



(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
22.10.2014 Bulletin 2014/43

(51) Int Cl.:
F24F 1/22 ^(2011.01) **F24F 1/36** ^(2011.01)

(21) Application number: **12857382.1**

(86) International application number:
PCT/JP2012/007949

(22) Date of filing: **12.12.2012**

(87) International publication number:
WO 2013/088713 (20.06.2013 Gazette 2013/25)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **12.12.2011 JP 2011271295**

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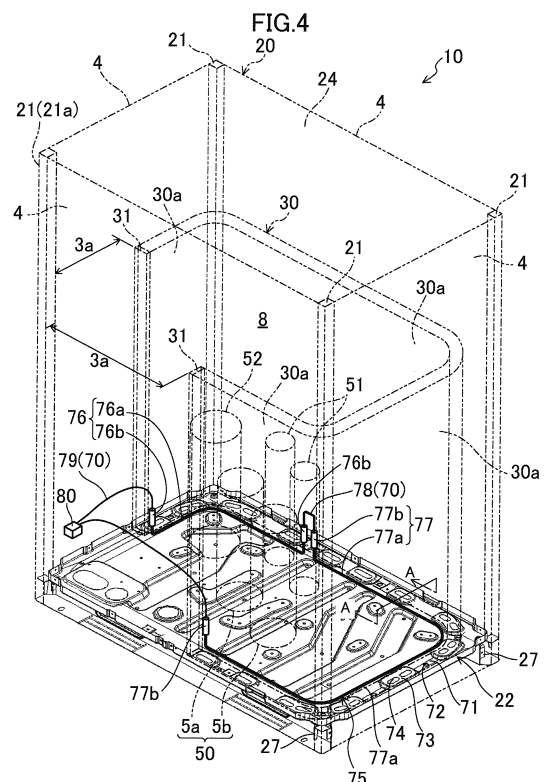
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(54) **HEATER AND OUTDOOR UNIT FOR REFRIGERATION UNIT PROVIDED WITH HEATER**

(57) An outdoor unit (10) includes a casing (20) including four side surfaces (4). The outdoor unit (10) includes an outdoor heat exchanger (30) disposed in the casing (20), including four heat exchange surfaces (30a) corresponding to the side surfaces (4) of the casing (20), and including an opening (3a) disposed on side surfaces of the outdoor heat exchanger (30). A heater (75) is in a shape of a rectangular frame along a lower end portion of the outdoor heat exchanger (30), and avoids freeze of drain water on the outdoor heat exchanger (30). The heater (75) includes hinges (70) allowing the heater to fold longitudinally.



Description

TECHNICAL FIELD

[0001] The present invention relates to a heater for avoiding freeze of drain water, and an outdoor unit including the heater for a refrigerator.

BACKGROUND ART

[0002] A typical outdoor unit for a refrigerator includes a heater for avoiding freeze of drain water on an outdoor heat exchanger. See, e.g., PATENT DOCUMENT 1. PATENT DOCUMENT 1 discloses a heater that is disposed on an outdoor unit base and below an outdoor heat exchanger. This heater, in plan view, is in the shape of an L-shaped frame along an L-shaped outdoor heat exchanger. This configuration allows the drain water on the outdoor heat exchanger to drop on the outdoor unit base and to be heated by the heater. This drain water is drained without freeze from a drain outlet disposed on the outdoor unit base.

CITATION LIST

PATENT DOCUMENT

[0003] PATENT DOCUMENT 1: Japanese Unexamined Patent Publication No. 2004-69220

SUMMARY OF THE INVENTION

TECHNICAL PROBLEM

[0004] Some outdoor heat exchangers include four heat exchange surfaces corresponding to four side surfaces of a casing to enlarge the heat exchange area. This outdoor heat exchanger is hereinafter referred to as a "four-surface heat exchanger." An outdoor unit with the four-surface heat exchanger includes a heater that is in the shape of a rectangular frame along the four-surface heat exchanger to avoid freeze of drain water on the four-surface heat exchanger. Installation of this heater shaped along the four-surface heat exchanger is complicated. For example, the heater might be stuck on the four-surface heat exchanger when retrofitted or installed for maintenance.

[0005] It is an object of the present invention to provide a heater that is easily installed in an outdoor unit for a refrigerator.

SOLUTION TO THE PROBLEM

[0006] The first aspect of the invention provides a heater for avoiding freeze of drain water on an outdoor heat exchanger (30) of an outdoor unit (10) for a refrigerator. The outdoor unit (10) includes a casing (20) including four side surfaces (4). The outdoor unit (10) also includes

the outdoor heat exchanger (30) disposed in the casing (20), including four heat exchange surfaces (30a) corresponding to the side surfaces (4) of the casing (20), and including an opening (3a) disposed on side surfaces of the outdoor heat exchanger (30). The heater is in a shape of a rectangular frame along a lower end portion of the outdoor heat exchanger (30). The heater includes hinges (70) allowing the heater to fold longitudinally.

[0007] The heater (75) of the first aspect of the invention is for the outdoor unit (10) of the refrigerator. The heater (75) is in the shape of a rectangular frame along the lower end portion of the outdoor heat exchanger (30). The outdoor heat exchanger (30) includes the four heat exchange surfaces (30a). The outdoor heat exchanger (30) includes the opening (3a) disposed on the side surfaces of the outdoor heat exchanger (30). This heater (75) includes the hinges (70) allowing the heater (75) to fold longitudinally. In other words, the hinges (70) fold so that the heater (75) folds longitudinally. The heater (75) that is folded is placed inside the outdoor heat exchanger (30) through the opening (3a) on the side surface of the outdoor heat exchanger (30). Then, the heater (75) is attached along the lower end portion of the outdoor heat exchanger (30).

[0008] The second aspect of the invention provides the heater (75), of the first aspect of the invention, including a first heating portion (76) and a second heating portion (77) that are aligned longitudinally. The hinges (70) are wirings (78, 79) connecting the first heating portion (76) and the second heating portion (77).

[0009] The heater (75) of the second aspect of the invention includes the first heating portion (76) and the second heating portion (77) that are aligned longitudinally. The hinges (70) are the wirings (78, 79) connecting the two heating portions (76, 77). The wirings (78, 79) are able to fold. In other words, the wirings (78, 79) fold so that the heater (75) folds longitudinally.

[0010] The third aspect of the invention provides the heater (75) of the second aspect of the invention. The first heating portion (76) of the second aspect of the invention includes a body (76a) and end portions (76b). The second heating portion (77) includes a body (77a) and end portions (77b). The bodies (76a, 77a) extend along a bottom board (22) of the casing (20). The end portions (76b, 77b) are bent upward from the bodies (76a, 77a). The end portions (76b, 77b) are connected with the wirings (78, 79).

