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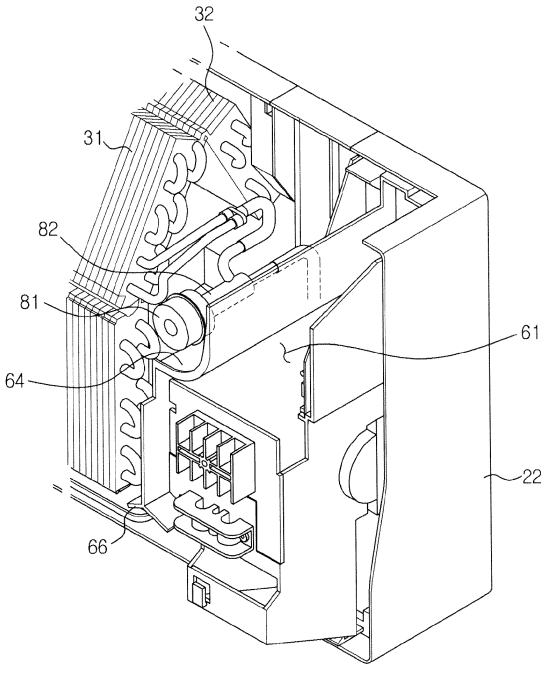
(54) **Indoor unit of air conditioner**

(57) An indoor unit of an air conditioner with an electronic expansion valve. The indoor unit includes a main body, a heat exchanger disposed at the front portion of the inside of the main body, a control unit, in which electrical components are mounted, disposed at the outside in the lengthwise direction of the heat exchanger, a control case including a first side surface part disposed between the control unit and the heat exchanger and an extension part connected with the first side surface part and extended in the lengthwise direction of the heat exchanger, and an electronic expansion valve disposed in a space defined by two surfaces neighboring with each other by the extension part.

FIG. 3



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Description

BACKGROUND

1. Field

[0001] Embodiments relate to an indoor unit of a multi-type air conditioner with an electronic expansion valve (EEV).

2. Description of the Related Art

[0002] In general, a refrigerating cycle system of an air conditioner includes a compressor, a condenser, an expansion device, an evaporator, and pipes connecting them. A refrigerant circulated through the pipes is compressed into a high-pressure state by the compressor, is introduced into the condenser, and is then condensed while emitting heat via the condenser. The condensed refrigerant is introduced into the expansion device, and is then expanded into a low-temperature and low-pressure state by the expansion device. The expanded refrigerant is introduced into the evaporator, and then receives heat from surrounding air while passing through the evaporator, thus being evaporated.

[0003] In a building having a plurality of independent indoor spaces, a multi-type air conditioner provided with a plurality of indoor units to condition air of the plurality of independent indoor spaces is used. The multi-type air conditioner requires one or more electronic expansion valves to adjust amounts of a refrigerant supplied to the respective indoor units so as to individually operate the respective indoor units.

[0004] When the electronic expansion valve is installed in a pipe connecting the indoor unit and an outdoor unit, the installation cost of the electronic expansion valve is increased and provision of a space required for installation of the electronic expansion valve is difficult.

[0005] Further, when the electronic expansion valve is installed in the indoor unit, an external size of the indoor unit is increased.

SUMMARY

[0006] Therefore, it is an aspect to provide an indoor unit of a multi-type air conditioner with an electronic expansion valve (EEV).

[0007] Additional aspects of the invention will be set forth in part in the description which follows and, in part, will be apparent from the description, or may be learned by practice of the invention.

[0008] In accordance with one aspect, an indoor unit of an air conditioner includes a main body, a heat exchanger disposed in the main body, an electronic expansion valve disposed in the main body and located at the outside in the lengthwise direction of the heat exchanger, a control unit controlling electrical components mounted in the main body, and a control case including a first side surface part disposed between the control unit and the electronic expansion valve and an extension part connected with the first side surface part and extended in the direction of the heat exchanger.

[0009] The electronic expansion valve may be located between the heat exchanger and the control unit.

[0010] The electronic expansion valve may be located above the extension part.

[0011] The indoor unit of the air conditioner may further include a water collector to receive condensed water formed around the electronic expansion valve, and the extension part may include a guide part downwardly inclined from the first side surface part toward the water collector and a water intake part upwardly inclined from the guide part.

[0012] The control case may further include a second side surface part connected with the extension part and downwardly extended and a protruding part connected with the second side surface part and protruded toward the water collector.

[0013] The electronic expansion valve may include a driving part in which a rotor is mounted, and the electronic expansion valve may be disposed such that the driving part faces the front surface of the main body.

[0014] The electronic expansion valve may further include a passage part, through which a refrigerant flows into and out of the electronic expansion valve, extended from the driving part, and the driving part may be located at a height equal to or higher than the passage part.

[0015] In accordance with another aspect, an indoor unit of an air conditioner includes a main body, a front heat exchanger and a rear heat exchanger disposed in the main body, an electronic expansion valve disposed in the main body, a control unit controlling electrical components mounted in the main body, a control case including a first side surface part disposed between the control unit and the electronic expansion valve and an extension part connected with the first side surface part and extended in the lengthwise direction of the heat exchanger, and a receipt space provided at the outside in the lengthwise direction of the front heat exchanger, wherein the receipt space is located above the extension part.

[0016] The receipt space may be located between the front heat exchanger and the control unit.

[0017] The receipt space may be located at the outside of the control case.

[0018] The indoor unit of the air conditioner may further include a water collector to receive condensed water formed within the main body, and the extension part may include a guide part downwardly inclined from the first side surface part toward the water collector and a water intake part upwardly inclined from the guide part.

