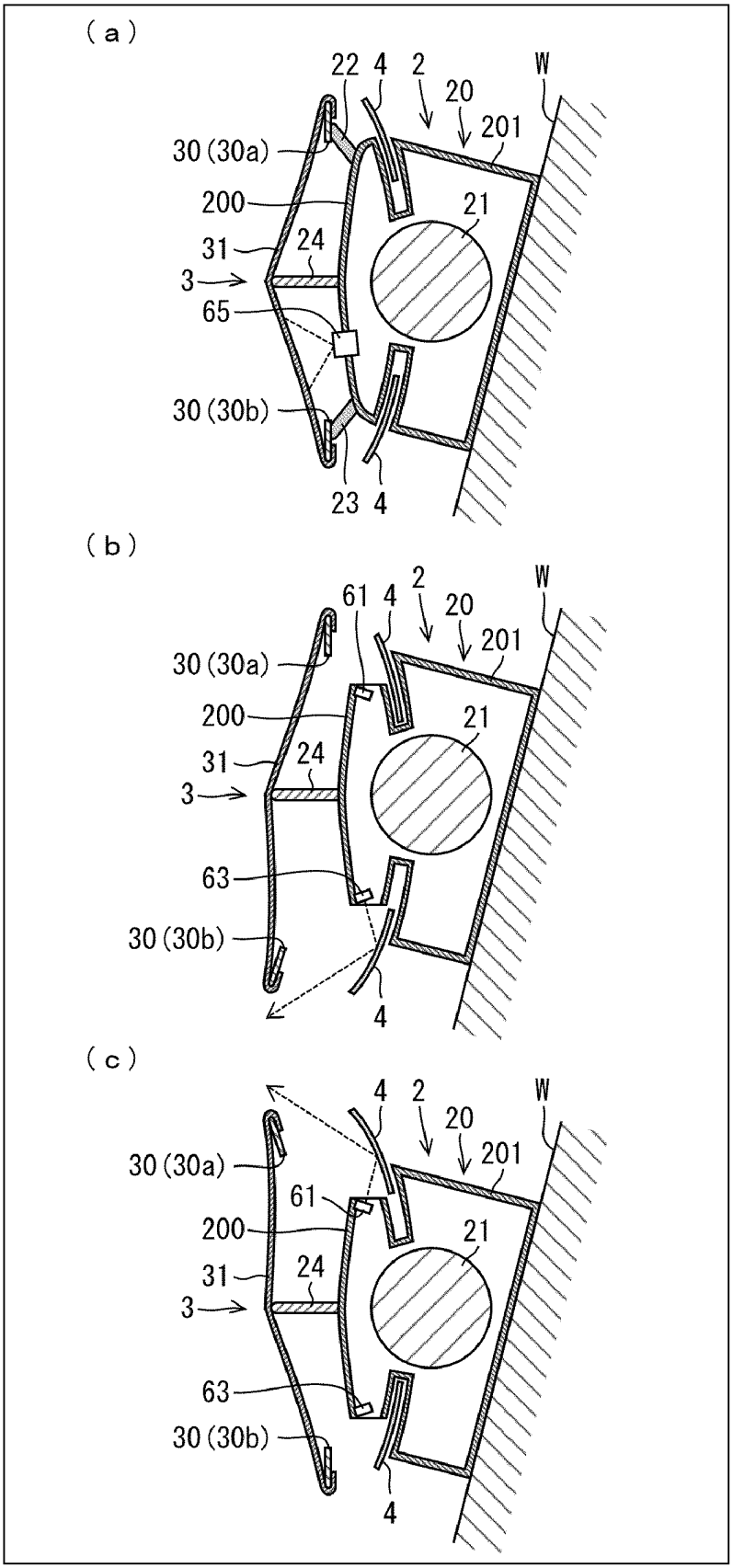


FIG. 8


(a)
22
4
2
20
W
201
30 (30a)
200
21
31
24
3
65
30 (30b)
23
4
(b)
61
4
2
20
W
201
30 (30a)
200
21
31
24
3
63
30 (30b)
4
(c)
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201
