

DESCRIPTION

INDOOR UNIT OF AIR CONDITIONER

TECHNICAL FIELD

5 The present invention relates to an indoor unit of an air conditioner provided with indoor air inlets in the front and the top of a body casing.

BACKGROUND ART

10 A wall-mounted indoor unit of a separate-type air conditioner is usually constituted such that an indoor air inlet is provided in the front of a body casing and an air outlet is provided therebelow. Further, for example, Japanese Patent Laid-Open Publication No. 9-14684 describes
15 an indoor unit constituted such that an inverted-V-shaped heat exchanger is provided in the body casing and, together with this, an indoor air inlet is provided in the top of the body casing as well.

 A constitution example of such indoor units will
20 be explained with reference to Fig. 2, which is an illustration of the present invention. A body casing 1 having a generally rectangular shape in cross section is constituted by a base frame 2 fixed along an indoor wall surface on a rear side (left side in Fig. 2) and a front
25 grill 3 mounted on a front side of this base frame 2. An

inverted-V-shaped heat exchanger 11 and an air-distributing fan 12 are disposed in this body casing 1. In addition, a front air inlet 4 and a top air inlet 6 are formed in the front and the top of the front grill 3, respectively. A front panel 5 provided with a front grill portion 5a so as to cover the front air inlet 4 is attached to this front grill 3. A dust-protective filter 8 is attached along the front air inlet 4 and the top air inlet 6.

In an indoor unit having the above constitution, indoor air is sucked from the front air inlet 4 and the top air inlet 6 into the body casing 1. The air is heated or cooled to a predetermined temperature when passing through a heat exchanger 11 to become conditioned air and then blown out from an air outlet 10 into a room.

When this operation is repeated, clogging gradually occurs in the dust-protective filter 8. Also, the front panel 5 is gradually contaminated because dust in the air passing through the panel is adhered.

Therefore, conventionally, for example, a front panel 53 can be opened by pulling a lower end of the front panel 53 to the front as shown in Fig. 13. The dust-protective filter 55 can be pulled out downward and removed in this state. Further, the front panel 53 can also be removed from a front grill 52 of the body casing 51 by pulling the entire panel in a tilted state as shown in the

figure. Thus, these dust-protective filter 55 and front panel 53 can be removed from the body casing 51 so as to be washed with water or the like.

A conventional indoor unit of an air conditioner, however, has a problem that enormous labor is required to clean the periphery of the top air inlet 54 shown in Fig. 13. That is, the top air inlet 54, which is provided a top grill portion 52a as shown in the figure, is contaminated as is the case with the front panel 53 since dust in the air passing the top grill portion 52a is adhered thereto. Therefore, this top grill portion 52a also needs to be cleaned as required. However, it is necessary to step on, for example, a chair to clean the top grill portion 52a since such an indoor unit is usually installed in the vicinity of the ceiling. Since it is still hard to see the top grill portion 52a even in this case, contaminants accumulated on the top grill portion 52a cannot be easily removed by the cleaning performed under this circumstance. Thus, such cleaning requires a long time and enormous labor.

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DISCLOSURE OF THE INVENTION

The present invention has been accomplished in consideration to the above-described problems. Accordingly, an object of the invention is to provide an indoor unit of an air conditioner where the periphery of the top air inlet

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of the body casing can also be easily cleaned.

In order to accomplish the above object, the present invention provides an indoor unit of an air conditioner, comprising: a front air inlet formed in a front surface of a body casing of the indoor unit; a top air inlet formed in a top surface of the body casing; a heat exchanger provided in a ventilation passage from both the front air inlet and the top air inlet to an air outlet; an air-distributing fan provided in the ventilation passage; and a top grating panel detachably attached to the top surface of the body casing so as to cover the top air inlet.

According to this constitution, the top air inlet is provided with a top grating panel separate from the body casing so that the top grating panel can be removed to clean the periphery of the top air inlet in a safe posture. Sites or degrees of contamination can be checked and washing with water can appropriately be included. Therefore, cleaning can be performed more easily in a shorter time.

In one embodiment of the present invention, the top grating panel is attached to or detached from the body casing by sliding the top grating panel along a generally front-and-rear direction of the body casing.

According to this constitution, the top grating

panel is attached or detached by sliding this panel along the generally front-and-rear direction of the body casing. Therefore, a working space above the indoor unit required to attach or detach the panel can be minimized.

5 Consequently, the indoor unit can be installed in the vicinity of the indoor ceiling. That is, freedom in installation sites can be ensured.

In one embodiment of the present invention, the front panel for covering the front air inlet is detachably
10 attached to the body casing and a locked portion for engaging to the front panel is provided in the top grating panel to prevent the attached top grating panel from moving.

