

SPECIFICATION

Title: AIR CONDITIONER AND RADIATION AIR CONDITIONER USING SAME

5 Technical Field

[0001] The present disclosure relates to an air conditioner and a radiation air conditioner using the same.

Background Art

10 [0002] As an air conditioner for comfortably maintaining an environment in an indoor space, a convection method has heretofore been generally used. This is a method in which air-conditioned air adjusted in temperature and humidity is blown into a room and air conditioning is performed by convection.

15 However, the convection method is easy to make people feel dissatisfied in terms of comfort.

20 One of the causes is that when air is convected, an upper and lower temperature distribution difference occurs in the indoor space, warm air tends to go to the ceiling side, and cold air tends to stay on the floor. It becomes a state of the opposite of the head cool and foot warm good in health and making people feel comfortable, thus inevitably making them feel uncomfortable.

25 As another cause of making people feel dissatisfactory, a phenomenon called a so-called draft in which the convected airflow directly hits the human body occurs. For example, in an air-conditioned room, it is said that the sensible temperature drops by 3°C at a wind speed of 0.5m. For this reason, if one enters an air-conditioned room from the outdoors under the scorching sun, one will feel comfortable at first, but after the body gets cold, it will feel cold on the contrary.

 Further, there are many people who feel uncomfortable that the airflow continues to hit the body directly.

30 [0003] An air conditioner of a radiation type improves the above-mentioned inconvenience of the convection type air conditioner in that the airflow is not directly

applied to the body.

As an example of such a radiation type air conditioner, Patent Document 1 discloses an air conditioner (called a "radiation air conditioning system" in Patent Document 1) in which an air conditioner and a radiation panel are attached to a ceiling surface.

The radiation panel has a structure in which an air passage is formed between a radiation panel having moisture permeability and a heat insulating panel, which face each other, and the inlet of the air passage faces a blow-out port of the air conditioner (refer to Paragraphs [0025] to [0029], FIGS. 1 to 11 in Patent Document 1). The air-conditioned air blown out from the blow-out port of the air conditioner is introduced into the air passage and circulates in the air passage. The temperature of the radiation panel is controlled by this, and hence radiant heating and cooling are performed.

Prior Art Document

Patent Document

[0004] Patent Document 1: Japanese Unexamined Patent Application

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Summary

Problem to be Solved

[0005] Patent Document 1 illustrates a thin type air conditioner low in height in the vertical direction (refer to FIGS. 1 to 5 of Document 1). Regarding this air conditioner, Patent Document 1 describes that "air in an indoor space 1 is taken in and cooled or heated by endothermy or heat-radiating action accompanying a phase change of heat medium fluid, and the cooled or heated air is blown out from an air-conditioned air blow-out port 211a" (refer to Paragraph [0027] of Document 1). On the other hand, there is no explanation about an internal structure of the air conditioner, and the details thereof are unknown.

[0006] A cross flow fan is widely used as a blower source for an air conditioner.

The cross flow fan is suitable for use as the blower source for the air conditioner because it can evenly blow out air-conditioned air even from a blow-out port wide in width, and is also low in operating sound.

5 [0007] Therefore, it is assumed that the cross flow fan is also used for the air conditioner described in Patent Document 1.

[0008] However, in order for the cross flow fan to perform a normal blowing operation, an air flow passage (hereinafter also referred to as an “in-machine flow passage”) in the air conditioner from the air intake port to the blow-out port must be bent. For this reason, a relatively wide space for arranging the in-machine flow
10 passage is required, and restrictions on the layout of the air intake port and the blow-out port also occur.

[0009] When the cross flow fan is used for the thin type air conditioner described in Patent Document 1, considerations should be taken about how to ensure a space for the in-machine flow passage and lay out the in-machine flow passage
15 within the housing of the air conditioner in which it is difficult to obtain a sufficient height dimension in the vertical direction. In other words, how to reduce the height dimension of the air conditioner while using the cross flow fan as the blower source becomes a problem.

[0010] An object of the present disclosure is to reduce the height dimension of an
20 air conditioner using a cross flow fan as a blower source.

Means for Solving the Problem

[0011] An air conditioner of the present disclosure includes a housing having an air intake port and a blow-out port arranged on one surface and another surface
25 opposite thereto which cross a horizontal surface, respectively, a heat exchanger arranged between the air intake port and the blow-out port, a cross flow fan arranged on the blow-out port side of the heat exchanger, and a drive unit which drives a drive source of the cross flow fan so that a rotation direction of a region above a rotational axis takes a direction directed from the heat exchanger to the
30 blow-out port.

[0012] An air conditioner of the present disclosure includes a housing having an air intake port and a blow-out port arranged on one surface and another surface opposite thereto which cross a horizontal surface, respectively, a heat exchanger arranged between the air intake port and the blow-out port, a cross flow fan arranged on the blow-out port side of the heat exchanger, a drive unit which drives a drive source of the cross flow fan so that a rotation direction of a region above a rotational axis takes a direction directed from the heat exchanger to the blow-out port, and an air flow controller which generates an air flow toward the cross flow fan from obliquely below on the side of the air intake port and generates an air flow traveling obliquely downward from the cross flow fan on the side of the blow-out port.

[0013] A radiation air conditioner of the present disclosure includes the above air conditioner installed on a ceiling surface, a back panel attached to the ceiling surface adjacent to a blow-out port of the air conditioner, a permeable radiation panel having a horizontal projection area larger than a combined area of the air conditioner and the back panel, and a pair of side walls interposed between the back panel and the radiation panel along a direction in which air-conditioned air is blown out from the blow-out port.

Effect

[0014] According to the present disclosure, the height dimension of an air conditioner can be lowered even if a cross flow fan is used as a blower source.

Brief Description of Drawings

[0015] FIG. 1 is a schematic view showing one embodiment of a radiation air conditioner.

FIG. 2 is a perspective view of an air conditioner as viewed from below.

FIG. 3 is a back view of the air conditioner.

FIG. 4 is a front view of the air conditioner.

FIG. 5 is a plan view of the air conditioner.

FIG. 6 is a right side view of the air conditioner.

FIG. 7 is a perspective view showing a rail further enlarged from obliquely above.

5 FIG. 8 is a perspective view showing the rail and magnets attached to the air conditioner enlarged from obliquely below.

FIG. 9 is a schematic view showing an internal structure of the air conditioner.

FIG. 10 is a front view of a heat exchanger.

10 FIG. 11 is a perspective view showing a panel substrate from the direction of the bottom surface thereof.

FIG. 12 is a plan view of a frame body of a radiation panel.

FIG. 13 is an exploded perspective view of the radiation panel.

FIG. 14 is a plan view of the radiation panel.

15 FIG. 15(a) is a schematic view showing a radiation panel unit in a cross section in a width direction, and FIG. 15(b) is a schematic view showing the radiation air conditioner in a cross section in a flow direction of air-conditioned air.

20 FIG. 16(a) is a perspective view showing a slider and a suction plate attached to the frame body of the radiation panel in an enlarged form, and FIG. 16(b) is a perspective view showing a connecting pin attached to a second frame body in an enlarged form.

FIG. 17 is a perspective view showing the slider in a larger scale.

FIG. 18 is a perspective view of a state in which the air conditioner is installed at a place where the air conditioner is installed, as viewed from below.

25 FIG. 19 is a perspective view of a state in which the air conditioner and the panel substrate are installed, as viewed from below.

FIG. 20 is a perspective view of a state in which the radiation panel is temporarily fixed to the air conditioner, as viewed from below.

FIG. 21 is a schematic view of a state in which the radiation panel is temporarily fixed to the air conditioner, as viewed from the side.

30 FIG. 22 is a schematic view showing a positional relationship between the

rail and the slider in an enlarged manner.

FIG. 23 is a schematic view of a state in which a second panel is rotated to be horizontal, as viewed from the side.

FIG. 24 is a schematic view showing a positional relationship between the
5 rail and the slider in an enlarged manner.

FIG. 25 is a schematic view of a state in which the second panel is moved horizontally and finally fixed, as viewed from the side.

FIG. 26 is a schematic view showing a positional relationship between the
rain and the slider in an enlarged manner.

FIG. 27 is a schematic view of a state in which a first panel is rotated and
10 held by a panel holding part, as viewed from the side.

FIG. 28 is a schematic view showing a positional relationship between the
rail and the slider in an enlarged manner.

FIG. 29 is a perspective view of a state in which the radiation panel is fixed
15 to the panel substrate, as viewed from below.

FIG. 30 is a perspective view of a state in which the first panel is set and
the installation of the radiation air conditioner is completed, as viewed from below.

FIG. 31 shows a modified example of the panel substrate, in which FIG.
31 (a) is a front view, FIG. 31 (b) is a bottom view, and FIG. 31 (c) is a bottom view
20 when different planar shapes are adopted.

FIG. 32 is a front view showing another modified example of the panel
substrate.

FIGS. 33 (a) through (d) are schematic views illustrating variations in
sliding fastener positions on a cloth cover.

FIG. 34 is a front view showing another configuration example of a
25 radiation air conditioner.

Description of Embodiments

[0016] An embodiment will be described with reference to the drawings.

