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(54) **INDOOR UNIT OF AIR CONDITIONING SYSTEM**

(57) An indoor unit body (2) of an air conditioning apparatus having an openable lower surface contains an electrical parts box (13), a heat exchanger (7), a drain pan (10), and an air blower (3) inside. A dress panel (3) closes the opening section of the lower surface of the indoor unit body (2). The drain pan (10) has first insert metal parts (24) for fixing the drain pan (10) to the indoor unit body (2) and second insert metal parts (25) for attaching and fixing the electrical parts box (13) to the drain pan (10). The first insert metal parts (24) and the second insert metal parts (25) are electrically connected and integrally formed with the drain pan (10).

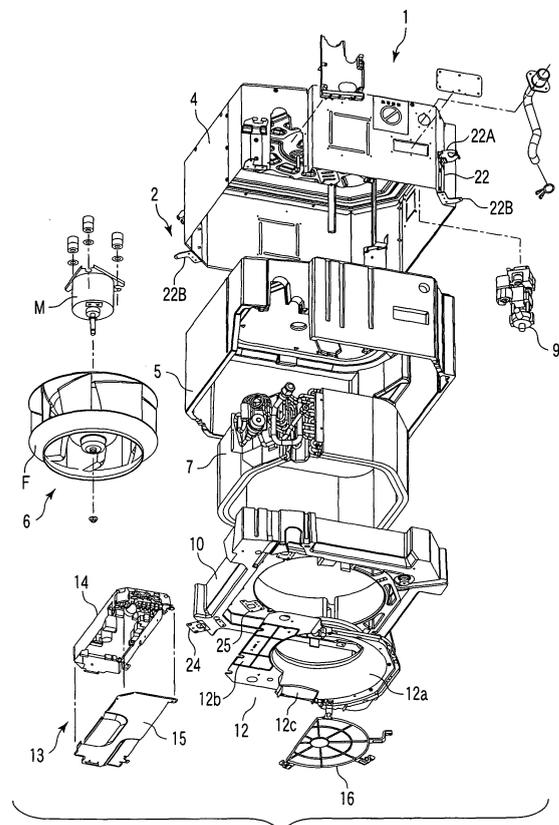


FIG. 2

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Description

Technical Field

[0001] The present invention relates to an indoor unit of an air conditioning apparatus, and more particularly to improvement in a ground configuration for reducing noise terminal voltage with respect to an electrical parts box.

Background Art

[0002] In an indoor unit of a typical ceiling embedded type air conditioning apparatus, an indoor unit body comprises a sheet metal casing formed by fabricating sheet metal in such a way that a substantially whole area of a lower surface is opened, and a heat insulating material to be incorporated inside the casing. Inside the indoor unit body, a heat exchanger, an air blower, a drain pan, etc. are arranged.

[0003] On a lower surface of the drain pan, a dress panel attractively made of synthetic resin is mounted. An air outlet and an air inlet are provided on the dress panel. A louver for setting an air outlet direction is attached to the air outlet, and a filter supported by an air inlet grill is fit into the air inlet.

[0004] Between the drain pan and the dress panel, an electrical parts box for containing electrical parts or the like for electrically controlling the indoor unit is arranged. The drain pan is made of, for example, styrofoam, and the electrical parts box is made of fabricated sheet metal. The electrical parts box as-is is therefore not mountable on the drain pan.

[0005] For instance, Jpn. Pat. Appln. KOKAI Publication No. 2001-235176 discloses a drain pan of an indoor unit of an air conditioning apparatus which is formed in such a manner that an insert metal part made of sheet metal is integrally embedded when molding styrofoam. A part of the insert metal part projects from the drain pan, and a screw hole is provided in this projected part. Furthermore, an insert connection is provided in the electrical parts box. Jpn. Pat. Appln. KOKAI Publication No. 2001-235176 discloses an art in which a screw is inserted into the insert connection and fixed thereto.

Disclosure of Invention

[0006] The electrical parts box mentioned above is made of a metallic material and contains electrical parts. Measures for reducing noise terminal voltage are therefore necessary. Though Jpn. Pat. Appln. KOKAI Publication No. 2001-235176 does not mention reduction of a noise terminal voltage, ground wiring for reducing noise terminal voltage is generally configured in such a manner that one end of a lead wire is connected to an electrical parts box, a midway part of the lead wire is interposed between a drain pan and a dress panel, and the other end is brought out of an indoor unit to be grounded.

[0007] Assembling work of an indoor unit is performed

by putting the indoor unit in a condition reverse to a condition in which the indoor unit is embedded in a ceiling. More specifically, a casing, namely an indoor unit body is put on a workbench in such a way that an upper surface is cast down and an opening section of a lower surface is cast up. An air blower, a heat exchanger, a drain pan, and an electrical parts box are sequentially inserted into and mounted in the casing from the opening section thereof, and a dress panel is attached to the casing at the end.

[0008] In order to install the ground wiring, an assembler has to insert his hand into the casing from the opening for connecting one end of a lead wire to the electrical parts box, since the electrical parts box is already mounted in the casing. During the installation, the assembler has to work with the lead wire and tools while avoiding the air blower, the heat exchanger, and the drain pan that are already mounted. The installing of the ground wiring is thus extremely troublesome.

[0009] Another method of installing the ground wiring is to connect one end of the lead wire to the electrical parts box in advance, and insert and mount the electrical parts box in the casing. However, in this condition, the lead wire hangs from the electrical parts box, and the hanging lead wire may tangle with the air blower, the heat exchanger, etc. Therefore, installation of the ground wiring is worrying. A midway part of the lead wire is necessary to be routed in a predetermined site, and this method is also extremely troublesome.

[0010] It is an object of the present invention to provide an indoor unit of an air conditioning apparatus in which an installation of ground wiring is unnecessary and improvement in assembling work can be obtained.

[0011] In order to satisfy the object, an indoor unit of an air conditioning apparatus of the present invention comprises an indoor unit body having an openable lower surface and containing an electrical components box, a heat exchanger, a drain pan, and air blower inside thereof; a dress panel for closing the lower surface of the indoor unit body; and a first insert metal part provided in the drain pan for fixing the drain pan with respect to the indoor unit body, and a second insert metal part for attaching and fixing the electrical parts box with respect to the drain pan; characterized in that the first insert metal part and the second insert metal part are electrically connected and integrally formed.

Brief Description of Drawings

[0012]

FIG. 1 is a perspective view of an indoor unit of a ceiling embedded type air conditioning apparatus according to one embodiment of the present invention.

FIG. 2 is a perspective view of the disassembled indoor unit body according to the embodiment of the present invention.

FIG. 3 is a longitudinal sectional view of the indoor unit body according to the embodiment of the present invention.

FIG. 4 is a plan view of the indoor unit body according to the embodiment of the present invention, in which a drain pan is mounted.

FIG. 5 is a plan view of the indoor unit body according to the embodiment of the present invention, in which a bell mouth is further mounted.

FIG. 6 is a plan view of the indoor unit body according to the embodiment of the present invention, in which an electrical parts box is further mounted.

FIG. 7 is a partially perspective view of the indoor unit body according to the embodiment of the present invention in which the electrical parts box is mounted.

FIG. 8 is a partially plan view of the electrical parts box according to the embodiment of the present invention.

FIG. 9 is a partially perspective view of the electrical parts box according to the embodiment of the present invention.

FIG. 10 is a partially perspective view of the bell mouth according to the embodiment of the present invention in ordinary use.

FIG. 11 is a partially perspective view of the bell mouth according to the embodiment of the present invention when slit part is cut.

FIG. 12 is a partially perspective view of the bell mouth according to the embodiment of the present invention when an electrical parts box for control is mounted thereto.

Best Mode for Carrying Out the Invention

[0013] Hereinafter, one embodiment of the present invention will be described on the basis of accompanying drawings (Unsigned component parts and sites in the description are not shown in the accompanying drawings. Also, in order to avoid complication of the drawings, there are cases where components parts and component sites purposefully do not have signs.)

[0014] FIG. 1 is a perspective view of an indoor unit 1 of a ceiling embedded type air conditioning apparatus according to one embodiment of the present invention which is shown from a lower surface side. FIG. 2 is a perspective view of a disassembled indoor unit body 2. FIG. 3 is a longitudinal sectional view of the indoor unit body 2.