In this constitution, the top grating panel is maintained while being stationed in the top air inlet of
15 the body casing as long as the front panel is not removed from the body casing since the top grating panel is provided with a locked portion engaged with the front panel. Therefore, even when a hand is placed on the top grating panel, for example, at the time of carrying or installing
20 the indoor unit or the like, the panel is not accidentally removed and thereby safety is ensured.

In one embodiment of the present invention, a handle to be projected in the front direction is provided at a front edge of the top grating panel as the locked
25 portion and is formed so as for an edge of the front panel

to overlap the handle from above in locking.

According to this constitution, a handle which also functions as the aforementioned locked portion is provided on a front edge of the top grating panel. Since
5 the edge of the front panel overlaps this handle from above in locking, the handle is hidden under the front panel and thereby the appearance is improved besides the ensured safety described above.

In one embodiment of the present invention, a
10 dust-protective filter is disposed in a generally vertical state along the front air inlet on a front surface side of the indoor unit, in a generally horizontal state along the top air inlet on a top surface side thereof and in a bent state between the front air inlet and the top air inlet and,
15 when this dust-protective filter is attached while being pressed upward from below along the front air inlet, the handle is placed above an area in which the dust-protective filter is in the bent state between the front air inlet and the top air inlet so that an upper end of the dust-
20 protective filter is guided backward along a lower surface of the handle.

According to this constitution, even when the dust-protective filter is attached while being bent backward on the upper front side, the attachment can be
25 easily performed since movement of the upper end of the

dust-protective filter in the bent area is guided by the handle. Since no member exclusively used for such guiding is required separately, the whole constitution can be simple.

5 In one embodiment of the present invention, a plurality of top grating panels are provided on the top surface of the body casing in parallel along a width direction of the body casing and these top grating panels are formed in the same shape.

10 According to this constitution, since a plurality of top grating panels provided in parallel along the direction of the body casing width are in the same shape, it can be attached interchangeably between the right and left sides when the user detaches the panel once and
15 reattaches it. Thus, attachment can be made easier. In addition, the manufacturing cost can be made lower since, for example, the same injection-molding mold is used when top grating panels are manufactured.

20 BRIEF DESCRIPTION OF DRAWINGS

Figs. 1A - 1E show a procedure of removing a top grating panel in an indoor unit of an air conditioner according to one embodiment of the invention.

Fig. 1A is a longitudinal section of an essential
25 part showing a state in which the top grating panel is

attached to the front grill.

Fig. 1B is a longitudinal section of the essential part showing a state in which the front panel is removed.

5 Fig. 1C is a longitudinal section of the essential part when the top grating panel is slid slightly forward;

Fig. 1D is an enlarged view showing portion D in Fig. 1C;

10 Fig. 1E is a longitudinal section of the essential part when the top grating panel is slid further forward;

Fig. 2 is a longitudinal section showing constitution of the indoor unit;

15 Fig. 3 is a plan view showing the indoor unit;

Fig. 4 is a perspective view showing the top grating panel;

Figs. 5A - 5E show constitution of an essential part of the top grating panel;

20 Fig. 5A is a plan view showing the top grating panel on a left end side;

Fig. 5B is a side view of the top grating panel;

Fig. 5C is a plan view thereof seen from below;

Fig. 5D is a cross section along a line A-A in

25 Fig. 5C;

Fig. 5E is an enlarged view of a portion B in Fig.
5B;

Figs. 6A and 6B show a left end of the front
grill in the indoor unit;

5 Fig. 6A is a plan view thereof;

Fig. 6B is a front view of a top thereof;

Fig. 7 is a cross section along a line C-C in Fig.
6B;

Fig. 8 is a longitudinal section of the essential
10 part of the front grill showing a state when a dust-
protective filter is attached to the indoor unit;

Figs. 9A - 9E show constitution of an essential
part of the front grill in an indoor unit of an air
conditioner according to another embodiment of the
15 invention.

Fig. 9A is a plan view of the left end thereof;

Fig. 9B is a cross section along a line E-E in
Fig. 9;

Fig. 9C is a cross section along a line F-F in
20 Fig. 9A;

Fig. 9D is a cross section along a line G-G in
Fig. 9A;

Fig. 9E is a cross section along a line H-H in
Fig. 9A;

25 Figs. 10A and 10B show a procedure of removing

the top grating panel from the indoor unit shown in Fig. 9;

Fig. 10A is a longitudinal section of an essential part when a handle of the top grating panel is lifted slightly upward;

5 Fig. 10B is a longitudinal section of an essential part when the top grating panel is slid forward from the above position;

Figs. 11A - 11C show the constitution of an essential part of an indoor unit of an air conditioner according to another embodiment of the invention. Fig. 11A is a plan view of the left end;

Fig. 11B is a cross section along line I-I in Fig. 11A;

Fig. 11C is a cross section along line J-J in Fig. 11A;

Figs. 12A and 12B show a procedure of removing the top grating panel from the indoor unit in shown in Fig. 11;

Fig. 12A is a longitudinal section of an essential part when the leading edge of the top grating panel is lifted slightly upward;

Fig. 12B is a longitudinal section of an essential part when the top grating panel is pulled out diagonally forward from the above position; and

25 Fig. 13 is a perspective view of a conventional

indoor unit of an air conditioner.