30 This will be described according to the following items.

- [0017] 1. Radiation air conditioner
- (1) Air conditioner
 - (a) Appearance
 - (b) Internal structure
 - (Rotation direction of cross flow fan)
 - (Shape of in-machine flow passage and arrangement of cross flow fan)
 - (2) Radiation panel unit
 - (a) Panel substrate
 - (b) Radiation panel
 - (c) Attachment/detachment structure of radiation panel to panel substrate
 - (temporary fixing structure of radiation panel)
 - (Final fixing structure of radiation panel)
- 5
- 10
- 15
- [0018] 2. Installation procedure
- (1) Installation of air conditioner
 - (2) Attachment of panel substrate
 - (3) Attachment of radiation panel
 - (a) Temporary fixing
 - (b) Rotation of second panel
 - (c) Final fixing
 - (d) Holding of first panel
 - (4) Removal of radiation panel
 - (a) Release of holding of first panel
 - (b) Release of connection of connector
 - (c) Rotation of second panel
 - (d) Dropping out
- 20
- 25
- 30 [0019] 3. Function and effect

- (1) Prevention of dew condensation
 - (a) Cause of dew condensation
 - (b) Radiation air conditioner of the present embodiment
 - (c) Principle of dew condensation prevention
- 5 (2) Thinning of air conditioner
 - (a) Cross flow fan
 - (b) Heat Exchanger
- (3) Heat exchanger
- (4) Expansion in heat radiation area
- 10 (a) Expansion in width direction
- (b) Expansion to region overlapping with air conditioner
- (5) Prevention of shortcut phenomenon
- (6) Function and effect brought about by shape and structure of sheet
 - (a) Expansion in heat radiation area
 - 15 (b) Simplification of manufacturing
 - (c) Elimination of disadvantages
- (7) Facilitation of attachment/detachment work of radiation panel
- (8) Degree of freedom in selecting sheet material
- (9) Suppression of sheet deformation
- 20 (10) Thermal efficiency
- (11) Appearance features
 - (a) Aesthetic
 - (b) Good function and beauty
- [0020] 4. Variations
- 25 (1) Installation location of radiation air conditioner
- (2) Installation state of radiation air conditioner
- (3) Arrangement of air conditioner and back panel
- (4) Structure of radiation panel
- (5) Fixing structure of radiation panel
- 30 (a) Slider mounting position

(b) Another fixing structure

(c) First panel

(6) Form of radiation panel

(7) Side wall

5 (8) Discharge port

(9) Variation of sliding fastener position of sheet

(10) Another configuration example of radiation air conditioner

(11) Others

[0021] 1. Radiation air conditioner

10 As shown in FIG. 1, the radiation air conditioner 11 of the present embodiment includes an air conditioner 51 and a radiation panel unit 101 both installed on a ceiling surface C. The radiation air conditioner 11 is arranged close to a wall surface W provided on one surface of a room R.

[0022] In the present embodiment, the directions of the air conditioner 51 and the
15 radiation panel unit 101 are defined as follows. First, assume a horizontal surface. This horizontal surface is not a horizontal surface that can exist as a tangible object, but an abstract and ideological virtual horizontal surface.

[0023] One surface and another surface on the opposite side of the one surface
crossing such a horizontal surface are respectively defined as the back surface
20 and the front surface of the air conditioner 51. The back surface is a surface on which each air intake port 52 to be described later is arranged (refer to FIGS. 1 and 3). The front surface is a surface on which a blow-out port 55 to be described later is arranged (refer to FIGS. 1 and 4).

When the air conditioner 51 is viewed from the front side, the surface
25 intersecting the horizontal surface is the side surface. The side surface on the right side is the right side surface, and the side surface on the left side is the left side surface.

In regard to the upper and lower surfaces of the air conditioner 51, the
upper side surface in the vertical direction is the upper surface, and the lower side
30 surface in the vertical direction is the lower surface.

When the air conditioner 51 is viewed from the front side, the direction connecting both side surfaces is defined as a lateral width direction (width direction), the direction connecting the front surface and the back surface is defined as a depth direction, and the direction connecting the upper surface and the lower surface is defined as a height direction. The front side is also called the foreside, and the back side is also called the deepside.

[0024] As shown in FIG. 1, the radiation panel unit 101 is arranged at a position adjacent to the front of the air conditioner 51. When such an arrangement relationship is maintained, the respective surfaces (ends) and directions of the radiation panel unit 101 are also defined as with the above-mentioned surfaces and directions described for the air conditioner 51. The surfaces (ends) and directions of the radiation panel unit 101 defined in this way are uniquely defined. Even if the arrangement relationship of the radiation panel unit 101 adjacent to the air conditioner 51, which is shown in FIG. 1 is broken, it does not change.

In regard to the point of conforming to the air conditioner 51, a housing 51a of the air conditioner 51, and a panel substrate 111 (back panel 112, side wall 113) and a radiation panel 131 (frame body 132, cloth cover 141) constituting a radiation panel unit 101, which will be described later, are also similar to the radiation panel unit 101. That is, when the radiation panel unit 101 is in the state of FIG. 1 of being adjacent to the front surface of the air conditioner 51, the surfaces (ends) and directions of the respective parts described above are also defined in the same manner as the above surfaces and directions described for the air conditioner 51. The surfaces (ends) and directions of the respective parts described above defined in this way are uniquely defined. Even if the arrangement relationship shown in FIG. 1 in which the radiation panel unit 101 is adjacent to the air conditioner 51 is broken, it does not change.

[0025] (1) Air conditioner

A ceiling surface C is a folded and raised ceiling and has a recess C1 (refer also to FIGS. 18 and 19). The air conditioner 51 is attached, for example, by hanging bolts so as to fit into the recess C1 (refer to FIG. 18).

As shown in FIG. 1, the air conditioner 51 takes in the air in the room R from each air intake port 52 provided at the back surface, brings it into contact with a heat exchanger 53, and then blows out it as air-conditioned air from the blow-out port 55 by a cross flow fan 54. Filters 56 are detachably attached to the air intake port 52.

[0026] (a) Appearance

As shown in FIGS. 2 through 6, the housing 51a of the air conditioner 51 has a thin shape in which the dimensions decrease in the order of a lateral width, a depth, and a height.

[0027] As shown in FIG. 3, the air intake port 52 arranged at the back surface of the housing 51a has three regions having a horizontally long rectangular shape, which are arranged in parallel in the horizontal direction. The individual air intake ports 52 are opened in each region to connect the space on the room R side to the internal space of the housing 51a.

The filters 56 are attached to each of the three regions of the air intake port 52. These filters 56 are attached to the housing 51a so that they can be freely inserted and removed by working from the lower surface side. The housing 51a is provided in the region on the back surface side with a structure which enables mounting of each filter 56 that pushes in from downward to upward and dropping out of the filter 56 that pulls out from upward to downward. This structure includes a structure that guides the filter 56 in the vertical direction and a structure that holds the filter 56 at a position to close the air intake port 52.

The three regions forming the air intake port 52 are arranged close to the right side surface of the housing 51a (refer to FIGS. 2 and 5). Therefore, when viewed from the back side, these three regions are biased to the left side.

[0028] As shown in FIG. 4, the blow-out port 55 arranged in front of the housing 51a has three horizontally elongated rectangular regions arranged in parallel in the horizontal direction. These three regions are aligned with the three regions forming the air intake port 52 and arranged close to the right side in the lateral width direction of the housing 51a (refer to FIGS. 2 and 5).

[0029] The number of three spots taken as the blow-out port 55 and the right-aligned arrangement of the blow-out port 55 are only one form. Upon implementation, they are not limited to this, and the blow-out port 55 may not be divided into a plurality of regions, or may be divided into two regions or four or more regions. The blow-out port 55 may be arranged closer to the left side surface of the housing 51a, or may be arranged in the center thereof. It is not essential either that the air intake port 52 and the blow-out port 55 are arranged close to the same side surface of the housing 51a. It is possible to perform various changes such as for example, the air intake port 52 being arranged left-aligned and the blow-out port 55 being arranged right-aligned or centrally.

[0030] As shown in FIGS. 2 and 4 to 6, the blow-out port 55 is provided at the tip of a hood 61 having a shape protruding from the front of the housing 51a. The three regions of the blow-out port 55 are partitioned by partition plates 62 provided vertically in the hood 61. When the blow-out port 55 is not divided into a plurality of regions, the partition plates 62 are unnecessary.

The root of the upper surface of the hood 61 that communicates with the front surface of the housing 51a is defined as an inclined surface 63. Such an inclined shape is the same not only on the outer surface of the hood 61 but also on the inner surface (refer to FIG. 9), and an inclined inner surface 64 which is inclined is provided at the upper surface in the hood 61 corresponding to the inclined surface 63.

The air conditioner 51 installed so as to fit into the recess C1 of the ceiling surface C projects the hood 61 more to the panel substrate 111 than an edge E forming a boundary between the ceiling surface C and the recess C1. The inclined shape of the inclined surface 63 of the hood 61 contributes to smooth connection with the panel substrate 111 to be described later.

The inclined shape of the inclined inner surface 64 of the hood 61 contributes to ensuring the normal operation of the cross flow fan 54 to be described later.

These contributions of the inclined surface 63 and the inclined inner

surface 64 will be described later.

[0031] As shown in FIGS. 2 through 6 and 8, rails 57 are attached to both side surfaces of the housing 51a of the air conditioner 51. The mounting positions of the pair of these rails 57 are relatively lower positions on the rear side of the housing 51a.

As shown in FIG. 7, the rail 57 extends along the arrangement direction (depth direction) of the air conditioner 51 and the panel substrate 111 and has a step 57a. The step 57a is low in height on the panel substrate 111 side and high in height on the air conditioner 51 side.

The pair of left and right rails 57 are used for attaching the radiation panel unit 101 to the radiation air conditioner 11. Details thereof will be described later.

[0032] As shown in FIGS. 3, 5 to 6, and 8, a pair of magnets MG are provided on both ends of the back surface of the housing 51a of the air conditioner 51.

As shown in FIG. 8, the housing 51a has a magnet holder 71 protruding from the back surface. The magnet MG is attached to the lower surface of the magnet holder 71.

The pair of left and right magnets MG are used for attaching the radiation panel unit 101 to the radiation air conditioner 11. Details thereof will be described later.

