



(12) **EUROPEAN PATENT APPLICATION**  
published in accordance with Art. 153(4) EPC

(43) Date of publication:  
**16.01.2008 Bulletin 2008/03**

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

(21) Application number: **06731649.7**

(86) International application number:  
**PCT/JP2006/307702**

(22) Date of filing: **12.04.2006**

(87) International publication number:  
**WO 2006/115049 (02.11.2006 Gazette 2006/44)**

(84) Designated Contracting States:  
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI SK TR**

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(30) Priority: **21.04.2005 JP 2005123446**

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(54) **AIR CONDITIONER AND INSTALLATION METHOD FOR THE SAME**

(57) An air conditioner that is easy to install and an installation method of the air conditioner are provided. The air conditioner (100) comprises a blowout chamber (3), a gap blockage sheet (5), a radiating panel (1), and a supporting frame (6). The blowout chamber (3) comprises a blowout opening (31) through which air with temperature thereof adjusted is blown out, and is arranged such that the blowout opening (31) faces the side of the room (RS) through a blowout chamber opening (32) arranged on the ceiling surface (CL). The gap blockage sheet (5) is fixed to the ceiling surface (CL), and blocks

the gap between the blowout opening (31) and the blow-out chamber opening (32) arranged on the ceiling surface (CL). The radiating panel (1) is arranged to cover the blowout opening (31) from the side of the room (RS), and forms a space (IS) in which air blown out from the blowout opening (31) is taken. In addition, the radiating panel (1) is formed by a material of the fiber system that has a predetermined radiation rate and through which air passes. The supporting frame (6) is a separate body from the gap blockage sheet (5), and is fixed to the ceiling surface (CL), and supports the radiating panel (1).

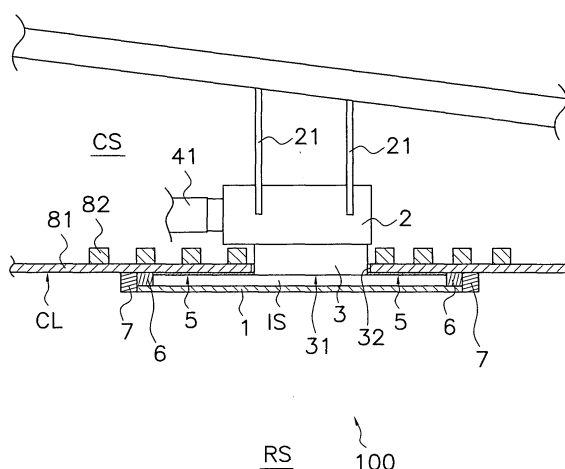


**Fig. 2**

## Description

### TECHNICAL FIELD

[0001] This invention relates to an air conditioner and an installation method of the air conditioner.

### BACKGROUND ART

[0002] An air conditioner is disclosed (refer to Patent Document 1) in which the adjustment of indoor temperature is carried out by the radiation from a radiating panel that is formed by woven fabric and the like having a predetermined radiation rate, and the blowing out of air from the radiating panel, to which air with temperature thereof adjusted is sent to the radiating panel.

<Patent Document 1> JP-A Publication No. 2004-271057

### DISCLOSURE OF THE INVENTION

#### <PROBLEM TO BE SOLVED BY THE INVENTION>

[0003] When installing an above described radiating panel to a ceiling surface, it is necessary to mount a supporting frame that supports the radiating panel to the ceiling surface. However, it is not always possible to mount this supporting frame to any place, and the mounting position thereof may be limited due to the structure of the ceiling surface. In the case that the mounting position of the supporting frame is limited and that the degree of freedom of mounting the supporting frame is low, the installation of the radiating panel becomes difficult.

[0004] The object of the present invention is to provide an air conditioner that is easy to install, and an installation method of the air conditioner.

#### <MEANS TO SOLVE THE PROBLEM>

[0005] An air conditioner of a first invention comprises a blowout portion, a gap blockage member, a radiating panel, and a supporting frame. The blowout portion comprises a blowout opening from which air with temperature thereof adjusted is blown out, and is arranged such that the blowout opening faces the side of the room through an opening that is arranged on the ceiling surface. The gap blockage member is fixed to the ceiling surface, and blocks the gap between the blowout opening and the opening that is arranged on the ceiling surface. The radiating panel is arranged to cover the blowout opening from the side of the room, and forms a space in which air blown out from the blowout opening is taken. In addition, the radiating panel is formed by a material of fiber system that has a predetermined radiation rate and through which the air passes. The supporting frame is a separate body from the gap blockage member, and is fixed to the ceiling surface, and supports the radiating panel.

[0006] In this air conditioner, it is arranged such that the blowout opening of the blowout portion faces the side of the room through the opening that is arranged on the ceiling surface. The radiating panel arranged to cover the blowout opening from the side of the room. Accordingly, the air blown out from the blowout opening is taken into the interior of the radiating panel. The temperature of the radiating panel is adjusted by the air taken in, and the temperature of the room is adjusted by the radiation. With this, by having the air taken into the space that the radiating panel forms blown out to the room from gaps in the fabric of the radiating panel, the temperature of the room is adjusted.

[0007] In addition, the gap between the opening arranged on the ceiling surface and the blowout opening is blocked by the gap blockage member, and therefore, it is possible to suppress air from leaking out from the gap.

[0008] Then, since the supporting frame that supports the radiating panel is a separate body from the gap blockage member, when mounting the supporting frame, it is possible to mount it separately from the gap blockage member. Therefore, in this air conditioner, the degree of freedom of the mounting position of the frame is high, and mounting can be performed easily.

[0009] An air conditioner of a second invention is the air conditioner of the first invention, and that the supporting frame is fixed to a base member that supports, on the ceiling underside, a ceiling board that forms the ceiling surface.

[0010] The ceiling surface is often formed by a ceiling board that is comparatively thin, and in the case the supporting frame is fixed only to the ceiling surface that is formed by this kind of ceiling board, a strong fixation is difficult. And so, fixing the supporting frame to the base member that supports the ceiling board from the ceiling underside can be considered. A strong fixation is possible if the supporting frame is fixed like this. However, the base member is arranged only on limited positions on the ceiling surface, and there is the possibility that the position adjustment of the supporting frame will become difficult.

[0011] However, in this air conditioner, since it is possible to mount the supporting frame separately from the gap blockage member, the supporting frame is arranged so that the position thereof overlaps the base member, and the position adjustment thereof is easy. Therefore, in this air conditioner, installation is easy, and it is possible to firmly mount the supporting frame.