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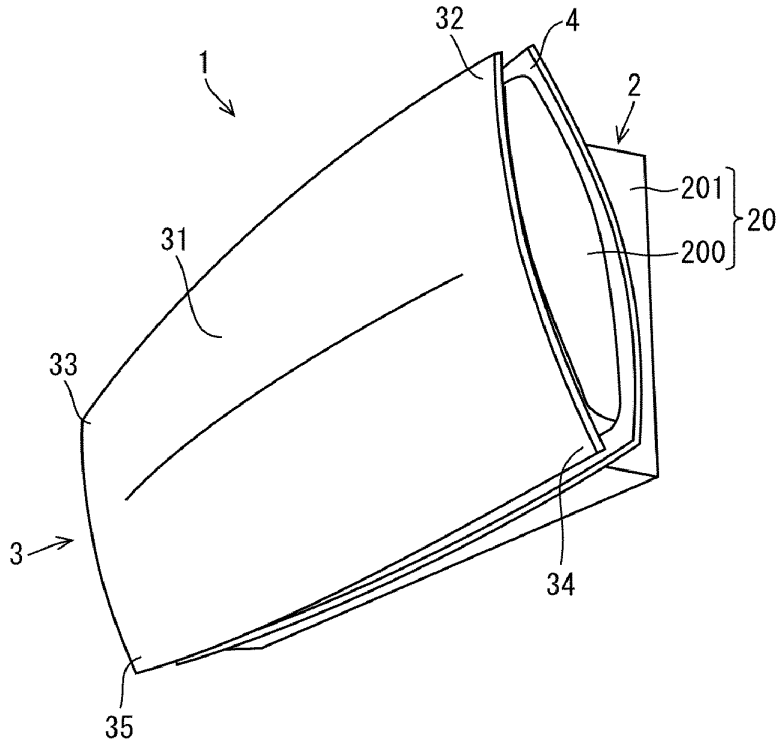
200
21
31
24
3
63
30 (30b)
4

FIG. 9


32
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200
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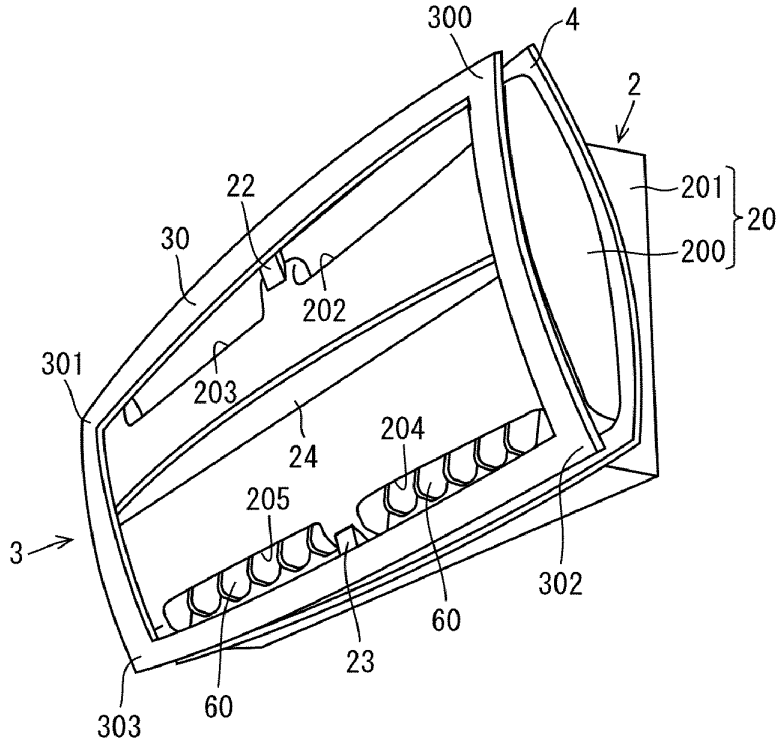
3
34
35