[0033] (b) Internal Structure

Referring to FIG. 9, it is understood that the air intake port 52 provided on the back side of the housing 51a and the blow-out port 55 provided on the front side thereof are arranged on one surface and another surface opposite thereto, which cross the horizontal surface, respectively.

In the housing 51a, the heat exchanger 53 is arranged between the air intake port 52 and the blow-out port 55, and the cross flow fan 54 is arranged on the blow-out port 55 side of the heat exchanger 53. The air intake port 52, the heat exchanger 53, the cross flow fan 54, and the blow-out port 55 are provided on a straight line in the depth direction.

The cross flow fan 54 rotates about a rotational axis A. Inside such a

housing 51a, there is provided an air flow passage (hereinafter also called an “in-machine flow passage 81”) of taking in the air in the room R through the air intake port 52 by the rotation of the cross flow fan 54, and bringing the taken-in air into contact with the heat exchanger 53 to blow out the air from the blow-out port 55.

5 [0034] The cross flow fan 54 does not perform a desired operation, that is, an operation of sucking air from the air intake port 52 and discharging it to the blow-out port 55 if it is simply placed in the in-machine flow passage 81. In order to generate an air flow in this direction (refer to arrows in FIG. 9), the following conditions must be met:

- 10 - The in-machine flow passage 81 is bent,
- The cross flow fan 54 is arranged at a predetermined position in the in-machine flow passage, 81, and
- The cross flow fan 54 is rotated in a direction matching the shape of the in-machine flow passage 81.

15 Therefore, in the present embodiment, there are provided a structure in which the cross flow fan 54 is rotated in a predetermined direction, and an air flow controller 82 that generates an air flow from the air intake port 52 to the blow-out port 55 by the rotation of the cross flow fan 54.

This will be described in detail.

20 [0035] (Rotation direction of cross flow fan)

As shown in FIGS. 2 through 5, in the housing 51a of the air conditioner 51, the air intake port 52 and the blow-out port 55 are arranged close to the right side. Consequently, on the left side of the housing 51a, a space connecting the air intake port 52 and the blow-out port 55, which is not related to the flow of air is
25 created. The air conditioner 51 arranges an electric structure in this space.

As shown in FIG. 9, the electrical structure is a drive unit DR and a control unit CR which drive a motor M being a drive source of the cross flow fan 54. The control unit CR controls all operations of the air conditioner 51, including the operation of the drive unit DR.

30 The drive unit DR controlled by the control unit CR drives the cross flow

fan 54 so as to rotate in the clockwise direction in FIG. 9. The clockwise direction of FIG. 9 is a direction in which the rotation direction of the upper half of the cross flow fan 54, that is, the region above the rotational axis A is directed from the heat exchanger 53 to the blow-out port 55.

5 [0036] (Shape of in-machine flow passage and arrangement of cross flow fan)

As shown in FIG. 10, in the heat exchanger 53, a refrigerant pipe 53b is penetrated through a plurality of aluminum plates 53a arranged in the vertical direction. The heat exchanger 53 has a mechanism to thermally conduct the temperature of a refrigerant to the aluminum plates 53a by passing the refrigerant
10 through the inside of the refrigerant pipe 53b, and regulate the temperature of the air passing through slits 53c formed between the individual aluminum plates 53a.

The heat exchanger 53 of the present embodiment takes three layers. That is, three single-layer heat exchangers 53 forming a unit are directly arranged.

Further, the three-layer heat exchangers 53 are fixed in the housing 51a in
15 an inclined state. The inclination direction of each heat exchanger is a direction in which the surface on the side of the cross flow fan 54 is directed downward.

[0037] As shown in FIG. 9, the air passing through the slits 53c of the heat exchanger 53 travels in the direction orthogonal to the surface of the heat exchanger 53. Consequently, an air flow that goes obliquely downward from the
20 heat exchanger 53 is generated.

The air flow controller 82 causes the air orthogonal to the surface of the heat exchanger 53 and traveling downward to be along the bottom surface of the housing 51a, and the air flowing along the bottom surface to be sucked up by the cross flow fan 54. The sucked air goes toward the cross flow fan 54 from obliquely
25 below.

In order to generate such flow of air, the air conditioner 51 is provided with two sheets of air flow control plates 83 around the cross flow fan 54, which changes the traveling direction of air traveling obliquely downward from the heat exchanger 53 obliquely upward to convert the air into an air flow that goes to the cross flow
30 fan 54 from obliquely below. The two sheets of air flow control plates 83 are

arranged so as to sandwich the cross flow fan 54 from the vertical direction while keeping a small gap so that the air flow from obliquely downward is introduced into the inside of the cross flow fan 54.

5 The air flow controller 82 connects between the cross flow fan 54 and the blow-out port 55 by a hollow member which forms a space inclined downward from the cross flow fan 54 toward the blow-out port 55. The two sheets of upper and lower air flow control plates 83 and the hood 61 are used as the hollow member.

10 The two sheets of upper and lower air flow control plates 83 have a shape in which the in-machine flow passage 81 closer to the blow-out port 55 side than the cross flow fan 54 is inclined obliquely downward. Thus, the in-machine flow passage 81 generates an air flow traveling obliquely downward from the cross flow fan 54 at the blow-out port 55.

15 More specifically, the in-machine flow passage 81 bends the air introduced from the heat exchanger 53 into the cross flow fan 54 by 90° and guides the same to the blow-out port 55. Consequently, the operation of the cross flow fan 54 in which air is sucked from the air intake port 52 and discharged to the blow-out port 55, is normally executed.

20 The inclined inner surface 64 of the hood 61 described above has a shape inclined obliquely downward. The inclined inner surface 64 having such a shape forms a part of the in-machine flow passage 81 closer to the blow-out port 55 side than the cross flow fan 54, and contributes to ensuring the normal operation of the cross flow fan 54.

[0038] (2) Radiation panel unit

25 The radiation panel unit 101 is comprised of the panel substrate 111 and the radiation panel 131.

[0039] (a) Panel substrate

30 As shown in FIG. 11, the panel substrate 111 is a heat insulating member having a shape in which a pair of side walls 113 are raised from both sides of a flat plate-shaped back panel 112 which is rectangular in shape. For example, expanded polystyrene (EPS), resin, gypsum, urethane, glass wool, rock wool, etc.

can be used as the material of the panel substrate 111.

5 The pair of side walls 113 are raised from both ends of the back panel 112 in the long side direction (width direction) thereof, that is, both side ends, and slightly wrap around in the width direction along the long side. In view of such a shape, three surfaces of a region on one end side and a region on the other end side of the pair of side walls 113, and a region facing the back panel 112 are open.

For convenience of description, the region on one end side of the pair of side walls 113 is referred to as an introduction port 114, the region on the other end side is referred to as a discharge port 115, and the region facing the back panel 112 is referred to as a facing region 116. The facing region 116 is a region in a plane including the upper end surfaces of the pair of side walls 113.

Thus, the panel substrate 111 uses the back panel 112 as a substrate and has each side wall 113 as a wall which rises from the back panel 112 in an enclosed shape. The introduction port 114 and the discharge port 115 are provided between the pair of side walls.

15 [0040] The introduction port 114 of the panel substrate 111 has a shape inclined toward the end edge thereof communicating with the blow-out port 55 of the air conditioner 51. This shape is compatible with the inclined surface 63 of the hood 61 provided with the blow-out port 55 at the tip thereof.

20 [0041] The panel substrate 111 having such a structure is attached to the ceiling surface C by aligning the position of the edge E forming the boundary between the ceiling surface C and the recess C1 with the position of the end edge forming the introduction port 114. Consequently, the inclined surface 63 of the hood 61 included in the air conditioner 51 is aligned with the introduction port 114 of the panel substrate 111, and hence the blow-out port 55 and the introduction port 114 are connected (refer to FIG. 19).

25 A means for attaching the panel substrate 111 to the ceiling surface C may be of any type. For example, there can be adopted means such as screwing, a hook-and-loop fastener, an adhesive tape, and adhesion, and an attachment means such as hanging bolts can also be adopted depending on the structure of

30

the ceiling surface C.

[0042] The panel substrate 111 is provided with a pair of stoppers 117 which is located at the discharge port 115. With this, the discharge port 115 is dispersed into three locations: one on the center side wide in width and two on both sides narrow in width. These stoppers 117 are comprised of stopper metal fittings 119 fixed to the back panel 112.

The stopper metal fittings 119 function as connecting tools and are provided with connecting grooves 119a.

[0043] Such a panel substrate 111 is integrally formed by, for example, EPS. Accordingly, the whole functions as a heat insulating material.

[0044] (b) Radiation panel

As shown in FIGS. 12 through 14, the radiation panel 131 is formed by covering the rectangular-shaped frame body 132 with the cloth cover 141 which is a bag-shaped cloth.

[0045] The frame body 132 is constituted by connecting a plurality of rod-shaped members 133 and forming the same into a rectangular shape having ribs for reinforcement and rotation prevention. The rod-shaped member 133 uses a part thereof as an outer frame member 133a assembled in a rectangular shape that determines the outer shape of the frame body 132, and the other part is used as a reinforcing member 133b for reinforcing the outer frame. As an example, a prismatic aluminum pipe having a hollow structure is used for the rod-shaped member 133, and the frame body 132 is formed by connecting these with resin-made connectors or screwing them.

As another example, the rod-shaped member 133 may be formed of a resin or may be formed of carbon.

Such a frame body 132 includes a first frame body 134 and a second frame body 135.

The first frame body 134 is arranged in a region facing the air conditioner 51. The width of the first frame body 134 is set wider than that of the air conditioner 51.

The second frame body 135 is larger both in width direction and depth direction than the panel substrate 111. The rear end thereof in the depth direction has a length at which it reaches the rear of the lower surface of the air conditioner 51 in the depth direction.