BEST MODE FOR CARRYING OUT THE INVENTION

Embodiment 1

5 An embodiment of the present invention will be described below with reference to drawings.

Fig. 2 shows an indoor unit of a separate type air conditioner according to this embodiment. This indoor unit has a body casing 1 having a generally rectangular shape in cross section. This body casing 1 is constituted by a base frame 2 fixed along an indoor wall surface on the rear side (left side in Fig. 2) and a front grill 3 attached to a front of the base frame 2.

A front panel 5 provided with a front grill portion 5a is further attached to the front grill 3 so that its front opening (front air inlet) 4 is covered. A top air inlet 6 is formed in the top of the front grill 3. The top air inlet 6 is provided with a top grating panel 7 for covering this inlet as described later. Further, a dust-protective filter 8 is attached along the front air inlet 4 and the top air inlet 6.

On the other hand, an air outlet 10 provided with a horizontal flap 9 or a vertical flap (not shown) is formed on a lower front of the body casing 1. In the body casing 1, a heat exchanger 11 and an air-distributing fan

12 composed of a crossflow fan are successively disposed in a ventilation passage from the front air inlet 4 and the top air inlet 6 to the air outlet 10. The heat exchanger 11 functions as a condenser (at the time of heating) or an evaporator (at the time of cooling) in a refrigerant circuit.

The heat exchanger 11 is constituted such that a front side heat exchanger 11a and a rear side heat exchanger 11b are combined into an inverted-V shape. The
10 aforementioned air-distributing fan 12 is positioned between respective lower end portions of the front side heat exchanger 11a and the rear side heat exchanger 11b. A surface of the base frame 2 from behind the air-distributing fan 12 to the air outlet 10 is formed as a
15 scroll portion 2b in a smoothly bent shape. A drain pan 13 is provided at the lower end of the front side heat exchanger 11a so as to receive drained water generated in the front side heat exchanger 11a. Also, a rear side drain pan 14 is provided at the lower end of this heat exchanger
20 11b so as to receive drained water generated in the rear side heat exchanger 11b.

In the indoor unit having the above-described constitution, when the air-distributing fan 12 is driven, indoor air is sucked from the front air inlet 4 and the top
25 air inlet 6 through the dust-protective filter 8 to the

inside of the body casing 1. The indoor air sucked through the front air inlet 4 passes through the front side heat exchanger 11a. At this time, the air is heated or cooled to a predetermined temperature and becomes conditioned air.

5 The indoor air sucked through the top air inlet 6 passes through an upper portion of the front side heat exchanger 11a and the rear side heat exchanger 11b which are positioned below this inlet. At this time, as in the case of the above, the air is heated or cooled and becomes
10 conditioned air. This conditioned air is blown out from the air outlet 10 into the room by the air-distributing fan 12. Continuation of this operation makes the indoor temperature close to the set temperature and maintains the temperature.

15 It is noted that the heat exchanger capacity of the heat exchanger 11 in this case is, for example, generally equal to that of the heat exchanger in a shape obtained by extending the front side heat exchanger 11a along the upper end thereof by the same length as the rear
20 side heat exchanger 11b. Therefore, the dimensions of this indoor unit in the height direction can be made smaller without lowering the heat exchanging ability.

When the above-described operation is repeated, clogging gradually occurs at the dust-protective filter 8
25 for collecting dust in the indoor air. This front panel 5

is also gradually contaminated since dust in the air passing through the front panel 5 is adhered to the panel. As in the case of the conventional example described with reference to Fig. 13, the front panel 5 in the indoor unit rotates about the upper end of the front panel 5 by pulling the lower end thereof to the front side and thereby the front panel 5 is tilted, for example, about 45 degrees and can be opened from the body casing 1.

Thus, the dust-protective filter 8 can be pulled downward and removed from the body casing 1 in a state that the front panel 5 is open. The front panel 5 can also be removed from body casing 1 by pulling the whole front panel 5 to the front in a tilted state. Thus, the dust-protective filter 8 and the front panel 5 can be removed from the body casing 1 to be washed with water or the like.