[0011] The first heating portion (76) of the third aspect of the invention includes a body (76a) and end portions (76b). The second heating portion (77) includes a body (77a) and end portions (77b). The bodies (76a, 77a) extend along a bottom board (22) of the casing (20). The end portions (76b, 77b) are bent upward from the bodies (76a, 77a). The end portions (76b, 77b) are connected with the wirings (78, 79) serving as the hinges (70). When the bodies (76a, 77a) of the heating portions (76, 77) are disposed on the bottom board (22) of the casing (20) of the outdoor unit (10), the end portions (76b, 77b) con-

nected with the wirings (78, 79) extend upward from the bottom board (22). In other words, the wirings (78, 79) connecting the heating portions (76, 77) are not in contact with the bottom board (22), of the casing (20), receiving the drain water. This configuration prevents the wirings (78, 79) connecting the heating portions (76, 77) from being in contact with the drain water.

[0012] The fourth aspect of the invention provides the outdoor unit, for the refrigerator, including the heater (75) of any one of the first to third aspects of the invention.

[0013] The heater (75), of the fourth aspect of the invention, that is folded longitudinally is placed inside the outdoor heat exchanger (30) through the opening (3a) on the side surface of the outdoor heat exchanger (30) including the four heat exchange surfaces (30a). Then, the heater (75) is expanded inside the outdoor heat exchanger (30). Then, the heater (75) is attached on the outdoor unit (10) along the lower end portion of the outdoor heat exchanger (30).

[0014] The fifth aspect of the invention provides the outdoor unit, of the fourth aspect of the invention, including compressors (5a, 5b) disposed inside the outdoor heat exchanger (30).

[0015] The heater (75), of the fifth aspect of the invention, that is folded longitudinally is placed inside the outdoor heat exchanger (30) through the opening (3a) on the side surface of the outdoor heat exchanger (30) including the four heat exchange surfaces (30a). During this time, the heater (75) is not in contact with the compressors (5a, 5b). Then, the heater (75) is expanded inside the outdoor heat exchanger (30) that accommodates the compressors (5a, 5b). Then, the heater (75) is attached on the outdoor unit (10) along the lower end portion of the outdoor heat exchanger (30).

ADVANTAGES OF THE INVENTION

[0016] In the first aspect of the invention, the heater (75) is in the shape of a rectangular frame and includes the hinges (70) that allow the heater (75) to fold longitudinally. This configuration allows, for installation in the outdoor unit (10) of the refrigerator, the heater (75) folded longitudinally to be placed inside the outdoor heat exchanger (30) through the opening (3a) disposed on the side surface of the outdoor heat exchanger (30). That is, if the opening (3a) on the side surface of the outdoor heat exchanger (30) is narrow, the heater (75) is still easily placed inside the outdoor heat exchanger (30) without being stuck on the outdoor heat exchanger (30). The folded heater (75) is also expanded after placed inside the outdoor heat exchanger (30). Thus, the heater (75) is easily installed along the lower end portion of the outdoor heat exchanger (30) without being stuck on the outdoor heat exchanger (30). This heater for the outdoor unit of the refrigerator is useful for easy installation.

[0017] In the second aspect of the invention, the simple configuration allows the heater (75) to fold longitudinally.

[0018] In the third aspect of the invention, the heater

(75) includes the heating portions (76, 77). These heating portions (76, 77) include the end portions (76b, 77b) connected with the wirings (78, 79) serving as the hinges (70). These end portions (76b, 77b) are bent upward from the bodies (76a, 77a) extending along the bottom board (22) of the casing (20). This configuration prevents the wirings (78, 79) connecting the heating portions (76, 77) from being in contact with the drain water when the heater (75) is attached on the bottom board (22) of the outdoor unit (10).

[0019] In the fourth aspect of the invention, the heater (75) is able to fold longitudinally. Thus, the heater (75) is placed inside the outdoor heat exchanger (30) and installed in the outdoor unit (10) without being stuck on the outdoor heat exchanger (30) including the four heat exchange surfaces (30a).

[0020] In the fifth aspect of the invention, the outdoor unit includes the compressors (5a, 5b) disposed inside the outdoor heat exchanger (30). The heater (75) to be installed in this outdoor unit might be stuck on not only the outdoor heat exchanger (30) but also on the compressors (5a, 5b) disposed inside the outdoor heat exchanger (30). Thus, the installation is more complicated. However, in the fifth aspect of the invention, the heater (75) that is able to fold longitudinally is installed in the outdoor unit. Thus, the folded heater (75) is placed inside the outdoor heat exchanger (30) through the opening (3a) on the side surface of the outdoor heat exchanger (30). Thus, the heater (75) is easily installed along the lower end portion of the outdoor heat exchanger (30) without contact with the compressors (5a, 5b).

BRIEF DESCRIPTION OF THE DRAWINGS

[0021]

[FIG. 1] FIG. 1 is a perspective view showing an appearance and shape of an outdoor unit of an air conditioner of a first embodiment of the present invention.

[FIG. 2] FIG. 2 is a first perspective view showing an internal structure of the outdoor unit in FIG. 1.

[FIG. 3] FIG. 3 is a second perspective view showing the internal structure of the outdoor unit in FIG. 1.

[FIG. 4] FIG. 4 is a perspective view showing, in particular, a bottom frame and a heater of the outdoor unit in FIG. 1.

[FIG. 5] FIG. 5 is a cross-sectional view taken along line A-A of FIG. 4.

[FIG. 6] FIG. 6 is a perspective view showing a heater configuration.

DESCRIPTION OF EMBODIMENTS

[0022] Embodiments of the present invention will be described in detail below with reference to the drawings.

First Embodiment of the Invention

[0023] FIGS. 1-4 illustrate an outdoor unit (10) of the first embodiment. The outdoor unit (10) is connected with an indoor unit (not shown) to operate vapor-compression refrigeration cycles. The outdoor unit (10) is used for an air conditioner serving as a refrigerator.

[0024] The outdoor unit (10) is installed on, e.g., a rooftop of a building. The outdoor unit (10) includes a casing (20), an outdoor heat exchanger (30), outdoor fans (40), and a compression system (50).

[0025] The casing (20) is rectangular in plan view. The casing (20) includes four poles (21), a bottom frame (22), side panels (23), and a flat top board (24). The bottom frame (22) serves as a bottom board. That is, the casing (20) includes four side surfaces (4) between the top board (24) and the bottom frame (22). See FIG. 4.

[0026] The four poles (21) are disposed in four corners. The four poles (21) each includes a lower part fixed to the bottom frame (22). The left and right poles (21, 21) disposed on a front side of the casing (20) each includes a lower end connected with a foundation leg (27). The left and right poles (21) disposed on a back side of the casing (20) each also includes a lower end connected with another foundation leg (27). The foundation legs (27) each protrudes downward from the bottom frame (22). These foundation legs (27) might be installed on four corners of a flat top board (24) of another casing (20), or upper ends of poles (21) of the another casing (20). These foundation legs (27) allow the plurality of outdoor units (10) to be stacked vertically. This configuration also secures a certain clearance between the flat top board (24) and the bottom frame (22).