FIG. 10


300
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22
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202
301
203
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3
302
60
23
60
303

FIG. 11

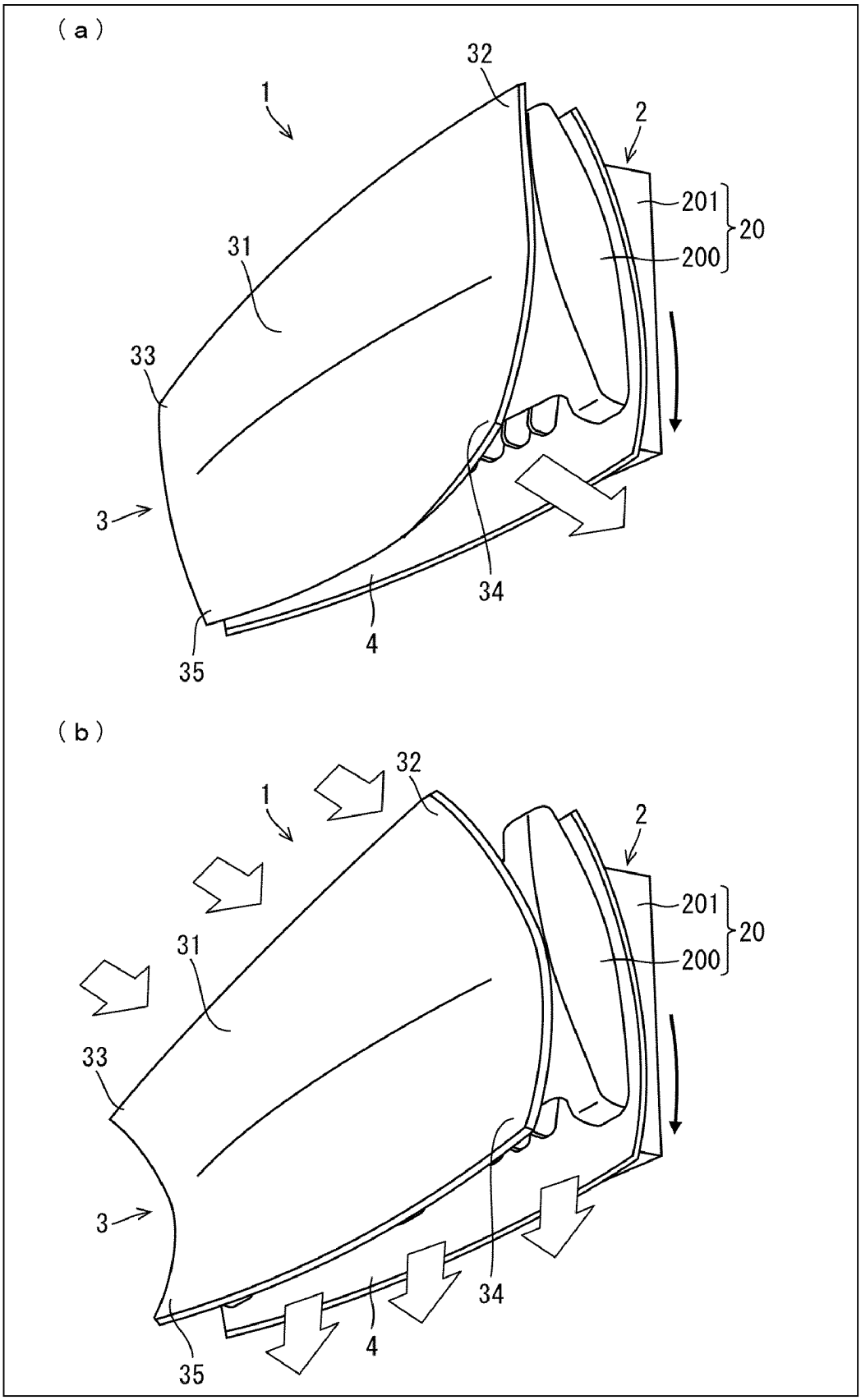


FIG. 12

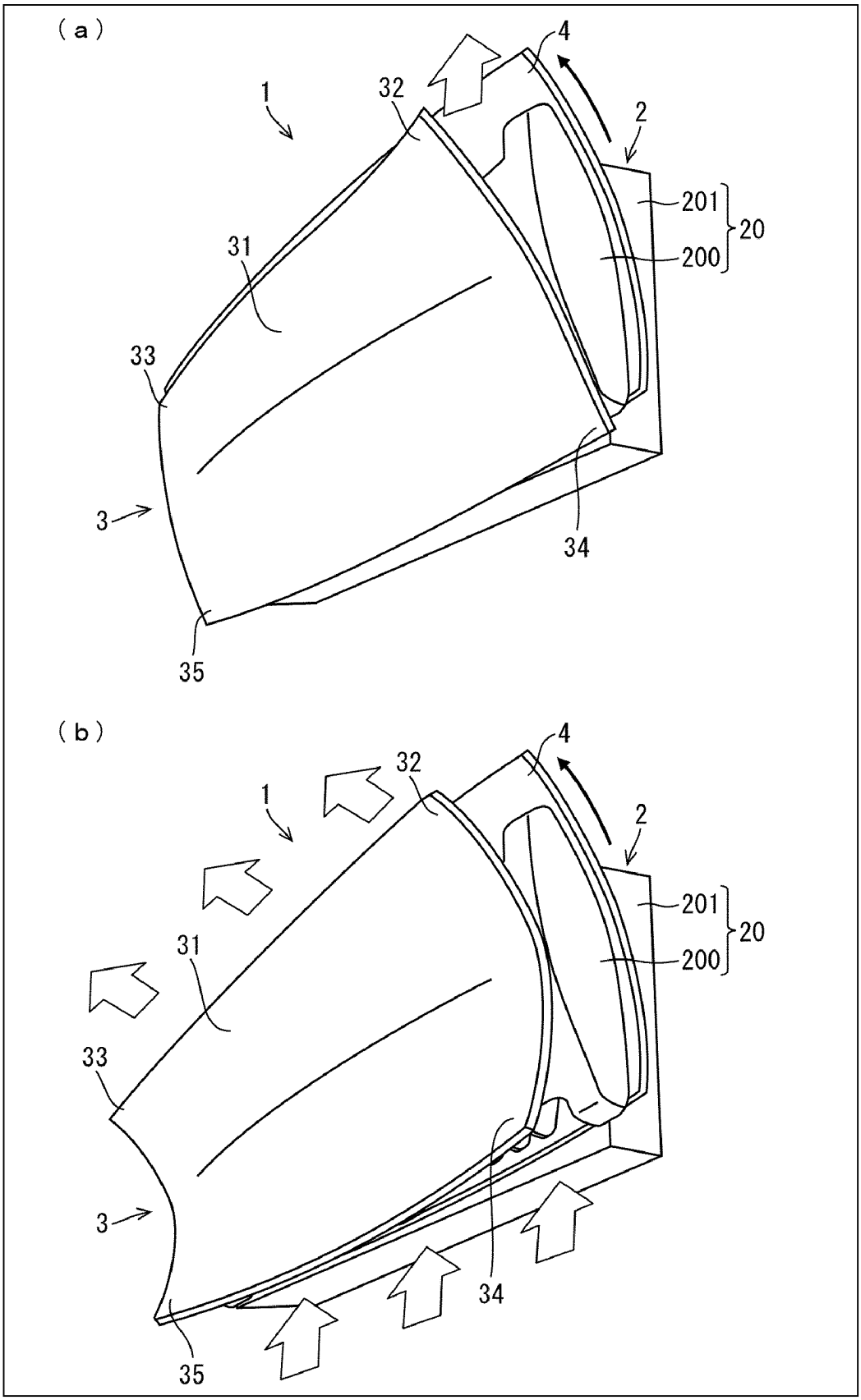


FIG. 13

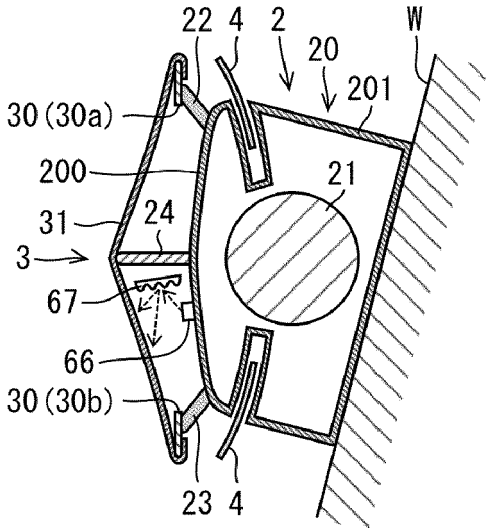
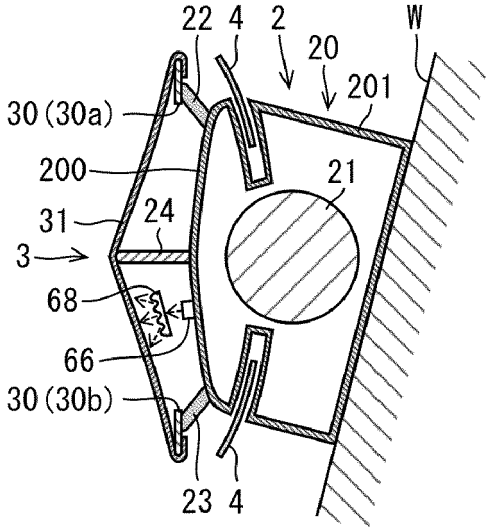

22
4
2
20
W
201
30 (30a)
200
21
31
24
3
67
66
30 (30b)
23
4

FIG. 14


22
4
2
20
W
201
30 (30a)
200
21
31
24
3
68
66
30 (30b)
23
4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2016/073421

A. CLASSIFICATION OF SUBJECT MATTER
F24F13/20(2006.01)i, *F24F11/02*(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F24F13/20, F24F11/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2016