In this embodiment, furthermore, the aforementioned top grating panel 7 can also be removed from the body casing 1. The constitution of the top grating panel 7 and the front grill 3 to which this panel is attached will be described in detail below. As shown in Fig. 3, a beam-like central support portion 3a extending from the rear side to the front side is provided in the approximately central portion of the top surface of the front grill 3 in the indoor unit width direction. Top grating panels 7, 7 are attached on both sides of this

central support portion 3a to sandwich the central support portion 3a. These panels 7, 7 have a shape approximately equal to each other. Since their attaching structures to the front grill 3 are also the same, the top grating panel 7 on the left side in the figure will be exemplified below.

The top grating panel 7 is composed of a synthetic resin such as, for example, polypropylene or the like. As shown in Fig. 4, a plurality of crossbar pieces 22 and vertical pieces 23 are provided in a grid inside an outer frame in a generally rectangular shape. The front of the panel is bent so that the front lowers forward (lower right side in Fig. 4). Each linear portion of the outer frame 21 along four sides of the rectangle will be described below. In Fig. 4, a linear portion on the lower left side is referred to as a left frame 21a. A linear portion in parallel with this on the upper right side is referred to as a right frame 21b. A linear portion between these left and right frames 21a, 21b on the front side is referred to as a front frame 21c. A linear portion on the rear side is referred to as a rear frame 21d.

Rear protrusions 24, 24 projected backward are formed at two sites on the bottom side of the rear frame 21d along the width direction of the top grating panel 7. A handle 25 projected forward from the bottom side of the front frame 21c, is provided over the approximately whole

length of the front frame 21c. A depressed portion 25a is provided at the approximately central portion of the handle 25 in the width direction, and can be caught with a fingertip when the top grating panel 7 is pulled from the body casing 1 described later.

On the other hand, an outward-widened portion 26 is provided on the bottom of the left frame 21a therealong over the approximately whole length thereof as shown in Fig. 5A. The outward-widened portion 26 is projected outward in the width direction from the side surface of the left frame 21a. This outward-widened portion 26 is provided with a hook-like portion 26a having a vertical surface on generally the same plane as the left frame 21a at a front end as shown in Fig. 5B. The rear of this hook-like portion 26a is formed such that the lower surface thereof is on the same plane as the left frame 21a.

Further, an inward-widened portion 27 projected inward in the width direction (upward in Fig. 5A) is provided over the whole length of the left frame 21a on the bottom of the left frame 21a as shown in Fig. 5A. The lower surface of the inward-widened portion 27 is also formed on the same plane as the bottom surface of the left frame 21a. Therefore, the bottom of the left frame 21a is formed wider than the top thereof since the outward-widened portion 26 and the inward-widened portion 27 are provided

on both thereof as shown in Fig. 5C.

As shown in Fig. 5D, an outside guide protrusion 26b is formed on the rear of the outward-widened portion 26, and extends in the front-and-rear direction along the outer end of the lower surface of the outward-widened portion 26. Also, an inside guide protrusion 27a extending over the whole length along the inner end of the lower surface of the inward-widened portion 27 is formed in a shape projected downward.

On the other hand, an engaging depressed portion 28 is provided over respective lower surfaces of the outward-widened portion 26 and the left frame 21a in portion B shown in Fig. 5B, that is, in the position slightly further forward than the central position in the front-and-rear direction, as shown in Fig. 5C. This engaging depressed portion 28 is formed in a shape depressed upward from the lower surface as shown in Fig. 5E.

The outward-widened portion 26 and the inward-widened portion 27 provided on both sides of the left frame 21a as described above are provided along the right frame 21b as well of the aforementioned top grating panel 7 shown in Fig. 4 symmetrically about the center of the top grating panel 7.

Figs. 6A and 6B show the constitution on the top surface side of the front grill 3 to which the top grating

panel 7 is attached. The front grill 3 is provided with a top panel 31 constituting the outer wall of the top surface of the indoor unit as shown in Fig. 6A. In this top panel 31, the top air inlet 6 is formed in a shape cut out from a leading edge. The top grating panel 7 is attached to a front grill 3 so that the upper surface is on the same plane as the top panel 31 and that the outer periphery of the outer frame 21 is almost engaged to the inner periphery of the top air inlet 6 as shown with an alternate long and short dashes line in Fig. 6A. In the description below, the portion left of the top air inlet 6 in the top panel 31 will be referred to as a side top panel 31a.

An inner wall panel 33 is further provided below the top panel 31. In the inner wall panel 33, an inside opening 32 is formed to correspond to the inner periphery shape of the outer frame 21 of the top grating panel 7. The area left of the inside opening 32 in the inner wall panel 33 is formed as a side edge support portion 34 in a shape extending generally in parallel with the side top panel 31a.

On the upper surface of the side edge support portion 34, a protrusion 35 projected upward is formed in a shape extending in the front-and-rear direction at a position slightly off leftward from the position directly below the inward edge of the side top panel 31a as shown in

Fig. 6B.

