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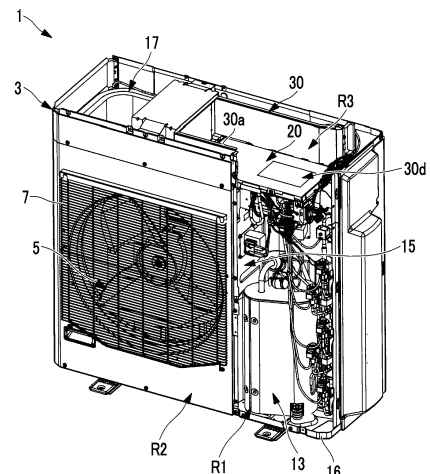
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(54) **OUTDOOR UNIT**

(57) Provided is an outdoor unit in which a control board in a control box can be easily replaced. The present invention comprises: an outdoor fan (5) for introducing outside air; a compressor (13) that compresses a refrigerant; a control board that is provided with electrical components that control the outdoor fan (5) and/or the compressor (13); a control box (20) that houses the control board; a housing (3) that houses the outdoor fan (5), the compressor (13), the control board and the control box (20); and an impermeable wall (30) that separates the control box (20) from the top plate of the housing so that an upper space (R3) is formed between same and the top plate. The control board is removable is a state in which the impermeable wall (30) is fixed to the housing (3) side.

FIG. 2



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Description

Technical Field

[0001] The present disclosure relates to an outdoor unit that is used in an air conditioner.

Background Art

[0002] An outdoor unit that is used in an air conditioner is provided with a control box that accommodates a control board having electrical components that control a compressor and the like (PTLs 1 and 2).

Citation List

Patent Literature

[0003]

[PTL 1] Japanese Unexamined Patent Application Publication No. 2001-281286

[PTL 2] Japanese Unexamined Patent Application Publication No. 2011-094926

Summary of Invention

Technical Problem

[0004] However, as disclosed in each of the patent literatures described above, since the control box is provided in the vicinity of a top plate of a housing of the outdoor unit, in a case where an obstacle or the like exists above the outdoor unit, so that it is not possible to easily access the control box from above, it becomes difficult to replace a control board in the control box.

[0005] Further, in a case where an air conditioner is operated for cooling under a condition where an outside air temperature is high, such as in the summer, an upper space inside the outdoor unit is filled with warm air (hot air) and becomes hot. When a temperature inside the outdoor unit rises in this manner, in order to prevent an abnormal temperature rise in the electrical component provided on the control board, it is necessary to limit a current value of the electrical component, resulting in a problem of reduced cooling capacity.

[0006] The present disclosure has been made in view of such circumstances, and has an object to provide an outdoor unit in which a control board in a control box can be easily replaced.

[0007] Further, the present disclosure has an object to provide an outdoor unit in which it is possible to suppress a temperature rise of an electrical component provided on a control board.

Solution to Problem

[0008] In order to solve the above problem, an outdoor

unit of the present disclosure includes; an outdoor fan for introducing outside air; a compressor that compresses a refrigerant; a control board provided with an electrical component that controls the outdoor fan and/or the compressor; a control box that accommodates the control board; a housing that accommodates the outdoor fan, the compressor, the control board, and the control box; and an isolation member that isolates the control box from a top plate of the housing such that a space is formed between the control box and the top plate, in which the control board is removable in a state where the isolation member is fixed to the housing side.

Advantageous Effects of Invention

[0009] It is possible to easily replace the control board in the control box.

[0010] It is possible to suppress a temperature rise of the electrical component provided on the control board.

Brief Description of Drawings

[0011]

Fig. 1 is a perspective view showing external appearance of an outdoor unit according to an embodiment of the present disclosure.

Fig. 2 is a perspective view showing a state where a service panel and a top plate are removed from the outdoor unit of Fig. 1.

Fig. 3 is a perspective view showing a state where a compressor and a control box shown in Fig. 2 are removed.

Fig. 4 is a perspective view showing a state where an impermeable wall shown in Fig. 2 is removed.

Fig. 5 is a perspective view showing the control box.

Fig. 6 is an exploded perspective view of the control box of Fig. 5.

Fig. 7 is a perspective view showing the impermeable wall.

Fig. 8 is a partially cut perspective view of the outdoor unit shown in Fig. 3.

Fig. 9 is a perspective view showing a state where a cover member is removed during work of replacing the control board.

Fig. 10 is a perspective view showing a state where the control board is removed during the work of replacing the control board.

Description of Embodiments

[0012] Hereinafter, an embodiment according to the present disclosure will be described with reference to the drawings.

[0013] Fig. 1 shows an outdoor unit 1 according to the present embodiment. The outdoor unit 1 is installed outdoors and connected to an indoor unit (not shown) through a refrigerant pipe (not shown). Air conditioning

of a room is performed by the indoor unit.

[0014] The outdoor unit 1 includes a rectangular parallelepiped-shaped housing 3 made of sheet metal. The housing 3 is provided with an outdoor fan 5 and the like. The outdoor fan 5 is driven by an electric motor (not shown).

[0015] The housing 3 includes a mesh-like fan guard 7 provided in front of the outdoor fan 5, and a service panel 9 provided at the side (on the right side in Fig. 1) of the fan guard 7. The housing 3 includes a back panel 10 that configures a back surface, a side panel 12 that laterally connects the back panel 10 and the service panel 9, and a top plate 11 that configures an upper surface. The service panel 9 and the top plate 11 can be detachably mounted on a main body of the outdoor unit 1.

[0016] Fig. 2 shows a state where the service panel 9 and the top plate 11 are removed from the outdoor unit 1. A compressor 13 is exposed by removing the service panel 9. The compressor 13 has a tubular shape provided to be erected in a vertical direction, and includes a compression mechanism such as a scroll member or a rotary member, which is driven by an inverter-driven electric motor (not shown) accommodated inside. A refrigerant compressed by the compression mechanism is led to an outdoor heat exchanger 17 or an indoor heat exchanger through a four-way valve (not shown).

[0017] A partition plate 15 is provided between the compressor 13 and the outdoor fan 5. The partition plate 15 is made of sheet metal and is a wall body provided to be erected upward from a bottom plate 16 of the housing 3. The partition plate 15 has an L-shaped cross section that covers the side and back surface of the compressor 13, as shown in Fig. 3 showing a state where the compressor 13 removed. A space on the compressor 13 side (the right side in Fig. 3) partitioned by the partition plate 15 is a machine room R1, and a space on the outdoor fan 5 side (the left side in Fig. 3) is a fan room R2. As shown in Fig. 2, the outdoor heat exchanger 17 is provided in the fan room R2. The outdoor heat exchanger 17 performs heat exchange between outside air taken into the housing 3 by the outdoor fan 5 and the refrigerant flowing through a heat transfer tube (not shown), and functions as a condenser during a cooling operation and as an evaporator during a heating operation.

[0018] As shown in Fig. 2, a control box 20 and an impermeable wall (isolation member) 30 are provided above the compressor 13 and above the partition plate 15.

[0019] The control box 20 is provided above the partition plate 15 and below the impermeable wall 30. Fig. 3 shows a state where the control box 20 is removed while the partition plate 15 and the impermeable wall 30 remain. As can be seen from the drawing, the control box 20 is installed in a space between an upper end 15a of the partition plate 15 and a lower end 30f of the impermeable wall 30. As shown in Fig. 4 showing a state where the impermeable wall 30 is removed, the control box 20 is provided to extend in a horizontal direction above the

partition plate 15.

