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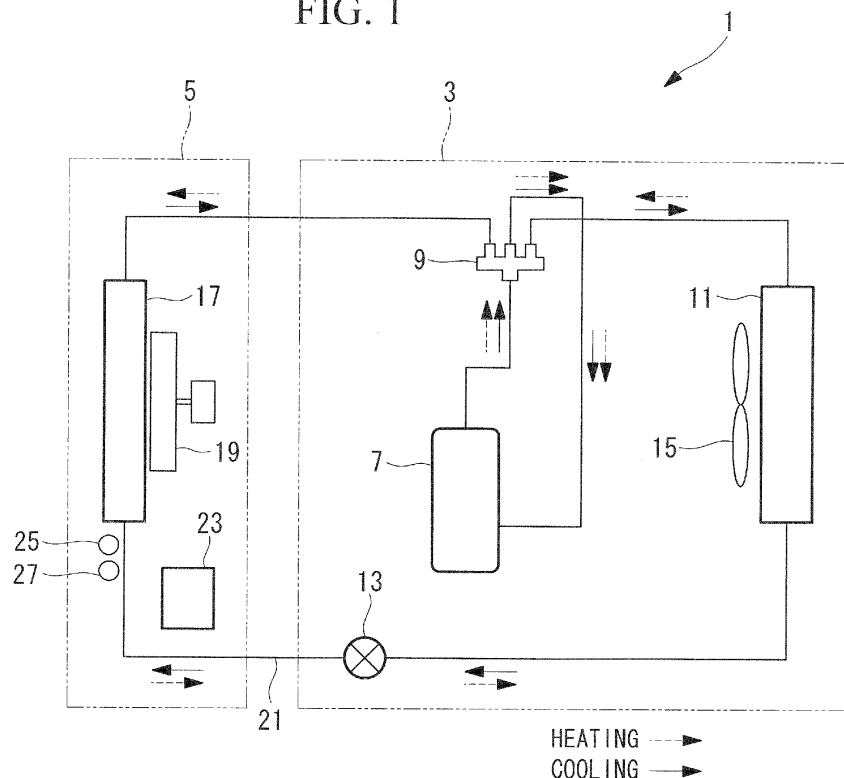
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(54) **Air conditioner**

(57) An object is to provide an air conditioner including an indoor temperature detector that can accurately detect indoor temperature without obstructing an airway, thus preventing a decrease in air-conditioning efficiency. The air conditioner includes a base (31) equipped with an indoor heat exchanger (17), a front panel (33) detachably attached to the front of the base (31) and having an

opening (37) for taking in indoor air in a front surface thereof, a pipe cover (59) attached to the base (31) so as to cover one side of the indoor heat exchanger (17) to prevent scattering of condensed water occurring on the indoor heat exchanger (17), and an intake-indoor-air temperature sensor (25) attached to the base (31) on the side of the pipe cover (59) facing away from the indoor heat exchanger (17).

FIG. 1



Description

BACKGROUND OF THE INVENTION

1. FIELD OF THE INVENTION

[0001] The present invention relates to air conditioners.

2. DESCRIPTION OF RELATED ART

[0002] The operation of an air conditioner is controlled so that indoor temperature reaches a preset temperature. For this purpose, the air conditioner includes an indoor temperature detector for measuring the temperature of indoor air.

[0003] Conventionally, an indoor temperature detector is disposed in the airway of indoor air taken into an indoor heat exchanger to measure the temperature of the indoor air taken into the indoor heat exchanger.

[0004] If the indoor temperature detector is disposed in the airway of the indoor air in this way, it can accurately measure the temperature of the indoor air, although it obstructs the flow of the intake air taken into the indoor heat exchanger, thus causing pressure loss of the intake air and decreasing air-conditioning efficiency.

[0005] In addition, if the indoor temperature detector is disposed in front of or near the indoor heat exchanger, it cannot accurately detect the indoor temperature because of the effect of radiant heat from the indoor heat exchanger.

[0006] To alleviate the effect of radiant heat, for example, as disclosed in Japanese Unexamined Patent Application, Publication No. 2008-144999, an air conditioner including an insulating member surrounding an indoor temperature detector disposed to the side of an indoor heat exchanger to block radiant heat from the radiant heat source has been proposed.

[0007] Although the air conditioner disclosed in Japanese Unexamined Patent Application, Publication No. 2008-144999 alleviates the effect of radiant heat, it leaves the problem of the indoor temperature detector obstructing the flow of the intake air taken into the indoor heat exchanger because the indoor temperature detector is disposed in the airway of the intake air.

[0008] In addition, the indoor temperature detector surrounded by the insulating member is so bulky that it obstructs the flow of the intake air, thus causing pressure loss of the intake air and decreasing air-conditioning efficiency.

BRIEF SUMMARY OF THE INVENTION

[0009] In light of such circumstances, an object of the present invention is to provide an air conditioner including an indoor temperature detector that can accurately detect indoor temperature without obstructing an airway, thus preventing a decrease in air-conditioning efficiency.

[0010] To solve the above problems, an air conditioner of the present invention employs the following solutions.

[0011] That is, an aspect of the present invention is an air conditioner including a base equipped with an indoor heat exchanger, a front panel detachably attached to the front of the base and having an opening for taking in indoor air in a front surface thereof, a cover member attached to the base so as to cover one side of the indoor heat exchanger to prevent scattering of condensed water occurring on the indoor heat exchanger, and an indoor temperature detector attached to the base on the side of the cover member facing away from the indoor heat exchanger.

[0012] According to the above aspect, the indoor air is taken in through the opening of the front panel to flow into the indoor heat exchanger. In other words, the airway of the indoor air is formed so as to extend from the outside of the front panel, that is, from around the edges of the opening, to the indoor heat exchanger through the opening.