[0027] FIG. 1 illustrates the side panels (23) that include upper side panels (23a), a front side panel (23b), and a lateral side panel (23c). The upper side panels (23a) serve as four upper side surfaces of the casing (20). The front side panel (23b) serves as a lower left portion of a front surface of the casing (20). The lateral side panel (23c) serves as a lower front portion of a left lateral side surface of the casing (20). The casing (20) includes an inlet (25) that is disposed on a lower right portion of the front surface of the casing (20). The casing (20) includes an inlet (25) that is disposed on a lower portion of a right lateral side surface of the casing (20). The casing (20) includes an inlet (25) that is disposed on a lower portion of a back surface of the casing (20). The casing (20) includes an inlet (25) that is disposed on a lower back portion of the left lateral side surface of the casing (20).

[0028] The four upper side panels (23a) are attached on the poles (21), and surround the outdoor fans (40). The upper side panels (23a) form an upper space (2b), which accommodates the two outdoor fans (40). See FIGS. 2 and 3.

[0029] The top board (24) is also fixed to the upper ends of the poles (21). The top board (24) includes two air outlets (26) positioned above the two outdoor fans

(40). The air outlet (26) is rectangular in plan view. The air outlet (26) is covered with a mesh grill (24a) that is rectangular. Specifically, the top board (24) includes installation surfaces for the grills (24a). The installation surface is recessed and positioned below an upper end surface of the top board (24). This configuration prevents the grill (24a) and screws that fasten the grill (24a) to the top board (24) from being positioned above the upper end surface of the top board (24).

[0030] FIGS. 2-4 illustrate the outdoor heat exchanger (30) that is a fin and tube heat exchanger. The outdoor heat exchanger (30) exchanges heat between outdoor air and a refrigerant. Specifically, the outdoor heat exchanger (30) includes a plurality of heat transfer tubes that are arranged vertically and pass through plate fins. The heat transfer tubes of the outdoor heat exchanger (30) are bent at a right angle in three points along the four side surfaces (4) of the casing (20). In other words, the outdoor heat exchanger (30) is a bent heat exchanger (a rectangular shell heat exchanger) that stands vertically and includes four heat exchange surfaces (30a) corresponding to the four side surfaces (4) of the casing (20). See FIG. 4.

[0031] A machine room (8) accommodating machines such as the compression system (50), an oil separator (51), an accumulator (52), etc. is provided inside the outdoor heat exchanger (30). The compression system (50), the oil separator (51), and the accumulator (52) are also attached on the bottom frame (22). The compression system (50) includes two compressors (5a, 5b).

[0032] Two of the four heat exchange surfaces (30a) of the outdoor heat exchanger (30) sandwich one of the four poles (21). This one of the four poles (21) is the pole (21 a) disposed in the left front corner. The two of the four heat exchange surfaces (30a) include openings (3a, 3a). See FIGS. 2 and 4. The two openings (3a, 3a) serve as maintenance openings for the machines in the casing (20). Ends of the outdoor heat exchanger (30) each serves the opening (3a). A tube plate (31) is provided on each of the ends of the outdoor heat exchanger (30) in order to fix the outdoor heat exchanger (30) to the casing (20).

[0033] FIG. 1 illustrates the casing (20) including the front side panel (23b) and the lateral side panel (23c) each corresponding to the opening (3a) of the outdoor heat exchanger (30). The front side panel (23b) and the lateral side panel (23c) serve as lower side panels in a lower portion of the casing (20). The front side panel (23b) and the lateral side panel (23c) are installed on the pole (21a) to freely open or close the openings (3a, 3a).

[0034] The outdoor heat exchanger (30) includes the opening (3a) on the front side of the casing (20). This front side serves as a service surface. The front side also serves an opening surface where the front side panel (23b) is detached. The opening (3a) that is opened by detaching the front side panel (23b) serves as a service opening through which a heater (75) to be installed passes. The heater (75) will be described later.

[0035] The casing (20) also includes horizontal stays (20a, 20b, 20c, 20d) on the four surfaces of the casing (20). The stays (20a, 20b, 20c, 20d) are positioned between a lower space (2a) accommodating the outdoor heat exchanger (30) and the upper space (2b) accom-

[0036] The two outdoor fans (40) each includes a rotating member (41), a fan motor (not shown), and a bell mouth (43). The outdoor fans (40) are mounted on the stays (20a, 20c).

[0037] The casing (20) also accommodates an electrical equipment unit (60) that accommodates electrical equipment for controlling the compression system (50) etc. The electrical equipment unit (60) is disposed above the front surface of the outdoor heat exchanger (30) and near an upper end of the outdoor heat exchanger (30). The electrical equipment unit (60) is also disposed between the upper side panel (23a) and the bell mouth (43) of the outdoor fan (40).

[0038] The bottom frame (22) includes a compressor cover that covers the compression system (50). This compressor cover serves as a soundproof box for reducing noises produced by vibrations of the compression system (50).

[0039] The bottom frame (22) also includes a plurality of drain passages (71) (five drain passages in this embodiment) for discharging drain water on the outdoor heat exchanger (30). See FIG. 4. The drain passages (71) are disposed below the outdoor heat exchanger (30).

[0040] FIG. 5 illustrates the drain passage (71) that is a recessed channel on the bottom frame (22). The recessed channel includes a bottom (71a) and slopes (71b). The bottom (71a) extends along the outdoor heat exchanger (30). The slopes (71b) are disposed on both sides of the bottom (71a), and extend along the bottom (71a). The bottom (71a) of the drain passage (71) includes a plurality of drain holes (72). The drain passage (71) includes a plurality of platforms (73) that the outdoor heat exchanger (30) stands on.

[0041] The platform (73) is a raised portion on the drain passage (71). The raised portion includes a stage (73a) and a side (73b). The stage (73a) is flat. The outdoor heat exchanger (30) stands on the stage (73a). The side (73b) is tapered from the drain passage (71) to the stage (73a). The stage (73a) of the platform (73) includes a plurality of drain holes (74).

[0042] The outdoor heat exchanger (30) stands on the stage (73a) of the platform (73). Screws, for example, engage the tube plates (31) provided on both ends of this outdoor heat exchanger (30) with the casing (20) including the bottom frame (22) so that the outdoor heat exchanger (30) is fixed to the casing (20).

[0043] FIGS. 4 and 5 also illustrate that the outdoor unit (10) includes the heater (75) for heating drain water on the drain passage (71) to avoid freeze of it. The heater (75) is in the shape of a rectangular frame along lower end portions of the four heat exchange surfaces (30a) of the outdoor heat exchanger (30).

[0044] Specifically, FIG. 5 illustrates that the heater (75) is sandwiched between the inside slope (71b) of the drain passage (71) and an inside portion of the tapered side (73b) of the platform (73). FIG. 6 also illustrates that the heater (75) includes two heating portions: a first heating portion (76) and a second heating portion (77). In other words, the heater (75) has a split structure consisting of the two heating portions.