[0020] As shown in Figs. 5 and 6, the control box 20 includes a frame body 22 that configures an outer shape, a control board 24 that is detachably fixed to the frame body 22, and a cover member 26 that covers the control board 24 from above.

[0021] The frame body 22 has a rectangular shape when viewed in a plan view, and is made of sheet metal. The frame body 22 includes an upper frame 22a and a lower frame 22b connected to the upper frame 22a.

[0022] The upper frame 22a is provided with a seat portion 22a1 that comes into contact with and supports an outer peripheral edge of the control board 24. A screw 23 for fixing the control board 24 can be detachably mounted on the seat portion 22a1. An opening for radiation fins 22c into which radiation fins 24a of the control board 24 are inserted is formed in the upper frame 22a. The shape of the opening for radiation fins 22c corresponds to an outer shape of the radiation fins 24a. As shown in Fig. 5, the radiation fins 24a are exposed below the upper frame 22a in a state of penetrating the opening for radiation fins 22c. As can be seen from Fig. 5, the lower frame 22b is not provided in a region where the radiation fins 24a are exposed. The lower frame 22b is provided over a region on a side (a right side in Figs. 5 and 6) avoiding the region where the opening for radiation fins 22c is provided.

[0023] The electrical components, wires, and the like provided on the control board 24 are protected by the lower frame 22b. For example, as can be seen by referring to Fig. 4, the lower frame 22b is provided on the machine room R1 side across the partition plate 15, and the radiation fins 24a side where the lower frame 22b is not provided is provided on the fan room R2 side across the partition plate 15.

[0024] A terminal block 22d is provided at the side of the frame body 22. The terminal block 22d performs connection of electrical wires between the electrical components of the control board 24, and the compressor 13 and the outdoor fan 5.

[0025] The control board 24 controls operations of the outdoor fan 5, the compressor 13, a four-way valve (not shown), and the like. The control board 24 includes the radiation fins 24a, a plate-like board main body 24b, and electrical components 24c mounted on the board main body 24b. The board main body 24b is a printed board having a rectangular shape when viewed in a plan view. Screw holes (six in Fig. 6) 24d through which the screws 23 for fixing are inserted are formed at the periphery of the board main body 24b. The control board 24 can be separated from the frame body 22 by removing the screws 23.

[0026] The electrical component 24c is, for example, an electronic component such as a capacitor or a CPU. The electrical component 24c is provided on the lower surface of the board main body 24b.

[0027] The radiation fins 24a are used to remove heat generated by the CPU or the like, and a metal material

having a relatively high thermal conductivity, such as an aluminum alloy, is used. The radiation fins 24a are provided so as to protrude downward from the lower surface of the board main body 24b.

[0028] The cover member 26 is made of sheet metal and has a shape that covers the control board 24 from above. The cover member 26 protects the control board 24 and also protects surrounding members from sparks generated from the control board 24. The cover member 26 has a lid shape that includes a rectangular main surface 26a and a side portion 26b bent downward from each of four sides of the main surface 26a. A plurality of protrusion portions 26b1 are provided on the side portion 26b. Each of the protrusion portions 26b1 is fitted to a corresponding claw portion 22e provided on the upper frame 22a of the frame body 22. In this way, the cover member 26 can be easily detachably mounted on the frame body 22.

[0029] As shown in Fig. 7, the impermeable wall 30 is made of sheet metal and includes a first side wall portion 30a, a second side wall portion 30b, and a third side wall portion 30c connected to form a U-shape. The height of the impermeable wall 30 has a dimension for allowing a predetermined space to be secured above the control box 20. Specifically, the height is set to the extent that work can be performed when replacing the control board 24 provided in the control box 20, and is, for example, 100 mm or higher and 150 mm or lower. The impermeable wall 30 is provided so as to surround the periphery of the control box 20, more specifically, the outer periphery of the control board 24. An upper end of the impermeable wall 30 abuts against the lower surface of the top plate 11 (refer to Fig. 1) of the housing 3 through, for example, a heat insulating material. In this case, the heat insulating material may be omitted. In this manner, the top plate 11 and the control box 20 are isolated from each other by the impermeable wall 30, and an upper space R3 (refer to Fig. 2) is formed above the control box 20. The upper space R3 surrounded by the impermeable wall 30 is hollow and has no devices installed therein.

[0030] As shown in Fig. 7, the first side wall portion 30a is a plate-like body that is located on the front surface side of the outdoor unit 1. A horizontal dimension of the first side wall portion 30a is smaller than a horizontal dimension of the control box 20. In this way, for example, as shown in Fig. 2, an access opening 30d through which the control box 20 can be accessed is formed on the right side of the first side wall portion 30a when the service panel 9 (refer to Fig. 1) is removed.

[0031] A connection piece 30a1 protruding downward is provided at the other end (a right open end) of the first side wall portion 30a. The connection piece 30a1 is used at the time of connection to the partition plate 15, as shown in Fig. 8. The connection piece 30a1 and the partition plate 15 are fixed to each other by screws (not shown).

[0032] As shown in Fig. 7, the second side wall portion 30b is a plate-like body connected to one end (a left end)

of the first side wall portion 30a so as to be orthogonal to the one end. The second side wall portion 30b extends in a depth direction of the outdoor unit 1. An upper end of the second side wall portion 30b is flush with an upper end of the first side wall portion 30a. The second side wall portion 30b is provided with a ventilation hole 30b1 that is a through-hole. Two ventilation holes 30b1 are provided as circular holes, and are provided at the center and on a lower side in a width direction of the second side wall portion 30b. However, the shape, position, and number of the ventilation hole 30b1 are not limited to an aspect shown in Fig. 7. The flow of a fluid from the upper space R3 (refer to Fig. 2) surrounded by the impermeable wall 30 toward the fan room R2 is formed by the ventilation hole 30b1. In this way, the hot air remaining in the upper space R3 can be sucked by the outdoor fan 5.

[0033] The third side wall portion 30c is a plate-like body connected to one end of the second side wall portion 30b so as to be orthogonal to the one end, and is located along the back surface side of the outdoor unit 1. An upper end of the third side wall portion 30c is flush with the upper end of the second side wall portion 30b. A horizontal dimension of the third side wall portion 30c is larger than the horizontal dimension of the first side wall portion 30a and larger than the horizontal dimension of the control box 20.

[0034] A connection piece 30c1 protruding downward is provided at the other end (a right open end) of the third side wall portion 30c. The connection piece 30c1 is used at the time of connection to the partition plate 15, as shown in Fig. 8. The connection piece 30c1 and the partition plate 15 are fixed to each other by screws (not shown). In this manner, the impermeable wall 30 is fixed to the upper portion of the partition plate 15 by the two connection pieces 30a1 and 30c1. In this way, a load that is applied downward from the top plate 11 is transmitted to the partition plate 15 through the impermeable wall 30. That is, a structure is made in which a load that is applied downward from the top plate 11 is not transmitted to the control box 20.

[0035] As shown in Fig. 8, a connection member 32 is provided at the other end (an open end) of the third side wall portion 30c. The connection member 32 connects the impermeable wall 30 to the back panel 10 of the housing 3. The connection member 32 is used as a member for fixing the outdoor heat exchanger 17 (refer to Fig. 2), and also functions as an isolation member that isolates the control box 20 from the top plate 11. A cutout is provided on the back panel 10 side at an upper end of the connection member 32, and a ventilation hole 33 is formed by this cutout. The flow of a fluid from the upper space R3 (refer to Fig. 2) surrounded by the impermeable wall 30 toward the fan room R2 is formed by the ventilation hole 33. In this way, the hot air remaining in the upper space R3 can be sucked by the outdoor fan 5.