[0012] An air conditioner of a third invention is the air conditioner of the first invention or the second invention, and that the supporting frame is arranged in a position that is separated in a predetermined distance from the opening, in an area around the opening arranged on the ceiling surface.

[0013] In this air conditioner, the supporting frame is arranged on a position that is separated in a predetermined distance from the opening, in an area around the opening arranged on the ceiling surface. In other words,

the opening is smaller than the area enclosed by the supporting frame. Therefore, in the case of arranging the opening on the ceiling surface, it is only necessary to bore an opening with an area that is smaller than the supporting frame, and the installation work is easy.

**[0014]** An air conditioner of a fourth invention is the air conditioner of the third invention, and that the gap blockage member is arranged across from the opening to the supporting frame.

**[0015]** In this air conditioner, since the gap blockage member is arranged across from the opening to the supporting frame, it is possible to cover and protect the ceiling surface in the area from the opening to the supporting frame.

**[0016]** An air conditioner of a fifth invention is the air conditioner of the fourth invention, and that the gap blockage member is a sheet-like member that is affixed to the ceiling surface.

**[0017]** In this air conditioner, since the gap blockage member is a sheet-like member that is affixed to the ceiling surface, it is comparatively light in weight. Therefore, it is possible to fix the gap blockage member easily to the ceiling surface.

**[0018]** An air conditioner of a sixth invention is the air conditioner of the first invention to the fifth invention, and that it further comprises a temperature adjustment unit that adjusts the temperature of the air and sends it to the blowout portion.

**[0019]** In this air conditioner, the air with temperature thereof adjusted in the temperature adjustment unit passes through the blowout opening of the blowout portion and is sent to the space that the radiating panel forms.

**[0020]** An air conditioner of a seventh invention is the air conditioner of the sixth invention, and that the temperature adjustment unit is arranged on the ceiling underside and positioned above the opening.

**[0021]** In this air conditioner, the temperature adjustment unit is arranged on the ceiling underside. Therefore, the temperature adjustment unit is prevented from being seen by the occupant and the like of the room, and it is possible to improve the beauty.

**[0022]** An air conditioner of an eighth invention is the air conditioner of one of any of the first invention to the seventh invention, and that it further comprises an outside frame that covers the perimeter of the supporting frame from the outside.

**[0023]** In this air conditioner, by having the outside frame covering the outside of the supporting frame, it is possible to hide the supporting portion between the radiating panel and the supporting frame. By doing so, it is possible to improve the beauty thereof.

**[0024]** An installation method of an air conditioner of a ninth invention is an installation method of an air conditioner that adjusts the temperature of a room by a radiating panel that is installed on a ceiling surface, and it comprises a blowout portion installation step, a supporting frame fixation step, a gap blockage member fixation step, and a radiating panel installation step. In the blow-

out portion installation step, a blowout portion comprising a blowout opening through which air with temperature thereof adjusted is blown out is arranged such that the blowout opening faces the side of the room through an opening arranged on the ceiling surface. In the supporting frame fixation step, a supporting frame that supports the radiating panel is fixed to the ceiling surface. In the gap blockage member fixation step, a gap blockage member which is a separate body from the supporting frame and blocks a gap between the blowout opening and the opening arranged on the ceiling surface is fixed on the ceiling surface. Then, in the radiating panel installation step, the radiating panel that forms a space in which air blown out from the blowout opening is taken, and formed by a material of fiber system that has a predetermined radiation rate and through which the air passes, is fixed to the supporting frame to cover the blowout opening from the side of the room.

**[0025]** In this installation method of an air conditioner, since the supporting frame that supports the radiating panel is a separate body from the gap blockage member, when mounting the supporting frame, it is possible to mount it separately from the gap blockage member. Therefore, in this air conditioner installation method, the degree of freedom of the mounting position of the frame is high, and the mounting thereof can be done easily.

#### <EFFECT OF THE INVENTION>

**[0026]** In the air conditioner of the first invention, since it is possible to mount the supporting frame separately from the gap blockage member, it is possible to install it easily.

**[0027]** In the air conditioner of the second invention, the supporting frame is arranged so that the position thereof overlaps with the base member, and the position adjustment thereof is easy, and therefore, installation is easy and it is possible to firmly mount the supporting frame.

**[0028]** In the air conditioner of the third invention, in the case of arranging an opening on the ceiling surface, it is only necessary to bore an opening with an area that is smaller than the supporting frame, and the installation work is easy.

**[0029]** In the air conditioner of the fourth invention, since the gap blockage member is arranged across from the opening to the supporting frame, it is possible to cover and protect the ceiling surface in the area from the opening to the supporting frame.

**[0030]** In the air conditioner of the fifth invention, since the gap blockage member is a sheet-like member that is affixed to the ceiling surface, it is comparatively light in weight, and therefore, it is possible to easily fix the gap blockage member to the ceiling surface.

**[0031]** In the air conditioner of the sixth invention, the air with temperature thereof adjusted in the temperature adjustment unit passes through the blowout opening of the blowout portion and is sent to the space that the ra-

diating panel forms.

[0032] In the air conditioner of the seventh invention, the temperature adjustment unit is prevented from being seen by the occupant and the like of the room, and it is possible to improve the beauty of appearance.

[0033] In the air conditioner of the eighth invention, it is possible to hide the supporting portion between the radiating panel and the supporting frame by the outside frame, and it is possible to improve the beauty of appearance.

[0034] In the installation method of an air conditioner of the ninth invention, since it is possible to mount the supporting frame separately from the gap blockage member, the installation can be done easily.

## BRIEF DESCRIPTION OF THE DRAWINGS

### [0035]

Figure 1 is a perspective view of an air conditioner looking from the side of the room.

Figure 2 is a side section view showing the configuration of the air conditioner.

Figure 3 is a flowchart showing the installation method of the air conditioner.

Figure 4 is a pattern diagram that shows the installation method of the air conditioner.