[0045] The first heating portion (76) is L-shaped along two of the four heat exchange surfaces (30a) of the outdoor heat exchanger (30). One of the two of the four heat exchange surfaces (30a) is a left side surface of the outdoor heat exchanger (30). The other one of the two of the four heat exchange surfaces (30a) is a back surface of the outdoor heat exchanger (30). On the other hand, the second heating portion (77) is U-shaped along three of the four heat exchange surfaces (30a) of the outdoor heat exchanger (30). The first one of the three of the four heat exchange surfaces (30a) is the back surface of the outdoor heat exchanger (30). The second one of the three of the four heat exchange surfaces (30a) is a right side surface of the outdoor heat exchanger (30). The third one of the three of the four heat exchange surfaces (30a) is a front surface of the outdoor heat exchanger (30).

[0046] The first heating portion (76) includes a body (76a) and end portions (76b). The body (76a) is L-shaped. The end portions (76b) are continuous with the body (76a). The end portions (76b) are bent upward from a plane on which the body (76a) extends. On the other hand, the second heating portion (77) includes a body (77a) and end portions (77b). The body (77a) is U-shaped. The end portions (77b) are continuous with the body (77a). The end portions (77b) are bent upward from a plane on which the body (77a) extends. One of the end portions (76b) of the first heating portion (76) is connected with one of the end portions (77b) of the second heating portion (77) through a connection wiring (78). The other end portion (76b) of the first heating portion (76) is connected with a power connector (80) through a lead wire (79). The other end portion (77b) of the second heating portion (77) is connected with the power connector (80) through another lead wire (79).

[0047] As described above, the first heating portion (76) is connected with the second heating portion (77) through the wirings (78, 79) so that the heater (75) is in the shape of a rectangular frame. The first heating portion (76) is connected with the second heating portion (77) through the wirings (78, 79) so that the first heating portion (76) and the second heating portion (77) are aligned longitudinally. This configuration allows the heater (75) to fold longitudinally. In other words, the wirings (78, 79) fold as hinges (70). The hinges (70) fold so that the heater (75) itself folds in two longitudinally.

Operation

[0048] During operation of the outdoor unit (10) of the air conditioner, the compression system (50) operates to

circulate a refrigerant in a refrigerant circuit between the outdoor unit (10) and an indoor unit (not shown) and create a refrigeration cycle. The outdoor fans (40) rotate in the casing (20) of the outdoor unit (10) to allow the outdoor air to enter the casing (20) through the four inlets (25) disposed in the lower portion of the casing (20). Then, the outdoor air passes through the outdoor heat exchanger (30). This outdoor air exchanges heat with the refrigerant in the outdoor heat exchanger (30). During heating operation, the outdoor air dissipates heat to the refrigerant in the outdoor heat exchanger (30) serving as an evaporator. Thus, the outdoor air is cooled. During cooling operation, the outdoor air absorbs heat from the refrigerant in the outdoor heat exchanger (30) serving as a condenser. Thus, the outdoor air is heated. Then, the outdoor air passes through the outdoor fans (40), moves upward, and flows out from the air outlets (26).

Drainage

[0049] During heating operation of the air conditioner, the heater (75) in the outdoor unit (10) is energized to avoid freeze of the drain water on the outdoor heat exchanger (30). The drain water on the outdoor heat exchanger (30) is dropped downward and received by the drain passages (71) on the bottom frame (22). The drain water flows into the drain passages (71) partly through the drain holes (74) of the platform (73) that the outdoor heat exchanger (30) stands on. During this time, the energized heater (75) heats the drain water in the drain passages (71) to avoid freeze. Then, the drain water flows from the drain passage (71) to the outside of the casing (20) thorough the drain holes (72).

[0050] During heating operation, the heater (75) of this embodiment is energized. Alternatively, the heater (75) may be energized in another operation mode when the outdoor temperature is less than or equal to a predetermined temperature. The heater (75) may also be energized in all the operations.

Heater Installation

[0051] The following description is the installation of the heater (75) in the casing (20) for retrofitting or maintenance without detachment of the other components.

[0052] First, detach the front side panel (23b) that blocks the opening (3a) of the casing (20). Then, fold the wirings (78, 79) to fold the heater (75) in two longitudinally. Then, place the heater (75) into the outdoor heat exchanger (30) through the opening (3a) of the casing (20). Then, expand the heater (75) folded in two inside the outdoor heat exchanger (30). Then, put the heater (75) along the lower end portion of the outdoor heat exchanger (30). Then, attach the heater (75) with an attaching plate (not shown).

Advantages of First Embodiment

[0053] In the first embodiment, the heater (75) is in the shape of a rectangular frame and includes the hinges (70) that allow the heater (75) to fold longitudinally. This configuration allows, for installation in the outdoor unit (10) of the refrigerator, the heater (75) folded longitudinally to be placed inside the outdoor heat exchanger (30) through the opening (3a) disposed on the side surface of the outdoor heat exchanger (30). That is, if the opening (3a) on the side surface of the outdoor heat exchanger (30) is narrow, the heater (75) is still easily placed inside the outdoor heat exchanger (30) without being stuck on the outdoor heat exchanger (30). The folded heater (75) is also expanded after placed inside the outdoor heat exchanger (30). Thus, the heater (75) is easily installed along the lower end portion of the outdoor heat exchanger (30) without being stuck on the outdoor heat exchanger (30). This heater for the outdoor unit of the refrigerator is useful for easy installation.

[0054] In the first embodiment, the heater (75) also includes the first heating portion (76) and the second heating portion (77) that are aligned longitudinally. The wirings (78, 79) connecting the first heating portion (76) and the second heating portion (77) also serve as the hinges (70). This simple configuration allows the heater (75) to fold longitudinally.

[0055] In the first embodiment, the heater (75) includes the heating portions (76, 77). These heating portions (76, 77) include the end portions (76b, 77b) connected with the wirings (78, 79) serving as the hinges (70). These end portions (76b, 77b) are bent upward from the bodies (76a, 77a) disposed along the bottom frame (22) of the casing (20). This configuration prevents the wirings (78, 79) connecting the heating portions (76, 77) from being in contact with the drain water when the heater (75) is attached on the bottom frame (22) of the outdoor unit (10).

[0056] In the first embodiment, the heater (75) is able to fold longitudinally. Thus, the heater (75) is placed inside the outdoor heat exchanger (30) and installed in the outdoor unit (10) without being stuck on the outdoor heat exchanger (30) including the four heat exchange surfaces (30a).

[0057] The outdoor unit (10) of the first embodiment includes the compressors (5a, 5b) disposed inside the outdoor heat exchanger (30). The heater (75) to be installed in this outdoor unit (10) might be stuck on not only the outdoor heat exchanger (30) but also on the compressors (5a, 5b) disposed inside the outdoor heat exchanger (30). Thus, the installation is more complicated. However, in the first embodiment, the heater (75) that is able to fold longitudinally is installed in the outdoor unit (10). Thus, the folded heater (75) is placed inside the outdoor heat exchanger (30) through the opening (3a) on the side surface of the outdoor heat exchanger (30). Thus, the heater (75) is easily installed along the lower end portion of the outdoor heat exchanger (30) without contact with the compressors (5a, 5b).