[0036] Next, a step for replacing the control board 24 of the control box 20 during maintenance of the outdoor unit 1 having the configuration described above will be

described.

[0037] First, as shown in Fig. 2, the service panel 9 (refer to Fig. 1) is removed. The top plate 11 (refer to Fig. 1) may be removed as shown in Fig. 2, and depending on work environment, work may be performed without removing the top plate 11.

[0038] Next, as shown in Fig. 9, the upper space R3 is accessed through the access opening 30d formed by the impermeable wall 30, and the cover member 26 is removed from the control box 20. The removal work is performed by disengaging the protrusion portion 26b1 (refer to Fig. 6) of the cover member 26 from the claw portion 22e (refer to Fig. 6) of the frame body 22. In this step, the impermeable wall 30 and the connection member 32 remain fixed to the partition plate 15 and are not removed.

[0039] Next, as shown in Fig. 10, the control board 24 is removed from the control box 20. The removal work is performed by removing the screws 23 (refer to Fig. 6) fixed through screw holes 24d (refer to Fig. 6) formed in the control board 24. Also in this step, the impermeable wall 30 and the connection member 32 remain fixed to the partition plate 15 and are not removed.

[0040] When mounting a new control board 24, the reverse order of the above removal step is performed. That is, after the control board 24 is fixed to the control box 20 with the screws 23, the cover member 26 is put over the control board 24 and fixed thereto. Then, the service panel 9 (refer to Fig. 1) is mounted to complete the replacement work.

[0041] The operation and effects of the present embodiment described above are as follows.

[0042] The impermeable wall 30 is provided as an isolation member above the control box 20 so as to form the upper space R3 between the control box 20 and the top plate 11. In this way, a working space can be secured above the control box 20, and work such as replacement of the control board 24 can be facilitated. Further, the heat generated from the electrical component 24c of the control board 24 is dissipated to the upper space R3, so that a temperature rise of the electrical component 24c can be suppressed.

[0043] The control board 24 can be removed in a state where the impermeable wall 30 is fixed to the housing 3 side (specifically, the partition plate 15). In this way, when replacing the control board 24, the control board 24 can be removed without removing the impermeable wall 30 from the housing 3 side.

[0044] Since the upper space R3 is formed above the control box 20, that is, above the control board 24, by the impermeable wall 30, a working space when replacing the control board 24 can be secured. In particular, since it becomes possible to access the control board 24 from the front surface side of the housing 3 without removing the top plate 11, it is advantageous in a case where an obstacle is present above the top plate 11.

[0045] Since the impermeable wall 30 includes the side wall portions 30a, 30b, and 30c provided to be erected

so as to surround the periphery of the control board when viewed in a plan view, water such as rainwater entering the upper space R3 above the control board 24 can be effectively blocked.

[0046] Since the upper space R3 surrounded by the impermeable wall 30 is hollow, it can be used as a working space when replacing the control board 24.

[0047] Since the impermeable wall 30 has the access opening 30d formed on the front surface side of the housing 3 and the control board 24 can be accessed, it is possible to perform replacement of the control board 24 without accessing the control board 24 from the top plate 11 side of the housing 3.

[0048] The ventilation holes 30b1 and 33 communicating with the fan room R2 in which the outdoor fan 5 is provided are formed in the impermeable wall 30 and the connection member 32, so that the flow from the upper space R3 above the control board 24 toward the outdoor fan 5 is formed. In this way, it is possible to suppress a temperature rise of the control board 24.

[0049] Since the impermeable wall 30 is provided so as to receive a load between the top plate 11 and the upper portion of the partition plate 15, it is possible to improve the strength of the outdoor unit 1. Further, since the impermeable wall 30 receives a load, a large load is not applied to the control box 20, eventually, the control board 24.

[0050] The impermeable wall 30 is provided to avoid a path between the radiation fins 24a provided on the control board 24 and the outdoor fan. In this way, the flow of a fluid from the radiation fins 24a toward the outdoor fan 5 can be smoothly formed, so that it is possible to improve the cooling efficiency.

[0051] The outdoor unit described in each of the embodiments described above is understood as follows, for example.

[0052] An outdoor unit (1) according to an aspect of the present disclosure includes: an outdoor fan (5) for introducing outside air; a compressor (13) that compresses a refrigerant; a control board (24) provided with an electrical component (24c) that controls the outdoor fan and/or the compressor; a control box (20) that accommodates the control board; a housing (3) that accommodates the outdoor fan, the compressor, the control board, and the control box; and an isolation member (30, 32) that isolates the control box from a top plate (11) of the housing such that a space (R3) is formed between the control box and the top plate, in which the control board is removable in a state where the isolation member is fixed to the housing side.

[0053] The isolation member is provided above the control box so as to form a space between the control box and the top plate. In this way, a working space can be secured above the control box, and work such as replacement of the control board can be facilitated. Further, the heat generated from the electrical component of the control board is dissipated to the upper space, so that a temperature rise of the electrical component can be sup-

pressed.

[0054] The control board can be removed in a state where the isolation member is fixed to the housing side. In this way, when replacing the control board, it is possible to remove the control board without removing the isolation member from the housing.

[0055] Since a space is formed above the control box, that is, above the control board, by the isolation member, it is possible to secure a working space when replacing the control board. In particular, since it becomes possible to access the control board from the front surface side of the housing without removing the top plate, it is advantageous in a case where an obstacle is present above the top plate.

[0056] In the outdoor unit according to an aspect of the present disclosure, the isolation member includes side wall portions (30a, 30b, 30c) provided to be erected so as to surround a periphery of the control board in a case of being viewed in a plan view.

[0057] Since the isolation member includes the side wall portions provided to be erected so as to surround the periphery of the control board in a case of being viewed in a plan view, the isolation member can be used as an impermeable wall that blocks water such as rainwater entering the space above the control board.

[0058] In the outdoor unit according to an aspect of the present disclosure, the isolation member has an opening (30d) which is formed on the front surface side of the housing and through which the control board can be accessed.

[0059] Since the isolation member has the opening formed on the front surface side of the housing and the control board can be accessed through the opening, it is possible to perform replacement of the control board without accessing the control board from the top plate side of the housing.

[0060] In the outdoor unit according to an aspect of the present disclosure, the space surrounded by the side wall portions is hollow.

[0061] Since the space surrounded by the side wall portions is hollow, it can be used as a working space when replacing the control board.

[0062] In the outdoor unit according to an aspect of the present disclosure, the isolation member is formed with a ventilation hole (30b1, 33) that communicates with a space in which the outdoor fan is provided.

[0063] The ventilation hole that communicates with the space in which the outdoor fan is provided is formed in the isolation member, so that a flow from the space above the control board toward the outdoor fan is formed. In this way, it is possible to suppress a temperature rise of the control board.

[0064] In the outdoor unit according to an aspect of the present disclosure, a partition plate (15) that partitions a fan room (R2) in which the outdoor fan is provided and a machine room (R1) in which the compressor is provided is provided to be erected upward from a bottom portion of the housing, and the isolation member is provided so

as to receive a load between the top plate and an upper portion of the partition plate.

[0065] Since the isolation member is provided so as to receive a load between the top plate and the upper portion of the partition plate, it is possible to improve the strength of the outdoor unit. Further, since the isolation member receives a load, a large load is not applied to the control box, eventually, the control board.

[0066] In the outdoor unit according to an aspect of the present disclosure, the outdoor unit further includes radiation fins (24a) fixed to the control board, in which the isolation member is provided to avoid a path between the radiation fins and the outdoor fan.