## DESCRIPTION OF THE REFERENCE SYMBOLS

### [0036]

- 1 Radiating panel
- 2 Temperature adjustment unit
- 3 Blowout chamber (blowout portion)
- 5 Gap blockage sheet (gap blockage member)
- 6 Supporting frame
- 7 Outside frame
- 31 Blowout opening
- 32 Blowout chamber opening (opening)
- 82 Base members
- 100 Air conditioner
- CL Ceiling surface

## BEST MODE FOR CARRYING OUT THE INVENTION

### <Configuration>

[0037] An air conditioner 100 of one embodiment of the present invention is shown in Figs. 1 and 2. This air conditioner 100 is an air conditioner 100 that adjusts the temperature in a room RS by a radiating panel 1 that is installed on the ceiling surface CL, and it is possible to air condition the room RS with cooling and heating and the like by the radiation and the blowing out of air of which the temperature is adjusted. Note that, Fig. 1 is a perspective view of the air conditioner 100 looking from the side of the room R, and Fig. 2 shows the structure of the

ceiling surface CL and the configuration of the air conditioner 100. The air conditioner 100 comprises a temperature adjustment unit 2, a blowout chamber 3, a suction chamber 4 (refer to Fig. 4(b)), a gap blockage sheet 5, a radiating panel 1, a supporting frame 6, and an outside frame 7.

### <Temperature Adjustment Unit>

[0038] The temperature adjustment unit 2 is a built-in type of indoor unit, and it is an apparatus that adjusts the temperature of the air taken in from the suction chamber 4, and sends it to an interior space IS comprised by the radiating panel 1, via the blowout chamber 3.

[0039] The temperature adjustment unit 2 is arranged on the ceiling underside CS, and fixed to a beam on the ceiling underside CS by hanging bolts 21 and the like. The temperature adjustment unit is arranged above a blowout chamber opening 32 to be described later. The temperature adjustment unit 2 forms a refrigerant circuit with an outdoor unit not shown in the figure, and performs heat exchange between refrigerant and air. A suction duct 41 that is connected to the suction chamber 4 is connected to the temperature adjustment unit 2, and the air in room RS drawn in from the suction chamber 4 passes through the suction duct 41 and is taken into the interior of the temperature adjustment unit 2. The temperature adjustment unit 2 comprises a blower and a heat exchanger in the interior thereof that are not shown in the figure, and it passes the air that was taken in through the heat exchanger, blows out the air that has been heat exchanged with the refrigerant, and sends it to the blowout chamber 3.

### <Blowout Chamber>

[0040] The blowout chamber 3 (blowout portion) is mounted to the bottom of the temperature adjustment unit 2, and it is a member in a shape of a box that comprises a blowout opening 31 on the under surface thereof from which air with temperature thereof adjusted is blown out. The blowout opening 31 is an opening through which the air that was blown out from the temperature adjustment unit 2, passed via the interior of the blowout chamber 3, and blown into room RS passes. Most part of the blowout chamber 3 is positioned on the side of the ceiling underside CS, and the blowout opening 31 is arranged to face the side of the room RS, through an opening (hereinafter referred to as "blowout chamber opening 32") that is arranged on the ceiling surface CL.

[0041] Note that, the blowout chamber opening 32 (opening) is arranged with a ceiling board 81 that forms the ceiling surface CL cut out, and penetrates from room RS to the ceiling underside CS. The blowout chamber opening 32 has a shape that approximately matches the blowout opening 31, and is formed to be slightly larger than the blowout opening 31. The blowout opening 31 has a square shape, and the blowout chamber opening

32 also has a square shape. In addition, the blowout chamber opening 32 is positioned on an area around the center of the radiating panel 1, looking from below.

#### <Suction Chamber>

**[0042]** The suction chamber 4 is a portion that takes in air in room RS and sends it to the temperature adjustment unit 2, and as shown in Fig. 4(b), it comprises a suction opening 41. The suction opening 41 is arranged on the under surface of the suction chamber 4. Most part of the suction chamber 4 is positioned on the side of the ceiling underside CS, and the suction opening 41 is arranged to face the side of the room RS, through an opening (hereinafter referred to as "suction chamber opening 42", (refer to Fig. 4(a))) that is arranged on the ceiling surface CL. The suction chamber 4 is connected to the suction duct 41 that is connected to the temperature adjustment unit 2, and sends the air taken in from the room RS via the suction duct 41 to the temperature adjustment unit 2.

#### <Supporting frame>

**[0043]** The supporting frame 6 is formed from sheet metal, and it is a member that is fixed to the ceiling surface CL, and supports the radiating panel 1. The supporting frame 6, as shown in Fig. 4(c), is a frame having a rectangular outer shape, and is arranged in a position away in a predetermined distance from the blowout chamber opening 32, and is arranged to surround the perimeter of the blowout chamber opening 32. The supporting frame 6 is formed of a combination of a plurality of linear members, and each linear member is in a shape of a rail. The thickness of the supporting frame 6 (dimension in the vertical direction) is small compared to the dimension thereof in the horizontal direction, and the entire supporting frame 6 has a thin shape in the vertical direction. On the supporting frame 6, a plurality of screw holes (not shown in the figure) are arranged, through which screws pass, and it is screwed in place to the ceiling board 81 that forms the ceiling surface CL and base members 82 that support the ceiling board 81 on the side of the ceiling underside CS. The number of screw holes is set to be more than the number used for fixing the supporting frame 6. Note that, in Fig. 2, only one of the base members 82 is numbered, and the others are omitted. The supporting frame 6 is a separate body from the blowout chamber 3, the radiating panel 1, and the gap blockage sheet 5, and is able to be mounted independently to the ceiling surface CL separated from the blowout chamber 3, the radiating panel 1, and the gap blockage sheet 5.

#### <Gap Blockage Sheet>

**[0044]** The gap blockage sheet 5 (gap blockage member) is a sheet-like member that is arranged across from the blowout chamber opening 32 to the supporting frame

6, and blocks the gap between edge of the blowout opening 31 of the blowout chamber 3 and the blowout chamber opening 32 arranged on the ceiling surface CL. The gap blockage sheet 5 is fixed to the ceiling surface CL by being affixed to the ceiling surface CL, but it may be fixed by a screw and the like. The gap blockage sheet 5 blocks the gap, and at the same time, functions also as an antifouling sheet that protects the ceiling surface CL from stain. Note that, insulation may be layered on the gap blockage sheet 5. Alternately, the gap blockage sheet 5 may be a material that has thermal insulating properties. The gap blockage sheet 5 is thinner than the thickness of the supporting frame 6, and has a rectangular outer shape, same as the supporting frame 6.