5 The first frame body 134 is connected to the rear end of the second frame body 135 by a hinge 136 and is rotatable with respect to the second frame body 135 (refer to FIGS. 12 through 13 and 16). The first frame body 134 has a size to completely cover the air conditioner 51 together with the rear end of the second frame body 135 in the depth direction.

10 [0046] As shown in FIGS. 13 and 14, the cloth cover 141 has a bag shape like a duvet cover. The cloth cover has a shape whose four sides are closed and having an open edge 142 which can be opened on three sides. A sliding fastener 143 is attached to the open edge 142, and the sliding fastener 143 allows the open edge to be opened and closed. By opening the open edge 142,
15 the frame body 132 can be stored. The open edge 142 is positioned slightly inside the end of the cloth cover 141.

Such a cloth cover 141 is formed using a cloth, i.e., fiber as a material, and has permeability and stretchability.

20 The cloth cover 141 is formed so that its width direction and depth direction are slightly smaller than those of the frame body 132. When the frame body 132 is stored, the cloth cover 141 maintains a stretched state.

25 The shape of the cloth cover 141, which is called the bag shape, can also be regarded as an endless shape when viewed as a shape that wraps the width direction of the frame body 132. This is because if the endless shape with both ends open are closed at both ends, the shape becomes a bag shape.

30 [0047] The cloth cover 141 having the bag shape has a sewn structure of a fiber material on the front surface side exposed on the room R side and a fiber material on the back surface side facing a flow passage 151. For convenience of description, the fiber material on the front surface side is referred to as a front surface fiber 141A (refer also to FIGS. 29 and 30), and the fiber material on the

back surface side is referred to as a back surface fiber 141B.

5 The front surface fiber 141A is exposed to the room R side when the radiation panel 131 is installed, and determines the appearance mode of the radiation air conditioner 11. To this end, when selecting the material for the front surface fiber 141A, an aesthetic point of view is emphasized.

10 The material for the back surface fiber 141B is selected from the viewpoint of not giving resistance to the air flow as much as possible when the air flow blown out from the blow-out port 55 of the air conditioner 51 is guided to the back side of the front surface fiber 141A. From this point of view, in the present embodiment, a mesh cloth, that is, the fiber of the mesh material is used as the back surface fiber 141B.

15 As shown in FIGS. 13 and 14, the front surface fiber 141A wraps around to the back surface facing the back panel 112, and is sewn with the back surface fiber 141B on the back surface side. The cloth cover 141 positions the sewn portion SP so as to be aligned with the pair of side walls 113 when the radiation panel 131 is attached to the panel substrate 111.

[0048] The radiation panel 131 in which the frame body 132 is covered by the cloth cover 141 is rotatable even when the cloth cover 141 is in a covered state because the first frame body 134 and the second frame body 135 are rotatable about an axis passing through the hinge 136. Therefore, for convenience of description, the portion of the radiation panel 131 in which the cloth cover 141 covers the first frame body 134 is referred to as a first panel 131A, and the portion in which the cloth cover 141 covers the second frame body 135 is referred to as a second panel 131B.

25 The first panel 131A bears a region facing a part of the air conditioner 51.

The second panel 131B bears a region facing the remaining part of the air conditioner 51 and the entire surface of the panel substrate 111.

30 [0049] As shown in FIG. 1, the radiation panel 131 is positioned and fixed to the facing region 116 of the panel substrate 111. Consequently, a space from the introduction port 114 to the discharge port 115 is defined, and this becomes the

flow passage 151 for the air-conditioned air.

As schematically shown in FIG. 15(a), the radiation panel 131 in which the frame body 132 is being covered by the cloth cover 141 forms a hollow shape having one surface made of the front surface fiber 141A and the opposite surface made of the back surface fiber 141B. Since the back surface fiber 141B of the cloth cover 141 is a mesh cloth, the radiation panel 131 creates a state equivalent to having an opening portion O on the back surface side. Therefore, the air-conditioned air flowing through the flow passage 151 freely enters the inside of the radiation panel 131 from the back surface fiber 141B and comes into contact with the inside of the front surface fiber 141A. Therefore, the front surface fiber 141A having permeability from the beginning functions as a radiation surface RS.

[0050] As described above, the frame body 132 of the radiation panel 131 is larger in projection area than the air conditioner 51 and the panel substrate 111. More specifically, the width of the first frame body 134 is set wider than that of the air conditioner 51, and the width and depth of the second frame body 135 are set larger than in the width direction and the depth direction of the panel substrate 111. Accordingly, the radiation panel 131 has a horizontal projection area larger than the combined area of the air conditioner 51 and the panel substrate 111.

As schematically shown in FIG. 15(a), since the radiation panel 131 is hollow by the cloth cover 141 covering the frame body 132, the radiation surface RS on the side of the front surface fiber 141A is wider than the width of the back panel 112 from the above dimensional relationship.

On the other hand, the opening portion O is narrower than the width of the back panel 112, which matches facing spacing between the pair of side walls 113. In other words, the pair of side walls 113 are interposed between the back panel 112 and the radiation panel 131 along the direction in which the air-conditioned air is blown out from the blow-out port 55 of the air conditioner 51, and are inserted therebetween and opposed to each other without coming out from the opening portion O. Thus, the flow passage 151 for the air-conditioned air has a width defined by the pair of side walls 113 and is communicated to the internal space of

the radiation panel 131 without leaking the air-conditioned air from the opening portion O to the outside.

[0051] As schematically shown in FIG. 15 (b), each rod-shaped member 133 of the frame body 132 is positioned in the internal space of the radiation panel 131.

5 Of these rod-shaped members 133, the outer frame member 133a of the first frame body 134 and the outer frame member 133a of the second frame body 135 are positioned directly below the heat exchanger 53 built in the air conditioner 51 as viewed in the vertical direction. The housing 51a of the air conditioner 51 has a lower surface defined as a flat surface to bring the frame body 132 into close
10 contact therewith via the cloth cover 141.

Of the first frame body 134 and the second frame body 135 that are in close contact with the lower surface of the housing 51a, the outer frame member 133a of the second frame body 135 connected to the first frame body 134 functions as a rod-shaped close contact member RM. The rod-shaped close contact
15 member RM is a part of the outer frame member 133a and is in close contact with the housing 51a of the air conditioner 51 via the cloth cover 141. The part to be in close contact with the housing is the lower surface of the housing 51a. The structure for bringing the part of the outer frame member 133a which serves as the close contact member RM into close contact with the housing 51a will be described
20 later.

Such a close contact member RM divides the internal space of the radiation panel 131 and prevents the air-conditioned air from going around to the rear side (the side of the air intake port 52) of the air conditioner 51 from the heat exchanger 53.

25 [0052] (c) Attachment/detachment structure of radiation panel to panel substrate

As shown in FIGS. 12 through 14 and FIGS. 16 (a) and 16 (b), as structures for temporarily fastening and fixing the radiation panel 131, the frame body 132 is provided with a pair of sliders 137, a pair of connecting pins 138 as tools to be connected, and a pair of suction plates 139 as members to be sucked.

30 [0053] The pair of sliders 137 are parts for temporarily fixing the radiation panel

131 in cooperation with the pair of rails 57 described above.

The pair of connecting pins 138 are parts for finally fixing the radiation panel 131 in cooperation with the stoppers 117 described above.

5 The pair of suction plates 139 are parts for holding the first panel 131A of the radiation panel 131 in cooperation with the magnets MG to be described later. [0054] (Temporary fixing structure of radiation panel)

As shown in FIGS. 2 through 5, 7 and 8, 12 through 14, 16 (a) and 17, the temporary fixing structure of the radiation panel 131 is comprised of the pair of rails 57 and the pair of sliders 137.

10 Each of the pair of sliders 137 is fixed to the outer frame member 133a which forms the close contact member RM of the second frame body 135. Their fixed positions are positions near both ends of the outer frame member 133a.

The slider 137 fixes a round bar-shaped pin 137b to a sheet metal 137a for screw-fixing to the outer frame member 133a. The sheet metal 137a positions 15 the pin 137b at a position higher than the outer frame member 133a. The pins 137b are arranged along the width direction of the radiation panel 131, that is, the direction of the rotational axis of the first frame body 134 and the second frame body 135.

[0055] The facing interval between the pins 137b included in the pair of sliders 20 137 is set to be slightly wider than the lateral width size of the housing 51a of the air conditioner 51. Therefore, the pair of sliders 137 can be guided from above the pair of rails 57, and their pins 137b can be placed on the rails 57 (refer to FIGS. 20 and 21).

25 The pin 137b mounted on the rail 57 is slidably moved on the rail 57. The pin 137b gets over the step 57a and changes the height of the slider 137, in other words, the height of the radiation panel 131. When the slider 137 moves from the panel substrate 111 to the air conditioner 51, the radiation panel 131 is positioned at a higher position. When the slider 137 moves from the air conditioner 51 to the panel substrate 111, the radiation panel 131 is positioned at a lower position. The 30 radiation panel 131 positioned at the higher position brings the outer frame

member 133a of the second frame body 135, which is taken as the close contact member RM, into close contact with the housing 51a of the air conditioner 51 through the cloth cover 141.

5 [0056] As shown in FIGS. 2 through 5 and FIGS. 7 and 8, regulating pieces 57b are provided at both ends of the rail 57, respectively. These regulating pieces 57b prevent the pins 137b each slidably moving on the rail 57 from falling off.

[0057] (Final fixing structure of radiation panel)

10 As shown in FIGS. 11 through 14 and FIG. 16 (b), the final fixed structure of the radiation panel 131 is made of the pair of stoppers 117 and the pair of connecting pins 138.