The top grating panel 7 is attached to the front grill 3 in a state that the left frame 21a of the top grating panel 7 is placed on this protrusion 35. At this time, the outside guide protrusion 26b and the inside guide protrusion 27a of the above-described outward-widened portion 26 and the inward-widened portion 27 on both sides of the left frame 21a are positioned on both sides of the protrusion 35. Consequently, sliding movement of the top grating panel 7 is guided in the front-and-rear direction as described later when the top grating panel 7 is pulled out forward or inserted from the front.

The outward-widened portion 26 is positioned below the side top panel 31a as shown in Fig. 6A in a state that the top grating panel 7 is attached to the front grill 3 as described above. Consequently, the upward movement of the top grating panel 7 is limited. The aforementioned rear protrusion 24 is provided in the rear frame 21d of the top grating panel 7. An engaging hole 36 is formed in a vertical wall 3b on the rear side of the front grill 3 (see Fig. 6B) so as to connect the top panel 31 and the inner wall panel 33 each other. The rear protrusion 24 is engaged into the engaging hole 36 from the front and thereby too the upward movement of the top grating panel 7 is limited.

On the other hand, a locking protrusion 35a is formed on the upper surface of the protrusion 35 as shown in Fig. 7. When the top grating panel 7 is attached to the front grill 3, the locking protrusion 35a is engaged into the engaging depressed portion 28 on the lower surface of the left frame 21a, resulting in a locked state that the position of the top grating panel 7 in the front-and-rear direction is limited.

The front panel 5 is shown with an alternate long and short dash line in Fig. 7. A shaft 37 is integrally provided on the upper and inner end of the front panel 5. A support depressed portion (not shown) into which the shaft 37 is engaged is provided on the end side of the front grill 3 (near side of the drawing) to support the front panel 5. As described above, the front panel 5 can be opened by rotating the panel about the shaft 37 as shown with an arrow in Fig. 7. Further, the front panel 5 can be removed from the front grill 3 by pulling the front panel 5 to the front (to right in Fig. 7) in a state that the panel is opened at about 45 degrees.

The procedure of removing the top grating panel 7 having the above constitution from the front grill 3 will be described below. The two-layer structure of the side top panel 31a and the side edge support portion 34 at the left end of the front grill 3 is also provided along the

left side edge of the central support portion 3a shown in Fig. 3 in a bilateral symmetry so as to support the right frame 21b of the top grating panel 7. The same structure is provided on the right side edges of the central support portion 3a and the right end of the front grill 3 interposing the top grating panel 7 in the width direction to support this panel on the right side in Fig. 3. Therefore, when removing the top grating panel 7 on the left side in Fig. 3, the following operation on the left frame 21a simultaneously occurs on the right frame 21b. Also, the top grating panel 7 on the right side can be removed with the same procedure.

Fig. 1A shows a cross section on the left frame 21a in a state that top grating panel 7 is attached to the front grill 3. At this time, the handle 25 in the top grating panel 7 is pressed from above by the top edge of the front panel 5. Therefore, by doing this too, upward and forward movement of the top grating panel 7 is prevented so that the panel is stationed and held in the top inlet 6 in the front grill 3.

When the top grating panel 7 is removed from this state, the front panel 5 is removed from the front grill 3 as described above as shown in Fig. 1B. Consequently, the handle 25 of the top grating panel 7 is exposed on the front side. Then, the top grating panel 7 is slid to the

front along the upper surface of the protrusion 35 by engaging the fingertip to the depressed portion 25a of the handle 25 to pull to the front.

At this time, as the engaging depressed portion 28 is moved forward from the state that locking protrusion 35a of the protrusion 35 is engaged into the engaging depressed portion 28 in the top grating panel 7, the top grating panel 7 made of a synthetic resin is pressed upward by the locking protrusion 35a and slightly deformed elastically. Consequently, the surface behind the engaging depressed portion 28 is stuck on the locking protrusion 35a as shown in Figs. 1C and 1D and thereby the locked state that the locking protrusion 35a is engaged into the engaging depressed portion 28 is released.

After this, the top grating panel 7 is moved forward as shown in Fig. 1E by continuing the operation of sliding the top grating panel 7 forward and the top grating panel 7 is removed from the front grill 3.

After the top grating panel 7 removed as described above is, for example, washed with water or the like together with the front panel 5, the panel is reattached by taking the procedure reverse to the above. That is, the top grating panel 7 is attached by placing the rear frame 21d over respective front ends of the protrusion 35 on the upper surface of the side edge support portion 34

and the protrusion (not shown) similarly provided on the central support portion 3a and by pressing the panel towards the rear from this state. During this operation process, for example, the outward-widened portion 26 of the left frame 21a in the top grating panel 7 is proceeded towards the rear between the side top panel 31a and the side edge support portion 34 as shown in Fig. 1E. Then, as shown in Fig. 1A, pressing operation is continued until the rear end of the top grating panel 7 is brought into contact with the vertical wall 3b of the front grill 3 and then attachment of the top grating panel 7 is completed.