[0013] The cover member is attached to the base so as to cover one side of the indoor heat exchanger, and the indoor temperature detector is attached on the side of the cover member facing away from the indoor heat exchanger. In other words, the indoor temperature detector is disposed inside the front panel and is located to the side of the indoor heat exchanger. This means that the indoor temperature detector is not located in the airway.

[0014] Thus, because the indoor temperature detector is not located in the airway of the intake air, it does not obstruct the flow of the intake air. This prevents pressure loss of the intake air, thus preventing a decrease in air-conditioning efficiency due to pressure loss.

[0015] The cover member, which prevents scattering of condensed water occurring on the indoor heat exchanger, at the same time blocks radiant heat radiated from the indoor heat exchanger. Because the indoor temperature detector is attached on the side of the cover member facing away from the indoor heat exchanger, the cover member can prevent the radiant heat from the indoor heat exchanger from reaching the indoor temperature detector. Thus, if the indoor temperature detector is insulated from the radiant heat from the indoor heat exchanger, it can directly detect the temperature of the indoor air, so that it can accurately measure the temperature of the indoor air. This allows operation control based on the accurate temperature of the indoor air, thus improving air-conditioning efficiency and the conditioned air feeling.

[0016] In the above aspect, the front panel preferably has a through-hole formed near the indoor temperature detector so as to penetrate the front panel.

[0017] In this case, the indoor air flows in through the through-hole, and the indoor temperature detector measures the temperature of the indoor air flowing in. This allows the indoor temperature detector to more accurately measure the temperature of the indoor air.

[0018] In the above aspect, the indoor temperature detector may be attached to a front surface of a control box attached to the base and containing components for controlling operation.

[0019] Because the control box contains or is equipped with a controller for controlling the operation of the air conditioner based on various signals from, for example, the indoor temperature detector, signal wiring can be easily installed. In addition, because the control box is often disposed to the side of the indoor heat exchanger and is firmly attached to the base, the control box is appropriate as the attachment position of the indoor temperature detector, in other words, complies with the installation conditions of the indoor temperature detector.

[0020] According to the present invention, because the indoor temperature detector is attached on the side of the cover member, attached to the base so as to cover one side of the indoor heat exchanger, facing away from the indoor heat exchanger, the indoor temperature detector does not obstruct the flow of the intake air. This prevents a decrease in air-conditioning efficiency due to pressure loss.

[0021] In addition, because the cover member insulates the indoor temperature detector from the radiant heat from the indoor heat exchanger, it can accurately measure the temperature of the indoor air.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0022]

Fig. 1 is a diagram of the refrigerant cycle of an air conditioner according to an embodiment of the present invention.

Fig. 2 is a perspective view showing the external appearance of an indoor unit according to the embodiment of the present invention.

Fig. 3 is a perspective view showing the external appearance of the indoor unit according to the embodiment of the present invention, with an inlet grille detached therefrom.

Fig. 4 is a horizontal sectional view of the indoor unit according to the embodiment of the present invention.

Fig. 5 is a partial front view of the indoor unit according to the embodiment of the present invention, with a front panel detached therefrom.

Fig. 6 is a side view of the indoor unit according to the embodiment of the present invention, with the front panel detached therefrom.

DETAILED DESCRIPTION OF THE INVENTION

[0023] An air conditioner 1 according to an embodiment of the present invention will be described below with reference to Figs. 1 to 6.

[0024] Fig. 1 shows a diagram of the refrigerant cycle

of the air conditioner 1.

[0025] The air conditioner 1 includes an outdoor unit 3 and an indoor unit 5.

[0026] The outdoor unit 3 includes an inverter-driven compressor 7 for compressing a refrigerant, a four-way switch valve 9 for switching the direction in which the refrigerant is circulated, an outdoor heat exchanger 11 for heat exchange between the refrigerant and outdoor air, an expansion valve 13 functioning as a refrigerant-throttling mechanism, and an outdoor air fan 15 for introducing outdoor air and causing it to pass through the outdoor heat exchanger 11.

[0027] The indoor unit 5 includes an indoor heat exchanger 17 supplied with the refrigerant from the outdoor unit 3 and a turbofan 19 serving as an indoor air fan for introducing air from the interior of a room and, when the air passes through the indoor heat exchanger 17, for blowing out conditioned air that has been subjected to heat exchange with the refrigerant.

[0028] The indoor heat exchanger 17 is, for example, of a plate-fin tube type.

[0029] The compressor 7, the four-way valve 9, the outdoor heat exchanger 11, and the expansion valve 13 in the outdoor unit 3 are coupled to the indoor heat exchanger 17 in the indoor unit 5 through refrigerant piping 21 to constitute a refrigeration cycle.

[0030] The indoor unit 5 includes a controller 23 for controlling the operation of the air conditioner 1.

[0031] The indoor unit 5 includes an intake-indoor-air temperature sensor (indoor temperature detector) 25 for detecting the temperature of the indoor air introduced from the interior of the room and an intake-indoor-air humidity sensor 27 for detecting the humidity of the indoor air.

[0032] The temperature of the indoor air detected by the intake-indoor-air temperature sensor 25 and the humidity of the indoor air detected by the intake-indoor-air humidity sensor 27 are input to the controller 23.

[0033] Fig. 2 is a perspective view showing the external appearance of the indoor unit 5. Fig. 3 is a perspective view showing the external appearance of the indoor unit 5, with an inlet grille 39, described later, detached therefrom. Fig. 4 is a horizontal sectional view of the indoor unit 5. Fig. 5 is a partial front view of the indoor unit 5, with a front panel 33, described later, detached therefrom. Fig. 6 is a side view of the indoor unit 5, with the front panel 33, described later, detached therefrom.