[0019] The control case may further include a second side surface part connected with the extension part and downwardly extended and a protruding part connected with the second side surface part and protruded toward the water collector.

[0020] The electronic expansion valve may include a

driving part in which a rotor is mounted, and the electronic expansion valve may be disposed such that the driving part faces the front surface of the main body.

[0021] The electronic expansion valve may further include a passage part, through which a refrigerant flows into and out of the electronic expansion valve, extended from the driving part, and the driving part may be located at a height equal to or higher than the passage part.

[0022] In accordance with a further aspect , an indoor unit of an air conditioner includes a main body, a heat exchanger disposed at the front portion of the inside of the main body, a control unit, in which electrical components are mounted, disposed at the outside in the lengthwise direction of the heat exchanger, a control case including a first side surface part disposed between the control unit and the heat exchanger and an extension part connected with the first side surface part and extended in the lengthwise direction of the heat exchanger, and an electronic expansion valve disposed in a space defined by two surfaces neighboring with each other by the extension part.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] These and/or other aspects of the invention will become apparent and more readily appreciated from the following description of the embodiments, taken in conjunction with the accompanying drawings of which:

FIG. 1 is an exploded perspective view illustrating main constitution of an indoor unit of an air conditioner in accordance with an embodiment;

FIG. 2 is a refrigerant circuit diagram of a multi-type air conditioner having the indoor unit of the air conditioner in accordance with the embodiment;

FIG. 3 is a perspective view illustrating a mounting structure of an electronic expansion valve in the indoor unit of the air conditioner in accordance with the embodiment;

FIG. 4 is a perspective view illustrating a space in which the electronic expansion valve is mounted in the indoor unit of the air conditioner in accordance with the embodiment;

FIG. 5 is a perspective view of a control unit of the indoor unit of the air conditioner in accordance with the embodiment;

FIG. 6 is a view illustrating disposition of the electronic expansion valve in the indoor unit of the air conditioner in accordance with the embodiment; and

FIG. 7 is a view illustrating a drain passage of condensed water in the indoor unit of the air conditioner in accordance with the embodiment.

DETAILED DESCRIPTION

[0024] Reference will now be made in detail to the embodiments, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to like elements throughout.

[0025] FIG. 1 is an exploded perspective view illustrating main constitution of an indoor unit of an air conditioner in accordance with an embodiment.

[0026] As shown in FIG. 1, an indoor unit 2 of an air conditioner includes a main body 20 including a rear panel 22 fixed to a wall of a building and a front panel 21 connected with the front portion of the rear panel 22, an indoor heat exchanger 30 disposed in the main body 20 to exchange heat with inhaled air, an air blower device 40 to blow air, and a water collector 90 to collect condensed water formed within the main body 20 and then to discharge the collected water to the outside of the main body 20.

[0027] The front panel 21 is provided with suction holes 21 a formed through most of the front surface and the upper surface thereof to inhale indoor air, and a discharge hole 21 b formed through the lower end thereof and extended in the longitudinal direction to discharge conditioned air. Further, a suction grill 23 provided with a plurality of ventilation holes 23a and rotatably connected to the upper portion of the front panel 21 is installed in front of the suction holes 21 a of the front panel 21, and a filter 23b to filter out foreign substances from the inhaled air is installed in the suction grill 23.

[0028] The indoor heat exchanger 30 may be extended in the longitudinal direction so as to exchange heat with air inhaled through the suction holes 21 a. The indoor heat exchanger 30 is provided with a plurality of heat exchanger fins made of a thin plate and disposed in parallel, and a refrigerant pipe bent in a U shape so as to pass the heat exchanger fins one or more times. The indoor heat exchanger 30 is disposed adjacent to the suction holes 21 a, and exchanges heat with the inhaled air.

[0029] The indoor heat exchanger 30 includes a front heat exchanger 31 located at the front and a rear heat exchanger 32 located at the rear. The front heat exchanger 31 and the rear heat exchanger 32 are disposed such that they may be detached or separated from each other or attached to each other.

[0030] The indoor heat exchanger 30 has a vertical width from the upper portion of the rear region to the lower portion of the front region of the inside of the main body 20, and the upper end of the indoor heat exchanger 30 is supported by the upper portion of the inside of the rear panel 22 and the lower end of the indoor heat exchanger 30 is supported by the lower portion of the inside of the front panel 21.

[0031] The air blower device 40 includes a cross flow air blower fan 41 installed at the rear of the indoor heat exchanger 30 and extended in the widthwise direction and a driving motor 42 mounted on the rear panel 22 to

drive the air blower fan 41 and axially connected to the air blower fan 41.

[0032] The indoor unit 2 of the air conditioner inhales indoor air from the suction grill 23 by rotating the air blower fan 41 driven by the driving motor 42. The inhaled air passes through the indoor heat exchanger 30 and the air blower fan 41, and is supplied to an indoor space through the discharge hole 21 b. Here, the indoor air is cooled or heated by exchanging heat with the indoor heat exchanger 30, and the cooled air (or heated air) is supplied to the indoor space through the discharge hole 21 b, thereby conditioning air of the indoor space.

[0033] The water collector 90 collects condensed water formed within the main body 20, particularly formed around the indoor heat exchanger 30, and then discharges the collected water to the outside of the main body 20. The water collector 90 is disposed under the indoor heat exchanger 30. A drain hole 91 is formed through the water collector 90, and a drain hose 92 is connected to the drain hole 91. Therefore, the condensed water collected in the water collector 90 is drained to the outside of the main body 20 through the drain hose 92.

[0034] In case of a multi-type air conditioner with a plurality of indoor units, it is necessary to adjust amounts of a refrigerant flowing to indoor heat exchangers 30 of the respective indoor units 2.