Kokai Jitsuyo Shinan Koho 1971-2016 Toroku Jitsuyo Shinan Koho 1994-2016

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y A	JP 2006-145105 A (Daikin Industries, Ltd.), 08 June 2006 (08.06.2006), paragraphs [0025] to [0042]; fig. 7 & US 2008/0047288 A1 paragraphs [0103] to [0132]; fig. 7 & WO 2006/054428 A1 & EP 1826500 A1 & CN 101057109 A	1 2,4-5 3
Y	JP 2001-182957 A (Hitachi, Ltd.), 06 July 2001 (06.07.2001), paragraphs [0032] to [0033] (Family: none)	2,4-5
Y	JP 5-44984 A (Mitsubishi Electric Corp.), 23 February 1993 (23.02.1993), paragraphs [0013], [0015] (Family: none)	4-5

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
17 October 2016 (17.10.16)	25 October 2016 (25.10.16)
Name and mailing address of the ISA/ Japan Patent Office 3-4-3,Kasumigaseki,Chiyoda-ku, Tokyo 100-8915,Japan	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2016/073421

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2010-190535 A (Fujitsu General Ltd.), 02 September 2010 (02.09.2010), paragraphs [0016] to [0026]; fig. 1 to 5 (Family: none)	5
A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 105805/1989(Laid-open No. 46121/1991) (Toshiba Corp.), 26 April 1991 (26.04.1991), specification, page 6, line 9 to page 8, line 5; fig. 1 to 3 (Family: none)	1-5
A	JP 50-12720 Y1 (Tokyo Shibaura Electric Co., Ltd.), 18 April 1975 (18.04.1975), column 2, lines 15 to 19 (Family: none)	2

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

REFERENCES CITED IN THE DESCRIPTION

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- JP 2006162216 A **[0004]**