The pair of connecting pins 138 are fixed to the second frame body 135. The fixed position thereof is at the pair of reinforcing members 133b connected to the outer frame member 133a on the side opposite to the side connected to the first frame body 134. Each connecting pin 138 in these reinforcing members 133b is attached at a relatively close position to the outer frame member 133a.

15

The pair of connecting pins 138 have the form of studs which fit into the connecting grooves 119a of the pair of left and right stoppers 117 provided on the panel substrate 111. The connecting groove 119a is located at the discharge port 115 of the radiation panel unit 101 and opened to the room R. Thus, the connecting pin 138 is fitted into the connecting groove 119a of the stopper 117 by the horizontal movement of the radiation panel 131 from the panel substrate 111 toward the air conditioner 51.

20

Therefore, the stopper 117 and the connecting pin 138 form a connector CN that is detachably connected according to the movement operation of the air conditioner 51 and the panel substrate 111 in the arrangement direction (depth direction) thereof.

25

[0058] (Holding structure of first panel)

As shown in FIGS. 1, 3, 5, 8, 12 through 14 and 16 (a), the holding structure of the first panel 131A is comprised of a pair of magnets MG (panel holding part) and a pair of suction plates 139 (members to be sucked).

30

The pair of suction plates 139 are fixed to the two reinforcing members 133b provided at the first frame body 134, respectively. The fixed position thereof is a position slightly lower than the pin 137b of the slider 137 in a state in which the first frame body 134 and the second frame body 135 are arranged in the same plane. These suction plates 139 horizontally position a flat plate-shaped suction surface 139a in a state in which the first frame body 134 stands horizontally.

As described above, the pair of magnets MG are provided at both ends of the back surface of the air conditioner 51 and are attached downward.

These magnets MG and suction plates 139 are positioned such that when the first panel 131A is raised horizontally with the radiation panel 131 finally fixed, the suction surfaces 139a of the suction plates 139 face the magnets MG and are sucked to the magnets MG by magnetic force.

[0059] (Ingenuity of cloth cover)

By providing the attachment/detachment structure of the radiation panel 131 to the panel substrate 111, unevenness occurs in the frame body 132 of the radiation panel 131. The occurrence thereof is at the locations of the slider 137, the connecting pin 138, and the suction plate 139.

If the cloth cover 141 has a structure in which the respective parts of these also cover the frame body 132 together, not only the work of attaching and detaching the cloth cover 141 to and from the frame body 132 becomes complicated, but also the functions of those respective parts cannot be normally exhibited.

Therefore, the cloth cover 141 is configured such that openings for exposure are made at the slider 137, the connecting pin 138, and the suction plate 139 to enable the respective parts of these to be exposed. The openings for exposure are not shown.

[0060] 2. Installation procedure

Description will be made about the installation procedure of the radiation air conditioner 11.

[0061] (1) Installation of air conditioner

First, as shown in FIG. 18, the air conditioner 51 is installed in the recess C1 provided in the ceiling surface C which serves as the folded and raised ceiling.

If there is provided the recess C1 in advance, this is used, whereas if the recess C1 is not provided, the ceiling surface C is constructed to create the recess C1.

[0062] (2) Attachment of panel substrate

As shown in FIG. 19, the panel substrate 111 is attached to the ceiling surface C.

The panel substrate 111 is aligned so that the introduction port 114 is positioned at the edge E forming the boundary between the ceiling surface C and the recess C1, and is fixed to the ceiling surface C.

At this time, the introduction port 114 of the panel substrate 111 is positioned along the edge E forming the boundary between the ceiling surface C and the recess C1. As a result, the blow-out port 55 of the air conditioner 51 and the introduction port 114 of the panel substrate 111 are aligned and become a state of communicating with each other (refer also to FIG. 1).

[0063] (3) Attachment of radiation panel

(a) Temporary fixing

First, the radiation panel 131 is temporarily fixed.

As shown in FIGS. 20 through 22, the pair of sliders 137 provided on the radiation panel 131 are brought close to the rails 57 provided on both sides of the air conditioner 51, and the sliders 137 are placed on the rails 57 to temporarily fix the radiation panel 131. The slider 137 is placed on the location low in height, which is positioned on the front side of the rail 57.

The temporarily fixed radiation panel 131 is not constrained in position even at both the second frame body 135 and the first frame body 134 and is in a rotatable state.

[0064] (b) Rotation of second panel

As shown in FIGS. 23 and 24, after the radiation panel 131 is temporarily fixed, the second panel 131B is rotated to make it horizontal.

At this time, the pair of sliders 137 are placed in a location where the height of the pair of rails 57 is low. The connecting pin 138 of the second panel 131B is in a state of facing the stopper metal fitting 119 of the panel substrate 111 at intervals.

5 [0065] (c) Final fixing

As shown in FIGS. 25 and 26, when the second panel 131B is leveled, the second panel 131B is pushed in while maintaining the unchanged posture. That is, the radiation panel 131 is moved toward the air conditioner 51.

10 Thus, the connecting pin 138 is fitted into the connecting groove 119a of the stopper metal fitting 119, and hence the radiation panel 131 is finally fixed.

At this time, the slider 137 slidably moves on the rail 57 and is positioned at a position high in height over the step 57a. Thus, the tip of the radiation panel 131, that is, the end of the second panel 131B connected to the first panel 131A is lifted and thereby pressed against the lower surface of the housing 51a of the air
15 conditioner 51. As a result, the outer frame member 133a, which becomes the close contact member RM of the second frame body 135, comes into close contact with the lower surface of the housing 51a via the cloth cover 141.

When the radiation panel 131 is finally fixed, the first panel 131A freely rotates by the hinges 136 and hangs down in the vertical direction.

20 [0066] (d) Holding of first panel

As shown in FIGS. 27 through 30, the first panel 131A is rotated to be horizontal.

Then, the suction surface 139a of the suction plate 139 provided on the first panel 131A is attracted to the magnet MG provided on the back surface of the
25 air conditioner 51 by the magnetic force, and is sucked to the magnet MG through the cloth cover 141. Consequently, the first panel 131A is held and kept in a horizontal state.

When the first panel 131A is kept in the horizontal state, the cloth cover 141 is pulled by the first frame body 134 and held in a stretched state.

30 Thus, the attachment work of the radiation panel 131 is completed.

[0067] (4) Removal of radiation panel

(a) Release of holding of first panel

As shown in FIG. 29, the first panel 131A is rotated against the attractive force of the suction plate 139 by the magnetic force of the magnet MG.

5 Then, as shown in FIGS. 25 and 26, when the hand is released, the first panel 131A freely rotates and becomes a state of hanging down in the vertical direction.

[0068] (b) Release of connection of connector

10 The second panel 131B is held and pulled so as to be brought from the state shown in FIG. 25 to the state shown in FIG. 23. That is, the radiation panel 131 is moved from the air conditioner 51 toward the panel substrate 111.

Consequently, the connecting pin 138 falls off from the connecting groove 119a of the stopper metal fitting 119, and the final fixing of the radiation panel 131 is released.

15 At this time, the slider 137 slidably moves on the rail 57, gets over the step 57a, and is positioned at a position low in height. Thus, the position at the tip of the radiation panel 131, that is, the end of the second panel 131B connected to the first panel 131A is also lowered and separated from the lower surface of the housing 51a of the air conditioner 51. As a result, the state in which the outer
20 frame member 133a which serves as the close contact member RM of the second frame body 135, is brought into close contact with the lower surface of the housing 51a through the cloth cover 141 is also released, and hence the radiation panel 131 becomes a temporarily fixed state.

[0069] (c) Rotation of second panel

25 As shown in FIGS. 21 and 22, the second panel 131B is rotated with the pin 137b of the slider 137 placed on the rail 57 as a starting point to bring it into an inclined state.

[0070] (d) Dropping out

30 Both ends of the second panel 131B are held, and the slider 137 is lifted from the rail 57 to drop out.

This completes the work of detaching the radiation panel 131.

[0071] 3. Function and effect

When the air conditioner 51 is operated, air-conditioned air is blown out from the blow-out port 55 and flows from the introduction port 114 to the discharge port 115 through the flow passage 151. Then, the temperature of the radiation panel 131 is adjusted by the air-conditioned air. The air-conditioned air is warmed during heating and cooled during cooling. Consequently, the room R is radiantly air-conditioned.

[0072] (1) Prevention of dew condensation

During cooling, the radiation air conditioner 11 of the present embodiment suppresses generation of dew condensation on the radiation panel 131.

The reason will be described in detail.

[0073] (a) Cause of dew condensation

Moisture is contained as gas (water vapor) in the air.

A state in which the air contains water vapor to the limit is called a saturated state, and the amount of water vapor at this time is called a saturated water vapor amount. The amount of saturated water vapor fluctuates depending on the temperature. The higher the temperature, the higher the amount, and the lower the temperature, the lower the amount.

When the air is cooled, the moisture in the form of water vapor will eventually saturate and change to liquid while the temperature is high. That is, as the temperature drops, the saturated water vapor amount also decreases. Therefore, if the air is kept cooled, the water vapor will saturate at some point in time and turn into liquid.

The temperature at this time is called a dew point temperature.

The dew point temperature fluctuates according to the amount of water vapor contained in the air. The higher the amount of water vapor, the higher the temperature, and the lower the amount of water vapor, the lower the temperature.

In terms of a more specific phenomenon, the water vapor saturated by falling below the dew point temperature condenses and adheres to the surface of

an object as water droplets. This is a phenomenon called dew condensation.

At this time, even if the temperature drops with the same temperature as the starting point, the temperature at which dew condensation occurs becomes lower when the amount of water vapor contained is smaller than when it is high.

5 For example, when the temperature starts to drop in an environment of 25°C, dew condensation occurs at about 14°C where water vapor of 50% of the saturated water vapor amount is contained, whereas the temperature at which dew condensation occurs when only 30% water vapor is contained is about 6.5°C.