[0034] The indoor unit 5 is of a floor-standing type that blows air upward and downward and includes a horizontally oriented, substantially rectangular casing 35 composed of a base 31 and the front panel 33.

[0035] The front panel 33 has a large opening 37 serving as a channel (airway) for indoor air in the front surface thereof.

[0036] The front panel 33 has an inlet grille 39 fitted to the front surface thereof so as to cover the opening 37.

[0037] The inlet grille 39 has two vertically separated inlets 41 for taking in indoor air.

[0038] An upper outlet 43 is provided horizontally in the lateral direction between the front and top surfaces of the front panel 33.

[0039] An upper outlet grille 45 is disposed so as to extend along the upper outlet 43 in the lateral direction. The upper outlet grille 45 is attached to the base 31 to constitute the outlet of an air-guiding channel, formed in the base 31, for guiding conditioned air to the upper outlet 43.

[0040] The upper outlet grille 45 has a horizontal louver 47 rotatable about an axis extending in the lateral direction. The upper outlet 43 can be opened up and closed off by the horizontal louver 47, which is rotatably disposed at the opening thereof.

[0041] A display unit 49 is disposed at one end of the upper outlet 43 and is adjacent to the upper outlet grille 45.

[0042] A lower outlet 51 is provided horizontally in the lateral direction at the bottom of the front panel 33. The lower outlet 51 can be opened up and closed off by a horizontal louver 53 rotatably disposed at the opening thereof.

[0043] In the casing 35, an air filter 55 is detachably attached at the front of the opening 37 so as to cover substantially the entire opening 37, and the indoor heat exchanger 17 is fixed behind the air filter 55.

[0044] A drain pan 57 is disposed under the indoor heat exchanger 17 to catch drain water (condensed water) condensed on the surface of the indoor heat exchanger 17 and dropping therefrom during cooling and dehumidifying modes and to drain it to the outside through a drain hose (not shown).

[0045] A pipe cover (cover member) 59 is attached to the base 31 on one side of the indoor heat exchanger 17 so as to cover the side thereof.

[0046] The pipe cover 59 is a plate member bent into an L-shape. As shown in Fig. 4, one side of the pipe cover 59 extends along the front surface, whereas the other side extends toward the rear surface.

[0047] The bottom end of the pipe cover 59 is located in the drain pan 57, whereas the top end is located substantially at the midway position in the height direction of a control box 77, described later.

[0048] The pipe cover 59 catches drain water condensed on the surface of the indoor heat exchanger 17 and scattered in the side direction during cooling and dehumidifying modes and guides it to the drain pan 57.

[0049] A bellmouth 61 is disposed behind the indoor heat exchanger 17 (downstream in the airflow direction) to guide air communicated through the indoor heat exchanger 17 to the turbofan 19 disposed downstream thereof.

[0050] A circular-bell-shaped inlet 63 is provided in the center of the bellmouth 61 so as to face the turbofan 19. In addition, the turbofan 19 is disposed downstream of the bellmouth 61 so as to face the inlet 63.

[0051] The turbofan 19 is composed of a base plate 65, a shroud 67, and a plurality of blades 69. The center

of the base plate 65 is fixed to an end of a rotating shaft 73 of a motor 71 fixed to the base 31 so that the motor 71 rotationally drives the turbofan 19 about a horizontal axis.

[0052] The conditioned air blown radially through the turbofan 19 is blown outward from the periphery of the turbofan 19 at a certain angle with respect to the tangential direction thereof.

[0053] Air-guiding channels 75 for guiding the conditioned air blown from the turbofan 19 to the upper outlet 43 or the lower outlet 51 are formed between the base 31 and the bellmouth 61.

[0054] The air-guiding channels 75 extending to the upper outlet 43 or the lower outlet 51 have a plurality of vertical louvers (not shown) arranged in the longitudinal direction thereof. The vertical louvers are each disposed so as to be rotatable about a vertical axis and are coupled together.

[0055] The control box 77, which has a vertically elongated, substantially rectangular shape, is attached between a side surface of the base 31 and the pipe cover 59.

[0056] The bottom end of the control box 77 is located substantially at the midway position of the base 31. The refrigerant piping 21, for example, is attached under the control box 77.

[0057] The control box 77 contains or is equipped with various control components constituting a controller 23 for controlling the operation of the air conditioner 1.

[0058] The controller 23 receives detected values input from the individual sensors and various settings designated by the user through, for example, the display unit 49 and outputs control signals based on a predetermined program to control the operation of the air conditioner 1.

[0059] The controller 23 controls, for example, the on/off state and the rotational speed of the compressor 7, flow switching by the four-way valve 9, the on/off state and the rotational speed of the turbofan 19 and the outdoor air fan 15, and the opening/closing of the upper outlet 43 and the lower outlet 51.

[0060] The intake-indoor-air temperature sensor 25 and the intake-indoor-air humidity sensor 27 are attached side by side to the front surface of the control box 77 at the bottom end thereof.

[0061] Thus, if the intake-indoor-air temperature sensor 25 and the intake-indoor-air humidity sensor 27 are attached to the control box 77, signal wiring can be easily installed.

[0062] The intake-indoor-air temperature sensor 25 and the intake-indoor-air humidity sensor 27 are attached closer to the rear (to the base 31 side) than the front surface of the pipe cover 59.

[0063] The control box 77, the pipe cover 59, and the intake-indoor-air temperature sensor 25 are disposed inside the front panel 33.

[0064] The control box 77 is disposed to the side of the indoor heat exchanger 17 and is firmly attached to the base 31. Accordingly, the control box 77 is appropriate as the attachment position of the intake-indoor-air

temperature sensor 25, in other words, complies with the installation conditions of the intake-indoor-air temperature sensor 25.