[0035] Therefore, the indoor unit 2 of the air conditioner includes an electronic expansion valve 80 to control an amount of the refrigerant.

[0036] FIG. 2 is a refrigerant circuit diagram of a multi-type air conditioner having the indoor unit of the air conditioner in accordance with the embodiment , FIG. 3 is a perspective view illustrating a mounting structure of the electronic expansion valve in the indoor unit of the air conditioner in accordance with the embodiment, FIG. 4 is a perspective view illustrating a space in which the electronic expansion valve is mounted in the indoor unit of the air conditioner in accordance with the embodiment , FIG. 5 is a perspective view of a control unit of the indoor unit of the air conditioner in accordance with the embodiment, and FIG. 6 is a view illustrating disposition of the electronic expansion valve in the indoor unit of the air conditioner in accordance with the embodiment.

[0037] As shown in FIG. 2, an outdoor unit 3 is connected to a plurality of indoor units 2a, 2b, and 2c. Pipes of the outdoor unit 3 and the plurality of indoor units 2a, 2b, and 2c are connected by service valves 15a and 15b.

[0038] A liquid pipe 4a and a plurality of branch pipes 5a, 5b, and 5c branched from a gas pipe 4b are connected to the plurality of indoor units 2a, 2b, and 2c, respectively. Further, the plurality of indoor units 2a, 2b, and 2c include the plurality of indoor heat exchangers 30a, 30b, and 30c and a plurality of electronic expansion valves 80a, 80b, and 80c connected by the plurality of branch pipes 5a, 5b, and 5c, respectively.

[0039] The outdoor unit 3 includes a compressor 11 to compress a refrigerant, a receiver-drier 12 to separate gas and liquid refrigerant and to filter out contaminants, an outdoor heat exchanger 13 to exchange heat between the refrigerant and outdoor air, and a four-way switching valve 14 to switch a flow direction of the refrigerant during cooling and heating. Cooling and heating modes of the air conditioner may be switched by changing a refrigerant circulation direction of a refrigerant circuit using the four-way switching valve 14.

[0040] As shown in FIGS. 3 to 6, the indoor unit 2 of the air conditioner includes the electronic expansion valve 80, a control unit 50, the water collector 90, and a control case 60.

[0041] The electronic expansion valve 80 adjusts an amount of the refrigerant flowing in the indoor heat exchanger 30. The electronic expansion valve 80 is connected to the indoor heat exchanger 30 in series, and is installed at a refrigerant inlet of the indoor heat exchanger 30.

[0042] The electronic expansion valve 80 includes a driving part 81 to open and close the electronic expansion valve 80, and a passage part 82 through which the refrigerant flows into and out of the electronic expansion valve 80. The driving part 81 controls an amount of the refrigerant passing through the passage part 82 using a rotor.

[0043] The electronic expansion valve 80 is disposed in the main body 20. For this purpose, a receipt space 70 is provided to receive the electronic expansion valve 80 in the main body 20. In the indoor unit 2 of the air conditioner, the receipt space 70 is provided at the outside in the lengthwise direction of the indoor heat exchanger 30.

[0044] The length of the rear heat exchanger 32 may be smaller than the length of the front heat exchanger 31, and the electronic expansion valve 80 may be disposed in a space formed due to such a length difference. Similarly, the length of the rear heat exchanger 32 may be greater than the length of the front heat exchanger 31. However, in these cases, a heat exchange amount may be reduced. Therefore, in order to dispose the electronic expansion valve 80 in the main body 20 while maintaining the heat exchange amount, the receipt space 70 is located at the outside in the lengthwise direction of the front and rear heat exchanger units 31 and 32.

[0045] When the refrigerant passes through the electronic expansion valve 80, the electronic expansion valve 80 vibrates due to flow and expansion of the refrigerant. In order to prevent vibration of the electronic expansion valve 80 from being transmitted to the main body 20, the electronic expansion valve 80 is not connected directly to the main body 20. The electronic expansion valve 80 is connected to respective heat transfer passages of the indoor heat exchanger 30, thus being fixed to the inside of the main body 20.

[0046] The electronic expansion valve 80 is disposed such that the driving part 81 faces the front surface of the main body 20. Therefore, maintenance and repair of the electronic expansion valve 80 by separating the front

panel 21 from the rear panel 22 is not difficult.

[0047] Further, the driving part 81 of the electronic expansion valve 80 is located at a height equal to or higher than the passage part 82. If the driving part 81 is located at a height lower than the passage part 82, pressure of the refrigerant applied to the driving part 81 through the passage part 82 may affect durability of valve components mounted in the driving part 81.

[0048] Electrical components, such as a circuit board, to control operation of the indoor unit 2 of the air conditioner are mounted in the control unit 50. The control unit 50 is disposed at one side end of the inside of the main body 20, and the electronic expansion valve 80 is disposed between the outside in the lengthwise direction of the indoor heat exchanger 30 and the control unit 50. That is, the receipt space 70 is provided between the outside in the lengthwise direction of the indoor heat exchanger 30 and the control unit 50.

[0049] Condensed water is formed within the main body 20, particularly formed around the indoor heat exchanger 30 and the electronic expansion valve 80, in which the refrigerant flows, due to a temperature difference between the refrigerant and air. In order to prevent the condensed water from electrically damaging the electrical components mounted in the control unit 50, introduction of the condensed water into the control unit 50 needs to be prevented.

[0050] The control case 60 fixes the control unit 50 to the inside of the main body 20 and prevents the condensed water from being introduced into the control unit 50. The control case 60 includes a mount part 61 in which the control unit 50 is mounted, a side wall 62 located between the control unit 50 and the indoor heat exchanger 30, and a motor fixing part 67 to fix the driving motor 42 to the rear panel 22. The motor fixing part 67 is formed in a shape surrounding the front surface portion of the driving motor 42, and thus also prevents the condensed water from being introduced into the driving motor 42 and electrically damaging the driving motor 42.