[0067] The radiation fins are fixed to the control board. The radiation fins cool the electrical component such as a CPU provided on the board. The isolation member is provided to avoid a path between the radiation fins and the outdoor fan. In this way, the flow of a fluid from the radiation fins toward the outdoor fan can be smoothly formed, so that it is possible to improve the cooling efficiency.

Reference Signs List

[0068]

- 1: outdoor unit
- 3: housing
- 5: outdoor fan
- 7: fan guard
- 9: service panel
- 10: back panel
- 11: top plate
- 12: side panel
- 13: compressor
- 15: partition plate
- 15a: upper end
- 16: bottom plate
- 17: outdoor heat exchanger
- 20: control box
- 22: frame body
- 22a: upper frame
- 22a1: seat portion
- 22b: lower frame
- 22c: opening for radiation fins
- 22d: terminal block
- 22e: claw portion
- 23: screw
- 24: control board
- 24a: radiation fin
- 24b: board main body
- 24c: electrical components
- 24d: screw hole
- 26: cover member
- 26a: main surface
- 26b: side portion
- 26b1: protrusion portion
- 30: impermeable wall (isolation member)

30a: first side wall portion
 30a1: connection piece
 30b: second side wall portion
 30b1: ventilation hole
 30c: third side wall portion
 30c1: connection piece
 30d: access opening
 30f: lower end
 32: connection member (isolation member)
 33: ventilation hole
 R1: machine room
 R2: fan room
 R3: upper space

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room in which the outdoor fan is provided and a machine room in which the compressor is provided is provided to be erected upward from a bottom portion of the housing, and
 the isolation member is provided to receive a load between the top plate and an upper portion of the partition plate.

7. The outdoor unit according to any one of Claims 1 to 6, further comprising:

radiation fins fixed to the control board, wherein the isolation member is provided to avoid a path between the radiation fins and the outdoor fan.

Claims

1. An outdoor unit comprising:

an outdoor fan for introducing outside air;
 a compressor that compresses a refrigerant;
 a control board provided with an electrical component that controls the outdoor fan and/or the compressor;
 a control box that accommodates the control board;
 a housing that accommodates the outdoor fan, the compressor, the control board, and the control box; and
 an isolation member that isolates the control box from a top plate of the housing such that a space is formed between the control box and the top plate,
 wherein the control board is removable in a state where the isolation member is fixed to the housing side.

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2. The outdoor unit according to Claim 1, wherein the isolation member includes a side wall portion provided to be erected so as to surround a periphery of the control board in a case of being viewed in a plan view.
3. The outdoor unit according to Claim 2, wherein the space surrounded by the side wall portion is hollow.
4. The outdoor unit according to any one of Claims 1 to 3, wherein the isolation member has an opening which is formed on a front surface side of the housing and through which the control board is capable of being accessed.
5. The outdoor unit according to any one of Claims 1 to 4, wherein the isolation member is formed with a ventilation hole that communicates with a space in which the outdoor fan is provided.
6. The outdoor unit according to any one of Claims 1 to 5, wherein a partition plate that partitions a fan