[0015] The indoor unit 1 of the air conditioning apparatus comprises: an indoor unit body 2 which is inserted into an opening section for installation provided in a ceiling board from an indoor side, and suspended and fixed to so-called back of a ceiling; and a dress panel 3 which is mounted on a lower surface of the indoor unit body 2 to be exposed from the ceiling board to the indoor side.

[0016] The indoor unit body 2 includes a casing 4 made of sheet metal, which is formed in such a manner that a sheet metal is fabricated to form an upper surface section

and side surface sections, and a lower surface section whose whole area is opened. A heat insulating material 5 molded by utilizing styrofoam material is attached to an inner periphery surface of the casing. Thus, the indoor unit body 2 has a heat insulating structure.

[0017] An air blower 6 is provided in a central part inside the casing 4, and an indoor heat exchanger 7, which is integrally formed to be a rectangular frame shape in plan view, is mounted in such a manner that the indoor heat exchanger 7 encloses the air blower 6. In addition, there is a case where a pair of heat exchangers that are formed to be an L-shape in plan view are utilized as an indoor heat exchanger 7. A drain pump 9 is attached to a corner part of the indoor unit body 2.

[0018] The lower surface opening section of the casing 4 is closed with the dress panel 3. This dress panel 3 is molded with, for example, synthetic resin and is finished attractively. The dress panel 3 is exposed to the indoor side from the ceiling board, and the panel covers a gap between the opening section for installation of the ceiling board and the peripheral surface of the indoor unit body 2.

[0019] The air blower 6 comprises a fan motor M which is attached and fixed to the upper surface section of the casing 4 with a suitable manner, and a fan F which is attached to a rotation axis of the fan motor M. The fan F is a multiblade type fan that makes blowing action in such a manner that the fan F rotates to take air in from a direction of the rotation axis and blow air out to a circumferential direction.

[0020] The indoor heat exchanger 7 is arranged opposing the circumferential direction, which is the blowing-out direction of the fan F. A lower end part of the indoor heat exchanger 7 is inserted into the rectangular frame shaped drain pan 10 provided in the casing 4, and drain water generated through the heat exchange action of the indoor heat exchanger 7 is thereby able to be received with the drain pan 10. The drain pump 9 is attached in such a manner that it is immersed in the drain water in the drain pan 10.

[0021] A bell mouth 12 is provided between the dress panel 3 and the air blower fan F, and is surrounded by the drain pan 10. The bell mouth 12 includes a convergent part 12a which is horn shaped and formed in such a manner that an air blower fan F side is small diametered and a dress panel 3 side is large diametered, a flat part 12b integrally provided on a large diametered side of the convergent part 12a, and a slit part 12c provided adjacent to one lateral of the flat part 12.

[0022] An electrical parts box 13 is mounted on the flat part 12b of the drain pan 12. The electrical parts box 13 comprises a box body 14 having a lower surface thereof opened for containing a control substrate on which electrical parts for control are mounted, and a lid plate 15 for openably closing the lower surface opening section of the box body 14. Both the box body 14 and the lid plate 15 are made of fabricated sheet metal.

[0023] A fan guard 16 is attached over the large diametered side of the convergent part 12a of the bell mouth

12. The fan guard 16 secures safety even in the condition where the dress panel 3 is detached for maintenance, since the fan guard 16 prevents a maintenance worker from touching the fan F comprising the air blower 6.

[0024] The dress panel 3 includes a panel body 3A having a rectangular shaped outline, and a rectangular shaped air inlet 17 is opened at a central part thereof. The air inlet 17 is provided in such a way that its shape and area substantially faces an inside surface of the drain pan 10, and an air inlet grill 18 for supporting a filter is detachably attached to the air inlet 17.

[0025] The air inlet grill 18 covers the casing 4 at the air inlet 17, while simultaneously letting air circulate through the air inlet 17. The filter can be detached together with the air inlet grill 18 during maintenance, and thus the filter and the air inlet grill 18 can be cleaned on an indoor floor.

[0026] Air outlets 19 are provided along each of side parts of the air inlet 17. The air outlets 19 are respectively provided at four sides of the air inlet 17, and each of the air outlets 19 has a shape extremely long and thin in a longitudinal direction with respect to a width direction. Also, each of the air outlets 19 is provided to face a gap between an outside surface of the drain pan 10 and a heat insulating material 5 attached to an inside surface of the casing 4, and the air outlet 19 itself is formed in an outwardly curved manner.

[0027] To each of the air outlet 19, a louver R of a louver mechanism is attached, and the louver R guides a heat exchanged air to be flown out toward wide area around the dress panel 3. At each of the four corners of the panel body 3A, an opening section for height adjustment 20 being rectangular shaped is provided, and a dress corner panel 21 is detachably attached to each of the opening sections for height adjustment 20.

[0028] On the other hand, the casing 4 is suspended and held by four hanger bolts that are hung from beams comprising the back of the ceiling. To explain more specifically, hanging lugs 22A that project outward in a horizontal direction are respectively attached to the corner parts on side surfaces of the casing 4. Each of the hanging lugs 22A has a long hole d and a hanger bolt is inserted into the long hole d. A nut is screwed up at down-side of the insertion section.

[0029] With the above structure, the hanging lugs 22A are on upper surfaces of the nuts and the casing 4 is thereby suspended by the hanger bolts at four places. Furthermore, height adjustment of the casing 4 is possible by adjusting positions at which the nuts are screwed up with respect to the hanger bolts. Height adjustment is performed in such a manner that the dress corner panels 21 are detached and tools are inserted from the opening sections for height adjustment 20.

[0030] The hanging lugs 22A are formed in such a way that upper edge parts of metal parts body 22, which are formed in substantially U-shape, are folded and projected in a horizontal direction. The metal parts body 22 are attached to the casing 4 with methods such as spot weld-

ing. Furthermore, lower edge parts of the metal parts body 22 are also folded and projected in a horizontal direction, and these parts are called attachment brackets 22B.

[0031] Therefore, the attachment brackets 22B and the hanging lugs 22A are integrally formed with the casing 4. The attachment brackets 22B are for attaching and fixing the dress panel 3 and the drain pan 10 to the casing 4, and a detailed explanation of attachment operation will be given later.

[0032] A part of a first insert metal part 24 and a part of the second insert metal part 25 are exposed from a lower surface of the drain pan 10. In other words, the part of the first insert metal part 24 and the part of the second insert metal part 25 are supported inside a molding die of the drain pan 10, and the parts of the first and second insert metal parts 24 and 25 are embedded (inserted) in the drain pan 10 as the drain pan 10 is foam molded.

[0033] The first insert metal part 24 is for attaching and fixing the drain pan 10 to the casing 4. The second insert metal part 25 is for attaching the bell mouth 12 and the electrical parts box 13 to the drain pan 10. Detailed explanation on the attachment operation will be given later.

[0034] In the indoor unit 1 of the ceiling embedded type air conditioning apparatus, indoor air is taken in via the air inlet grill 18 and the filter as the air blower 6 is driven. Then, the taken-in air is further taken in a direction of a rotation axis of the air blower 6 while being guided by the bell mouth 12, and then blown out in a circumferential direction.

[0035] The indoor air that is blown out in the circumferential direction is heat exchanged while being circulated through the indoor heat exchanger 7 and thereby turned into cool air during cooling operation, and thereby turned into warm air during heating operation. The heat exchanged air is guided along a gap between the indoor heat exchanger 7 and the heat insulating material 5, and is blown out to the room from a plurality of air outlets 19 formed in the dress panel 3.

[0036] Thus, the heat exchanged air is evenly blown out from the indoor unit 1 of the air conditioning apparatus that is mounted on the ceiling board, and air conditioning action with respect to the room is efficiently performed.

[0037] Next, assembling configuration of the indoor unit body 2 will be described in detail.

[0038] FIG. 4 is a plan view of the casing 4 in which a drain pan 10 is mounted, FIG. 5 is a plan view of the casing 4 on which a bell mouth 12 is further mounted, FIG. 6 is a plan view of the casing 4 in which an electrical parts box 13 is further mounted, and FIG. 7 is a partially perspective view of the electrical parts box 13 shown in FIG. 6 and surrounding parts thereof.

[0039] In the metal part 22, proximal end parts, namely the hanging lug 22A on the upper side and the attachment bracket 22B on the under side, are formed to have same width size and provided in such a way that the hanging lug 22A and the attachment bracket 22B are facing each other above and below. The hanging lug 22A has a long

hole d for inserting a hanger bolt. A part of the attachment bracket 22B projects in such a manner that the projected part does not face the long hole d.