[0051] The side wall 62 includes a first side surface part 63, an extension part 64 connected with the first side surface part 63, a second side surface part 65 connected with the extension part 64, and a protruding part 66 formed on the second side surface part 65.

[0052] The first side surface part 63 is disposed in the vertical direction between the control unit 50 and the electronic expansion valve 80. The control unit 50 and the electronic expansion valve 80 are horizontally divided by the first side surface part 63. Further, one side of the extension part 64 is connected with the first side surface part 63, and the extension part 64 is extended to a designated length in the direction of the indoor heat exchanger 30. The electronic expansion valve 80 may be located above the extension part 64. Therefore, two neighboring surfaces of the receipt space 70 are defined by the first side surface part 63 and the extension part 64.

[0053] The extension part 64 includes a guide part 64a provided with a front end downwardly inclined from the first side surface part 63 toward the water collector 90, and a water intake part 64b upwardly inclined from the guide part 64a. The water intake part 64b may be configured such that both ends of the water intake part 64b are inclined upwardly, and in this case, the extension part 64 has a V shape. The condensed water formed around the electronic expansion valve 80 is collected along a channel formed by the water intake part 64b and the guide part 64a.

[0054] The second side surface part 65 is connected with the extension part 64 and is inclined downwardly. Further, the protruding part 66 protruding toward the water collector 90 is formed on the second side surface part 65. The protruding part 66 may be inclined downwardly toward the water collector 90. The water collector 90 is disposed below the protruding part 66, and the condensed water dropping from the protruding part 66 is received in the water collector 90.

[0055] FIG. 7 is a view illustrating a drain passage of condensed water in the indoor unit of the air conditioner in accordance with the embodiment.

[0056] Indoor air is inhaled into the main body 20 through the suction holes 21 a by driving the air blower fan 41 while filtering out foreign substances from the indoor air. The inhaled air undergoes heat exchange via the indoor heat exchanger 30, and is discharged to the indoor space through the discharge hole 21 b by the air blower fan 41. Here, condensed water formed around the indoor heat exchanger 30 is collected in the water collector 90 which is disposed below the indoor heat exchanger 30, and is discharged to the outside of the main body 20 through the drain hose 92.

[0057] As shown in FIG. 7, condensed water is also formed around the electronic expansion valve 80 exposed to the indoor air. The condensed water is collected in the channel formed by the water intake part 64b and the guide part 64a of the extension part 64 located below the electronic expansion valve 80. The collected condensed water flows on the second side surface part 65, and then drops down to the water collector 90 from the protruding part 66. Therefore, the condensed water formed around the electronic expansion valve 80 is not introduced into the control unit 50 and the driving motor 42, and is discharged to the outside of the main body 20.

[0058] As is apparent from the above description, an indoor unit of an air conditioner in accordance with an embodiment reduces costs and a space required to install a separate electronic expansion valve, and simplifies an installation process of the electronic expansion valve.

[0059] Further, although the electronic expansion valve is disposed in the indoor unit, an external size of the indoor unit is not increased and a capacity of a heat exchanger is not reduced to dispose the electronic expansion valve, thereby maintaining heat-exchanging efficiency of the indoor unit.

[0060] Although a few embodiments have been shown and described, it would be appreciated by those skilled in the art that changes may be made in these embodi-

ments without departing from the principles and spirit of the invention, the scope of which is defined in the claims and their equivalents.

Claims

1. An indoor unit of an air conditioner comprising:

a main body;
a heat exchanger disposed in the main body;
an electronic expansion valve disposed in the main body and located at the outside in the lengthwise direction of the heat exchanger;
a control unit controlling electrical components mounted in the main body; and
a control case including a first side surface part disposed between the control unit and the electronic expansion valve and an extension part connected with the first side surface part and extended in the direction of the heat exchanger.

2. The indoor unit according to claim 1, wherein the heat exchanger includes a front heat exchanger located at the front and a rear heat exchanger located at the rear, the front heat exchanger and the rear heat exchanger are disposed such that they may be detached or separated from each other or attached to each other.

3. The indoor unit according to claim 2, further comprising a receipt space provided at the outside in the lengthwise direction of the heat exchanger.

4. The indoor unit according to claim 3, wherein the receipt space is located between the heat exchanger and the control unit.

5. The indoor unit according to claim 4, wherein the receipt space is located at the outside of the control case.

6. The indoor unit according to claim 5, wherein the electronic expansion valve is located the receipt space.

7. The indoor unit according to claim 6, wherein the electronic expansion valve is located above the extension part.

8. The indoor unit according to claim 7, wherein the electronic expansion valve includes a driving part in which a rotor is mounted,
wherein the electronic expansion valve is disposed such that the driving part faces the front surface of the main body.

9. The indoor unit according to claim 8, wherein the electronic expansion valve further includes a passage part, through which a refrigerant flows into and out of the electronic expansion valve, extended from the driving part,
wherein the driving part is located at a height equal to or higher than the passage part.

10. The indoor unit according to claim 1, further comprising a water collector to receive condensed water formed around the electronic expansion valve,
wherein the extension part includes a guide part downwardly inclined from the first side surface part toward the water collector and a water intake part upwardly inclined from the guide part..

11. The indoor unit according to claim 10, wherein the control case further includes a second side surface part connected with the extension part and downwardly extended and a protruding part connected with the second side surface part and protruded toward the water collector.