#### <Radiating Panel>

**[0045]** The radiating panel 1 is mounted on the supporting frame 6 from below, to cover the entire under surface of the supporting frame 6, and is supported by the supporting frame 6. The radiating panel 1 is arranged to cover the blowout opening 31 from the side of the room RS, and is arranged approximately parallel to the ceiling surface CL separated from the ceiling surface CL by a distance corresponding to the thickness of the supporting frame 6. Therefore, the radiating panel 1 forms an interior space IS in which air blown out from the blowout opening 31 is taken. In other words, this interior space IS is formed by the gap blockage sheet 5, the supporting frame 6, and the radiating panel 1, and the upper side thereof is closed by the gap blockage sheet 5 excluding the blowout chamber opening 32, the sides thereof are closed by the supporting frame 6, and the bottom side thereof is closed by the radiating panel 1. The radiating panel 1 is formed by a material of fiber system, such as a fabric and the like that air passes through. As a material of fiber system, a woven fabric is preferable. However, it may be a nonwoven fabric and other material of the fabric system. In addition, the radiating panel 1, as shown in Fig. 1, has a shape that is flat and small in the thickness thereof. Due to the air from the blowout opening 31 with the temperature thereof adjusted being sent to the interior space IS formed by the radiating panel 1, a pressure is generated that is greater than the atmosphere pressure. In addition, the material of the fabric system that forms the radiating panel 1 is soft and air is able to pass through it, and has a radiation rate of approximately 0.9. Therefore, the air being sent to the interior space IS is blown out to the room RS peacefully, from the gaps of the holes in the fabric of the radiating panel 1. In addition, due to the temperature of the radiating panel 1 being adjusted by the air sent to the interior space IS, radiation is generated from the radiating panel 1. For this reason, it is possible to adjust the temperature in the room RS via the radiation and the quiet blowing out of air. Note that, the material of fabric system has stretching properties. The radiating panel 1 with an outer shape that is plate-like, flat, and thin has a rectangular projection geometry with respect

to the room RS below. The radiating panel 1, for example, has a size to the extent that covers a bedding arranged in room RS in plane.

#### <Outside Frame>

**[0046]** The outside frame 7 is a frame shaped member that covers the perimeter of the supporting frame 6, in which the radiating panel 1 is mounted, from the outside. The outside frame 7 has a rectangular outside shape that is slightly larger than the supporting frame 6, and has a thickness that is approximately the same as the supporting frame 6. The outside frame 7 is fixed to the supporting frame 6 or fixed to the ceiling surface CL. The outside frame 7 is formed from resin or wood, for example, by forming it from wood, beautiful wood grain shown on the exterior improves the beauty thereof.

#### <Installation Method>

**[0047]** An installation method when installing this air conditioner 100 in a residential building will be described based on Figs. 3 and 4.

**[0048]** First, in a first step S1, the blowout chamber opening 32 is made. Here, as shown in Fig. 4(a), the ceiling board 81 that forms the ceiling surface CL is perforated, and the blowout chamber opening 32 is arranged on the ceiling surface CL. This blowout chamber opening 32 has a size to the extent of the outside shape of the blowout opening 31 of the blowout chamber 3, and may be smaller than the radiating panel 1 and the supporting frame 6. In addition, the blowout chamber opening 32 is arranged to suit the layout and the like of the room RS, for example above a bed and the like arranged in the room RS.

**[0049]** In a second step S2, the suction chamber opening 42 is made. Here, as shown in Fig. 4(a), the ceiling board 81 is perforated, and the suction chamber opening 42 is arranged on the ceiling surface CL. In addition, the suction chamber opening 42 is arranged in a position that is comparatively unnoticeable, such as in a corner and the like of the ceiling surface CL.

**[0050]** Note that, the first step S1 and the second step S2 can be omitted, in the case that openings are arranged on the ceiling surface CL from the beginning, like in a newly built building and the like.

**[0051]** Next, in a third step S3, the temperature adjustment unit 2 is installed. Here, as shown in Fig. 4(b), the temperature adjustment unit 2 is carried into the ceiling underside CS, and fixed to a beam and the like arranged on the ceiling underside CS. The temperature adjustment unit 2 is fixed by hanging bolts 21 (refer to Fig. 2) and the like, and suspended from the beam.

**[0052]** In a fourth step S4 (blowout portion installation step), the blowout chamber 3 is installed. Here, as shown in Fig. 4(b), the blowout chamber 3 is arranged such that the blowout opening 31 faces the side of the room RS, through the blowout chamber opening 32 arranged on

the ceiling surface CL. The blowout chamber 3 is carried into the ceiling underside CS, and the blowout chamber 3 is installed such that the blowout opening 31 of the blowout chamber 3 is inserted from the side of the ceiling underside CS into the blowout chamber opening 32. In this state, the blowout opening 31 is exposed on the side of the room RS from the blowout chamber opening 32.

**[0053]** Note that, in the case that the temperature adjustment unit 2 and the blowout chamber 3 are arranged integrally, the third step S3 and the fourth step S4 may be carried out simultaneously.

**[0054]** In a fifth step S5, the suction chamber 4 is installed. Here, as shown in Fig. 4(b), the suction chamber 4 is arranged such that the suction opening 41 faces the side of the room RS, through the suction chamber opening 42. The suction chamber 4 is carried into the ceiling underside CS, and the suction chamber 4 is installed such that the suction opening 41 of the suction chamber 4 is inserted from the side of the ceiling underside CS into the suction chamber opening 42.

**[0055]** In a sixth step S6, the connection of the suction duct 41 is performed. Here, as shown in Fig. 4(b), the suction chamber 4 and the temperature adjustment unit 2 are connected by the suction duct 41. Note that, the suction duct 41 is arranged on the ceiling underside CS.

**[0056]** In a seventh step S7 (supporting frame fixation step), the fixation of the supporting frame 6 is performed. Here, as shown in Fig. 4(c), the supporting frame 6 that supports the radiating panel 1 is fixed to the ceiling surface CL. At this time, as shown in Fig. 2, alignment is performed such that the supporting frame 6 overlaps with the base members 82, looking from the vertical direction. Then, screws are hammered into the ceiling board 81 and the base members 82 through the screw holes in the supporting frame 6, and the supporting frame 6, the ceiling board 81, and the base members 82 are screwed together. Note that, in the case that the supporting frame 6 is configured from a plurality of members of separate bodies, the supporting frame 6 may be fixed to the ceiling surface CL after assembling each member, or each member may be individually fixed to the ceiling surface CL prior to the assembly thereof.

**[0057]** In an eighth step S8 (gap blockage member fixation step), the fixation of the gap blockage sheet 5 is performed. Here, as shown in Fig. 4(d), the gap blockage sheet 5 is fixed to the ceiling surface CL, and the gap between the blowout opening 31 of the blowout chamber 3 and the blowout chamber opening 32 is blocked. The size of the blowout chamber opening 32 is nearly equal to that of the blowout opening 31. However, in order to install the blowout chamber 3, it is formed slightly bigger than the blowout opening 31. The gap blockage sheet 5 is arranged in order to block this gap. The gap blockage sheet 5 is affixed to the ceiling surface CL, to fill in the gap between the edge of the blowout opening 31 and the supporting frame 6.