[0040] Corner parts of the dress panel 3 are laid over the projected parts of the attachment brackets 22B, and fixation screws are inserted into screw holes that are provided in both of the attachment brackets 22B and corner parts of the dress panel 3 to be screwed up. The dress panel 3 is thereby attached to the casing 4. Thus, the projected parts of the attachment brackets 22B do not interfere with height adjustment operation with respect to the hanger bolts of the hanging lugs 22A.

[0041] Each of the first insert metal part 24 and the second insert metal part 25 is made of sheet metal fabricated in a bending manner. As mentioned above, the insert metal parts 24 and 25 are inserted into the drain pan 10 at the time of foam molding. Though most part of the insert metal parts 24 and 25 are embedded in the drain pan 10, a part of the insert metal parts 24 and 25 are respectively exposed out of the drain pan 10 as indicated in FIGS. 4 to 6 with hatching.

[0042] Only a first insert metal part 24 at bottom right corner part as shown in FIGS. 4 to 6 has different shape and size from the other first insert metal parts 24 respectively at the other corner parts. The first insert metal parts 24 at the corner parts other than the first insert metal part 24 at the bottom right corner part have the same shape and size with each other.

[0043] The second insert metal parts 25 are attached only at top and bottom parts on the left side as shown in FIGS. 4 to 6, and they are not attached to top and bottom parts on the right side. FIG. 7 is an enlarged drawing showing a side on which the second insert metal parts 25 are attached.

[0044] In every first insert metal part 24, one part thereof projects outside from a corner part of the drain pan 10 so that it faces the proximal end parts, namely the hanging lug 22A and the attachment bracket 22B. In a condition where the projected part of the first insert metal 24 is fitted to the proximal end of the attachment bracket 22B, screw holes in the projected part and the attachment bracket 22B are communicated with each other.

[0045] The first insert metal parts 24 of the drain pan 10 are attached to the attachment brackets 22B on the lower end part of the casing 4, by inserting fixation screws in each of the screw holes and screwing them up. In other words, as shown in FIG. 4, the drain pan 10 is attached and fixed to the casing 4.

[0046] The first insert metal part 24 at the bottom right corner part has a pair of rectangular shaped exposed parts g that are provided apart from the part projected from the drain pan 10, as shown in FIGS. 4 to 6. The rest of the first insert metal parts 24 respectively have horizontally long shaped exposed parts h that are provided in parallel with the parts projected from the drain pan 10. These exposed parts g and h have hole parts. These hole parts are for engaging pins that hold the first insert metal parts 24 during the foam molding of the drain pan

10.

[0047] As shown in FIGS. 4 to 6, circular shaped exposed parts i are provided adjacent to the horizontally long shaped exposed parts h of the first insert metal parts 24 at top and bottom parts on the left side. Each of these exposed parts i has a fixation screw 26 as shown in FIG. 7. The fixation screw 26 is for fixing the projected parts respectively provided in the first and second insert metal parts 24 and 25 with each other.

[0048] More specifically, inside the drain pan 10, the projected part of the first insert metal part 24 and the projected part of the second insert metal part 25 are overlapped and tightly in contact with each other. These projected parts have screw holes to be communicated with each other, and the fixation screw is inserted and fixed thereto. Therefore, the parts of the insert metal parts 24 and 25 are strongly fixed with each other.

[0049] The second insert metal part 25, which is shown in an upper part side of FIGS. 4 to 6 and shown in the right side of FIG. 7, is attached in an angle different from a direction in which the first insert metal part 24 is attached. On the other hand, the second insert metal part 25, which is shown in a bottom part side of FIGS. 4 to 6 and shown in the left side of FIG. 7, is attached along a direction in which the first insert metal part 24 is attached.

[0050] As described above, a couple of the second insert metal parts 25 used in the embodiment of the present invention have different attachment directions with respect to the first insert metal parts 24. However, these two second insert metal parts 25 are formed to have the completely same shape and size. In the exposed parts of the second insert metal parts 25, a plurality of screw holes and holes used for being held during insert fabrication are provided.

[0051] As shown in FIG. 5, screw holes provided in the flat part 12b of the bell mouth 12 communicate with screw holes of the second insert metal parts 25, when the flat part 12b is fitted to parts of the drain pan 10 where the second insert metal parts 25 are exposed. The bell mouth 12 can be fixed to the drain pan 10 by inserting fixation screws into these screw holes and screwing the screws up.

[0052] With the condition mentioned above, the bell mouth 12 has see-through opening sections 27, each of which faces the screw hole provided in the second insert metal part 25 and having diameter larger than diameter of the screw hole. As shown in FIGS. 6 and 7, the see-through opening sections 27 respectively faces screw holes k provided in a box body 14 of the electrical parts box 13, when the box body 14 is aligned with the flat part 12b of the bell mouth 12.

[0053] Then, fixation screws are inserted and fixed into the screw holes of the second insert metal parts 25 from the screw holes k of the box body 14, via the see-through opening sections 27 of the bell mouth 12, and the box body 14 is thereby attached to the drain pan 10 via the bell mouth 12. Incidentally, a bottom part of the box body 14 is pressed through to form the screw holes k in a tiered

manner. Therefore, the bottom part of the box body is strengthened.

[0054] In the vicinity of the screw holes k of the box body 14, projected parts for clearance m are provided. These projected parts for clearance m are situated at positions facing the heads of the fixation screws that fix the bell mouth 12 to the second insert metal parts 25, in a condition wherein the box body 14 is closely attached to the bell mouth 12. In other words, projected parts for clearance m prevent the heads of the fixation screws from pushing up the bottom part of the box body 14.

[0055] The electrical parts box 13 is assembled by containing a control substrate in the box body 14 and attaching a lid plate 15 to the box body 14. Then, a fan guard 16 is attached to the bell mouth 12, and the dress panel 3 is attached to the indoor unit body 2 as mentioned above, for assembling the indoor unit 2. The assembled indoor unit 2 is to be carried into a place for installation, and suspended by hanger bolts.

[0056] As explained above, since the electrical parts box 13 made of sheet metal is attached to the second insert metal parts 25 also made of sheet metal, the electrical parts box 13 and the second insert metal parts 25 are in a conduction state. The first insert metal parts 24 and the second insert metal parts 25, which are made of sheet metal, are inserted in the drain pan 10, and projected parts of the first and second insert metal parts 24 and 25 are in contact with each other and in a conduction state.

[0057] Furthermore, the projected parts of the first insert metal parts 24 and the second insert metal parts 25 are closely fixed with each other with the fixation screws 26. In other words, though each of the insert metal parts 24 and 25 are inserted in the drain pan 10, the fixation screws 26 make the insert metal parts 2 and 25 securely in the conduction state.

[0058] The first insert metal parts 24 and the attachment brackets 22B, made of sheet metal, are fixed with each other with fixation screws and in an electrically conduction state. The attachment brackets 22B is formed at the bottom part of the metal parts body 22 made of sheet metal, and the hanging lugs 22A are formed at the upper part of the metal parts body 22. The attachment brackets 22B and the hanging lugs 22A are therefore in an electrically conduction state.

[0059] The metal parts body 22 respectively having hanging lugs 22A and the attachment brackets 22B are fixed to the sheet metal casing 4 and in an electrically conductive state. The hanging lugs 22A are suspended by metal hanger bolts and they are electrically conductive with each other. The hanger bolts are provided on beams comprising the ceiling and are in a grounding condition.

[0060] The indoor unit 1 is thus completed as a product when the dress panel 3 is attached to the assembled indoor unit body 2. When the completed indoor unit 1 is carried into a place for installation and suspended by hanger bolts, an ground path is inevitably formed since the electrical parts box 13 is grounded via the first and

second insert metal parts 24 and 25, the casing 4, and the hanger bolts, etc.

[0061] With an adoption of the configuration according to the embodiment of the present invention, a conventional lead wire performing as ground wiring for reducing noise terminal voltage becomes unnecessary. Parts cost can be thus reduced, and furthermore, operation for connecting a lead wire to the electrical parts box can be omitted. Therefore, improvement in workability and reduction in cost is both possible.