[0074] (b) Radiation air conditioner of the present embodiment

10 In the radiation air conditioner 11 of the present embodiment, on the back surface side partitioned by the radiation panel 131, that is, on the side of the flow passage 151 where the air conditioner 51 is arranged, the drying of air is promoted by the cooling operation of the air conditioner 51, and the dry air flows. This is because the air in the room R taken into the air conditioner 51 from the air
15 intake port 52 is rapidly cooled when passing through the heat exchanger 53, and a part of the water vapor contained in the air is liquefied and removed.

Therefore, even if the air passing through the air-conditioned air flow passage 151 is reduced in the saturated water vapor amount by being cooled by the cooling operation, the dew point temperature is lowered by drying, so that
20 dew condensation does not occur on the back surface of the radiation panel 131. More specifically, neither the back surface fiber 141B in the cloth cover 141 nor the front surface fiber 141A wrapping around to the back surface side causes dew condensation.

On the other hand, the surface of the radiation panel 131 is cooled by the
25 cooling operation, and the air in the room R is radiatively cooled. Therefore, since the cloth cover 141 located on the surface of the radiation panel 131, that is, the front surface fiber 141A maintains a low temperature state, the air in contact with the front surface fiber 141A approaches the dew point temperature.

At this time, when the air in contact with the front surface fiber 141A reaches the dew point temperature, the water vapor contained in the air tries to change into liquid.

[0075] (c) Principle of dew condensation prevention

5 On the other hand, in the present embodiment, the cloth cover 141 has permeability.

 Therefore, the air passing through the air-conditioned air flow passage 151 passes through the cloth cover 141 and leaks to the front of the front surface fibers 141A exposed on the room R side. As a result, the dry air is in a layered
10 state on the front side of the front surface fiber 141A.

 Thus, since the dew point temperature of the air becomes lower than the lowered temperature of front surface fiber 141A on the front side of the front surface fiber 141A in which the dry air forms the layer, dew condensation does not occur.

15 With the above principle, according to the present embodiment, it is possible to prevent the dew condensation from occurring on the surface of the radiation panel 131 in various environments during cooling.

[0076] (2) Thinning of air conditioner

 (a) Cross flow fan

20 The air conditioner 51 uses the cross flow fan 54 as a blower source. When the cross flow fan 54 is used, the height of the housing 51a inevitably tends to be high because it is necessary to bend the in-machine flow passage 81.

 On the other hand, the air conditioner 51 of the present embodiment is provided with the air flow controller 82 including the inclined arrangement of the
25 three-layer heat exchangers 53 and the pair of air flow control plates 83, and has the in-machine flow passage 81 bent within the limited height dimension in the housing 51a. Consequently, the air intake port 52, the heat exchanger 53, the cross flow fan 54, and the blow-out port 55 can be arranged on a straight line.

 Thus, even if the cross flow fan 54 is used as the blower source, the
30 height dimension of the air conditioner 51 can be lowered. As a result, it is

possible to realize the radiation air conditioner 11 that covers the air conditioner 51 with the radiation panel 131 along the ceiling surface C.

[0077] (b) Heat Exchanger

5 The heat exchanger 53 tilts the surface on the side of the cross flow fan 54 obliquely downward, and causes the air flow passing through the heat exchanger 53 to travel obliquely downward. After that, the air flow is guided to the pair of upper and lower air flow control plates 83 to change the traveling direction so as to be directed toward the cross flow fan 54 from obliquely below. Such a so-called V-shaped air flow contributes to the generation of an air flow
10 that allows the cross flow fan 54 to function normally within a slight separation distance between the heat exchanger 53 and the cross flow fan 54.

[0078] (3) Heat exchanger

The heat exchanger 53 is in the form of three layers. Consequently, the area of the aluminum plate 53a that contributes to heat exchange can be
15 increased, and high heat exchange efficiency can be obtained.

On the other hand, the air sucked by the cross flow fan 54 passes through each slit 53c formed between the aluminum plates 53a of the heat exchanger 53. Therefore, if the number of layers for the heat exchanger 53 increases, air resistance increases correspondingly, and the amount of air-
20 conditioned air blown out from the blow-out port 55 decreases.

In the present embodiment, this problem is solved by inclining the heat exchanger 53 in the housing 51a. As described above, the air passes in the direction orthogonal to the surface of the heat exchanger 53. Therefore, if the number of the refrigerant pipes 53b is the same, the area of the slit 53c can be
25 made larger when the heat exchanger 53 is inclined with respect to the air flow than when the heat exchanger 53 is arranged in the direction orthogonal to the air flow. The air resistance can be reduced correspondingly.

Such an inclined arrangement of each heat exchanger 53 brings another advantage of improving the heat exchange efficiency. This is because the area

of the aluminum plate 53a that the air comes into contact with can be increased by inclining the heat exchanger with respect to the air flow.

As described above, the tilt-arranged three-layer heat exchangers 53 produce three effects simultaneously.

5 The first effect is that the heat exchanger 53 plays a role in generating a V-shaped air flow on the downstream side thereof and thus contributes to the generation of an air flow allowing the cross flow fan 54 to function normally.

 The second effect is to reduce the resistance given to the air passing through the slit 53c and to put a stop to the decrease in the amount of air-
10 conditioned air blown out from the blow-out port 55.

 The third effect is to increase the area of the aluminum plate 53a that the air comes into contact with and improve the efficiency of heat exchange.

[0079] (4) Expansion in heat radiation area

(a) Expansion in width direction

15 As shown in FIG. 15 (a), the air-conditioned air flow passage 151 is formed in space between the back panel 112 included in the panel substrate 111 and the radiation panel 131. The width of the flow passage 151 is defined by the facing interval between the pair of side walls 113 provided at the panel substrate 111.

20 The facing interval between the pair of side walls 113 is determined by the width of the back panel 112. The facing interval between the pair of side walls 113 does not extend beyond the width of the back panel 112. Therefore, the width of the air-conditioned air flow passage 151 does not widen beyond the width of the back panel 112 either.

25 In the present embodiment, the hollow radiation panel 131 is used. The radiation panel 131 expands the internal space from the opening portion O in contact with the flow passage 151 of the air conditioner, and forms a radiation surface RS at one surface opposite to the opening portion O. The radiation surface RS has a horizontal projection surface wider than the width of the back
30 panel 112.

Thus, according to the present embodiment, the heat radiation region of the radiation panel 131 can be expanded beyond the flow passage width of the air-conditioned air defined by the pair of side walls 113. As a result, it is possible to obtain heat radiation efficiency higher than the actual size.

5 [0080] (b) Expansion to region overlapping with air conditioner

As shown in FIG. 15(b), the hollow radiation panel 131 is a region hollow to a position where it overlaps the air conditioner 51 beyond the position of the blow-out port 55 of the air conditioner 51. The radiation surface RS is also arranged in this region.

10 Therefore, the heat radiation region of the radiation panel 131 can be further expanded.

Moreover, the expansion range of the heat radiation region is limited to the region where the close contact member RM formed by the outer frame member 133a of the second frame body 135 is in close contact with the housing
15 51a of the air conditioner 51 through the cloth cover 141. Since the close contact member RM is arranged directly below the heat exchanger 53 built in the air conditioner 51 in the vertical direction, the region up to the close contact member RM is used as the heat radiation region as a whole, and the heat radiation efficiency is improved.

20 [0081] (5) Prevention of shortcut phenomenon

As described above, the air-conditioned air blown out from the blow-out port 55 of the air conditioner 51 goes around to the back surface of the air conditioner 51, i.e., the side where the air intake port 52 is provided, in terms of the structure in which the hollow region of the radiation panel 131 is expanded to
25 the position where it overlaps with the air conditioner 51. At this time, if the air-conditioned air goes around to the back surface of the air conditioner 51, the air-conditioned air is taken in from the air intake port 52, causing a so-called shortcut phenomenon. Thus, the operating efficiency of the air conditioner 51 is lowered, and hence some measures are required.

In this regard, in the present embodiment, the close contact member RM formed by the outer frame member 133a of the second frame body 135 blocks the flow of the air-conditioned air and prevents the occurrence of the shortcut phenomenon. When the radiation panel 131 is finally fixed (refer to FIGS. 27 through 30), the close contact member RM is brought into close contact with the housing 51a of the air conditioner 51 through the cloth cover 141 to prevent the flow of the air-conditioned air passing through the inside of the radiation panel 131 and going to the back surface of the air conditioner 51.

Moreover, in the present embodiment, when the first panel 131A is placed in the horizontal state (refer to FIGS. 27 and 30), the cloth cover 141 is pulled by the first frame body 134 and kept in the stretched state. Consequently, the front surface fiber 141A of the cloth cover 141 forming the radiation surface RS come into close contact with the close contact member RM, and the leakage of air-conditioned air from between the close contact member RM and the front surface fiber 141A is also prevented.

Thus, according to the present embodiment, it is possible to prevent a reduction in the operating efficiency of the air conditioner 51 due to the shortcut phenomenon.

[0082] (6) Function and effect brought about by shape and structure of sheet

The cloth cover 141 has the bag shape for accommodating the frame body 132.

This brings about the following function and effect.

(a) Expansion in heat radiation area

One is the function/effect of making it easier to make the radiation panel 131 hollow.

As a result, it also becomes easy to expand the heat radiation area of the radiation surface RS in the width direction and expand the same to the region overlapping with the air conditioner 51.

(b) Simplification of manufacturing

The other is the function/effect that it is easy to attach to the frame body 132, and the manufacturing of the radiation panel 131 can be facilitated.