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FIG. 1

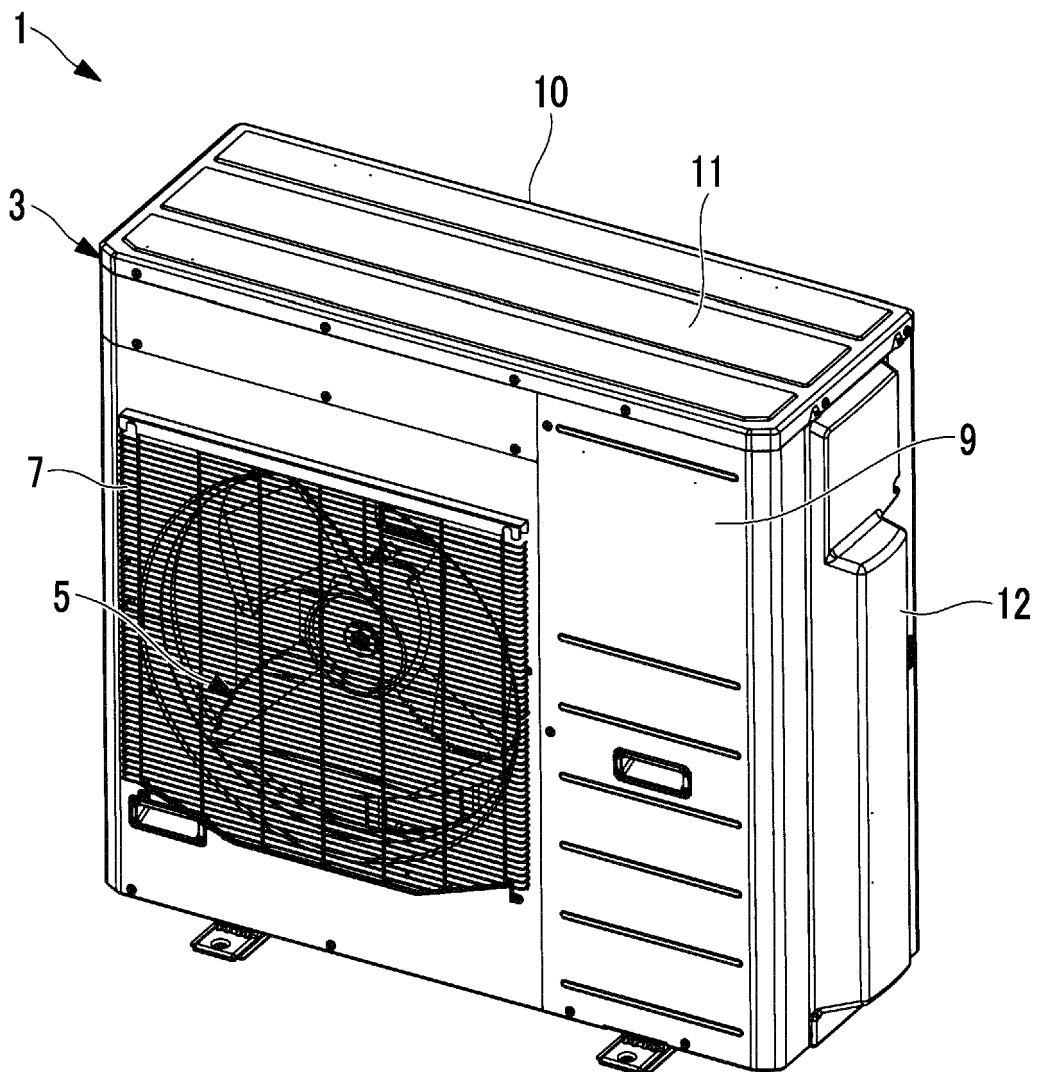


FIG. 2

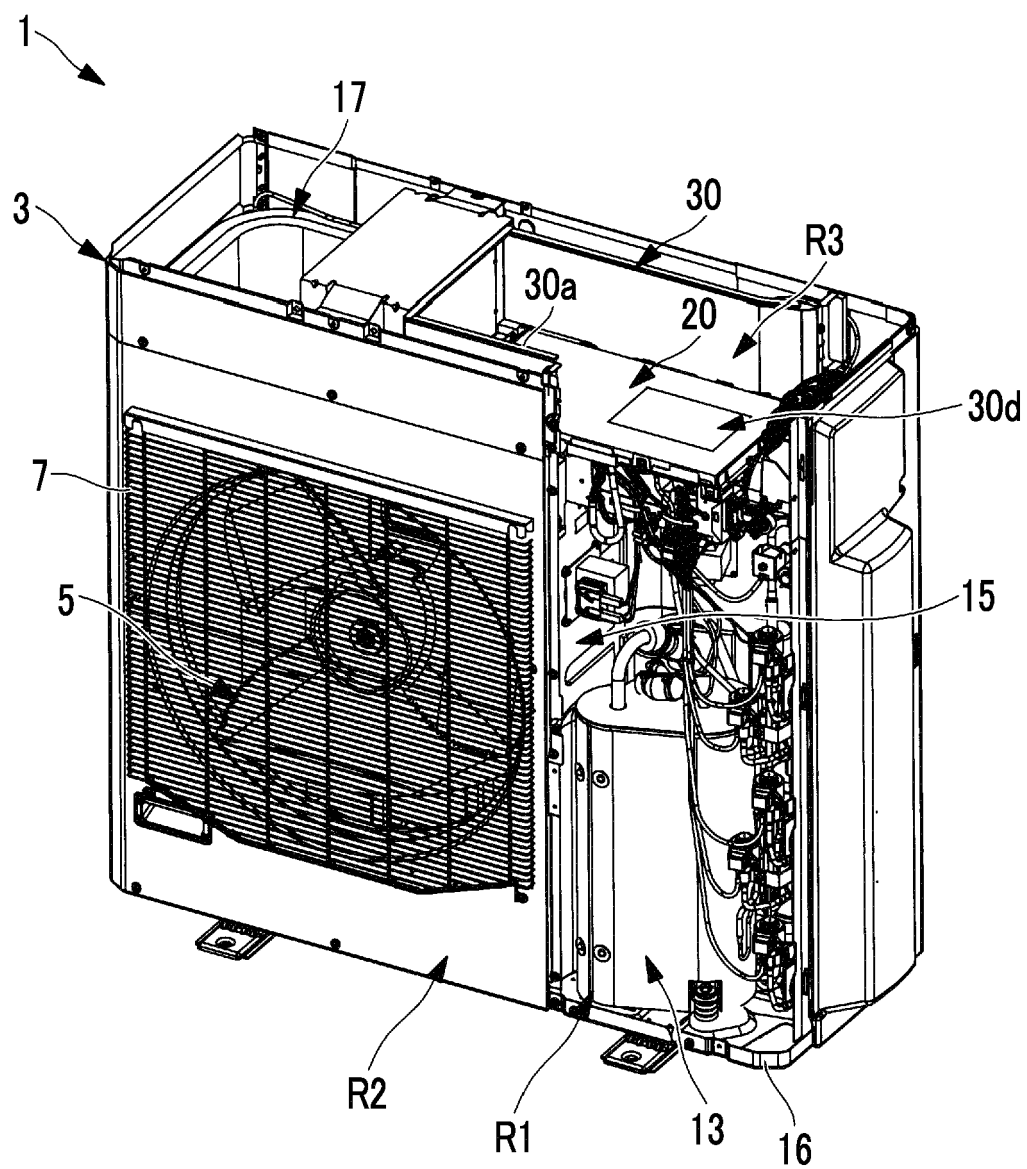


FIG. 3

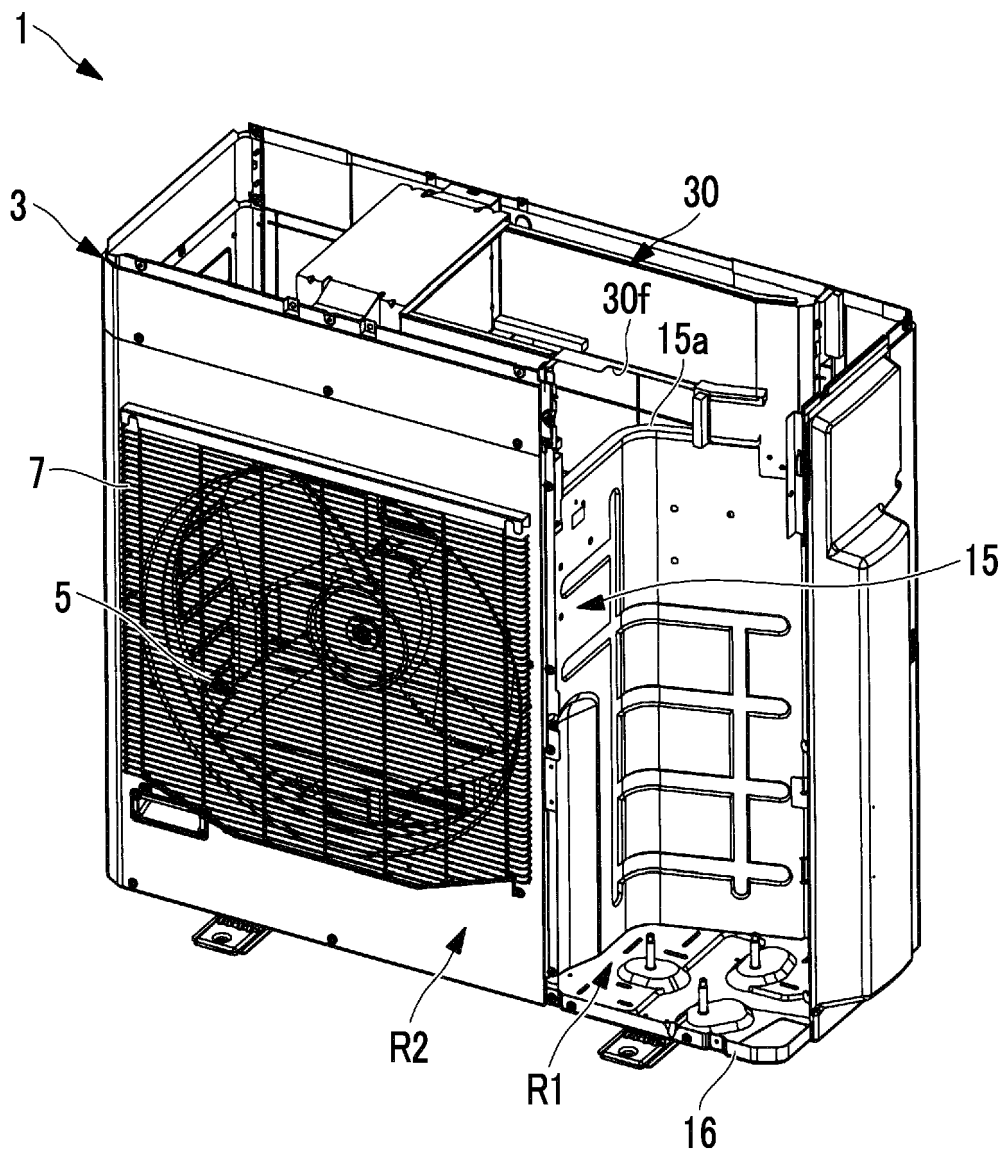


FIG. 4

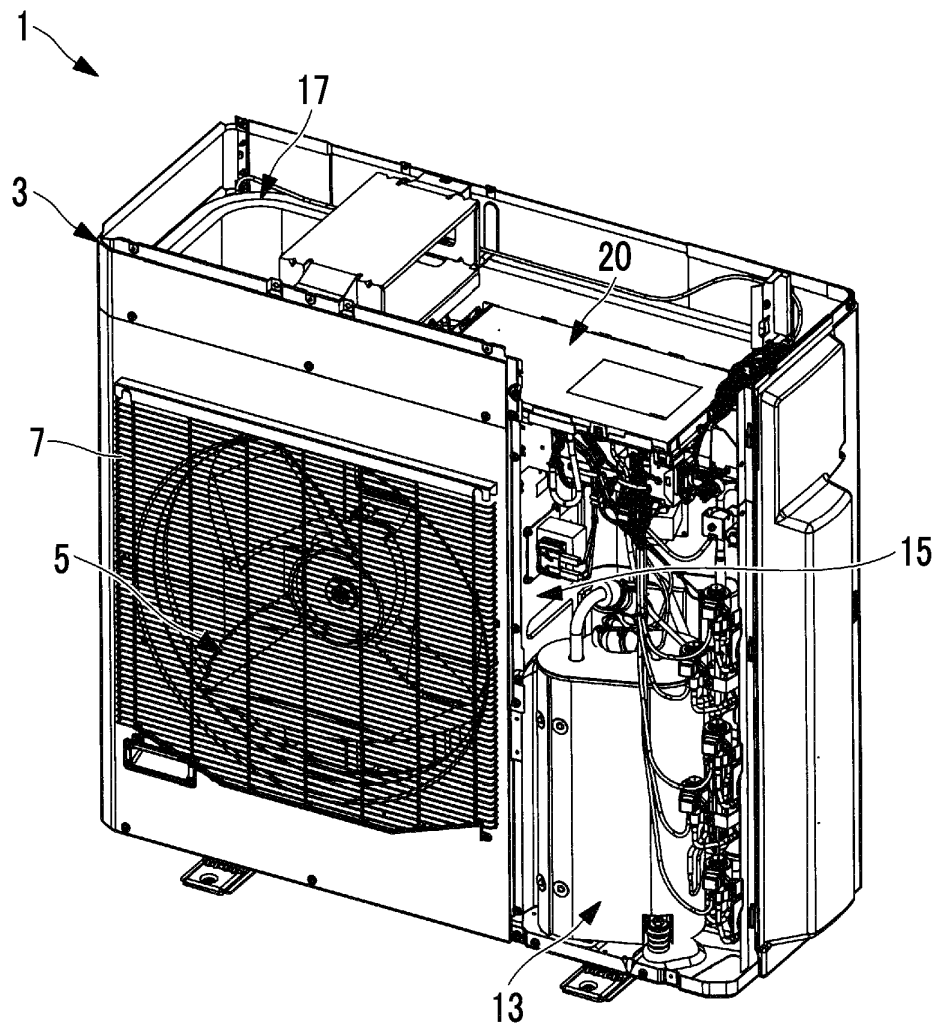


FIG. 5

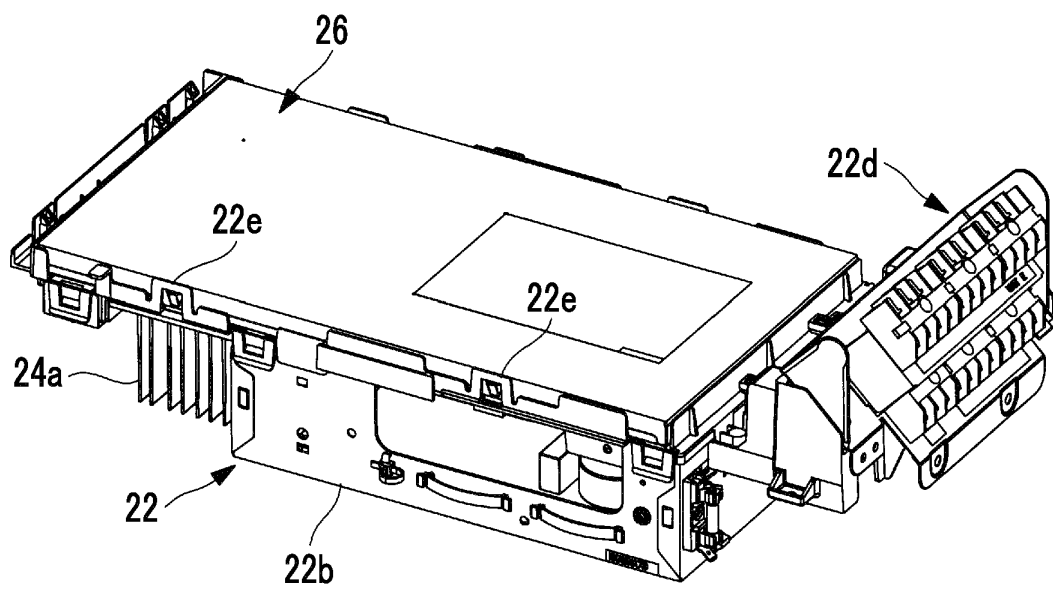


FIG. 6

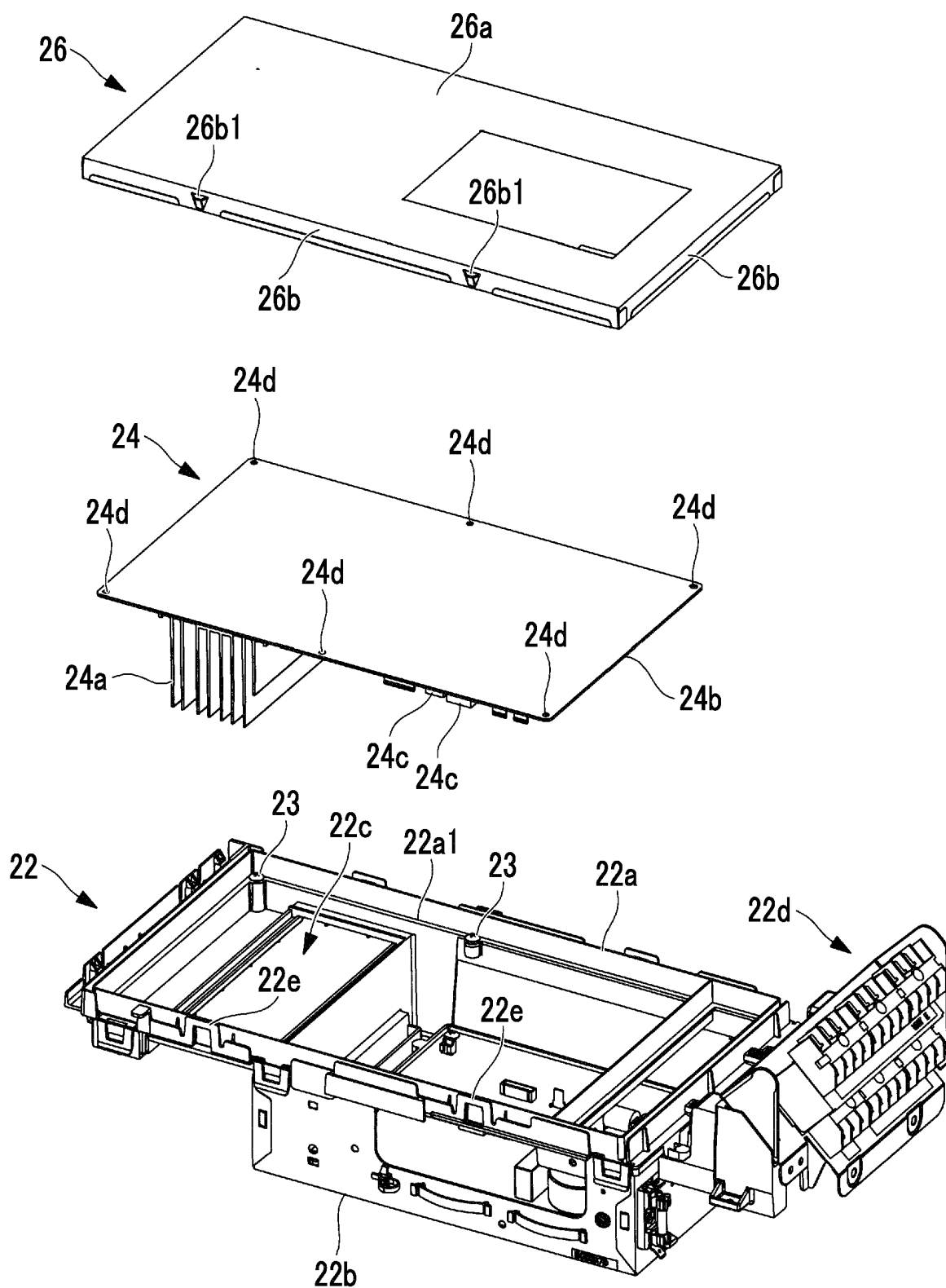


FIG. 7

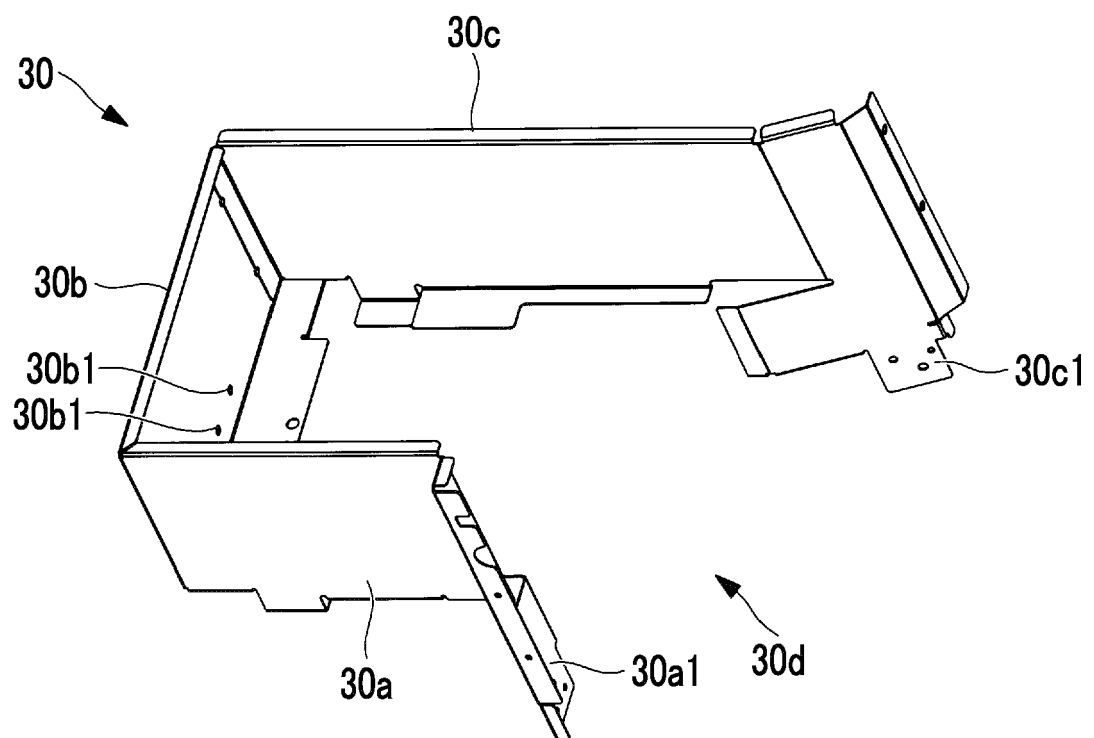


FIG. 8

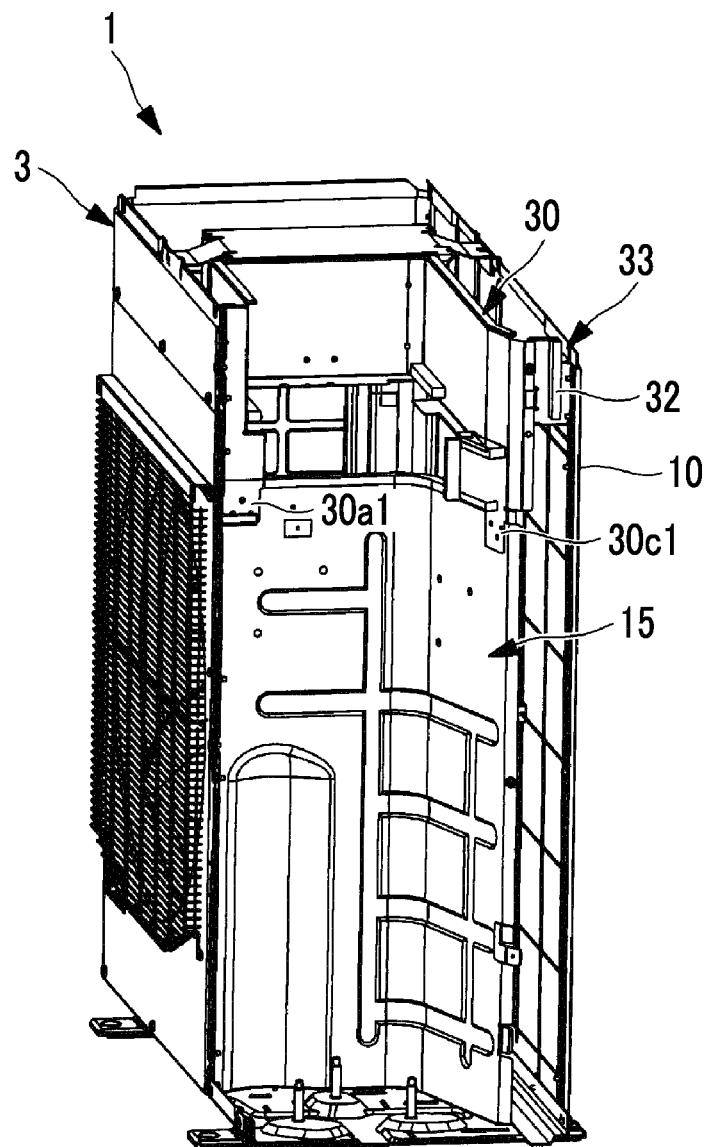


FIG. 9

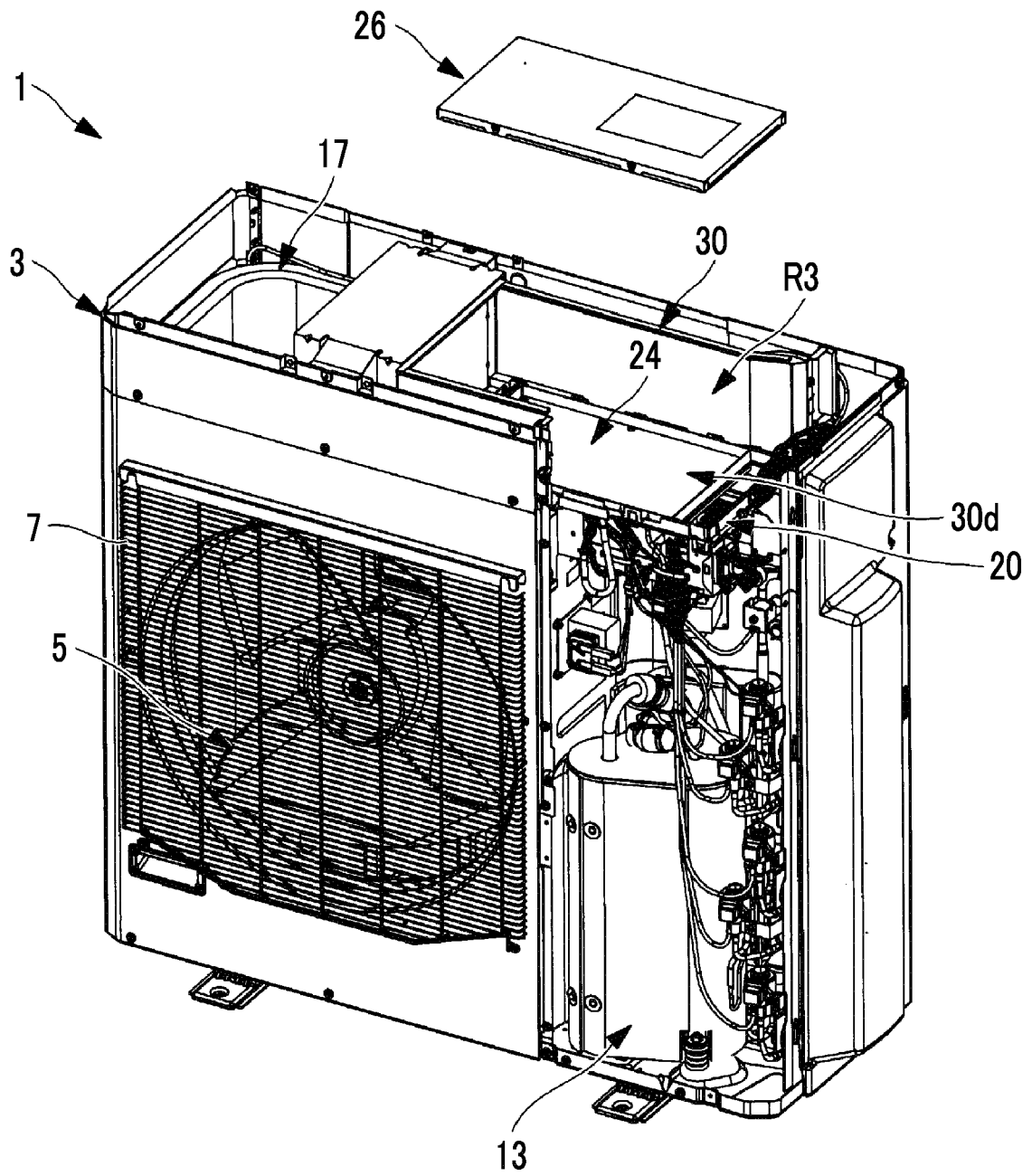