[0062] Incidentally, since the first insert metal parts 24 and the second insert metal parts 25 are individually formed, attachment positions of the first and second insert metal parts 24 and 25 with respect to the drain pan 10 can be varied in accordance with design specifications. In other words, with a plurality of the first and second insert metal parts 24 and 25, drain pans having different shapes and configurations may be applicable.

[0063] Next, a box body 14 comprising the electrical parts box 13 will be described in detail.

[0064] FIG. 8 is a partially plan view of the box body 14 in which electrical parts to be contained are omitted. FIG. 9 is a perspective view of the electrical parts box 14, showing the same part as in FIG. 8, including electrical parts contained inside the box body 14.

[0065] The electrical parts box 13 has a rectangle shape which is long in a longitudinal direction. A terminal block base 28 is attached to a bottom part of one side part of the box body 14. To explain more specifically, this terminal block base 28 is attached in a slant manner over the bottom part of the box body 14 and a lateral end, and there is a gap between the bottom part of the box body 14 and the terminal block base 28 to make a double structure.

[0066] Especially as shown in FIG. 9, a plurality of terminal blocks 29 and cord retainers 30 are attached to the terminal block base 28, and a ground symbol 31 is provided at a location between the terminal blocks 29 and the cord retainers 30. Furthermore, a screw through hole 32 formed by barring is provided in the vicinity of the ground symbol, and the screw hole k is provided in the bottom part of the box body 14, at a location facing the screw through hole 32.

[0067] A notched part 33 is provided at a corner part of the box body 14, more specifically at a location over an attachment position of the terminal block base 28 and the bottom part of the box body 14. In the case where a fixation screw is accidentally come off when inserting the fixation screw into the screw through hole 32 of the terminal block base 28 during attachment of the box body 14, the fixation screw j may be taken out from the notched part 33.

[0068] After the indoor unit body 2 is suspended with the hanger bolts and necessary height adjustment is finished, the air inlet grill 18 and the filter is detached for exposing the electrical parts box 13. The lid plate 15 of the electrical parts box 13 is also detached for exposing electrical parts and the terminal blocks 29, etc. contained

in the box body 14.

[0069] A lead wire terminal for electrical power or for signal is at least attached to the terminal block 29, for electrically connecting the electrical parts for control with the lead wire. Although a worker has to look up the electrical parts box 13 for performing this connecting operation, the attachment manner in which the terminal block base 28 is slantly attached with respect to the bottom of the box body 14 makes the worker to perform the operation easier. The improvement in workability is therefore obtained.

[0070] Next, explanation on the bell mouth 12 will be given.

[0071] FIGS. 10-12 are partially perspective views respectively showing the bell mouth 12 in ordinary use, when a slit part is cut, and when the electrical parts box for control is attached.

[0072] As shown in FIG. 10, a slit part 12c having a rectangular shaped slit is provided in the bell mouth 12. This slit part 12c of the bell mouth 12 is broken out when a certain level of force is applied to the slit part 12c. In ordinary use, however, the slit part 12c is maintained without being broken out. Therefore, when bell mouth 12 is in ordinary use, air volume is secured.

[0073] In a case of optional specification where the number of indoor units is increased with respect to an outside unit, for example, an electrical parts box for control 40 including a control substrate has to be additionally mounted in the indoor unit. In that case, a certain level of force is applied to the slit part 12c for removing a part at an end part side, as shown in FIG. 11 (the slit part is cut).

[0074] In the above condition in which the slit part is removed, a plurality of ribs 35 that are parallelly provided on an extension of a flat part 12b with a predetermined space are exposed. There is narrow space between pointy ends of these ribs 35 and a plate surface of the flat part 12b. A lead wire 36 can be held in with the ribs 35 by embedding the lead wire 36 into the narrow space.

[0075] Then, as shown in FIG. 12, the electrical parts box for control 40 which is stored for optional use is mounted in the taken-away slit part 12c in such a manner that the box 40 is placed on and faces the ribs 35. Furthermore, the electrical parts box for control 40 is fixed to the bell mouth 12 with fixation screws (when the electrical parts box for control is attached).

[0076] In other words, the electrical parts box for control 40 for optional use can be easily mounted only by removing the slit part 12c, without increasing the number of parts. The ribs 35 serve as a pedestal for the electrical parts box for control 40 and also as a guide for the lead wire 36, for being able to comply with an optional specification.

[0077] Note that the present invention is not limited to the above-described embodiments as are, and structural requirements can be modified and materialized within a range which does not deviate from the gist of the present invention at the practical phase. Further, various inven-

tions can be formed due to the plurality of structural requirements which have been disclosed in the above-described embodiments being appropriately combined.

5 Industrial Applicability

[0078] According to the present invention, an installation of ground wiring for reduction of noise terminal voltage during assembly of an indoor unit becomes unnecessary, and improvement in assembling workability is possible.

15 Claims

1. An indoor unit of an air conditioning apparatus comprising:

an indoor unit body having an openable lower surface and containing an electrical components box, a heat exchanger, a drain pan, and air blower inside thereof;
a dress panel for closing the lower surface of the indoor unit body; and
a first insert metal part provided in the drain pan for fixing the drain pan with respect to the indoor unit body, and a second insert metal part for attaching and fixing the electrical parts box with respect to the drain pan;
characterized in that the first insert metal part and the second insert metal part are electrically connected and integrally formed.

2. The indoor unit of the air conditioning apparatus according to claim 1, **characterized in that** a part of the first insert metal part and a part of the second insert metal part overlap, and the overlapped part is fixed with a fixation screw.

3. The indoor unit of the air conditioning apparatus according to either claim 1 or claim 2, **characterized in that** a bell mouth is attached and fixed to the second insert metal part.