**[0058]** In a ninth step S9 (radiating panel installation step), the radiating panel 1 is installed. Here, as shown

in Figs. 4(e) and 2, the radiating panel 1 is fixed to the supporting frame 6 to cover the blowout opening 31 from the side of the room RS. The radiating panel 1 is fixed in a stretched state, so that accidental rotation does not occur.

**[0059]** In a tenth step S 10, the outside frame 7 is mounted. Here, as shown in Fig. 4(f), the outside frame 7 is mounted to the supporting frame 6 and the outer circumference of the radiating panel 1.

**[0060]** In addition, if possible, the order of the processes from the above described first step S1 to the tenth step S10 may be switched, if necessary.

#### <Characteristics>

##### (1)

**[0061]** In this air conditioner 100, air with temperature thereof adjusted is sent from the blowout opening 31 to the interior space IS of the radiating panel 1. The radiating panel 1 is formed by a material having a predetermined radiation rate, and therefore, by adjusting the temperature of the radiating panel 1 by the air with temperature thereof adjusted, radiation is generated from the surface thereof. In addition, since the material that forms the radiating panel 1 is a material of fiber system, if the pressure in the interior space IS becomes greater than the pressure in the room RS, air with temperature thereof adjusted is blown out to the room RS from the gaps in the fabric of the radiating panel 1. As a result, it is possible to adjust the temperature in the room RS by the combination of the radiation and the blowing out of air, and it is possible to adjust the temperature of the room RS by the quieter blowing out of air than the case that temperature is adjusted by only the blowing out of air. In addition, the air that blows out from the radiating panel 1 flows quietly, since it is blown out from the gaps in the fabric. Therefore, it is possible to adjust the temperature in room RS with little feeling of draft, and it is possible to adjust the temperature that is comfortable for the occupant of the room RS.

##### (2)

**[0062]** In the above described kind of air conditioner 100, since temperature of the room RS is adjusted with little feeling of draft, it is preferable that the radiating panel 1 has an area that is comparatively large. In the case that the radiating panel 1 is large in plane, it is difficult to fill air sufficiently in the interior thereof. For example, in the case that a blowout opening is mounted on one end portion of the radiating panel 1 and air with temperature thereof adjusted is sent to the interior thereof from one end portion of the radiating panel 1, it is difficult to have the air reach the other end portion sufficiently. In addition, if the flow speed of the air is increased in order for air to sufficiently reach the other end portion, there is the possibility that a negative pressure is generated near the

blowout opening 31, and to the contrary, the air in the room RS may be drawn into the interior of the radiating panel 1.

**[0063]** However, in this air conditioner 100, as described above, since the blowout opening 31 is arranged in an area around the center of the radiating panel 1, the air with temperature thereof adjusted is sent to the interior of the radiating panel 1 from the center portion of the radiating panel 1. For this reason, it is possible for the air with temperature thereof adjusted to easily reach the end portions of the radiating panel 1.

##### (3)

**[0064]** In this air conditioner 100, since the supporting frame 6 is a separate body from the gap blockage sheet 5, at the time of mounting the supporting frame 6, the effect of the arrangement of the gap blockage sheet 5 is little. Therefore, alignment at the time of mounting the supporting frame 6 to the ceiling surface CL is easy. In addition, as a result, it is also easy to fix it to the base members 82 that are arranged in restricted positions of the ceiling surface CL. Furthermore, a strong fixation is possible by fixing it to the base members 82.

##### (4)

**[0065]** In this air conditioner 100, the blowout chamber opening 32 is smaller than the supporting frame 6, and since the supporting frame 6 and the blowout chamber 3 are separate bodies, at the time of installing the supporting frame 6 to the ceiling surface CL, the degree of freedom of the installation position of the supporting frame 6 is high. In other words, within the range that the blowout chamber opening 32 is positioned on the inner side of the supporting frame 6, it is possible to freely set the position and the direction of the supporting frame 6.

##### (5)

**[0066]** In this air conditioner 100, since the opening that is arranged on the ceiling surface CL as the blowout chamber opening 32 can be comparatively small, the construction work is simple. In other words, in the case that an opening with a size same as the radiating panel 1 is arranged on the ceiling surface CL in order to mount the radiating panel 1 to the ceiling surface CL, the construction work becomes difficult since it is necessary to bore a large opening on the ceiling surface CL. In addition, in the case that an opening with a size same as the radiating panel 1, or an opening with a size same as the outer shape of the supporting frame 6 is arranged on the ceiling surface CL, there is a need to install the supporting frame 6 to match the position of this opening. Therefore, the degree of freedom of the mounting position of the supporting frame 6 becomes low, and the mounting thereof is difficult. However, in this air conditioner 100, since the blowout chamber opening 32 is comparatively

small, the construction work of the blowout chamber opening is easy, and the mounting of the supporting frame 6 is also easy.

<Other Embodiments>

(1)

**[0067]** In the above described embodiment, the supporting frame 6 is made of sheet metal. However, it may be made of resin. By doing so, it is possible to make the weight of the supporting frame 6 lighter.

(2)

**[0068]** In the above described embodiment, the radiation rate of the material of fiber system that forms the radiating panel 1 is 0.9. However, it is acceptable as long as the radiation rate is 0.6 or more. However, it is more preferable that it is 0.9 or more, from the standpoint of improving the adjustment of temperature by radiation.

(3)

**[0069]** Plate-like gap blockage panel may be arranged in place of the gap blockage sheet 5. Also in this case, by having the gap blockage panel and the supporting frame 6 being separate bodies, the degree of freedom of mounting the supporting frame 6 is improved, and it is possible to make the mounting thereof easy.

(4)

**[0070]** In the above described embodiment, the blowout chamber 3 is mounted to the under surface of the temperature adjustment unit 2. However, the temperature adjustment unit 2 may be arranged in a position away from the blowout chamber 3, and the blowout chamber 3 and the temperature adjustment unit 2 may be connected by a duct. By doing so, the air with temperature thereof adjusted blown out from the temperature adjustment unit 2 passes through the duct, and is sent to the blowout chamber 3, and is blown out from the blowout opening 31.

(5)

**[0071]** In the above described embodiment, the supporting frame 6 is fixed to the ceiling surface CL by screws. However, it may be fixed by other fixation means, such as nails, bolts and nuts, and the like.