(c) Elimination of disadvantages

On the other hand, since the air-conditioned air passes through the two
5 cloth covers 141 from the flow passage 151 thereof to the room R, the cloth cover 141 on the side of the flow passage 151 serves as the resistance against the air-conditioned air directed to the cloth cover 141 on the room R side. If the resistance is too large, hindrance occurs in the operation of producing a layer of dry air-conditioned air in the region of the cloth cover 141 facing the room R.

10 Thus, in the present embodiment, the opening portion O is provided in the surface of the cloth cover 141 facing the flow passage 151 of the air-conditioned air, and the mesh cloth is provided in the opening portion O.

More specifically, there is adopted the sewn structure of the fiber material on the front surface side (front surface fiber 141A) exposed to the room R and the
15 fiber material on the back surface side (back surface fiber 141B) facing the back panel 112. The cloth cover 141 is formed in the bag shape. By doing so, the back surface fiber 141B does not need to form the body as the cloth cover 141, and various materials and forms can be freely adopted. In the present embodiment, by using the mesh-like material for the back surface fiber 141B, the
20 resistance given by the back surface fiber 141B to the air-conditioned air from the flow passage 151 toward the cloth cover 141 on the room R side is reduced.

Further, the sewn portion SP of the front surface fiber 141A and the back surface fiber 141B is aligned with the side walls 113. Consequently, when the radiation panel 131 is viewed from below, it is possible to prevent the sewn
25 portion SP from being seen through the front surface fiber 141A.

[0083] (7) Facilitation of attachment/detachment work of radiation panel

According to the present embodiment, the radiation panel 131 can be temporarily fixed in the oblique state when the radiation panel 131 is attached/detached. After that, the radiation panel 131 can be finally fixed by
30 making the radiation panel 131 horizontal by moving it as it is.

Therefore, the work of attaching and detaching the radiation panel 131 can be facilitated.

In the present embodiment, the radiation panel 131 is divided into the first panel 131A and the second panel 131B. When the radiation panel 131 is temporarily fixed and finally fixed, attention may be focused only on the first panel 131A more compact than the radiation panel 131. Thus, the work of attaching and detaching the radiation panel 131 can be made even easier.

[0084] (8) Degree of freedom in material selection of sheet

According to the present embodiment, the air-conditioned air blown out from the blow-out port 55 of the air conditioner 51 is led out to the room R from the discharge port 115. That is, it is not necessary to intentionally lead out the air-conditioned air to the room R through the cloth cover 141.

Therefore, the cloth cover 141 is not required to have characteristics for passing the air-conditioned air.

Basically, the cloth cover 141 is required to have only air permeability enough to allow air passing through the air-conditioned air flow passage 151 to leak to the room R to form the layer of dry air on the front side of the surface fiber 141A.

Thus, according to the present embodiment, the range of material selection for the sheet can be expanded.

[0085] (9) Suppression of sheet deformation

According to the present embodiment, the cloth cover 141 of the radiation panel 131 is arranged along the direction in which the air-conditioned air blown out from the blow-out port 55 flows through the flow passage 151. Since the air flowing through the flow passage 151 is discharged from the discharge port 115, the internal pressure in the flow passage 151 does not increase.

Therefore, upon the operation of the radiation air conditioner 11, the air flow and pressure rise that bend the cloth cover 141 of the radiation panel 131 do not occur, and the deformation of the cloth cover 141 which occurs therein can be suppressed as much as possible.

[0086] (10) Thermal efficiency

The panel substrate 111 is made of the heat insulating material, and is in a state equivalent to the provision of heat insulating portions on the back panel 112 and the side walls 113.

5 Consequently, the heat of the air-conditioned air flowing through the flow passage 151 is not taken by the panel substrate 111, and the cloth cover 141 can be efficiently heated or cooled. As a result, the radiation air conditioner 11 excellent in thermal efficiency can be obtained.

10 Further, since the panel substrate 111 itself is formed of the heat insulating material, there is no complexity in preparing a heat insulating material separately and attaching it to the panel substrate 111. It is possible to reduce the component cost and manufacturing cost of the panel substrate 111 and facilitate manufacturing of the panel substrate 111.

[0087] (11) Appearance features

15 (a) Aesthetic

The air conditioner 51 is accommodated in the recess C1 provided in one surface (ceiling surface C) of the room R, and the panel substrate 111 is joined to one surface of the room R. Consequently, the radiation air conditioner 11 can be made to look thin and small in the room R.

20 Further, since the radiation panel 131 also covers the air conditioner 51 and the opening side of the bag-shaped cloth cover 141 is closed by the sliding fastener 143, the radiation air conditioner 11 looks like the form of only one radiation panel 131 arranged near the ceiling surface C in appearance. Since only the cloth cover 141 made of the fiber material is in the exposed state, the
25 radiation panel 131 shows a gentle facial expression familiar to human senses and sensibilities.

Thus, it is possible to obtain the radiation air conditioner 11 having a sophisticated appearance aspect that does not get in the way or bothers when installed in the room R.

30 (b) Good function and beauty

One step is further taken to think about the reason why the radiation air conditioner 11 looks like the form of only one radiation panel 131 arranged near the ceiling surface C in appearance. It is noticed that this is due to the following three factors.

- 5 · The radiation panel 131 is hollow due to the structure in which the frame body 132 is covered by the cloth cover 141.
- The horizontal projection area of the radiation panel 131 is larger than the width of the back panel 112.
- The horizontal projection area of the radiation panel 131 is larger than the
10 combined area of the air conditioner 51 and the back panel 112.

Such a magnitude relationship of the horizontal projection areas of the structure and each part of the radiation panel 131 is closely related to the above-mentioned "good function" of expanding the heat radiation area. That is, the magnitude relationship of the horizontal projection area that the radiation panel
15 131 is wider than the back panel 112 contributes to expanding the heat radiation area of the radiation surface RS in the width direction. The magnitude relationship of the horizontal projection area that the radiation panel 131 covers the air conditioner 51 contributes to expanding the heat radiation area of the radiation surface RS to the region overlapping the air conditioner 51. Further,
20 such an expansion of the heat radiation area of the radiation surface RS depends on the structure of the radiation panel 131, which is hollow in the first place.

From the observation described above, it can be seen that the aesthetic in appearance of the radiation air conditioner 11 is "beauty" associated with "good function".

25 [0088] 4. Variations

Various modifications and changes are possible upon implementing.

[0089] (1) Installation location of radiation air conditioner

For example, in the present embodiment, the radiation air conditioner 11 to be installed on the ceiling surface C has been shown, but upon its
30 implementation, it may be configured to be installed on one different side of the

room R, for example, the wall surface W (refer to FIG. 1). In this case, if a recess is provided in the wall surface W and the air conditioner 51 is accommodated in the recess, there can be realized the radiation air conditioner 11 in the flat form, which looks as if the radiation panel 131 is simply installed in the wall surface W as with the present embodiment.

[0090] (2) Installation state of radiation air conditioner

One example is shown in which the ceiling surface C is taken as the folded and raised ceiling, and the air conditioner 51 is stored in the recess C1, but this is not always essential. The air conditioner 51 may be installed on the flat ceiling surface C or the wall surface W. In this case, the blow-out port 55 of the air conditioner 51 is apt to be separated from the ceiling surface C or the wall surface W, but by installing the radiation panel unit 101 while floating from the ceiling surface C or the wall surface W, the introduction port 114 which becomes the entrance of the flow passage 151 can be made to face the blow-out port 55.

The means for attaching the air conditioner 51 to the ceiling surface C is not limited to the hanging bolts exemplified above, and various means can be adopted. For example, various modifications such as a fastening structure using screws or the like, a fastening structure using a surface tape, and a press-fit fitting structure are allowed.

[0091] (3) Arrangement of air conditioner and back panel

In the present embodiment, the blow-out port 55 of the air conditioner 51 and the back panel 112 of the panel substrate 111 are arranged neighboring each other with the gap open therebetween. Upon implementation, the back panel 112 may be attached to the ceiling surface C adjacent to the blow-out port 55 of the air conditioner 51.

The important thing here is that the introduction port 114 of the panel substrate 111 is in communication with the blow-out port 55.

The "communication" referred to here means that the air-conditioned air blown out from the blow-out port 55 is guided to the introduction port 114.

Insofar as it is concerned, the blow-out port 55 and the introduction port 114 may

be arranged apart from each other, may be arranged in contact with each other, or may be arranged in an overlapping manner. That is, the air conditioner 51 and the back panel 112 may be arranged apart from each other, arranged in contact with each other, or arranged so as to overlap each other.

5 [0092] (4) Structure of radiating panel

The radiation panel 131 is not necessarily limited to the structure in which the frame body 132 is covered with the cloth cover 141, and may be, for example, one in which Japanese paper is applied on the frame body 132 or one assembled by a board having permeability. As long as a hollow one is taken
10 which is provided with a radiation surface RS having permeability at one surface, and an opening portion O in its opposite surface, a radiation panel 131 of various materials and structures is allowed.

When the structure in which the frame body 132 is covered with the cloth cover 141 as in the radiation panel 131 of the present embodiment is adopted,
15 various modifications and changes are allowed in terms of the respective structures, shapes, materials, etc. of the frame body 132 and the cloth cover 141. For example, the number and arrangement positions of the rod-shaped members 133 constituting the frame body 132 are not limited to those introduced in the present embodiment, and may be various numbers and arrangements.

20 [0093] (5) Fixing structure of radiation panel

(a) Slider mounting position

In the present embodiment, the configuration example in which the slider 137 is mounted on the second frame body 135 has been illustrated. The implementation is not limited to such a configuration, and the slider 137 may be
25 provided in the connecting region between the first frame body 134 and the second frame body 135. For example, it is also possible to attach the slider 137 to the first frame body 134. Alternatively, the hinge 136 is used as the member for connecting the first frame body 134 and the second frame body 135, but a larger one is used as such a connecting member, and the slider 137 may be
30 attached to such a large connecting member.