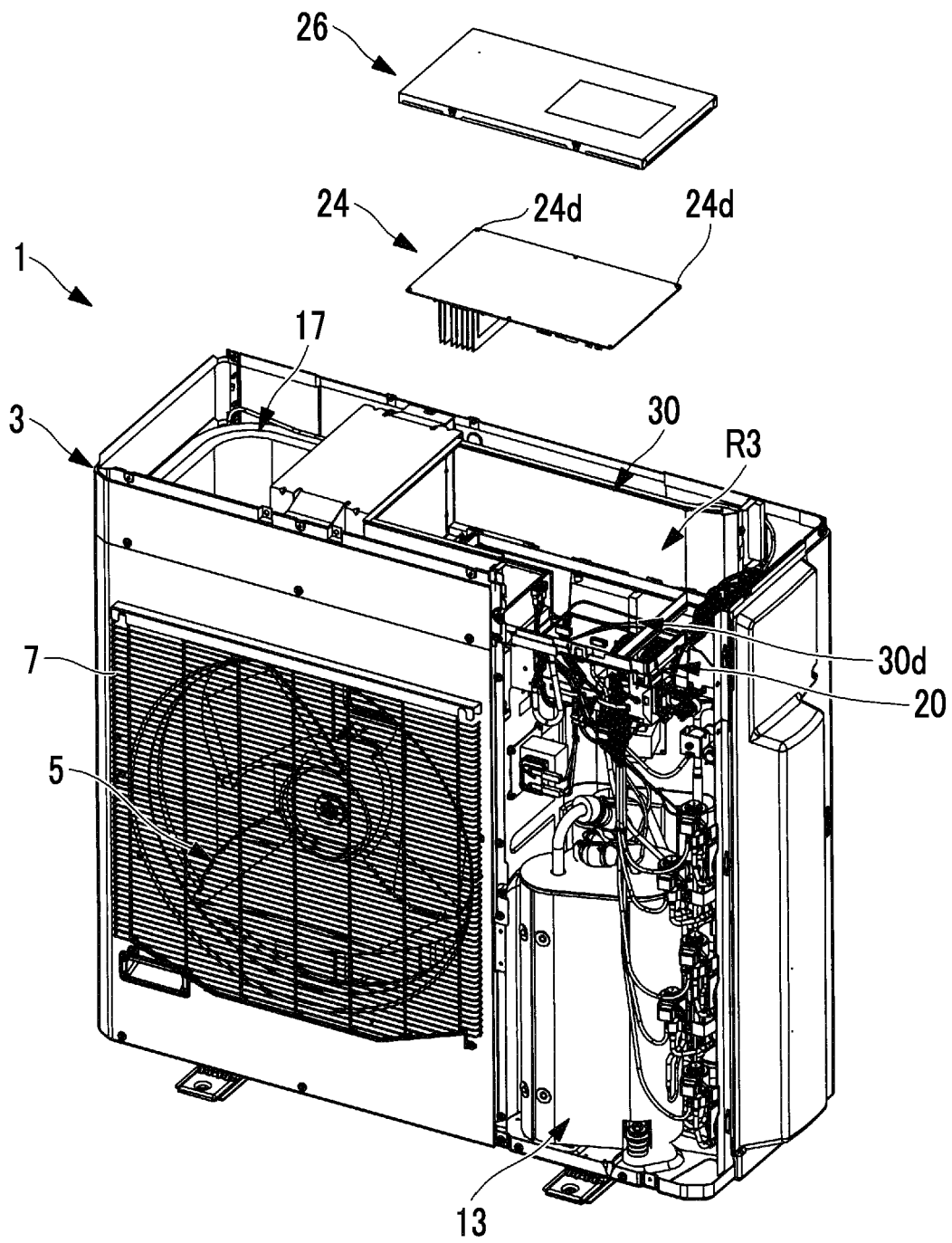


FIG. 10



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2022/005197

A. CLASSIFICATION OF SUBJECT MATTER

F24F 1/22(2011.01)i

FI: F24F1/22

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F24F1/22

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Published examined utility model applications of Japan 1922-1996

Published unexamined utility model applications of Japan 1971-2022

Registered utility model specifications of Japan 1996-2022

Published registered utility model applications of Japan 1994-2022

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 111018/1989 (Laid-open No. 52527/1991) (FUJITSU GENERAL LTD.) 22 May 1991 (1991-05-22), p. 2, line 4 to p. 6, line 12	1-7
Y	JP 2009-97743 A (PANASONIC CORP.) 07 May 2009 (2009-05-07) paragraphs [0017]-[0021]	1-7

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

03 March 2022

Date of mailing of the international search report

26 April 2022

Name and mailing address of the ISA/JP

Japan Patent Office (ISA/JP)
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Japan

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2022/005197

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Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
JP	3-52527	U1	22 May 1991	(Family: none)	
JP	2009-97743	A	07 May 2009	(Family: none)	

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2001281286 A [0003]
- JP 2011094926 A [0003]