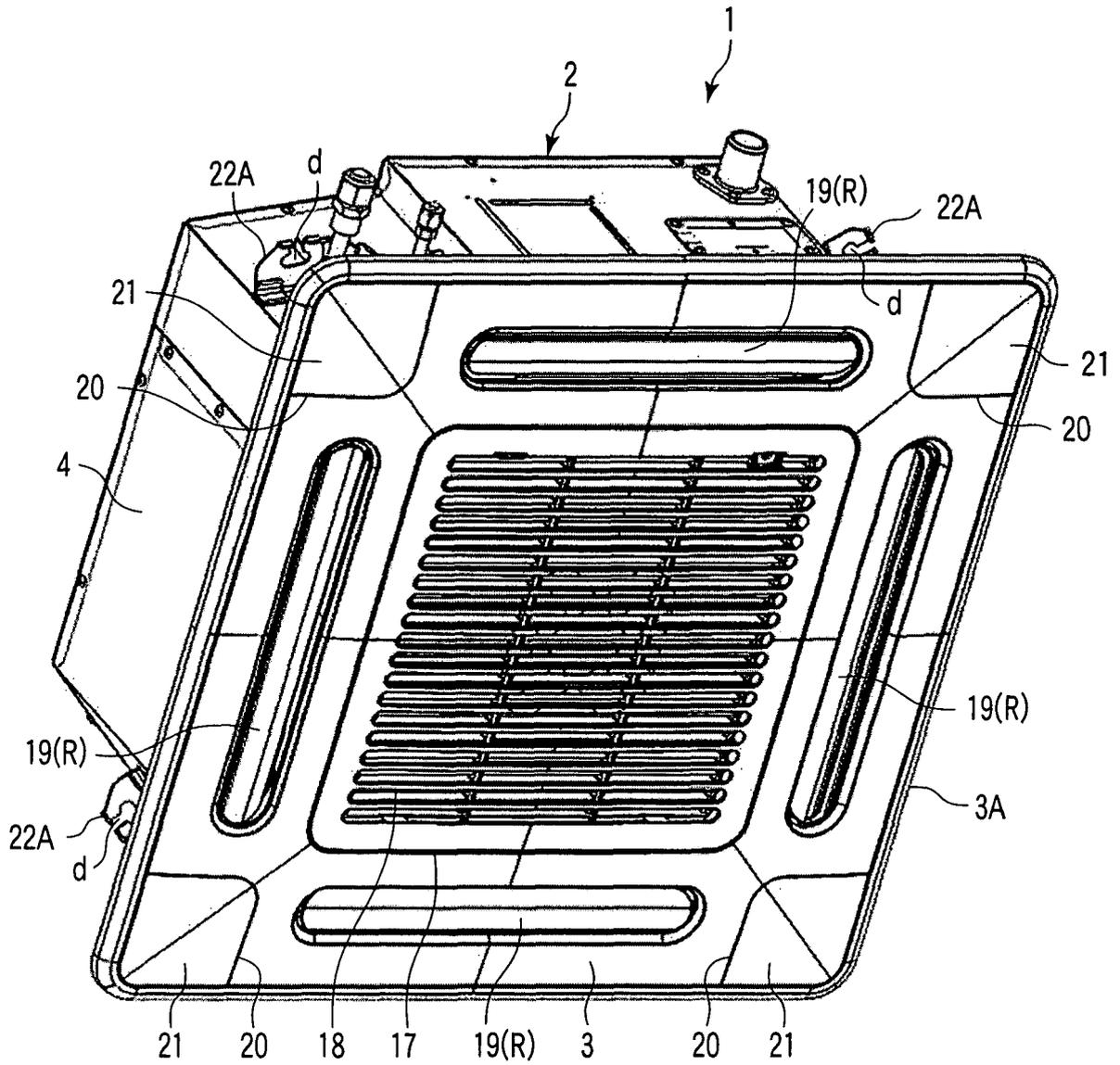


FIG. 1

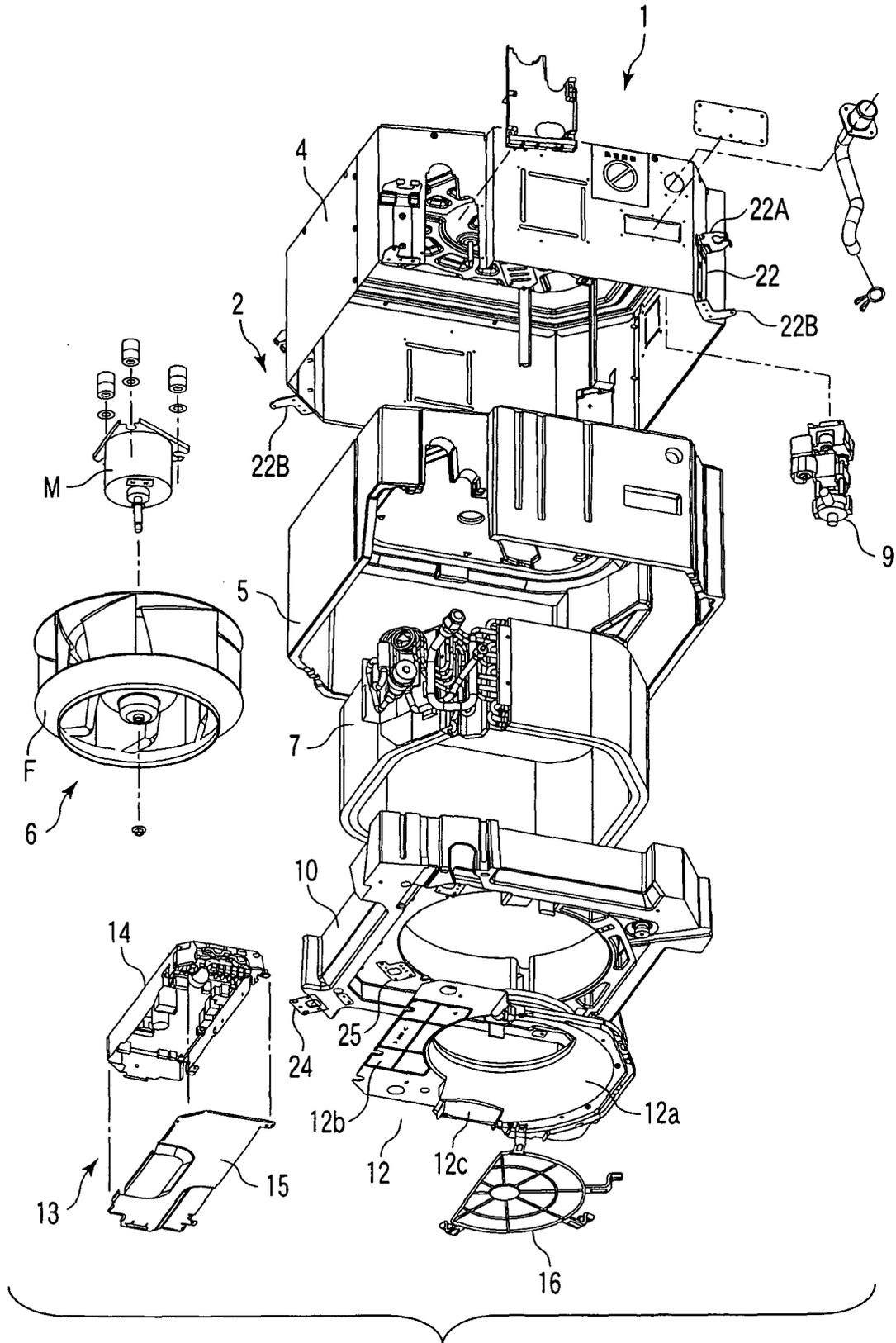


FIG. 2

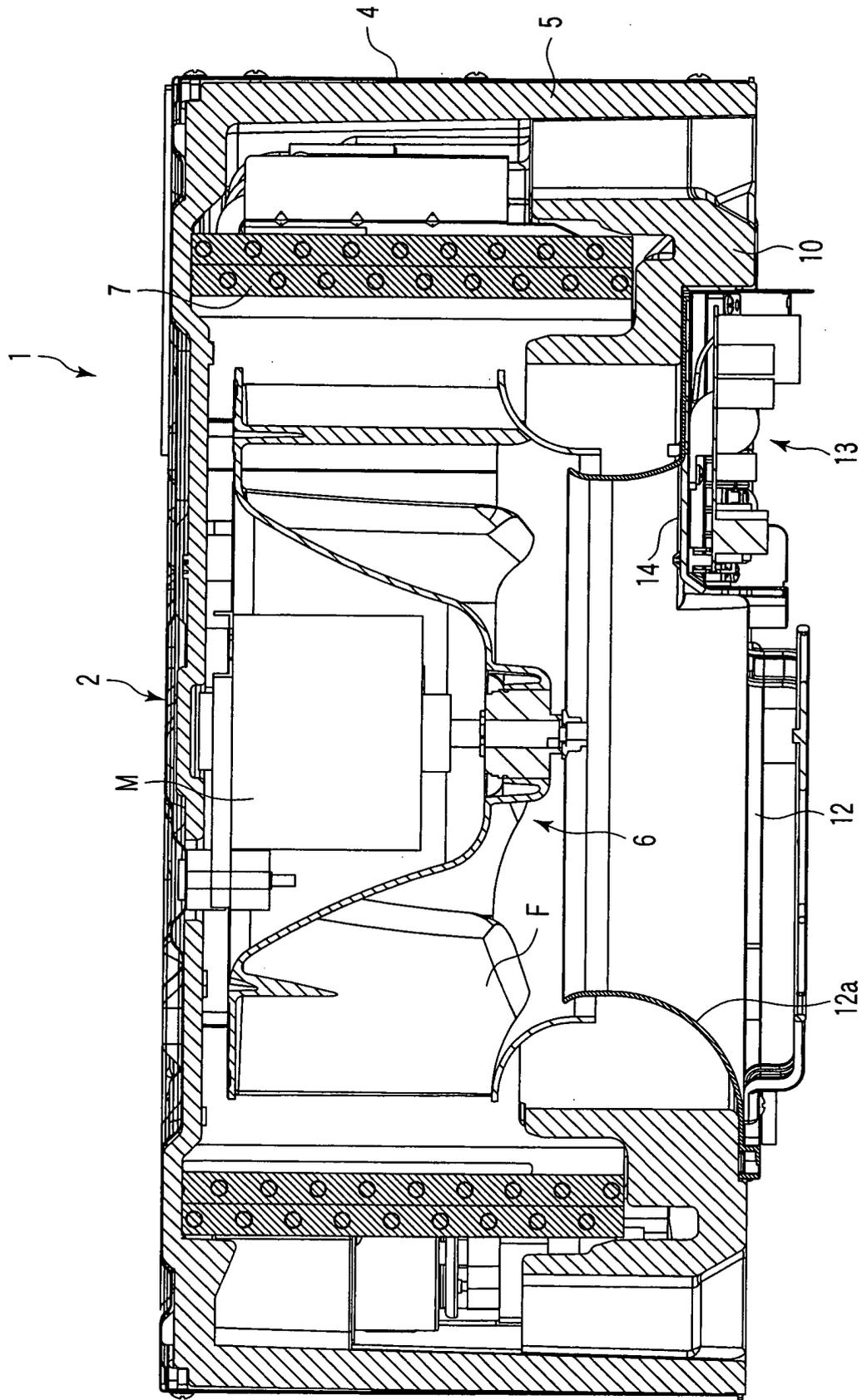


FIG. 3

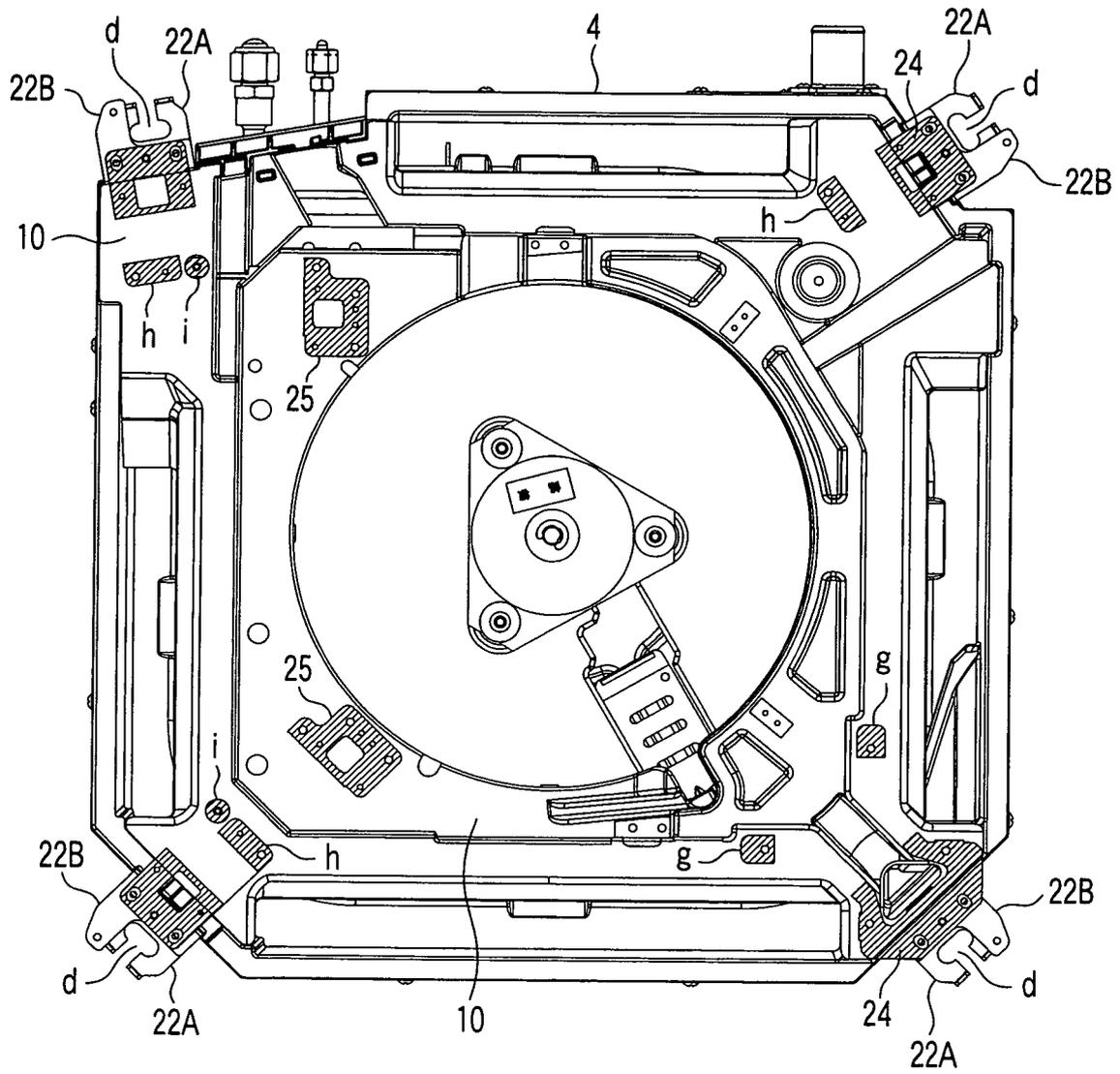


FIG. 4

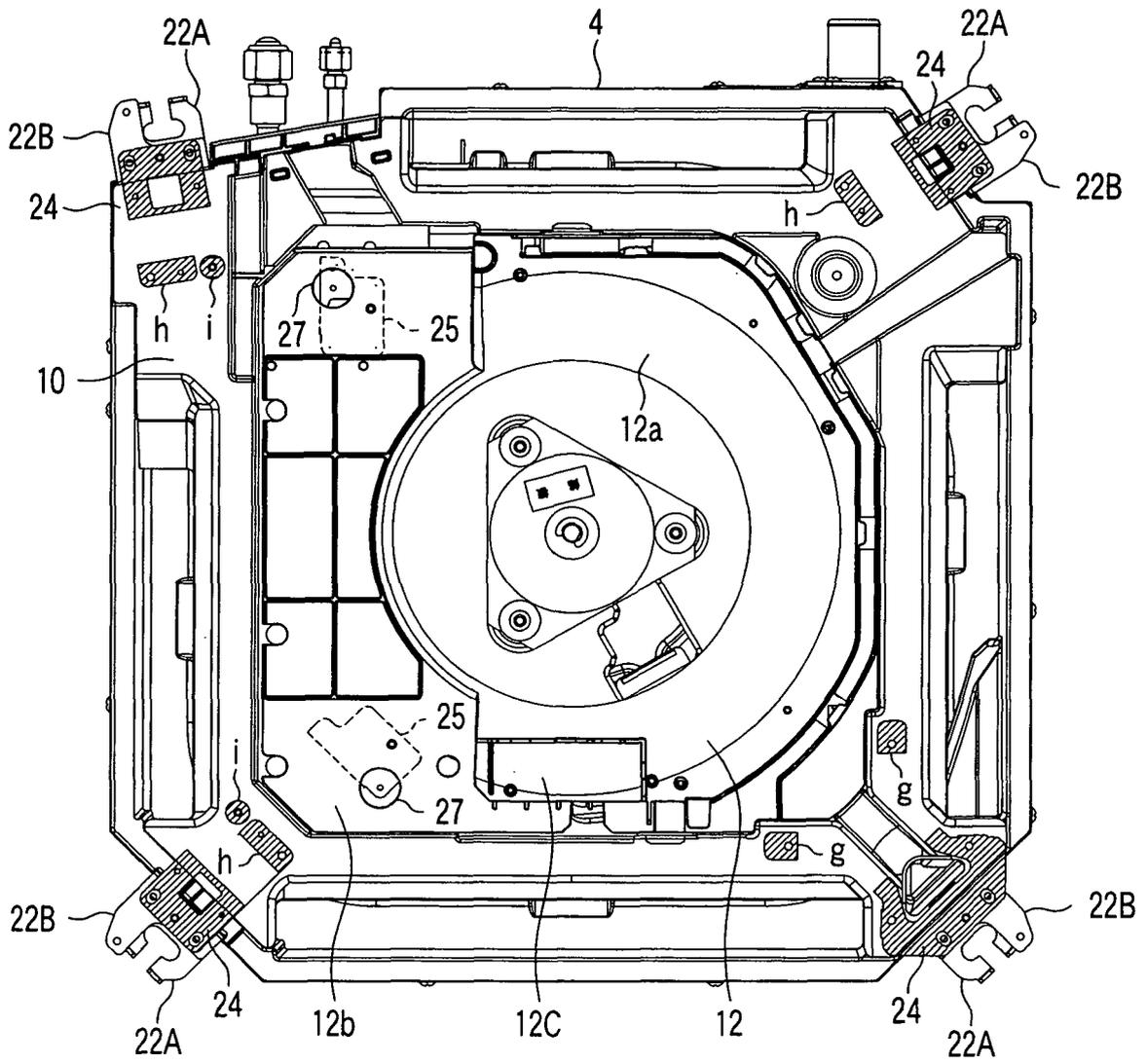


FIG. 5

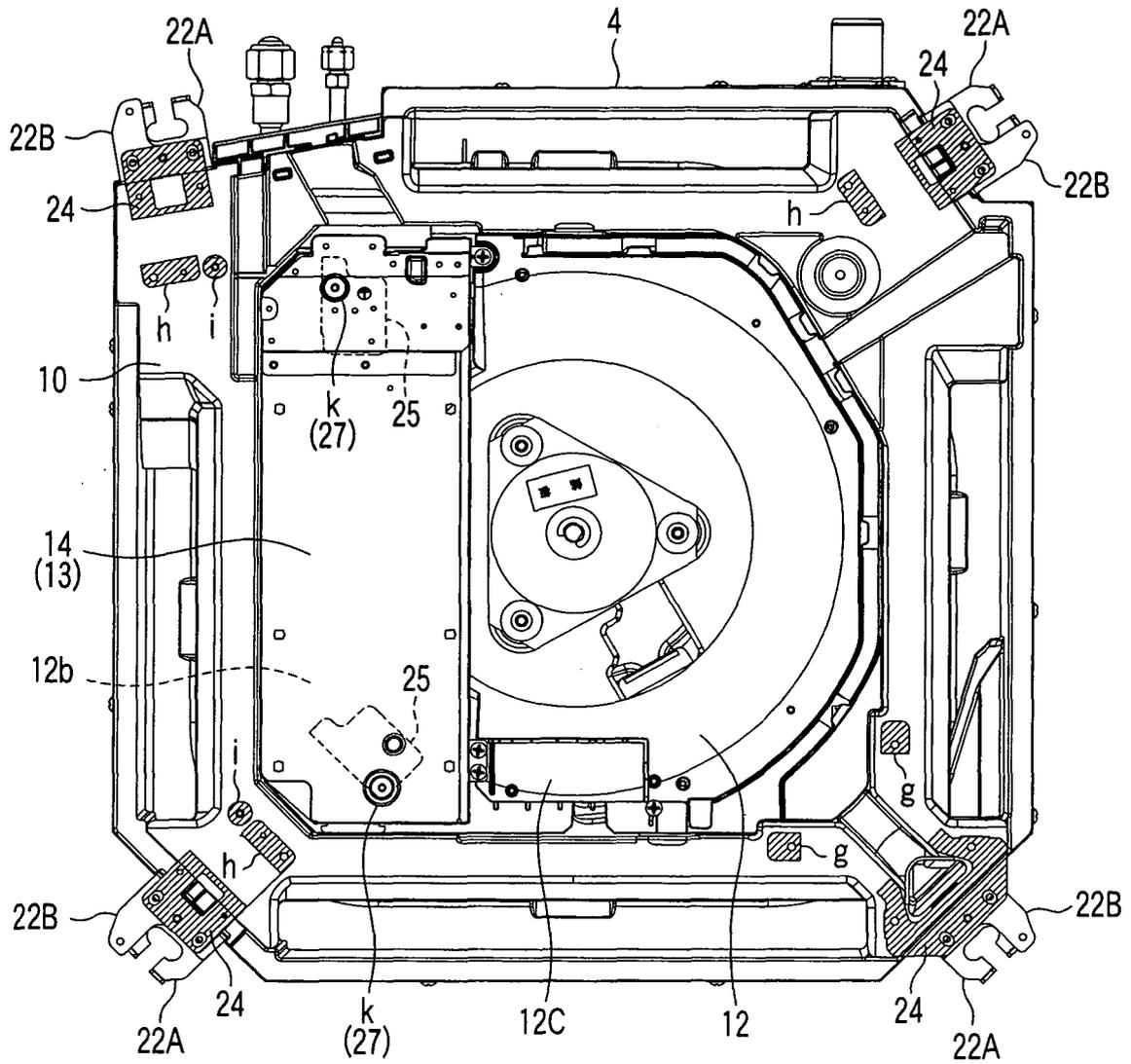


FIG. 6

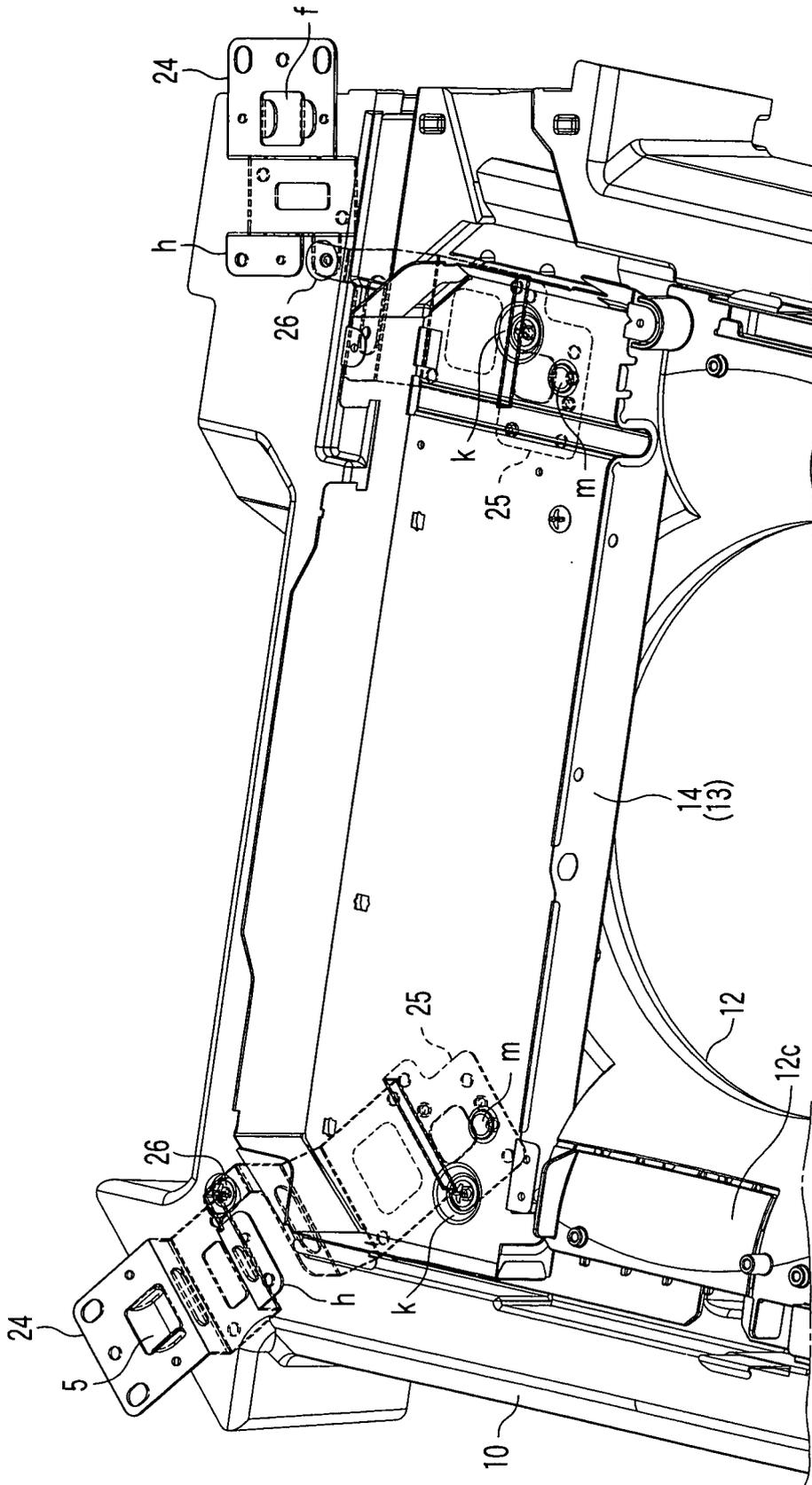


FIG.7

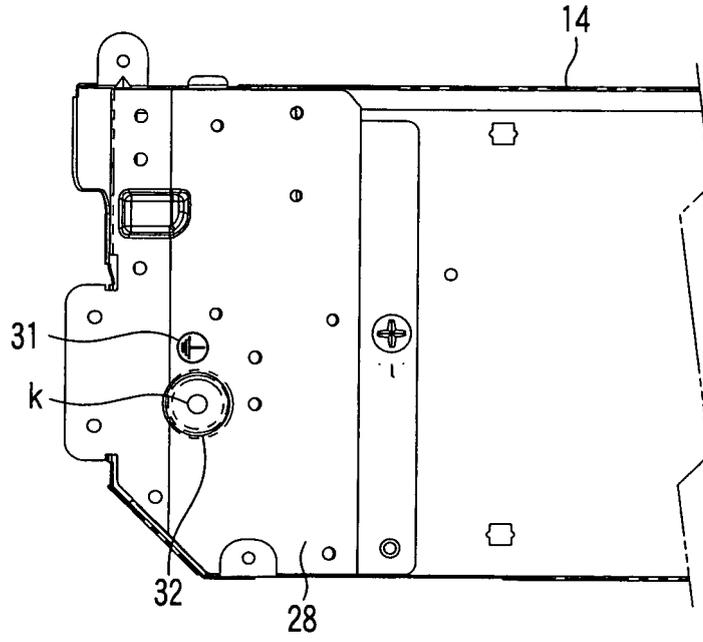


FIG. 8

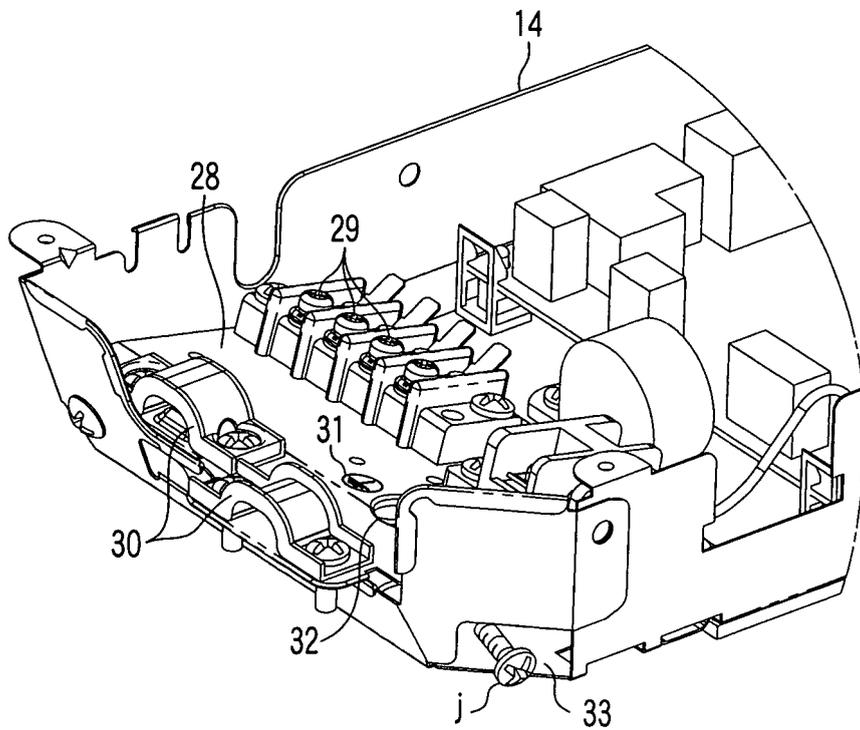


FIG. 9