(6)

**[0072]** In the above described embodiment, the blowout chamber opening 32 is square. However, it may be in another shape such as a rectangle, a circle, and the like.

## INDUSTRIAL APPLICABILITY

**[0073]** It is possible to make the installation of an air conditioner easy according to the present invention, and it is useful as an air conditioner and an installation method of the air conditioner.

## Claims

1. An air conditioner (100), comprising:

a blowout portion (3) that comprises a blowout opening (31) from which air with temperature thereof adjusted is blown out, and is arranged such that said blowout opening (31) faces the side of the room (RS) through an opening (32) that is arranged on the ceiling surface (CL);  
a gap blockage member (5) that is fixed to said ceiling surface (CL), and blocks the gap between said blowout opening (31) and said opening (32) that is arranged on said ceiling surface (CL);  
a radiating panel (1) that is arranged to cover said blowout opening (31) from the side of said room (RS), and forms a space (IS) in which air blown out from said blowout opening (31) is taken, and is formed by a material of fiber system that has a predetermined radiation rate and through which said air passes; and  
a supporting frame (6) which is a separate body from said gap blockage member (5), and is fixed to said ceiling surface (CL), and supports said radiating panel (1).

2. The air conditioner (100) as recited in Claim 1, wherein

said supporting frame (6) is fixed to a base member (82) that supports, on the ceiling underside, a ceiling board (81) that forms said ceiling surface (CL).

3. The air conditioner (100) as recited in Claim 1 or Claim 2, wherein

said supporting frame (6) is arranged in a position that is separated in a predetermined distance from said opening (32), in an area around said opening (32) arranged on said ceiling surface (CL).

4. The air conditioner (100) as recited in Claim 3, wherein

said gap blockage member (5) is arranged across from said opening (32) to said supporting frame (6).

5. The air conditioner (100) as recited in Claim 4, wherein

said gap blockage member (5) is a sheet-like member that is affixed to said ceiling surface (CL).

6. The air conditioner (100) as recited in one of any of

the Claims 1 to 5, further comprising a temperature adjustment unit (2) that adjusts the temperature of said air and sends it to said blowout portion (3).

7. The air conditioner (100) as recited in Claim 6, wherein said temperature adjustment unit (2) is arranged on the ceiling underside (CS) and positioned above said opening (32).

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8. The air conditioner (100) as recited in one of any of the Claims 1 to 7, further comprising an outside frame (7) that covers the perimeter of said supporting frame (6) from the outside.

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9. An installation method of an air conditioner (100) that adjusts the temperature of a room (RS) by a radiating panel (1) that is installed on a ceiling surface (CL), the installation method of the air conditioner (100) comprising:

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a blowout portion installation step (S4) which a blowout portion (3) comprising a blowout opening (31) through which air with temperature thereof adjusted is blown out is arranged such that said blowout opening (31) faces the side of said room (RS) through an opening (32) arranged on said ceiling surface (CL);

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a supporting frame fixation step (S7) which a supporting frame (6) that supports said radiating panel (1) is fixed to said ceiling surface (CL);

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a gap blockage member fixation step (S8) which a gap blockage member (5) which is a separate body from said supporting frame (6) and blocks a gap between said blowout opening (31) and said opening (32) arranged on said ceiling surface (CL) is fixed on said ceiling surface (CL); and

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a radiating panel installation step (S9) which said radiating panel (1) that forms a space (IS) in which air blown out from said blowout opening (31) is taken, and formed by a material of fiber system that has a predetermined radiation rate and through which said air passes, is fixed to said supporting frame (6) to cover said blowout opening (31) from the side of said room (RS).

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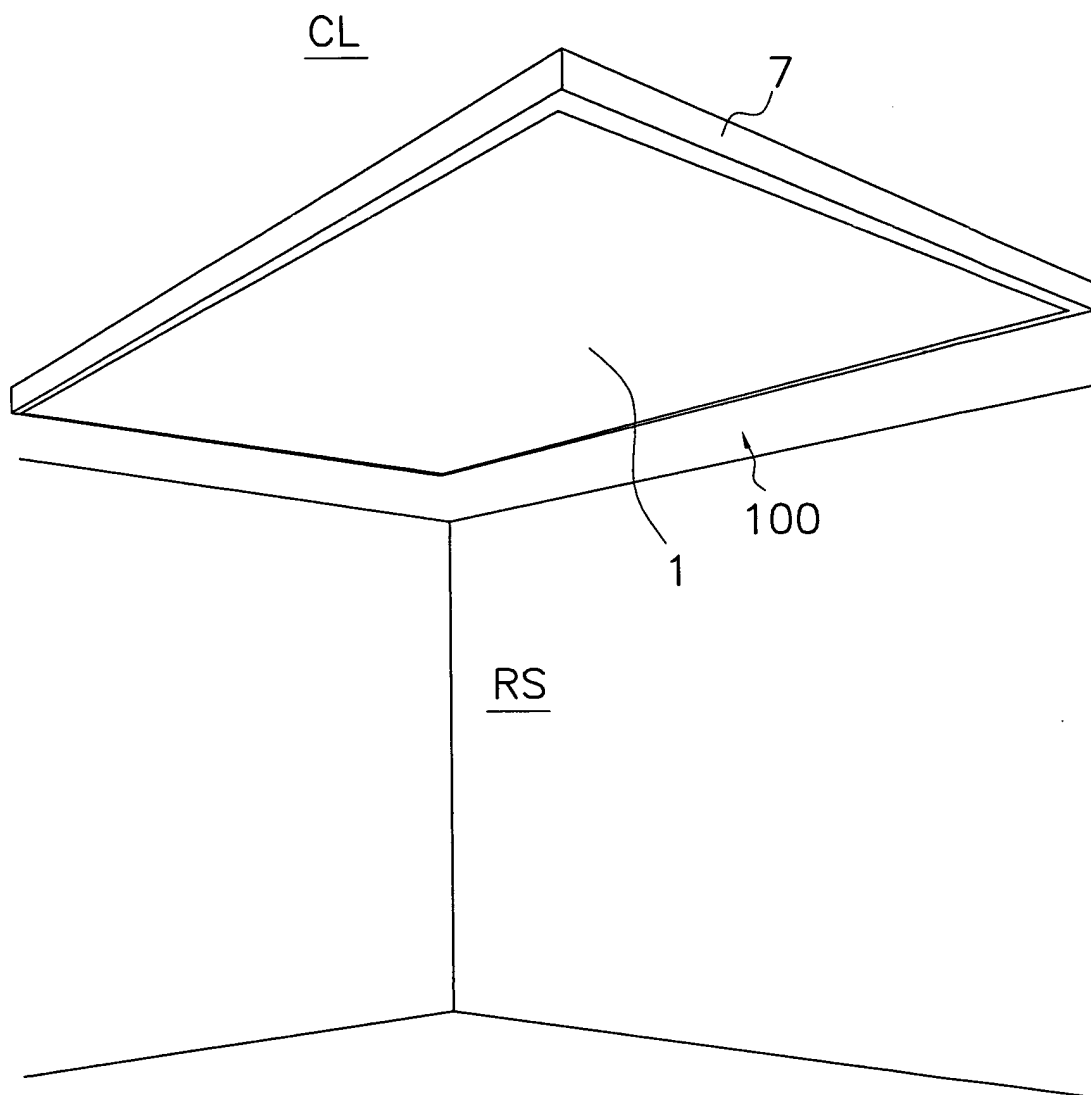