(b) Another fixing structure

In the present embodiment, the radiation panel 131 is fixed to the air conditioner 51 and the panel substrate 111 by using the pair of sliders 137, the pair of connecting pins 138, and the pair of suction plates 139. However,
5 various structures can be adopted for fixing of the radiation panel 131.

For example, although the fixing of the radiation panel 131 depends on the weight thereof, a fixing structure using only magnets may be adopted.

(c) First panel

The structure of fixing the first panel 131A is not limited to the magnet
10 MG, and various modifications such as a fastening structure using screws and bolts, a fastening structure using a surface tape, and a press-fit fitting structure are allowed.

[0094] (6) Form of radiation panel

In the above embodiment, the flat plate shape is exemplified as the
15 radiation panel 131, but various forms are allowed upon implementation.

For example, as shown in FIG. 31 (a), the radiation panel 131 may have an arch-like shape in which both sides hang down when viewed from the front. As the planar shape of the radiation panel 131, various shapes are acceptable even if it is a rectangular shape as shown in FIG. 31 (b) or an elliptical shape as
20 shown in FIG. 31 (c).

Further, the radiation panel 131 does not need to be in close contact with the ceiling surface C, and may be suspended from the ceiling surface C as shown in FIG. 32.

[0095] (7) Side wall

25 In the above embodiment, the form of raising the pair of side walls 113 from both side edges of the back panel 112 is exemplified. On the other hand, upon implementation, the side wall 113 may not necessarily rise from the side edge, but may take such a form of rising from a position closer to the center side.

Also, in the present embodiment, the wall portion realized as the pair of side walls 113 can be of any form as long as it rises from the back panel 112 in an enclosed shape with the introduction port 114 and the discharge port 115 left.

Further, the pair of side walls 113 may not be integrated with the back panel 112 as long as they are interposed between the back panel 112 and the radiation panel 131.

[0096] (8) Discharge port

In the above embodiment, the example in which the discharge port 115 is provided in the region facing the introduction port 114 has been shown, but various modifications and changes are allowed upon implementation. For example, the discharge port 115 may be provided in a part of the side wall 113. In this case, the discharge port 115 may be dispersed in a plurality of locations.

[0097] (9) Variation of sliding fastener position of sheet

As the position of the sliding fastener 143 of the cloth cover 141, various embodiments are acceptable such as not only the position shown in FIG. 33 (a) for example as in the above embodiment, but also the position closer to one side as shown in FIG. 33 (b), the position surrounding the three sides as shown in FIG. 33 (c), or a V-shape as shown in FIG. 33 (d), etc.

[0098] (10) Another configuration example of radiation air conditioner

FIG. 34 is a front view showing another configuration example of the radiation air conditioner 11.

In the embodiment and variations thereof shown in FIGS. 1 through 33, the side wall 113 is provided on the panel substrate 111, thereby securing the space for the flow passage 151 between the back panel 112 and the radiation panel 131. On the other hand, the radiation panel unit 101 of the radiation air conditioner 11 shown in FIG. 34 secures the space for the flow passage 151 by the radiation panel 131.

Thus, the radiation panel 131 is provided with not a planar but a three-dimensional frame body 132 so as to create a space for the flow passage 151 between the radiation panel 131 and the back panel 112. More specifically, the

frame body 132 is curved in a curved shape when viewed from the front and back, and both ends are connected and fixed to the back panel 112. The cloth cover 141 is attached to such a frame body 132 so as to cover it from the side of the room R. For fixing of the cloth cover 141 to the frame body 132, for
5 example, a method of hooking both side portions of the cloth cover 141 to both side portions of the frame body 132 and stopping the cloth cover 141 is adopted. The cloth cover 141 is fixed to the frame body 132 in a stretched state.

In terms of such a structure, the panel substrate 111 does not have the side wall 113, and is constituted mainly of the back panel 112.

10 The radiation panel unit 101 configured in this way has an introduction port 114 formed on the back side and a discharge port 115 formed on the front side, and has a flow passage 151 for air-conditioned air leading from the introduction port 114 to the discharge port 115, which is formed between the back panel 112 of the panel substrate 111 and the radiation panel 131.

15 Therefore, it brings about the common function and effects with the embodiments shown in FIGS. 1 through 33.

[0099] (11) Others

All other modifications and changes are possible.

20 Description of Reference Numerals

[0100] 11 radiation air conditioner

51 air conditioner

51a housing

52 air intake port

25 53 heat exchanger

53a aluminum plate

53b refrigerant pipe

53c slit

54 cross flow fan

30 55 blow-out port

	56 filter
	57 rail
	57a step
	57b regulating piece
5	61 hood (hollow member)
	62 partition plate
	63 inclined surface
	64 inclined inner surface
	71 magnet holder
10	81 in-machine flow passage
	82 air flow controller
	83 air flow control plate (hollow member)
	101 radiation panel unit
	111 panel substrate
15	112 back panel
	113 side wall (wall portion)
	114 introduction port
	115 discharge port
	116 facing region
20	117 stopper
	119 stopper metal fitting (connecting tool)
	119a connecting groove
	131 radiation panel
	131A first panel
25	131B second panel
	132 frame body
	133 rod-shaped member
	133a outer frame member (close contact member)
	133b reinforcing member
30	134 first frame body

	135 second frame body
	136 hinge
	137 slider
	137a sheet metal
5	137b pin
	138 connecting pin (tool to be connected)
	139 suction plate (member to be sucked)
	139a suction surface
	141 cloth cover (cloth)
10	141A front surface fiber
	141B back surface fiber (mesh cloth)
	142 open edge
	143 sliding fastener
	151 flow passage
15	A rotational axis
	C ceiling surface
	C1 recess (ceiling)
	CN connector
	CR control unit
20	DR drive unit
	E edge
	M motor
	MG magnet (panel holding part)
	O opening portion
25	R room
	RM close contact member
	RS radiation surface
	SP sewn portion
	W wall surface.
30	

CLAIMS

1. An air conditioner comprising:
 - a housing having an air intake port and a blow-out port arranged on one
5 surface and another surface opposite to the one surface, which cross a horizontal surface, respectively;
 - a heat exchanger arranged between the air intake port and the blow-out port;
 - a cross flow fan arranged on the blow-out port side of the heat exchanger;
 - 10 and
 - a drive unit which drives a drive source of the cross flow fan so that a rotation direction of a region above a rotational axis takes a direction directed from the heat exchanger to the blow-out port.
2. The air conditioner according to claim 1, including an air flow controller
15 which generates an air flow toward the cross flow fan from obliquely below on the side of the air intake port and generates an air flow traveling obliquely downward from the cross flow fan on the side of the blow-out port.
3. The air conditioner according to claim 2, wherein the air intake port, the heat exchanger, the cross flow fan, and the blow-out port are provided on a straight
20 line.
4. The air conditioner according to claim 2, wherein the heat exchanger tilts a surface on the side of the cross flow fan downwardly, and
 - wherein the air flow controller causes an air flow orthogonal to the surface
of the heat exchanger and traveling downward to be along the bottom surface of
25 the housing and causes the air flow to be directed toward the cross flow fan from obliquely below.
5. The air conditioner according to claim 2, wherein the air flow controller connects between the cross flow fan and the blow-out port by a hollow member which forms a space inclined downward from the cross flow fan toward the blow-
30 out port.

6. The air conditioner according to claim 2, wherein the air intake port, the heat exchanger, the cross flow fan, and the blow-out port are provided on a straight line,

5 wherein the heat exchanger tilts a surface on the side of the cross flow fan downwardly, and

wherein the air flow controller causes an air flow orthogonal to the surface of the heat exchanger and traveling downward to be along the bottom surface of the housing, causes the air flow to be directed toward the cross flow fan from obliquely below, and connects between the cross flow fan and the blow-out port by
10 a space inclined downward from the cross flow fan toward the blow-out port.

7. A radiation air conditioner comprising:

an air conditioner according to any one of claims 1 to 6, which is installed on a ceiling surface;

15 a back panel attached to the ceiling surface adjacent to a blow-out port of the air conditioner;

a permeable radiation panel having a horizontal projection area larger than a combined area of the air conditioner and the back panel; and

20 a pair of side walls interposed between the back panel and the radiation panel along a direction in which air-conditioned air is blown out from the blow-out port.

8. The radiation air conditioner according to claim 7, wherein the radiation panel has a hollow structure having a permeable radiation surface at one surface and having an opening portion arranged on the back panel side at the surface opposite to the radiation surface, and

25 wherein the pair of side walls face each other with the opening portion inserted between the side walls without protruding.

9. The radiation air conditioner according to claim 8, wherein the radiation panel is provided in a state in which a bag-shaped cloth is stretched on a frame body.

30 10. The radiation air conditioner according to claim 9, wherein the cloth has a

mesh cloth in the opening portion.

11. The radiation air conditioner according to claim 9, wherein the frame body rotatably connects a first frame body arranged on the air conditioner side and a second frame body arranged on the back panel side.
- 5 12. The radiation air conditioner according to claim 11, wherein the second frame body constitutes an outer frame member connected to the first frame body as a close contact member being in close contact with the housing of the air conditioner through the cloth.
- 10 13. The radiation air conditioner according to claim 9, wherein the frame body includes a rod-shaped close contact member which comes into close contact with the housing of the air conditioner through the cloth.
14. The radiation air conditioner according to claim 13, wherein the frame body is rotatable at a position opposite to the back panel with respect to the close contact member.
- 15 15. The radiation air conditioner according to claim 12, wherein the close contact member is arranged directly below the heat exchanger built in the air conditioner in the vertical direction.