Another Embodiment

[0058] The following is an alternative embodiment.

[0059] In the first embodiment, the heater (75) includes the two heating portions (76, 77) connected with each other by the wirings (78, 79). The heater (75) is able to fold in two longitudinally. Alternatively, the heater (75) may be able to fold in three or four.

[0060] The layout etc. of the refrigerant circuit equipment in the embodiments is only an example, and may be modified if necessary. For example, no compressors (5a, 5b) etc. may be provided inside the outdoor heat exchanger (30).

[0061] The above-described embodiments have been set forth merely for the purposes of preferred examples in nature, and are not intended to limit the scope, applications, and use of the invention.

INDUSTRIAL APPLICABILITY

[0062] As described above, the present invention is useful for a heater for avoiding freeze of drain water, and an outdoor unit including the heater for a refrigerator.

DESCRIPTION OF REFERENCE CHARACTERS

[0063]

4	Side Surface
5a, 5b	Compressor
10	Outdoor Unit
20	Casing
22	Bottom Frame (Bottom Board)
30	Outdoor Heat Exchanger
30a	Heat Exchange Surface
70	Hinge
75	Heater
76	First Heating Portion
76a	Body
76b	End Portion
77	Second Heating Portion
77a	Body
77b	End Portion
78	Connection Wiring (Wiring)
79	Lead Wire (Wiring)

Claims

1. A heater for avoiding freeze of drain water on an outdoor heat exchanger (30) of an outdoor unit (10) for a refrigerator, wherein the outdoor unit (10) includes

a casing (20) including four side surfaces (4) and the outdoor heat exchanger (30) disposed in the casing (20), including four heat exchange surfaces (30a) corresponding to the side surfaces

(4) of the casing (20), and including an opening (3a) disposed on side surfaces of the outdoor heat exchanger (30),

- 5 the heater is in a shape of a rectangular frame along a lower end portion of the outdoor heat exchanger (30), and
the heater includes hinges (70) allowing the heater to fold longitudinally.

2. The heater of claim 1, comprising:

a first heating portion (76) and a second heating portion (77) that are aligned longitudinally, wherein
the hinges (70) are wirings (78, 79) connecting the first heating portion (76) with the second heating portion (77).

3. The heater of claim 2, wherein
the first heating portion (76) includes a body (76a) and end portions (76b),
the second heating portion (77) includes a body (77a) and end portions (77b),
the bodies (76a, 77a) extend along a bottom board (22) of the casing (20),
the end portions (76b, 77b) are bent upward from the bodies (76a, 77a), and
the end portions (76b, 77b) are connected with the wirings (78, 79).

4. An outdoor unit for a refrigerator, comprising:

the heater (75) of any one of claims 1-3.

5. The outdoor unit for the refrigerator of claim 4, comprising:

at least one compressor (5a, 5b) disposed inside the outdoor heat exchanger (30).