At this time, the rear protrusion 24 provided on the rear frame 21d in the top grating panel 7 is engaged into the engaging hole 36 formed in the vertical wall 3b. Also, the locking protrusion 35a on the protrusion 35 is engaged into the engaging depressed portion 28 in the top grating panel 7 from the lower side and held in a locked state that removal of the panel forward is prevented.

Subsequently, the handle 25 of the top grating panel 7 is pressed as described above by the front panel 5 from above by attaching the front panel 5 to the front grill 3 with the procedure reverse to the above, resulting in the assembled state that the top grating panel 7 is stationed in the top air inlet 6 in the front grill 3.

As described above, a dust-protective filter 8 is

further attached below the top grating panel 7. This dust-protective filter 8 is formed in width dimensions generally equal to the inside dimensions of the left frame 21a and the right frame 21b in the top grating panel 7. To support the dust-protective filter 8 from inside, the front grill 3 is further provided with support frames 3c extending downward on the front side at positions corresponding to the both side edges of the dust-protective filter 8 in the width direction as shown in Fig. 6B.

After this dust-protective filter 8 is removed and cleaned, the dust-protective filter 8 is attached by pressing up the filter from the lower side along the above-described support frames 3c. At this time, the handle 25 of the top grating panel 7 is positioned in a diagonally tilted state at the upper position of the portion where the support frame 3c is bent from the front side to the top surface side as shown in Fig. 8. The dimension between the handle 25 and the support frame 3c is gradually narrowed from the front side towards the rear.

Therefore, during the process of pressing up the dust-protective filter 8 along the support frame 3c, the end portion of the dust-protective filter 8 is brought into contact with the lower surface of the handle 25 at the position of the bent portion of the support frame 3c and guided towards the rear along this lower surface. Thus,

since the dust-protective filter 8 is guided by the handle 25 of the top grating panel 7 so that the direction of the dust-protective filter 8 is changed to the rear at the position of the bent portion when attached, the dust-protective filter 8 can also be easily attached.

Embodiment 2

Another embodiment of the invention will be described below with reference to Figs. 9A - 9E and Figs. 10A and 10B. It is noted that members having the same functions as those of members described in the above embodiment 1 will be denoted with the same reference numerals and detailed description thereof will be omitted.

Figs. 9A - Fig. 9E show the constitution of the left end of the indoor unit in this embodiment. In this embodiment, the top grating panel 7 shown in Fig. 9A is constituted as shown in Fig. 9B such that a plurality of crossbar pieces 22 and vertical pieces 23 are provided in a grid as in the case of Embodiment 1. The constitutions of the left frame 21a of an outer frame 21 surrounding these and the right frame 21b (not shown) is different from those in Embodiment 1. The left frame 21a will be exemplified as above for explanation. In this left frame 21a, an upward widened portion 41 extending outward from the upper end side in the width direction (downward in Fig. 9C) is provided as shown in Fig. 9C. A connecting portion 42

extending outward as in the case of the above is provided therebelow.

The upward widened portion 41 is formed over the whole length of the upper end side of the left frame 21a as shown in Fig. 9D. The connecting portion 42 is formed in a local area at a mid-position in the front-and-rear direction on the lower end side of the left frame 21a. A position limit portion 43 in a generally trapezoidal shape with a longer top side and a shorter bottom side is interlocked in front of the left end side (near side of the drawing) in this connecting portion 42 as shown in Fig. 9E.

On the other hand, a side middle wall 44 extending forward is provided at the mid-position of a vertical wall 3b in the front grill 3. A top grating panel 7 is attached to the front grill 3 in a state that the position limit portion 43 is inserted and engaged between the end side of the side middle wall 44 and the side edge support portion 34 therebelow from the front. Thus, movement of the top grating panel 7 in the up-and-down direction is limited by the constitution that the position limit portion 43 is vertically interposed between the side middle wall 44 and the inner wall panel 33.

Further, a locking protrusion 44a projecting upward is formed at the end of the side middle wall 44. Also, an engaging protrusion 41a projecting downward is

provided on the lower surface of the upward widened portion 41. The engaging protrusion 41a is brought into contact with the locking protrusion 44a from the rear in an attached state shown in the figure and thereby forward movement of the top grating panel 7 is also prevented.