12. The indoor unit according to claim 11, wherein the control case further includes a motor fixing part which is formed in a shape surrounding a front surface portion of a driving motor which is mounted to the main body, in order to prevents the condensed water from being introduced into the driving motor.

FIG. 1

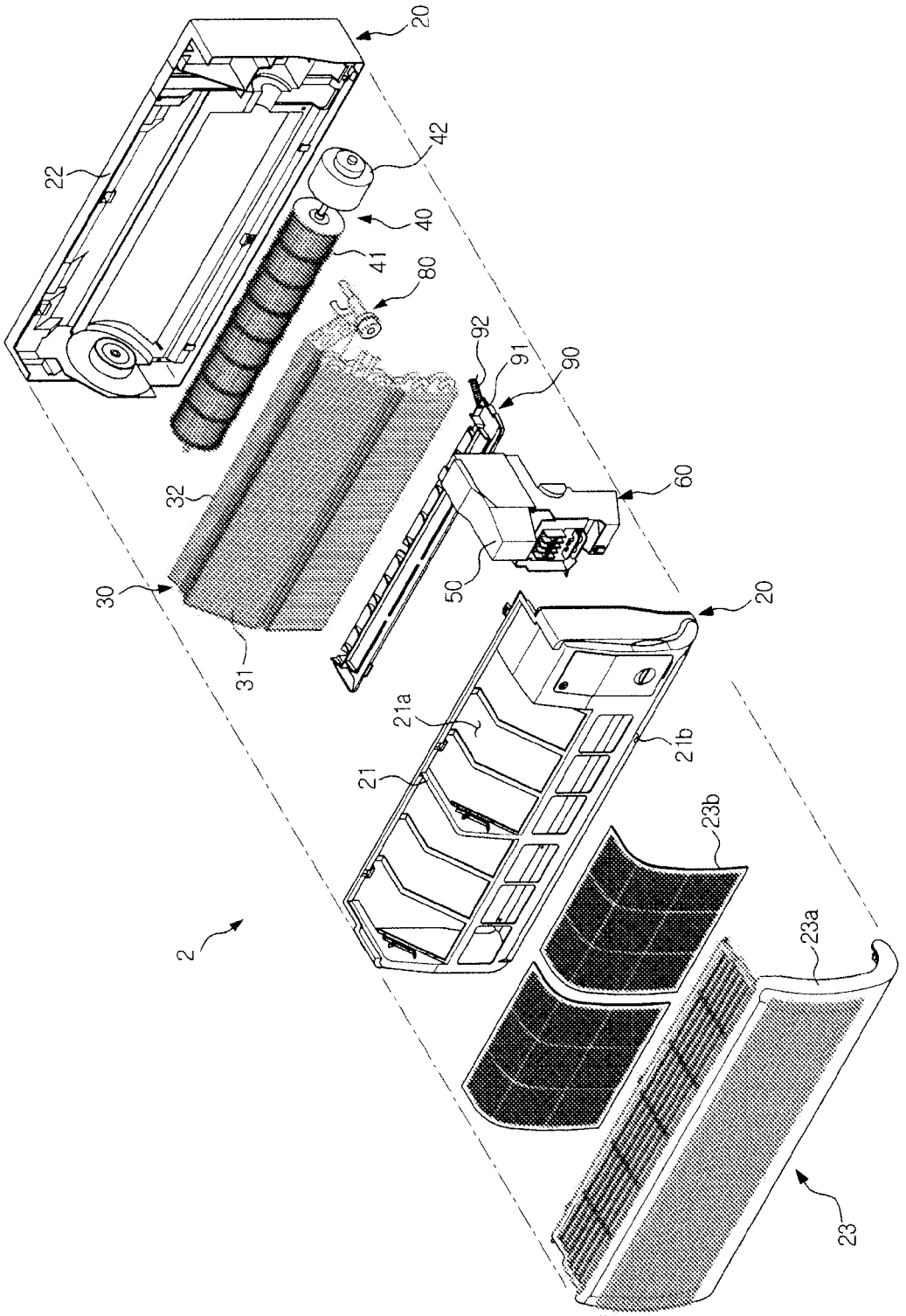

FIG. 2

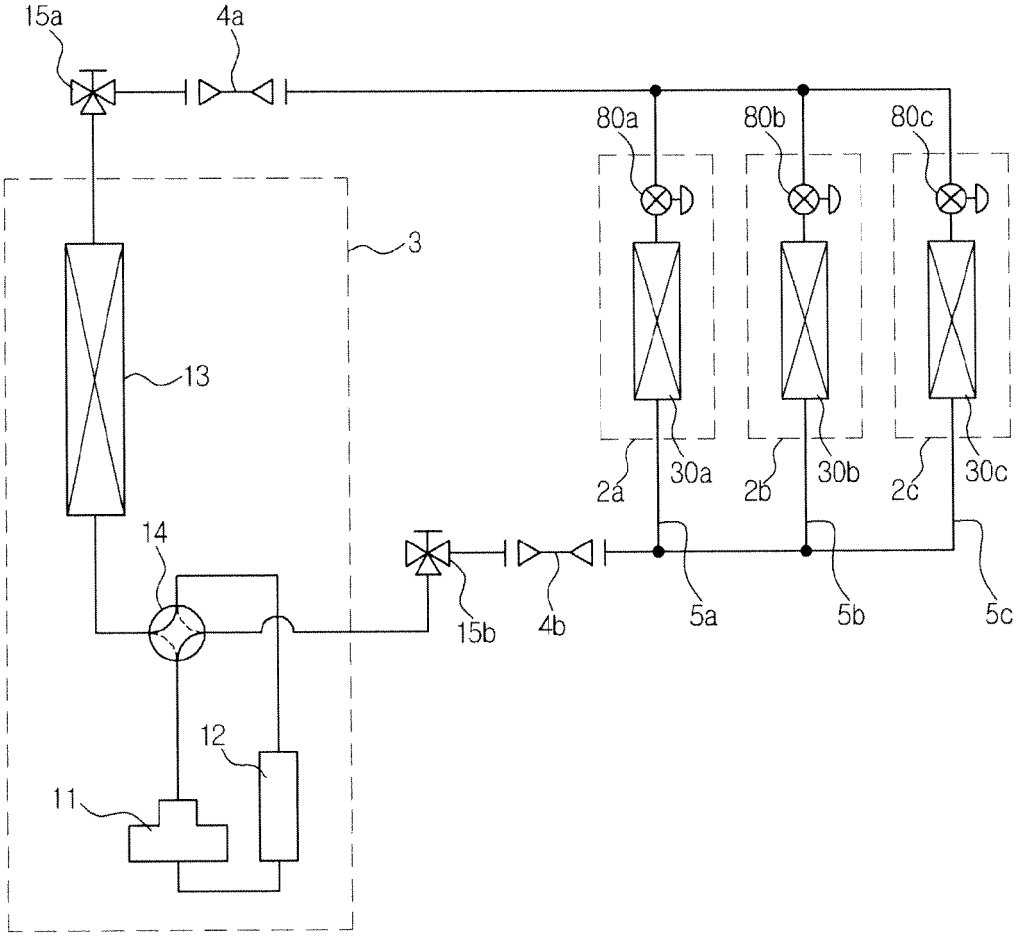

FIG. 3

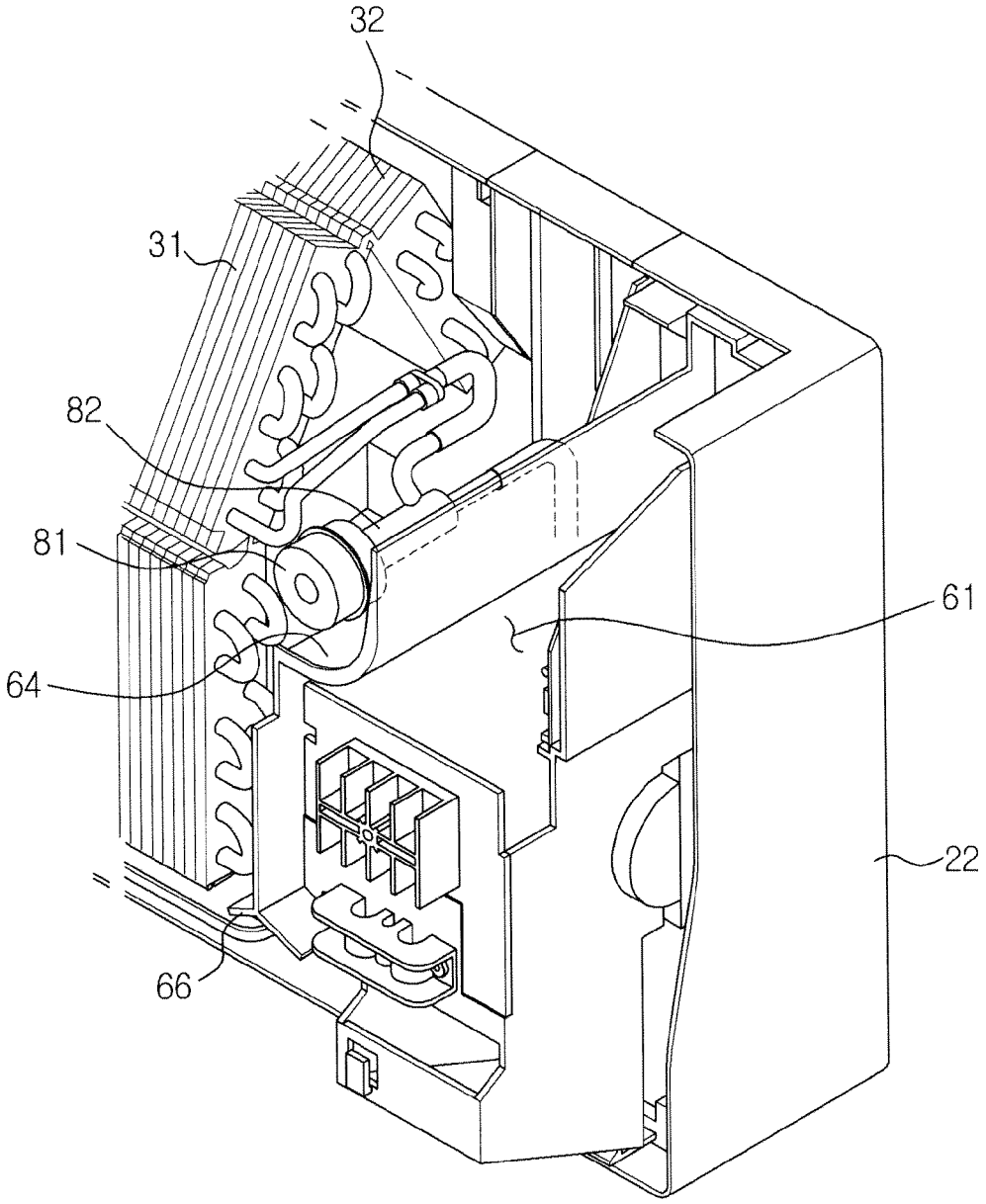