*Fig. 1*

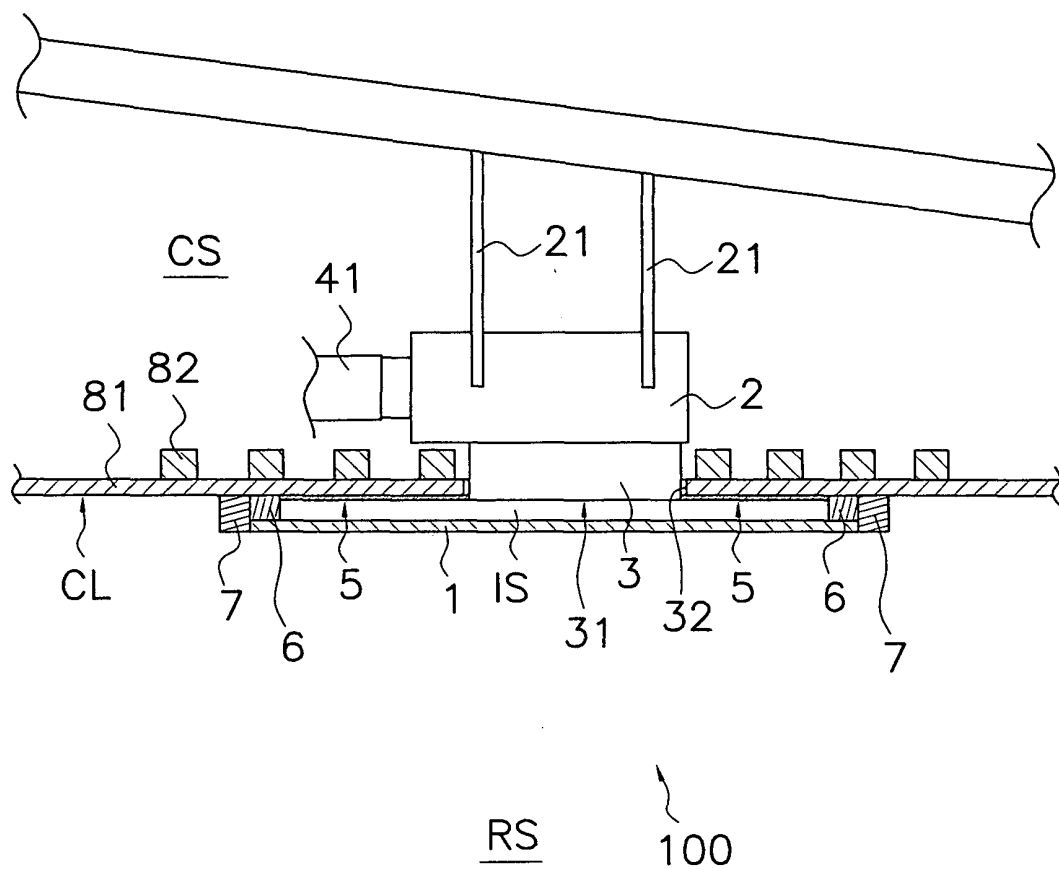


*Fig. 2*

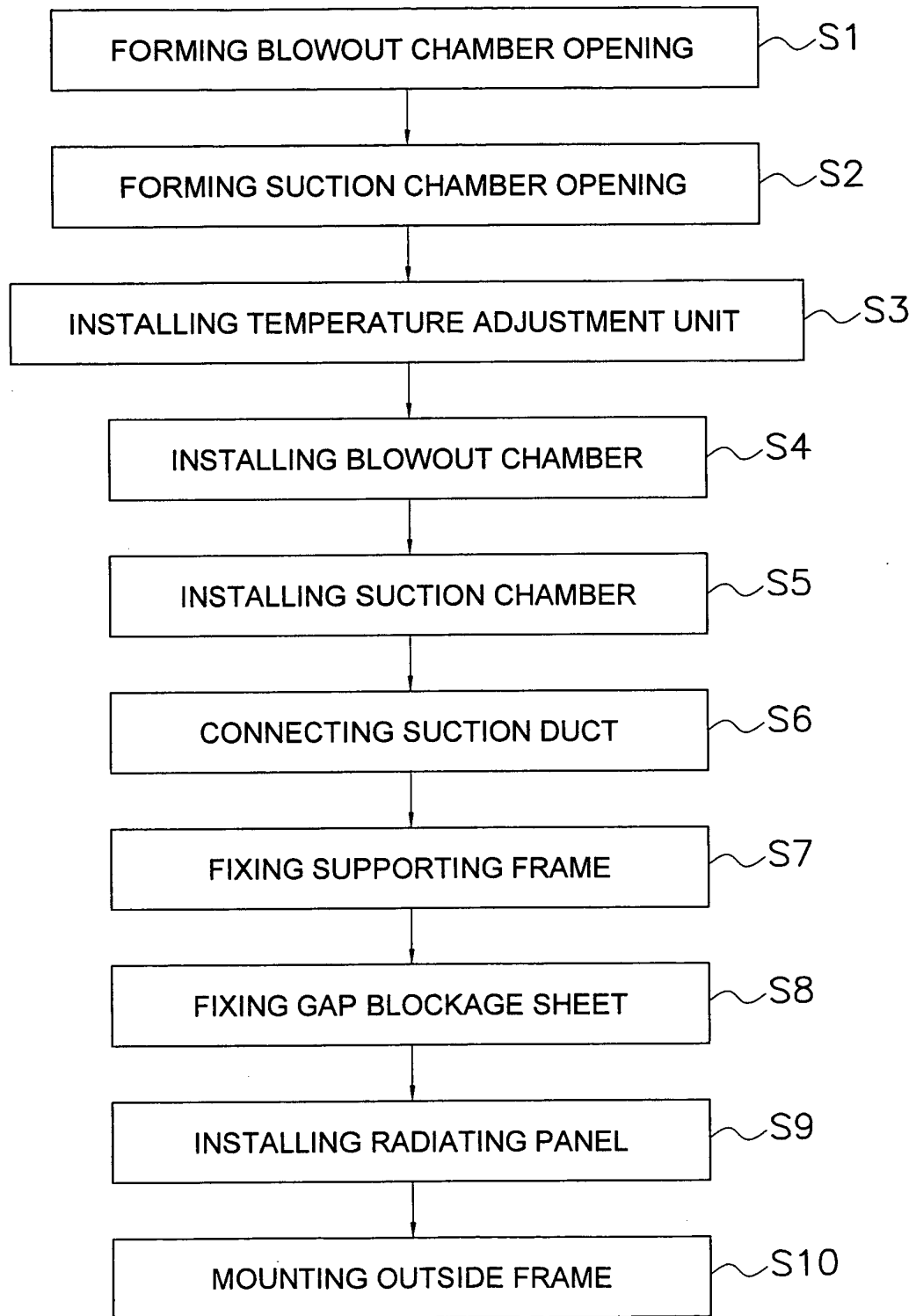


*Fig. 3*

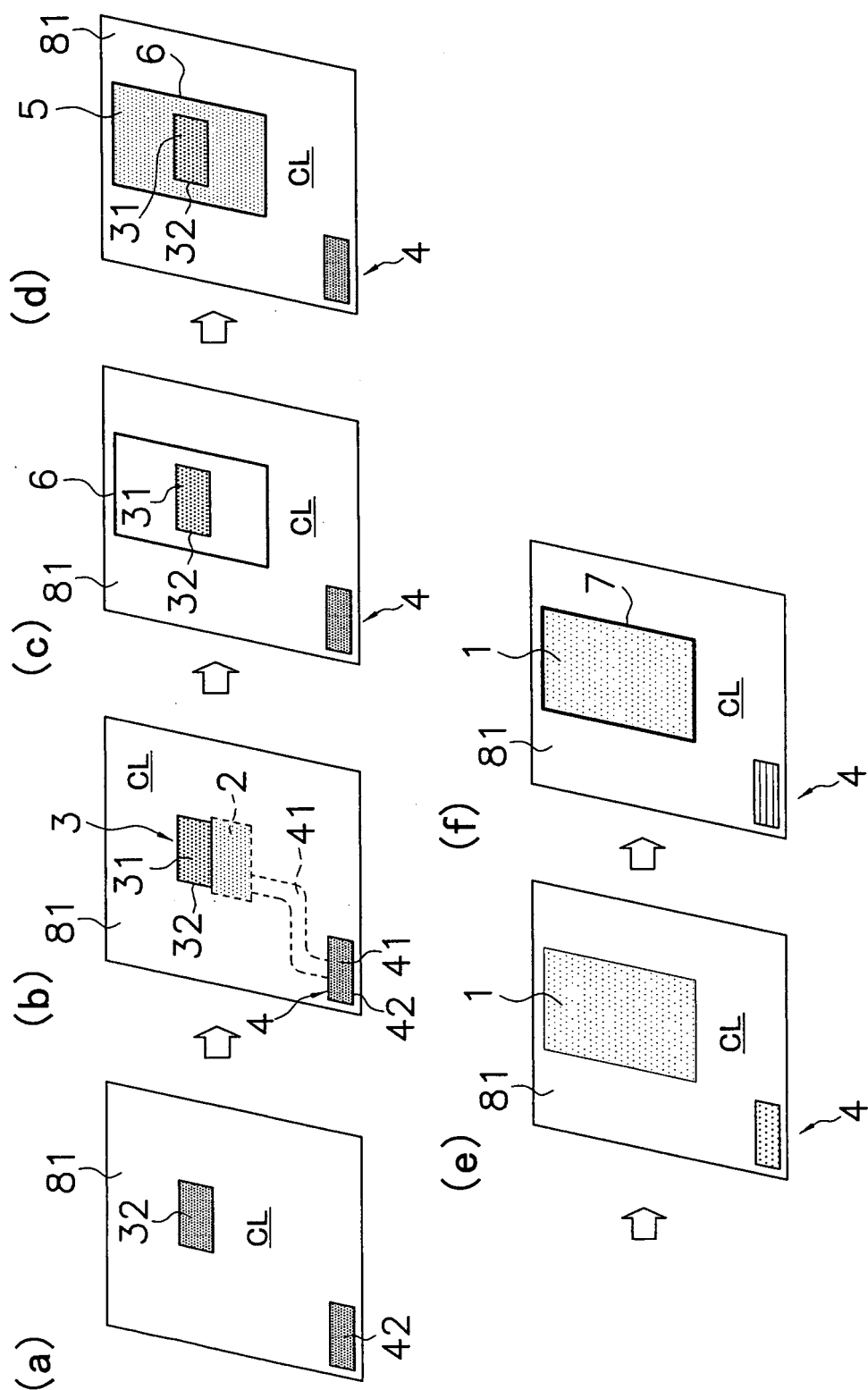


Fig. 4

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2006/307702

## A. CLASSIFICATION OF SUBJECT MATTER

F24F1/00(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)

F24F1/00

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 1996-2006

Kokai Jitsuyo Shinan Koho 1971-2006 Toroku Jitsuyo Shinan Koho 1994-2006

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. |
|-----------|----------------------------------------------------------------------------------------------------------------|-----------------------|
| A         | JP 2004-271057 A (Daikin Industries, Ltd.),<br>30 September, 2004 (30.09.04),<br>Full text<br>(Family: none)   | 1-9                   |
| A         | JP 6-11154 A (Matsushita Electric Works, Ltd.),<br>21 January, 1994 (21.01.94),<br>Full text<br>(Family: none) | 1-9                   |



Further documents are listed in the continuation of Box C.



See patent family annex.

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"&amp;" document member of the same patent family

Date of the actual completion of the international search

18 July, 2006 (18.07.06)

Date of mailing of the international search report

25 July, 2006 (25.07.06)

Name and mailing address of the ISA/

Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.

**REFERENCES CITED IN THE DESCRIPTION**

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**Patent documents cited in the description**

- JP 2004271057 A [0002]