In this constitution, the top grating panel 7 is removed by first removing the front panel (not shown) from the front grill 3 as in the case of Embodiment 1 and then lifting the handle 25 slightly upward and pulling the panel to the front. That is, as shown in Fig. 10A, elastic twisting deformation is caused in the connecting portion 42 while the position limit portion 43 is positioned between the side middle wall 44 and side edge support portion 34 by lifting the handle 25 slightly upward. Then, the left frame 21a and the upward widened portion 41 move upward integrally with handle 25. Consequently, a locked state that the engaging protrusion 41a is positioned in front of the locking protrusion 44a as shown in Fig. 10B by pulling the handle 25 to the front in a state that the engaging protrusion 41a is positioned above the locking protrusion 44a. Then, the top grating panel 7 is pulled out and removed from the front grill 3 as the pulling of the handle 25 to the front is continued. The top grating panel 7 is attached to the front grill 3 with the procedure reverse to the above.

Embodiment 3

Another embodiment of the invention will be described below with reference to Figs. 11A - 11C and Figs. 12A and 12B.

5 In the top grating panel 7 in Embodiment 1, the handle 25 positioned below the front panel 5 and the outward-widened portion 26 positioned below the side top panel 31a are provided so that the front grill 3 can be detachable by sliding operation in the front-and-rear
10 direction. However, in the top grating panel 7 in this embodiment, no handle 25 or outward-widened portion 26 described above is provided as shown in Figs. 11A and 11B. Therefore, the outer periphery shape of the top grating panel 7 is formed in generally the same shape as that of
15 top air inlet 6 in such a manner that the panel can be lifted upward even in a state in which the front panel 5 is attached to the front grill 3.

However, a pin-like locking portion 45 projecting downward is provided on the front end side on respective
20 lower surfaces of the left frame 21a (and the aforementioned right frame 21b) as shown in Fig. 11C so that upward removal is prevented unless removed on purpose. A locking hole 46 into which the locking portion 45 is inserted is formed in the side edge support portion 34 of
25 the front grill 3.

An engaging portion 45a slightly larger in diameter than the inner diameter of the locking hole 46 is provided at the end of the locking portion 45. As long as an external force is not applied, upward movement of the front end of the top grating panel 7 is prevented by pressing the locking portion 45 into the locking hole 46 so that the engaging portion 45a is positioned below the locking hole 46 as shown in the figure. In this attached state, movement in the front-and-rear direction is also prevented.

In the rear frame 21d of the top grating panel 7, a rear protrusion 24 extending over the whole length thereof is further formed as shown in Fig. 11A. Upward movement of the rear end of the top grating panel 7 is also prevented by attaching the panel in a state that the rear protrusion 24 is engaged into the engaging depressed portion 47 formed in the vertical wall 3b of the front grill 3 from the front as shown in Fig. 11C.

The top grating panel 7 having this constitution is removed first by gripping both ends in the width direction of the crossbar piece 22 on the front frame 21c and lifting them with fingertips. Thus, when a lifting force acts on the front end of the top grating panel 7, the engaging portion 45a at the end of the locking portion 45 moves upward over the locking hole 46 and the locking

portion 45 is removed from the locking hole 46 as shown in Fig. 12A. Consequently, a locked state of the top grating panel 7 on the front end side is released. Then, the rear protrusion 24 is pulled out from the engaging depressed portion 47 in the front grill 3 as shown in Fig. 12B by pulling out the top grating panel 7 upward diagonally to the front. A locked state on the rear end side is also released and thus the top grating panel 7 is removed from the front grill 3. The top grating panel 7 is attached to the front grill 3 with the procedure reverse to the above.

As described above, in each embodiment, the top grating panel 7 covering the top air inlet 6 formed in the front grill 3 in the body casing 1 is provided separately from the front grill 3 and the top grating panel 7 is detachably attached to the front grill 3. Therefore, when the top grating panel 7 is cleaned, cleaning can be performed by removing this panel from the front grill 3 in a safe posture and washing with water can appropriately be included while checking sites and degrees of contamination. Thus, cleaning can be easily done in a shorter time.

Particularly in Embodiments 1 and 2, work space above the indoor unit required to attach or detach the top grating panel 7 can be minimized since this panel is attached or detached by sliding the panel along generally the front-and-rear direction of the indoor unit. Therefore,

the indoor unit can be installed in the vicinity of the indoor ceiling. That is, freedom in installation sites is ensured.

In the top grating panel 7 in Embodiment 1, the outward-widened portions 26 projected from the left and right frames 21a, 21b are positioned below the top panel 31. Upward removal is prevented by attaching the panel in a state that the rear protrusion 24 is engaged into the engaging hole 36 of the front grill 3. Further, since the handle 25 is positioned below the top edge portion of the front panel 5, the top grating panel 7 is reliably held by the front grill 3 as long as the front panel 5 is not removed from the front grill 3. Therefore, safety is ensured since the top grating panel 7 is not accidentally removed even if a hand is placed on the panel, for example, in the case where the indoor unit is appropriately tilted when the indoor unit is carried, installed or the like. Overall appearance is also improved since the handle 25 is hidden under the front panel 5.