FIG. 1

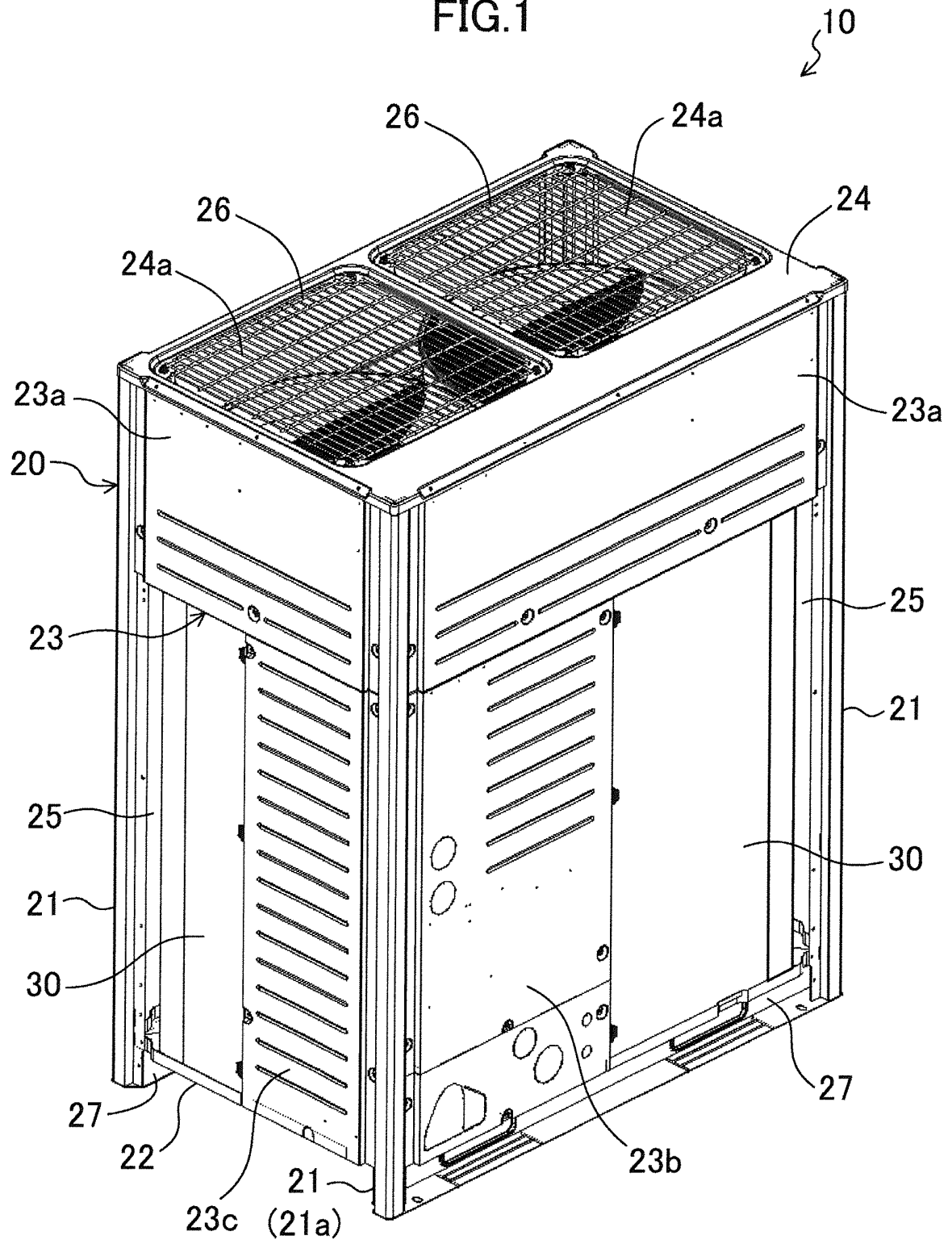


FIG.2

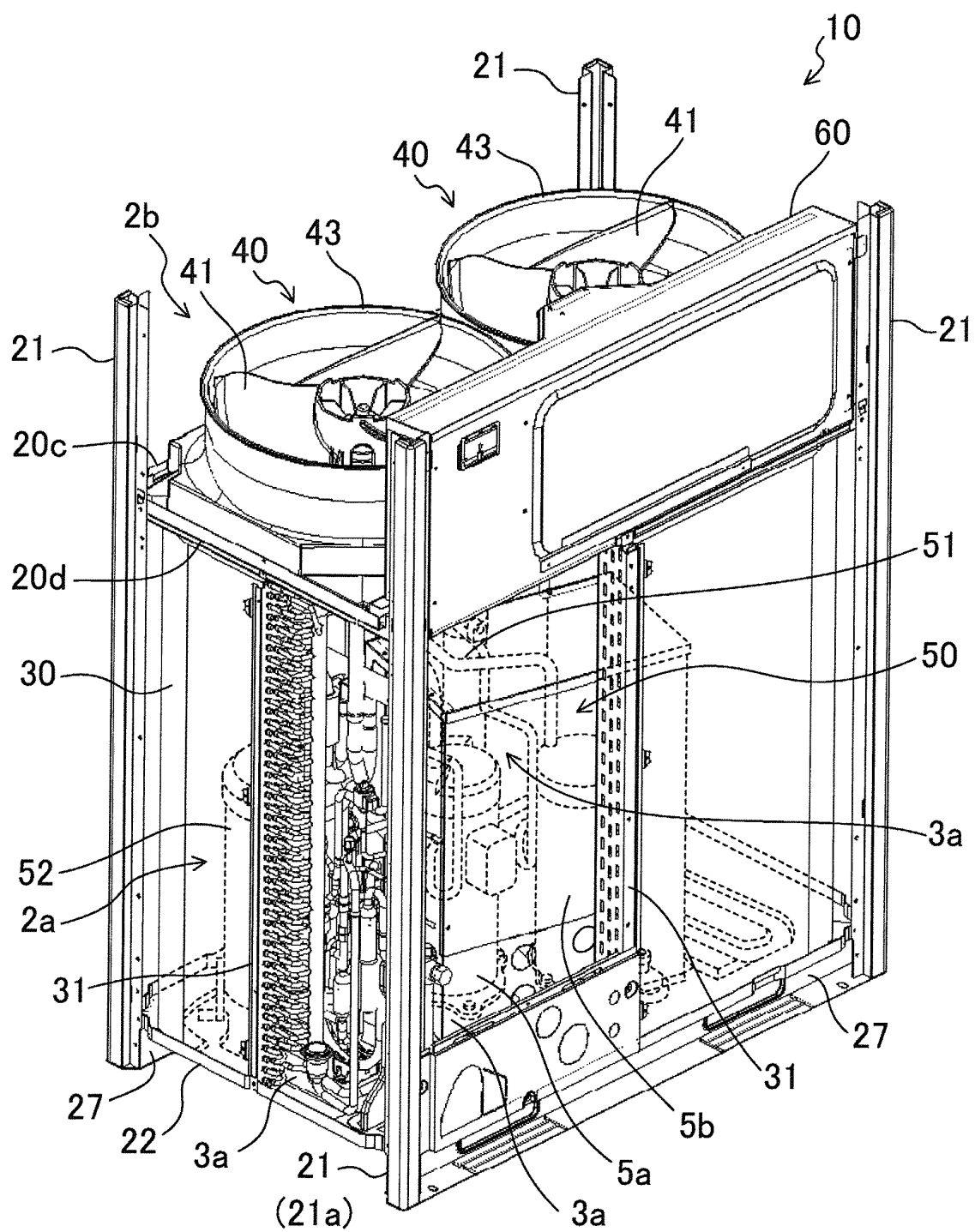


FIG.3

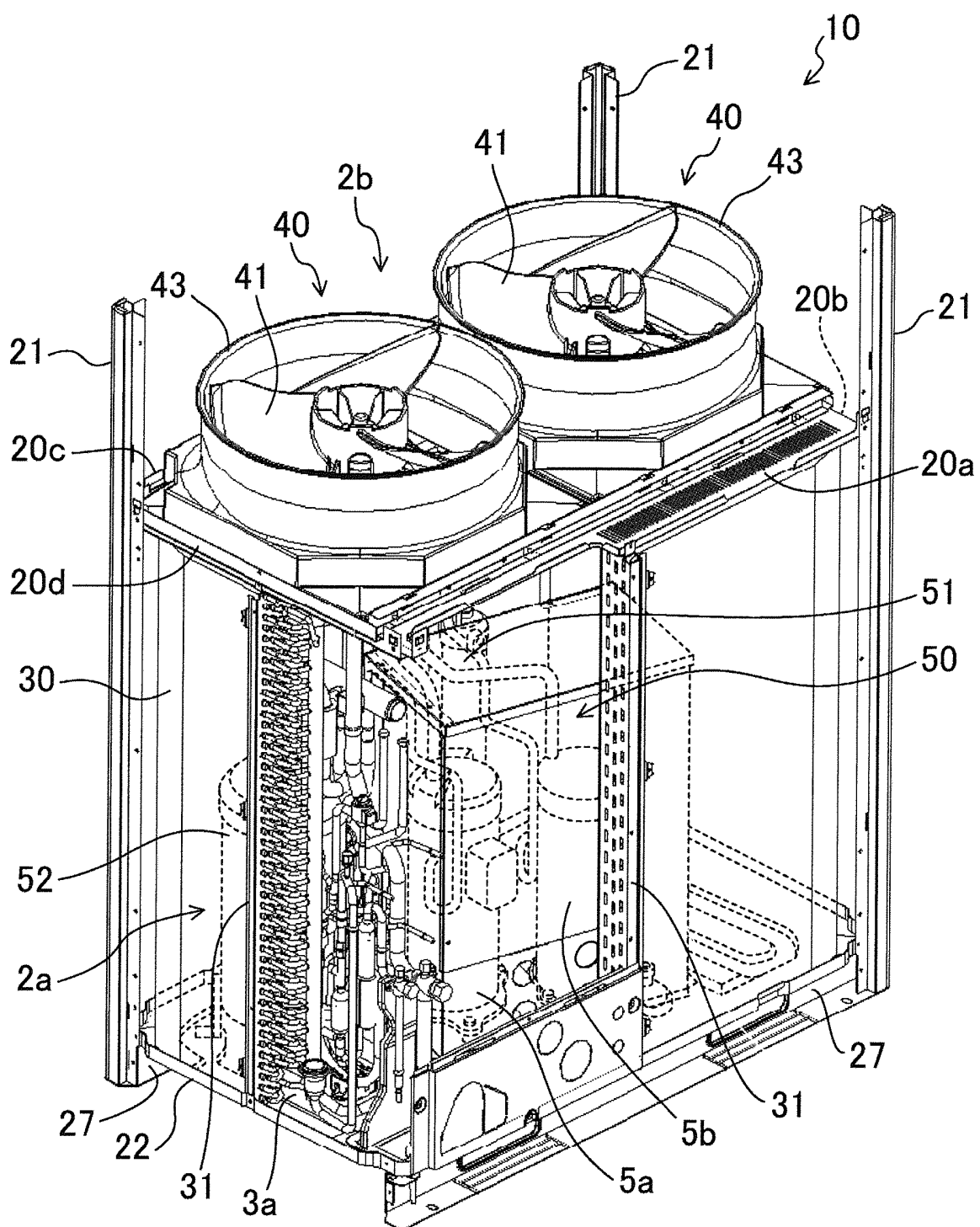