[0065] A plurality of vertically spaced inlet holes (through-holes) 79 are provided substantially at the mid-way position of the edge between the front and side surfaces of the front panel 33 in the height direction thereof, that is, at the position corresponding to the installation position of the intake-indoor-air temperature sensor 25.

[0066] With the configuration described above, this embodiment provides the following effects and advantages.

[0067] First, in the air conditioner 1, the directions in which the refrigerant is circulated in a cooling mode and a heating mode are as follows.

[0068] In the cooling mode, the refrigerant is circulated in the direction indicated by the solid-line arrows in Fig. 1. As a result, the outdoor heat exchanger 11 functions as a heat radiator (evaporator), whereas the indoor heat exchanger 17 functions as a heat absorber (condenser). Accordingly, the refrigerant absorbs heat from the indoor air passing through the indoor heat exchanger 17 to decrease the temperature thereof before the conditioned air is blown into the interior of the room.

[0069] In the heating mode, the refrigerant is circulated in the direction indicated by the broken-line arrows in Fig. 1. As a result, the indoor heat exchanger 17 functions as a heat radiator (evaporator), whereas the outdoor heat exchanger 11 functions as a heat absorber (condenser). Accordingly, the refrigerant radiates heat into the indoor air passing through the indoor heat exchanger 17 to increase the temperature thereof before the conditioned air is blown into the interior of the room.

[0070] The conditioned air is blown from the turbofan 19 in the indoor unit 5 as follows.

[0071] As the turbofan 19 is rotated, the indoor air is taken into the casing 35 through the inlets 41 via the inlet grille 39.

[0072] After dust is removed from the air by the air filter 55, the air is cooled or heated by heat exchange with the refrigerant while passing through the indoor heat exchanger 17, thus generating conditioned air.

[0073] While being guided by the bellmouth 61, the conditioned air is taken through the bell-shaped inlet 63 into the turbofan 19, which increases the pressure thereof.

[0074] That is, the intake airway of the indoor air is formed so as to extend from the inlets 41 of the inlet grille 39 to the indoor heat exchanger 17 through the opening 37 of the front panel 33. Thus, the front half of the intake airway is formed outside the front panel 33, whereas the rear half is formed in front of the indoor heat exchanger 17.

[0075] The conditioned air whose pressure has been increased by the turbofan 19 is blown outward from the periphery of the turbofan 19 at a certain angle with respect to the tangential direction thereof.

[0076] The conditioned air is guided to the upper outlet

43 and/or the lower outlet 51 through the air-guiding channels 75 and is blown into the interior of the room, thus contributing to cooling or heating.

[0077] The conditioned air is selectively blown into the interior of the room via either or both of the upper outlet 43 and the lower outlet 51, depending on the set blowing mode.

[0078] The controller 23 receives detected values input from the individual sensors and various settings designated by the user through, for example, the display unit 49 and outputs control signals based on a predetermined program to control the operation of the air conditioner 1. The controller 23 controls, for example, the on/off state and the rotational speed of the compressor 7, flow switching by the four-way valve 9, the on/off state and the rotational speed of the turbofan 19 and the outdoor air fan 15, and the opening/closing of the upper outlet 43 and the lower outlet 51.

[0079] As the indoor air is taken in along the intake airway described above by rotating the turbofan 19, an airway of the intake air flowing from the opening 37 into the indoor heat exchanger 17 is formed inside the front panel 33.

[0080] Because the intake-indoor-air temperature sensor 25 and the intake-indoor-air humidity sensor 27 are not located in the airway of the intake air, they do not obstruct the flow of the intake air. This prevents pressure loss of the intake air, thus preventing a decrease in air-conditioning efficiency due to pressure loss.

[0081] In the casing 35, an airflow toward the indoor heat exchanger 17 occurs while being attracted by the airflow through the airway described above. This airflow causes the indoor air to flow in through the inlets 79 toward the indoor heat exchanger 17.

[0082] By measuring the temperature and humidity of the indoor air flowing in, the intake-indoor-air temperature sensor 25 and the intake-indoor-air humidity sensor 27 can measure the temperature and humidity of the indoor air.

[0083] The pipe cover 59 catches the drain water condensed on the surface of the indoor heat exchanger 17 and scattered in the side direction and guides it to the drain pan 57, and also blocks radiant heat radiated from the indoor heat exchanger 17.

[0084] Because the intake-indoor-air temperature sensor 25 is attached on the side of the pipe cover 59 facing away from the indoor heat exchanger 17, the pipe cover 59 can prevent the radiant heat from the indoor heat exchanger 17 from reaching the intake-indoor-air temperature sensor 25.

[0085] Thus, if the intake-indoor-air temperature sensor 25 is insulated from the radiant heat from the indoor heat exchanger 17, it can directly detect the temperature of the indoor air, so that it can accurately measure the temperature of the indoor air.

[0086] This allows the controller 23 to operate the air conditioner 1 based on the accurate temperature of the indoor air, thus improving air-conditioning efficiency and

the conditioned air feeling.

[0087] The present invention is not limited to the above embodiment; various modifications are permitted without departing from the spirit thereof.

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Claims

1. An air conditioner comprising:

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a base equipped with an indoor heat exchanger;
a front panel detachably attached to the front of
the base and having an opening for taking in
indoor air in a front surface thereof;

a cover member attached to the base so as to
cover one side of the indoor heat exchanger to
prevent scattering of condensed water occurring
on the indoor heat exchanger; and

an indoor temperature detector attached to the
base on the side of the cover member facing
away from the indoor heat exchanger.