As described above, the handle 25 also functions as a guide when the dust-protective filter 8 is attached. That is, the dust-protective filter 8 is disposed in a generally vertical state along the front air inlet 4 on the front side of the indoor unit, in a generally horizontal state along the top air inlet 6 on the top side and in a

bent state between the front air inlet 4 and the top air inlet 6. When attached by lifting the filter along the front air inlet 4 from below, the handle 25 is placed over the bent area of the dust-protective filter 8 so that the upper end portion of the dust-protective filter 8 is guided along the lower surface of the handle 25. Therefore, the attaching operation is easy even while the dust-protective filter 8 is being bent on the upper front side as described above. Since no member exclusively used for such guiding is required separately, the whole constitution can be simple.

Further, in each embodiment, two top grating panels 7 are provided in parallel on the top surface of the body casing 1. These top grating panels 7 are in the same shape and can be attached to the front grill 3 interchangeably between the left and right sides. Consequently, when the user detaches the panel once and reattaches it, it can be attached interchangeably between the right and left sides and thereby attachment can be made easier. Also, since, for example, the same injection-molding mold is used when top grating panels 7 are manufactured, the manufacturing cost can be made lower.

Concrete embodiments of the present invention have been described. The present invention is not limited to the above embodiments, but can be changed in various

ways in the scope of the present invention. For example, in Embodiments 1 and 2, the handle 25 is also served as a locked portion engaged to the front panel 5 to prevent movement of the top grating panel 7. But this handle 25 can be provided only in the central portion area of the front frame 21c and protrusions functioning as the locked portion are separately provided on both sides of the front frame 21c.

In each of the above embodiments, an indoor unit constituted such that two top grating panels 7 are provided in parallel on the top surface is exemplified. But the present invention can be applied to an indoor unit constituted by providing one top grating panel or a large-size indoor unit constituted by providing three or more top grating panels.

INDUSTRIAL APPLICABILITY

As described above, an indoor unit of an air conditioner according to the present invention is provided with an air inlet in a top surface of the indoor unit and has a structure where a top grating panel covering the air inlet of the top surface is detachable. Consequently, the top surface of the indoor unit can be easily cleaned. Therefore, this indoor unit is suitable for a wall-mounted indoor unit which is provided with an air inlet in the top

surface thereof and installed at a high position.



CLAIMS:

1. An indoor unit of an air conditioner, comprising:
a front air inlet (4) formed in a front surface of a body casing (1) of the indoor unit; a top air inlet (6) formed
5 in a top surface of the body casing (1); a heat exchanger (11) provided in a ventilation passage from both the front air inlet (4) and the top air inlet (6) to an air outlet (10); an air-distributing fan (12) provided in the ventilation passage; and a top grating panel (7) detachably
10 attached to the top surface of the body casing (1) so as to cover the top air inlet (6).
2. The indoor unit of an air conditioner according to claim 1, wherein
15 the top grating panel (7) is attached to or detached from the body casing (1) by sliding the top grating panel (7) along a generally front-and-rear direction of the body casing (1).
- 20 3. The indoor unit of an air conditioner according to claim 2, wherein
the front panel (5) for covering the front air inlet (4) is detachably attached to the body casing (1) and a locked portion for engaging to the front panel (5) is
25 provided in the top grating panel (7) to prevent the

attached top grating panel (7) from moving.



4. The indoor unit of an air conditioner according to claim 3, wherein

5 a handle (25) to be projected in the front direction is provided at a front edge of the top grating panel (7) as the locked portion and is formed so as for an edge of the front panel (5) to overlap the handle (25) from above in locking.

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5. The indoor unit of an air conditioner according to claim 4, wherein

15 a dust-protective filter (8) is disposed in a generally vertical state along the front air inlet (4) on a front surface side of the indoor unit, in a generally horizontal state along the top air inlet (6) on a top surface side thereof and in a bent state between the front air inlet (4) and the top air inlet (6) and,

20 when this dust-protective filter (8) is attached while being pressed upward from below along the front air inlet (4), the handle (25) is placed above an area in which the dust-protective filter (8) is in the bent state between the front air inlet (4) and the top air inlet (6) so that an upper end of the dust-protective filter (8) is guided
25 backward along a lower surface of the handle (25).



6. The indoor unit of an air conditioner according to any one of claims 1 to 5, wherein

5 a plurality of top grating panels (7) are provided on the top surface of the body casing (1) in parallel along a width direction of the body casing (1) and these top grating panels (7) are formed in the same shape.