FIG.4

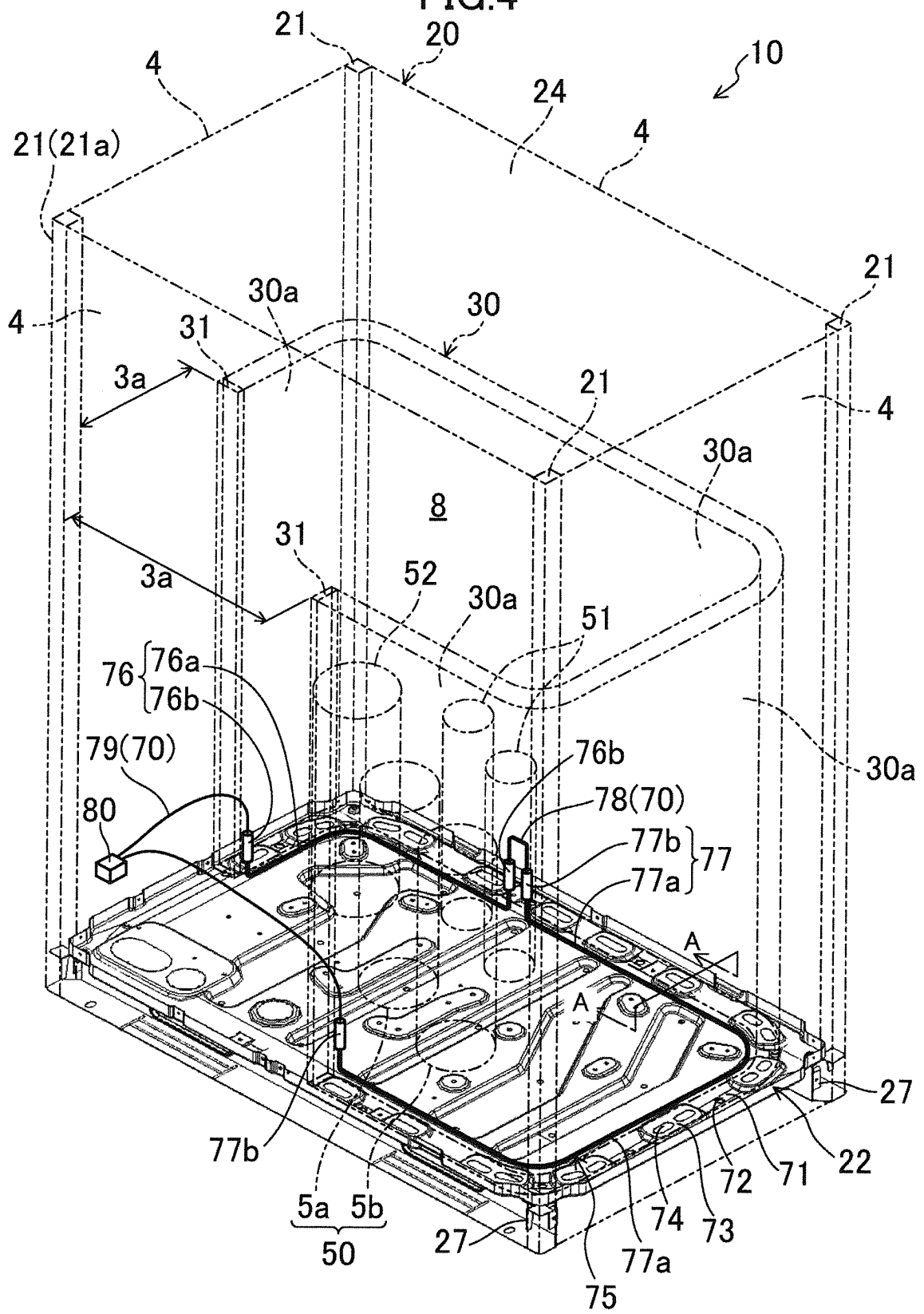
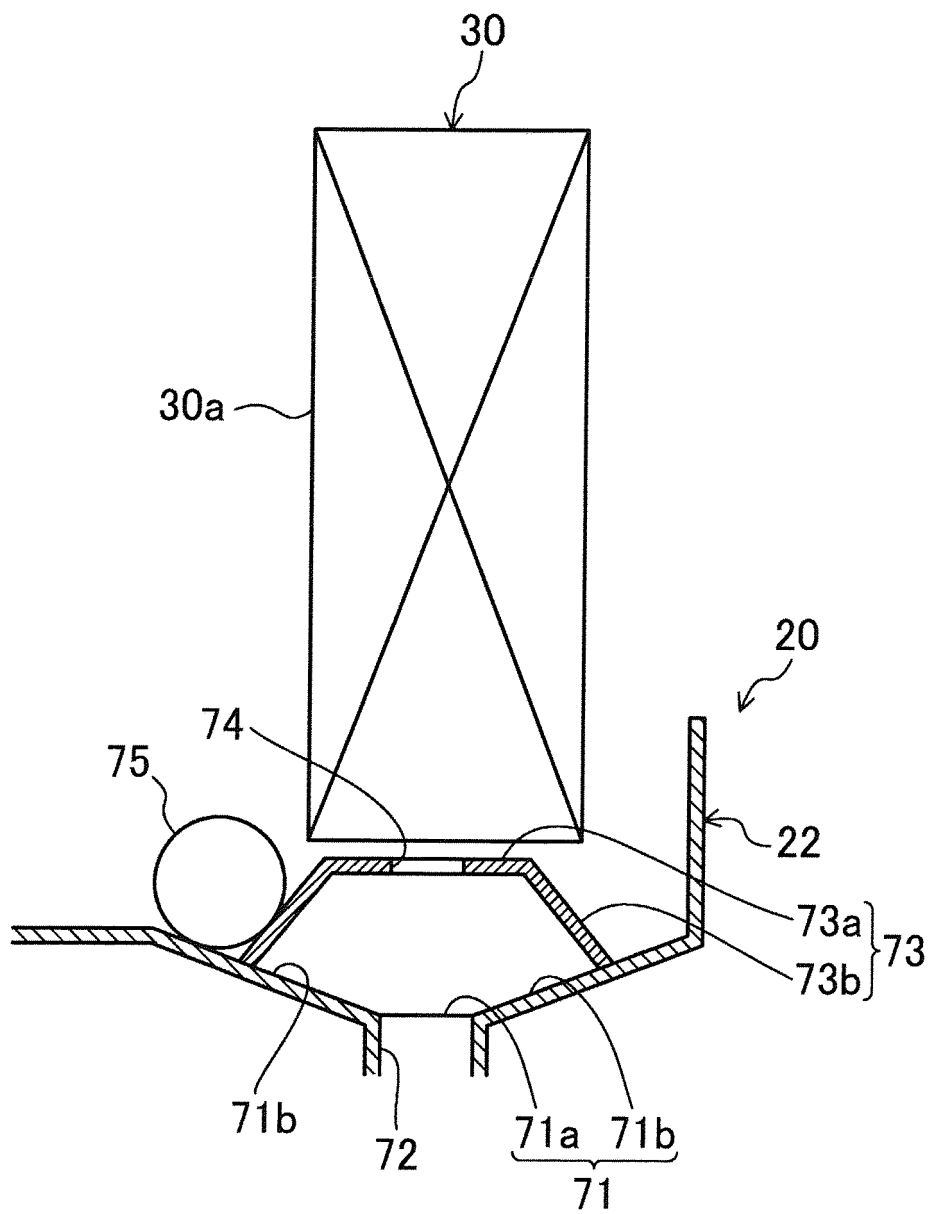
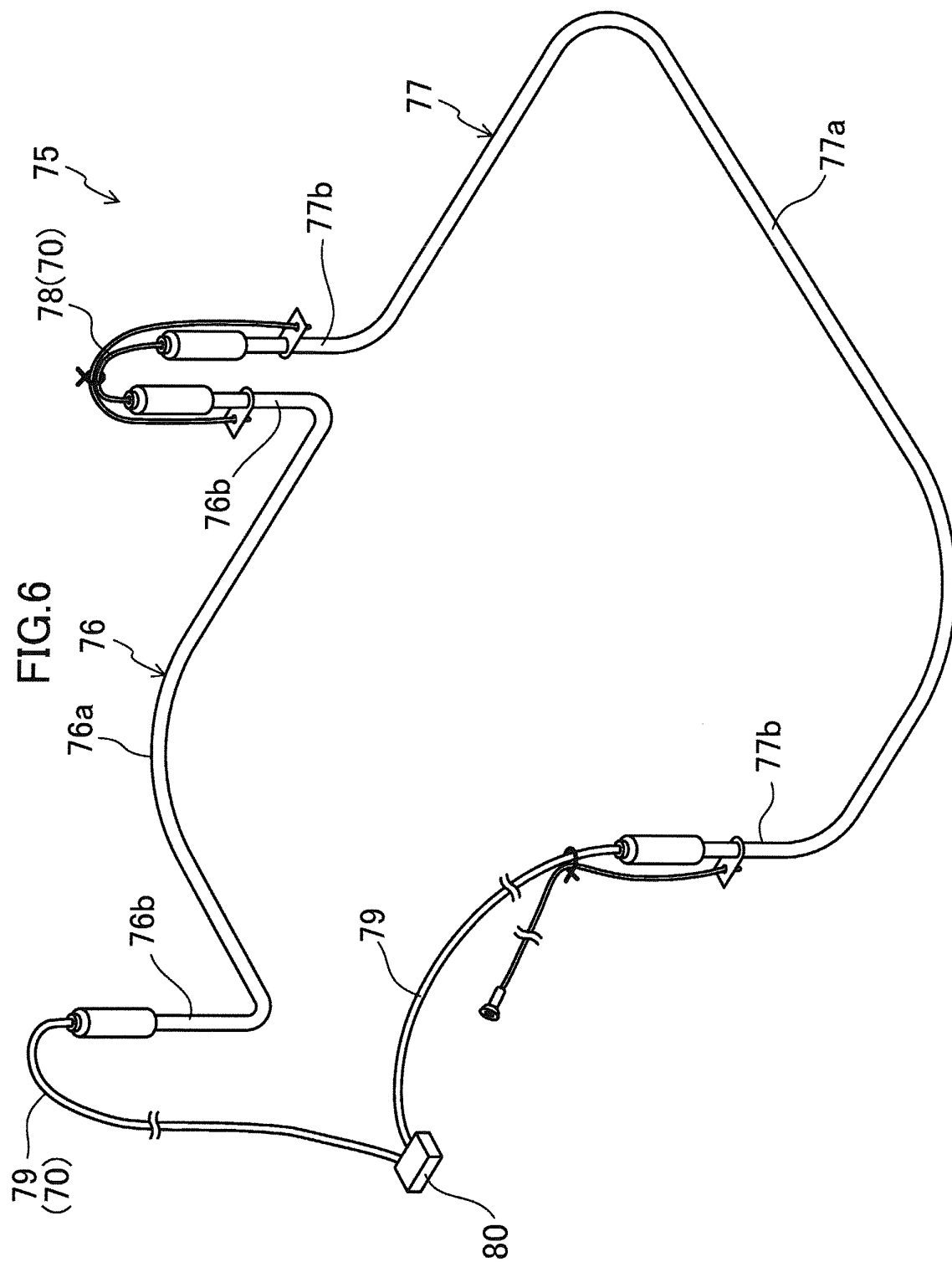