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2. The air conditioner according to Claim 1, wherein
the front panel has a through-hole formed near the
indoor temperature detector so as to penetrate the
front panel.

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3. The air conditioner according to Claim 1 or 2, wherein
the indoor temperature detector is attached to a front
surface of a control box attached to the base and
containing components for controlling operation.

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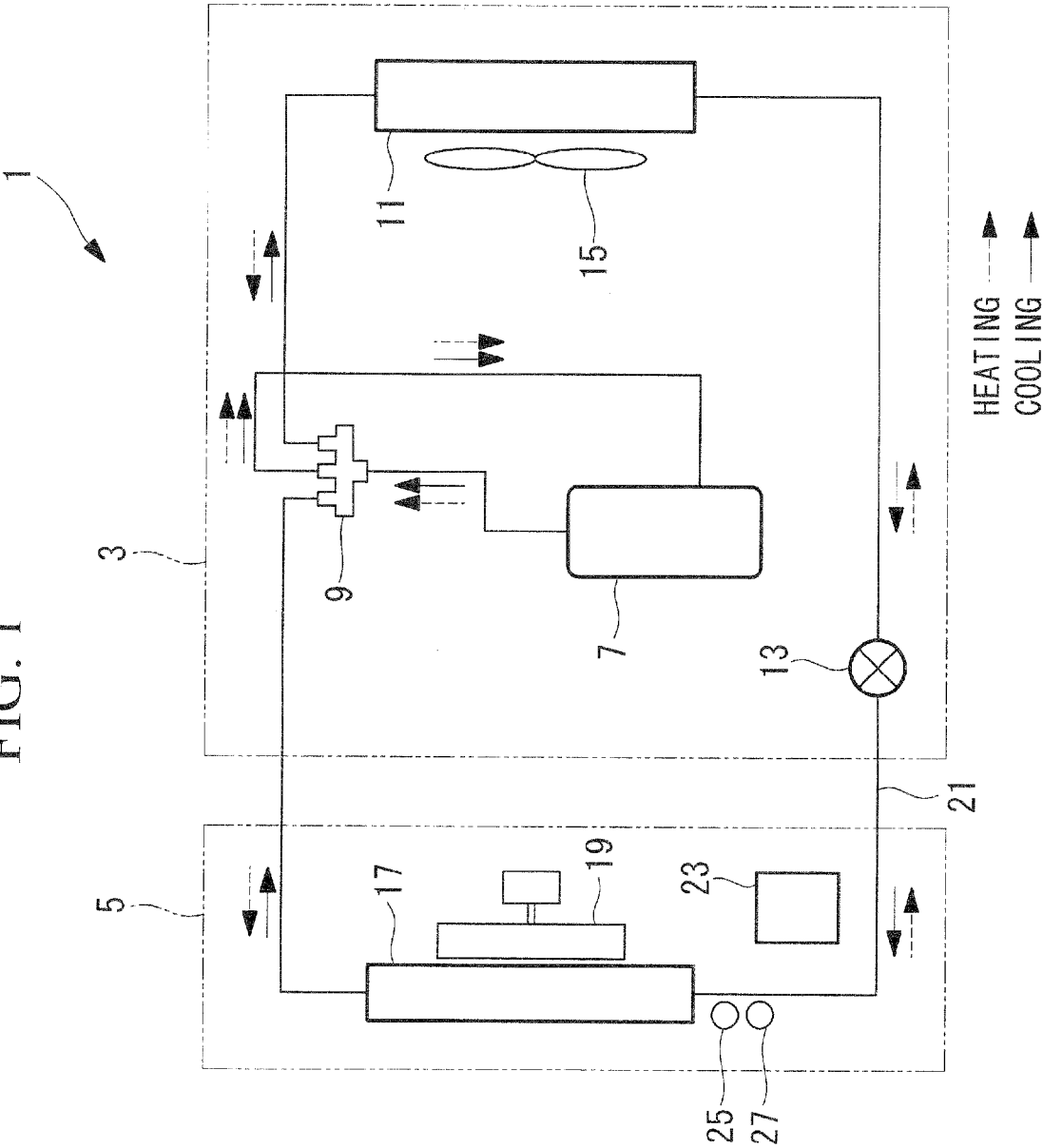
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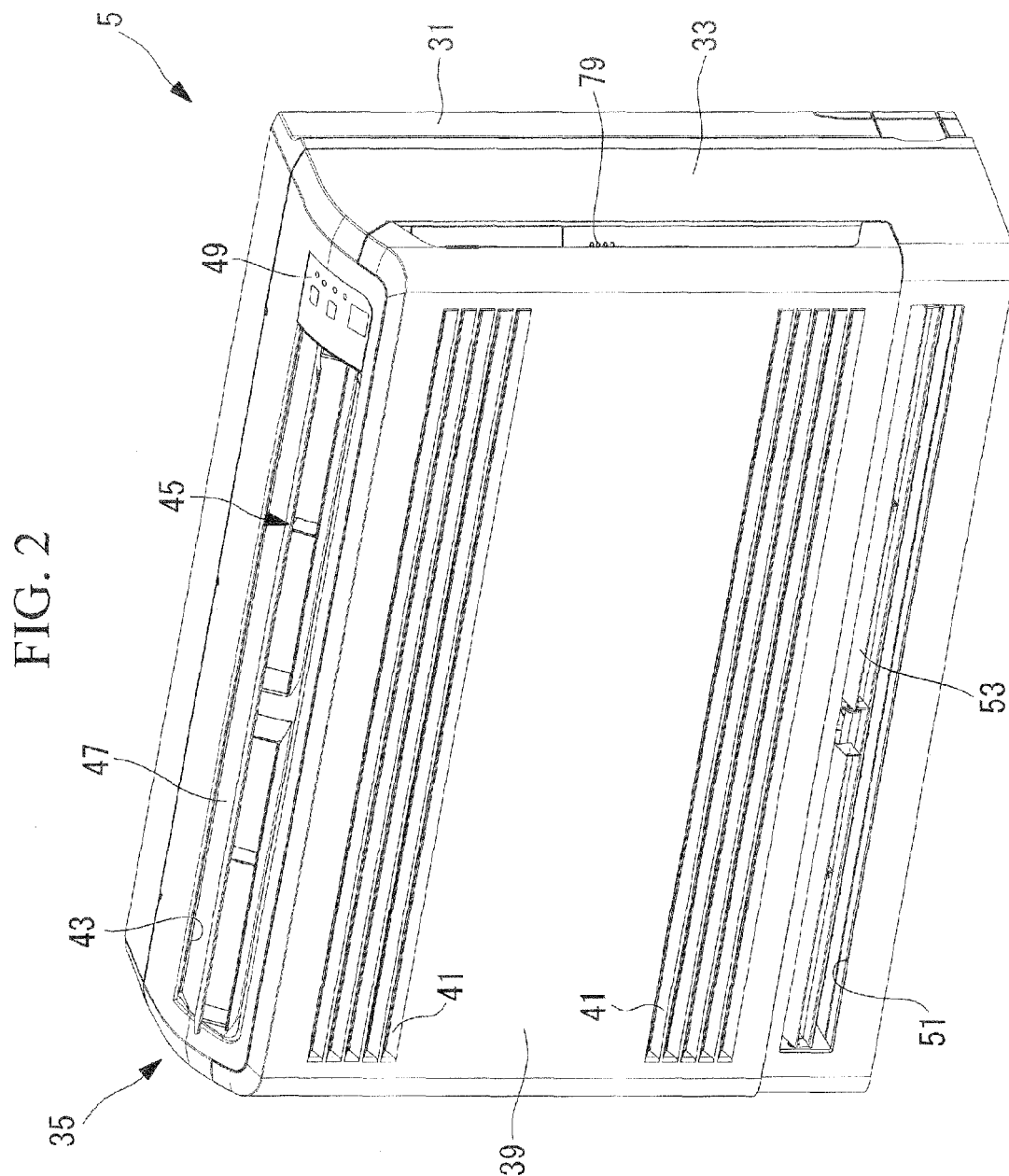
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FIG. 1