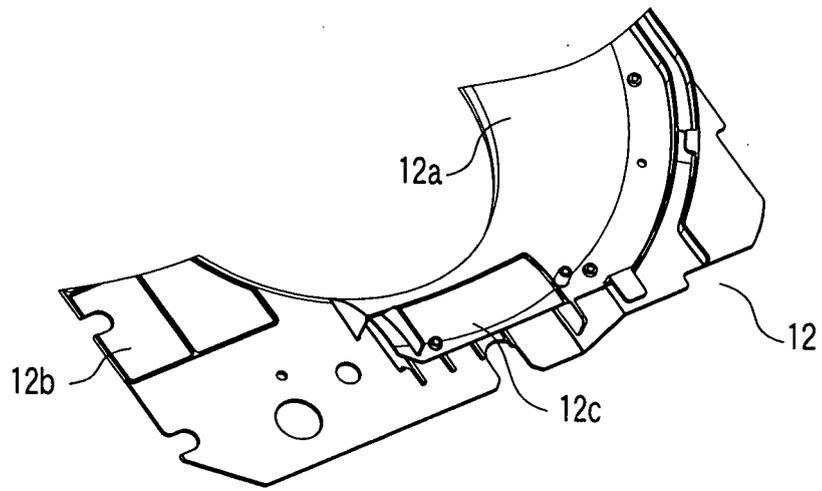


FIG. 10

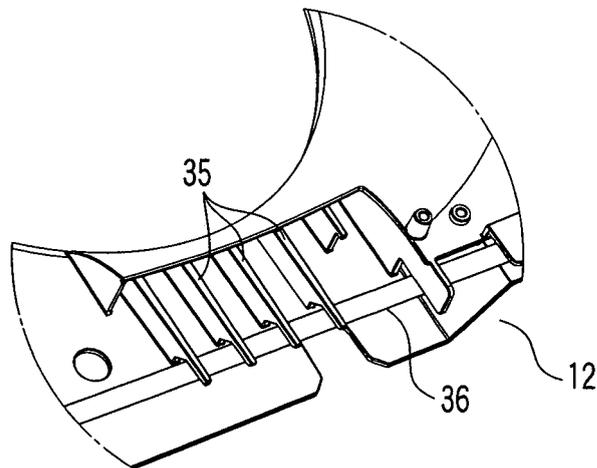


FIG. 11

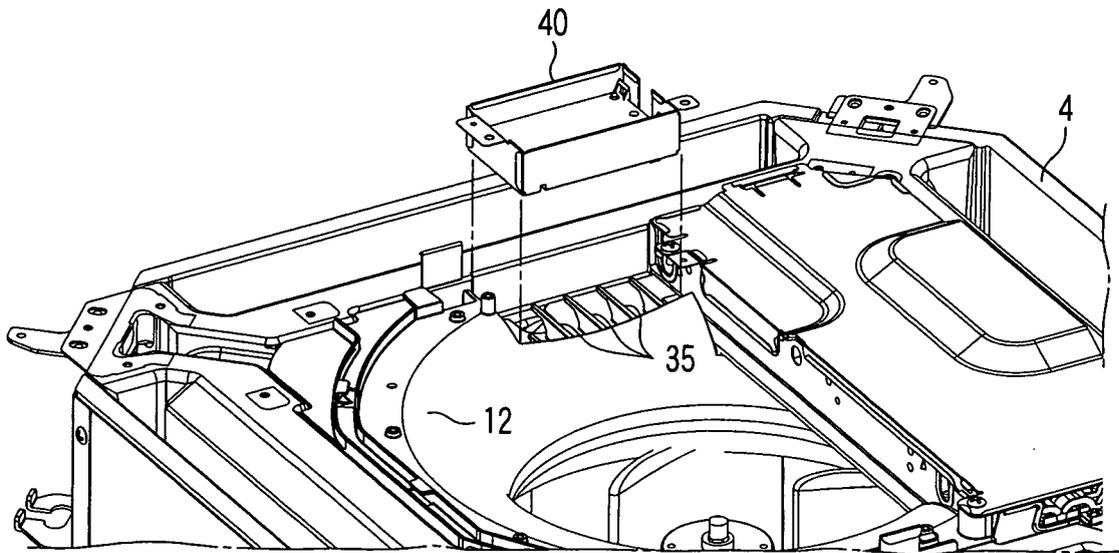


FIG. 12

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2007/059231

A. CLASSIFICATION OF SUBJECT MATTER F24F13/20(2006.01) i		
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) F24F13/20		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2007 Kokai Jitsuyo Shinan Koho 1971-2007 Toroku Jitsuyo Shinan Koho 1994-2007		
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.
A	JP 11-201496 A (Daikin Industries, Ltd.), 30 July, 1999 (30.07.99), Par. No. [0019]; Fig. 3 (Family: none)	1-3
A	JP 2006-3011 A (Daikin Industries, Ltd.), 05 January, 2006 (05.01.06), Par. No. [0002] & WO 2005/124238 A1	1-3
A	JP 2004-93005 A (Toshiba Carrier Corp.), 25 March, 2004 (25.03.04), Par. No. [0002] & WO 2004/020914 A1 & EP 1548372 A1	1-3
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "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 "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 26 July, 2007 (26.07.07)		Date of mailing of the international search report 07 August, 2007 (07.08.07)
Name and mailing address of the ISA/ Japanese Patent Office		Authorized officer
Facsimile No.		Telephone No.

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Patent documents cited in the description

- JP 2001235176 A [0005] [0005] [0006]