FIG.5





INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2012/007949

A. CLASSIFICATION OF SUBJECT MATTER

F24F1/22(2011.01) i, F24F1/36(2011.01) 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)

F24F1/22, F24F1/36

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 1996-2013

Kokai Jitsuyo Shinan Koho 1971-2013 Toroku Jitsuyo Shinan Koho 1994-2013

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 2004-69220 A (Mitsubishi Electric Corp.), 04 March 2004 (04.03.2004), claims (Family: none)	1-5
A	JP 2010-60177 A (Mitsubishi Electric Corp.), 18 March 2010 (18.03.2010), paragraphs [0062] to [0063]; fig. 13 (Family: none)	1-5
A	JP 2008-96018 A (Daikin Industries, Ltd.), 24 April 2008 (24.04.2008), paragraph [0095] (Family: none)	1-5

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

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Date of the actual completion of the international search
29 January, 2013 (29.01.13)Date of mailing of the international search report
12 February, 2013 (12.02.13)Name and mailing address of the ISA/
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2012/007949

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2011/0016903 A1 (CARRIER CORP.), 27 January 2011 (27.01.2011), paragraphs [0037], [0043] to [0045]; fig. 3 & EP 2060152 A1 & WO 2008/030231 A1	1-5
A	JP 2-213624 A (Carrier Corp.), 24 August 1990 (24.08.1990), page 4, lower left column, line 12 to lower right column, line 4; fig. 1 to 2 & US 4911234 A	1-5
A	JP 9-229422 A (Sanyo Electric Co., Ltd.), 05 September 1997 (05.09.1997), claims; fig. 2 & US 5832733 A & EP 791787 A2	1-5

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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