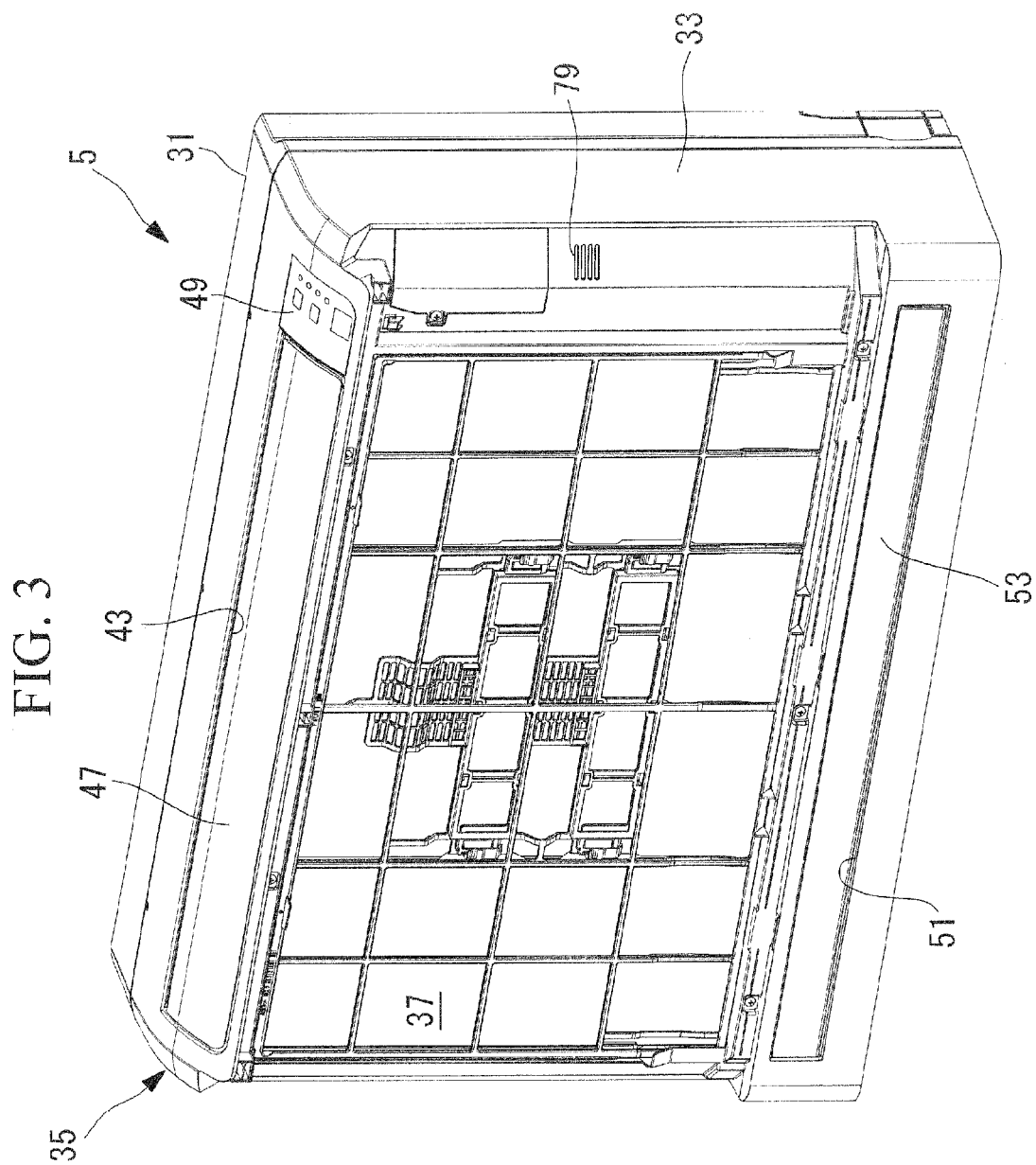


FIG. 4

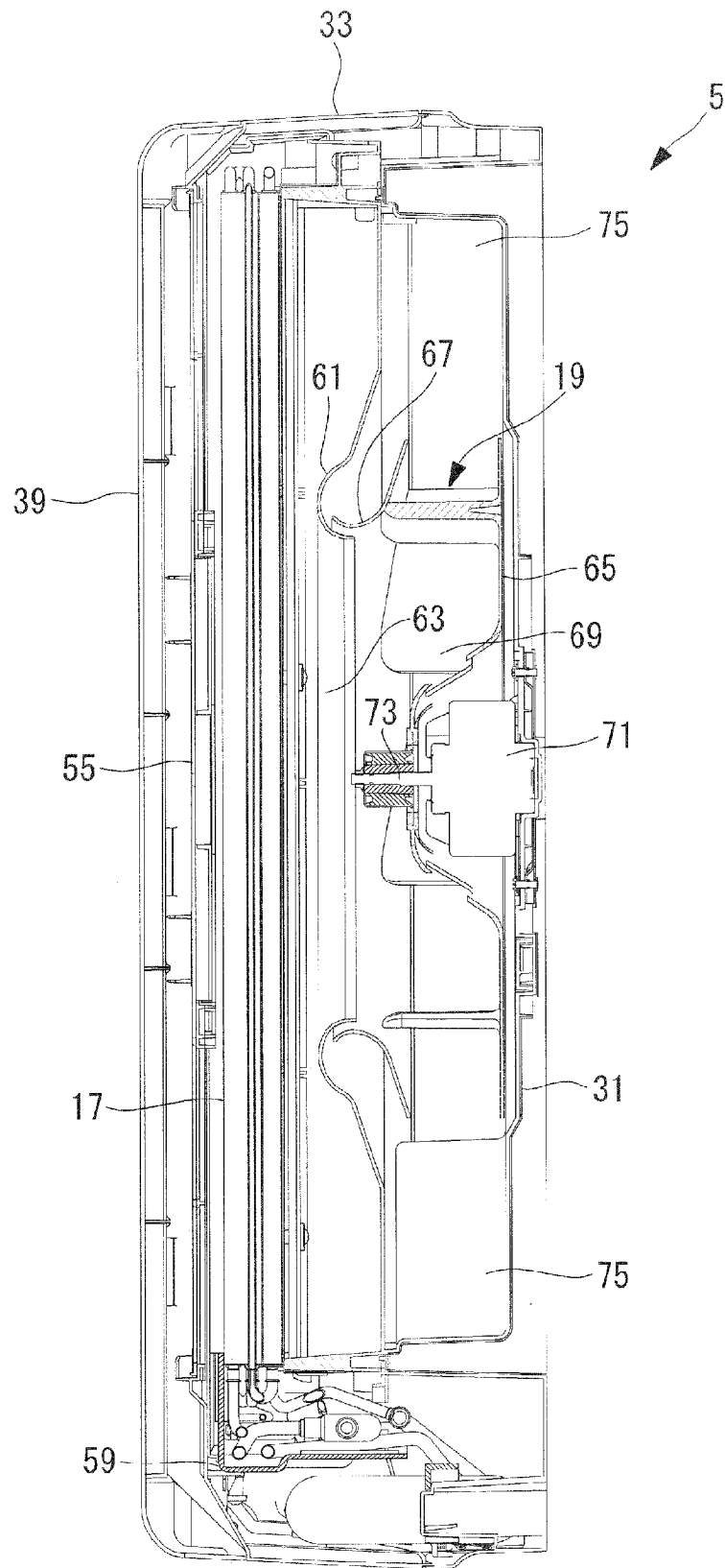