FIG. 4

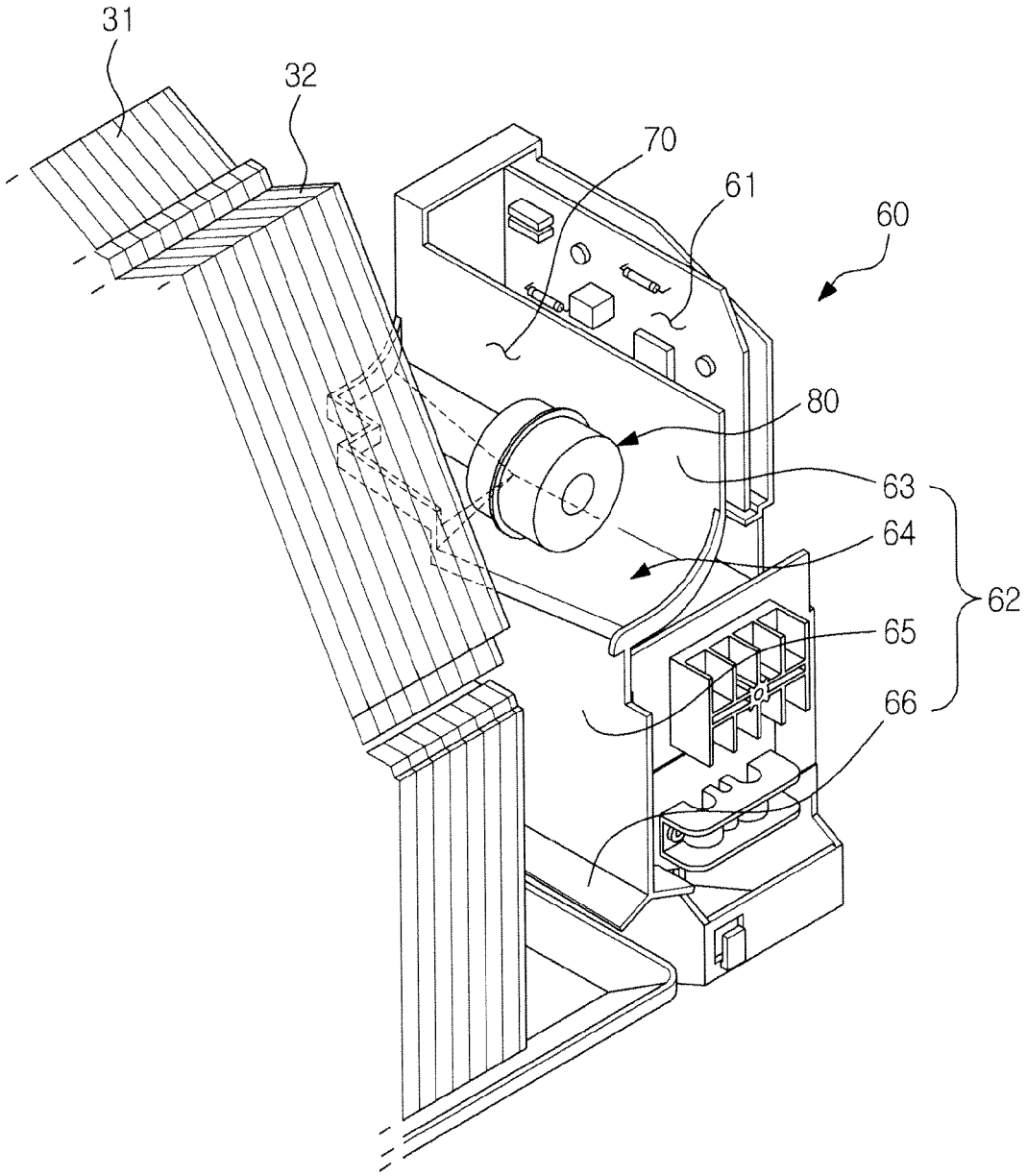

FIG. 5

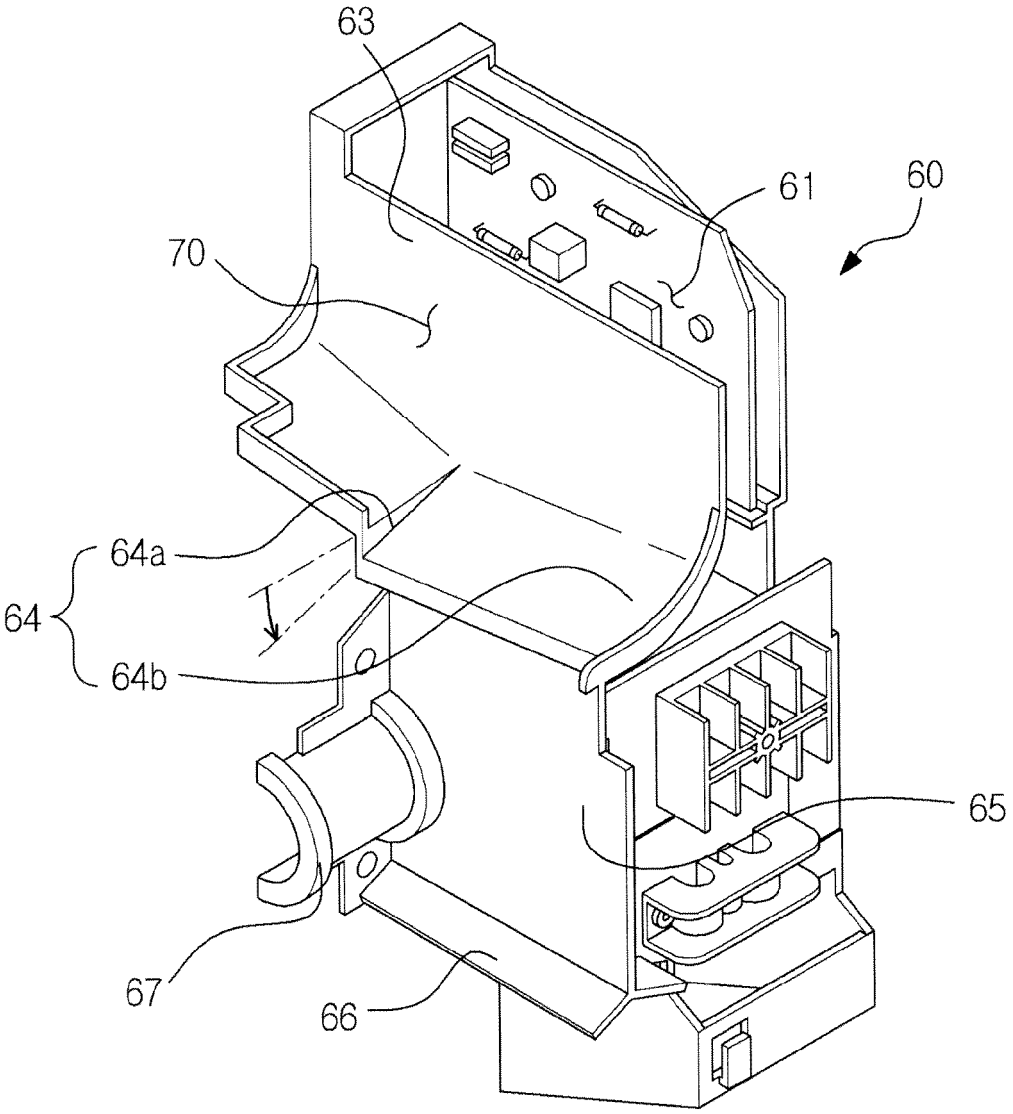

FIG. 6

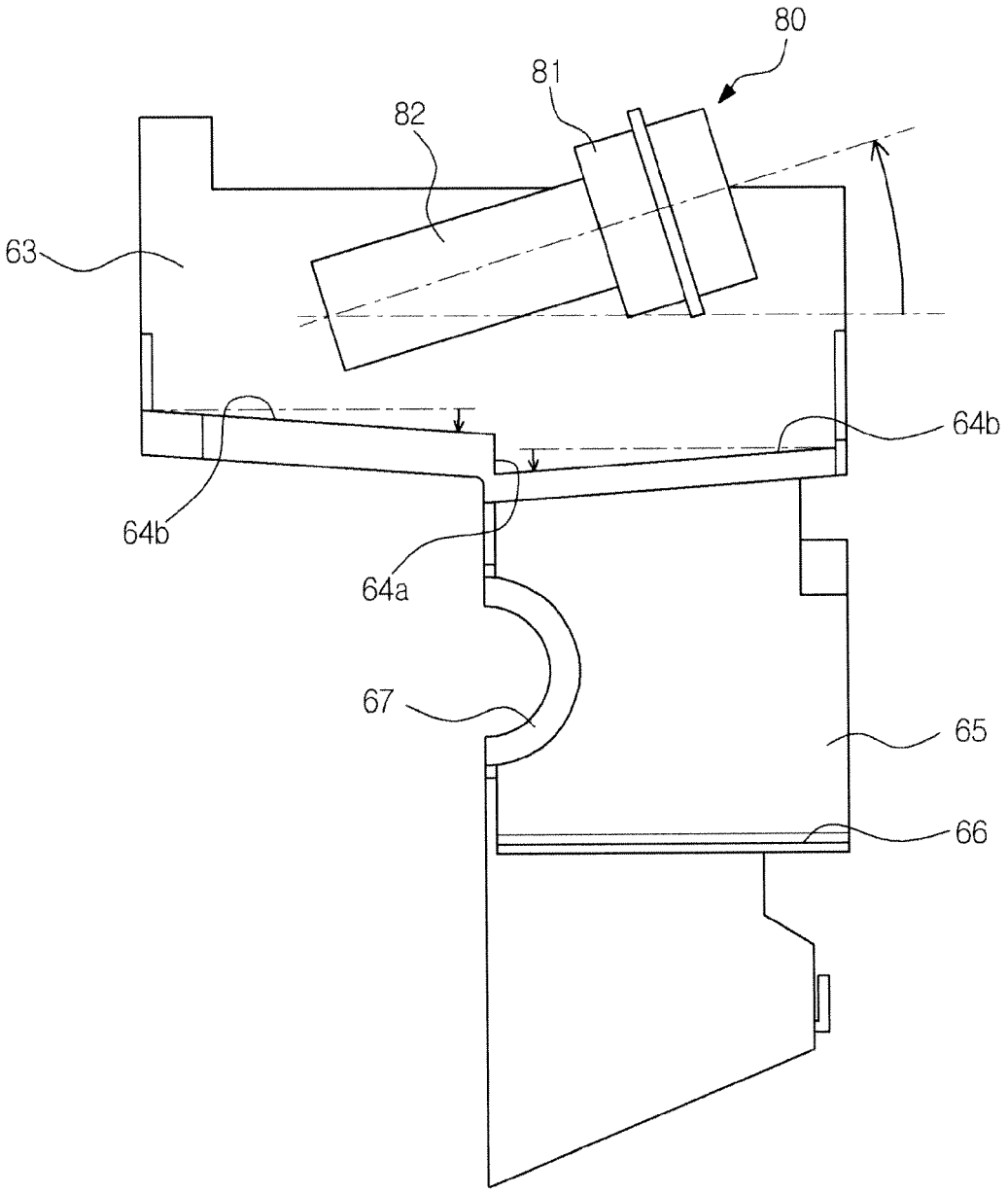

FIG. 7