FIG. 5

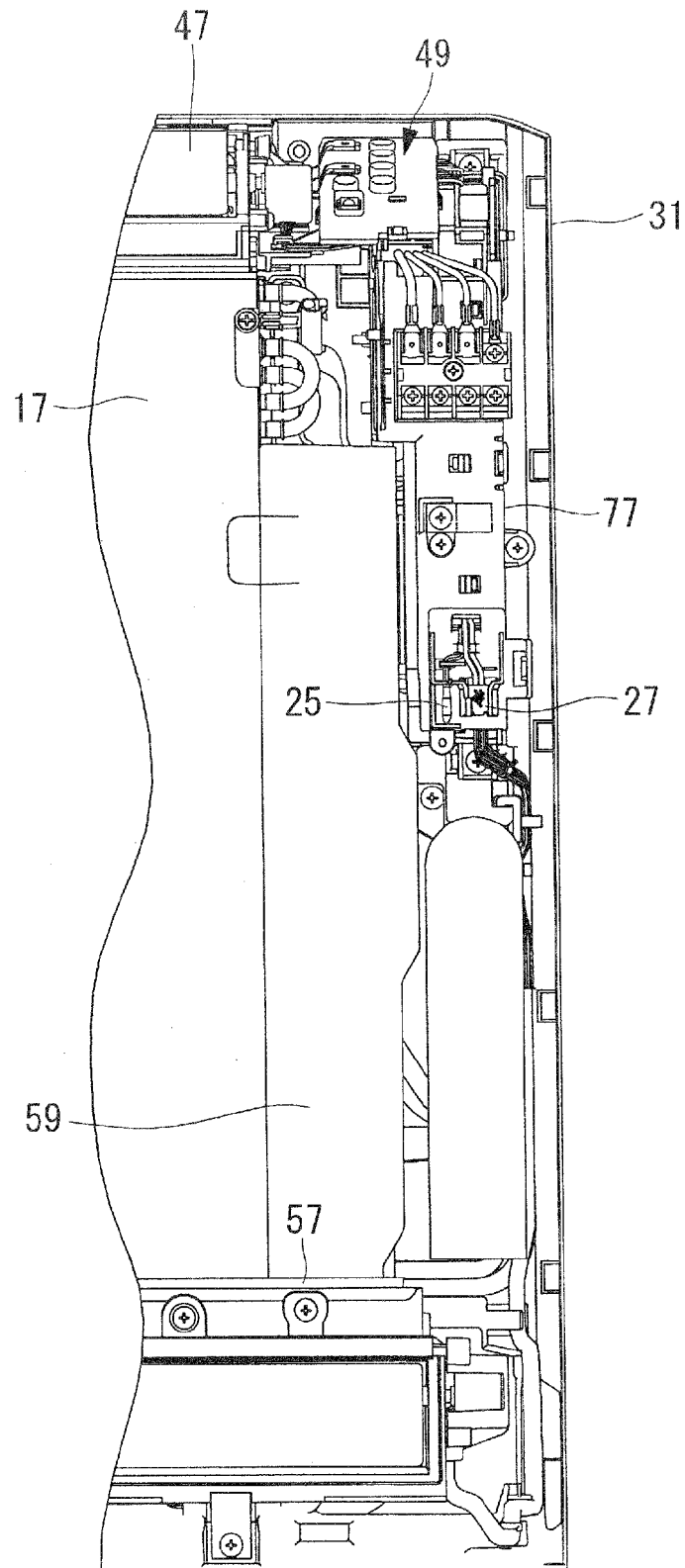
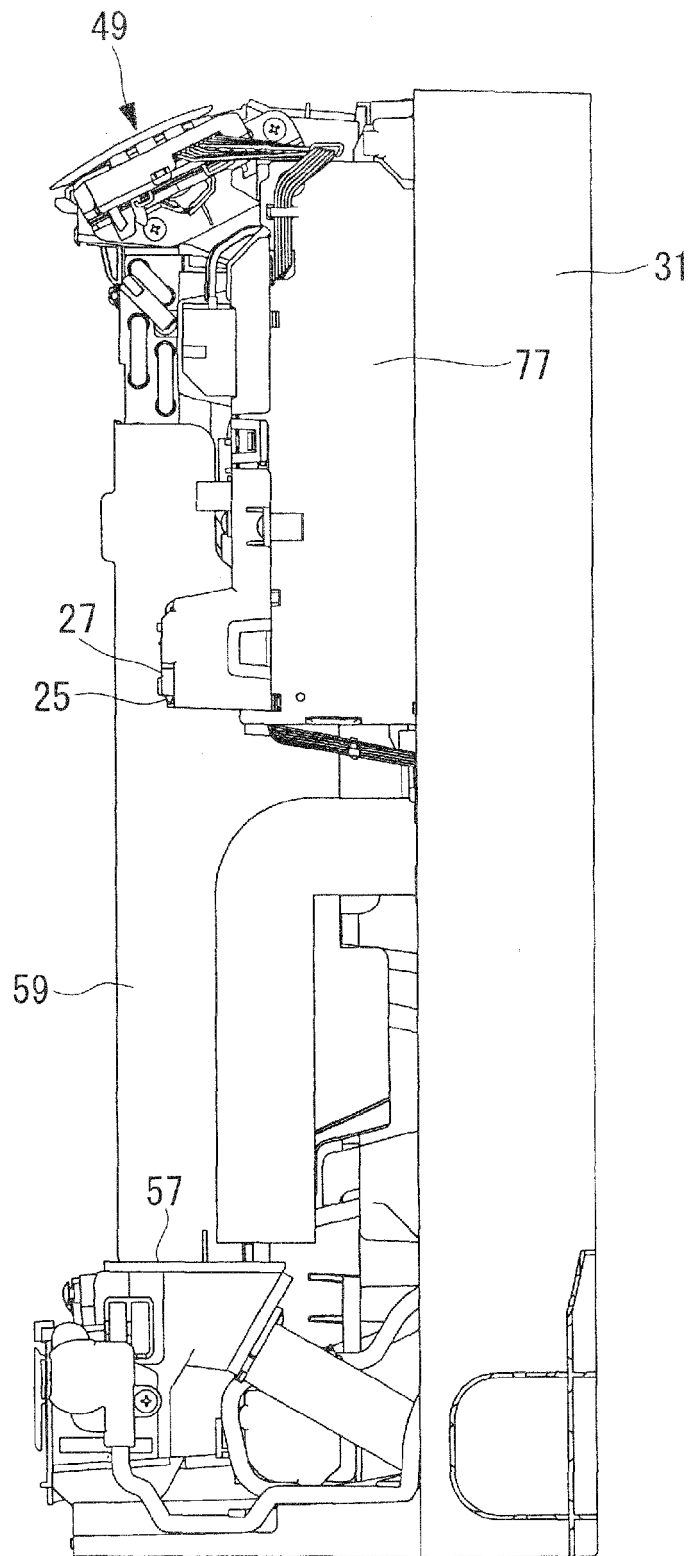


FIG. 6



REFERENCES CITED IN THE DESCRIPTION

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