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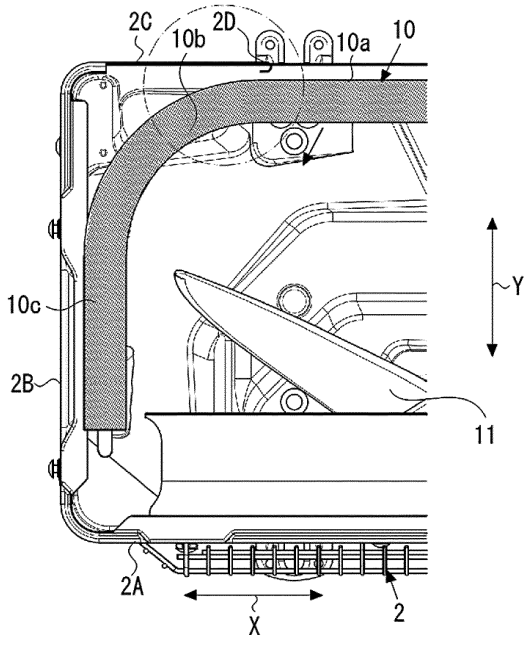
(54) OUTDOOR MACHINE FOR AIR-CONDITIONER

(57) Provided is an outdoor unit for an air-conditioning apparatus, including: a casing having an opening formed at a rear surface side thereof; and a heat exchanger having a flat surface region formed into a planar shape, and being accommodated in the casing so that the flat surface region is exposed through the opening formed at the rear surface side of the casing. A side edge portion of the opening formed at the rear surface side is formed at a position opposed to the flat surface region, and is bent toward the heat exchanger side so as to narrow a gap between the side edge portion and the heat exchanger.

FIG. 5A



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Description

Technical Field

[0001] The present invention relates to an outdoor unit for an air-conditioning apparatus, and more particularly, to an outer shell structure of an outdoor unit.

Background Art

[0002] To downsize an outdoor unit for an air-conditioning apparatus while securing a heat exchange amount, there is proposed an L-shaped heat exchanger having an L-shape in cross section. The L-shaped heat exchanger is generally accommodated in a casing so as to be opposed to one side surface of the outdoor unit and a surface of the outdoor unit having an air inlet formed therein (air inlet-side surface). The outdoor units for an air-conditioning apparatus of recent years may have such a structure that the air inlet is formed in a rear surface thereof and a panel opposed to the air inlet is omitted, thereby exposing the heat exchanger to the outside.

[0003] In such an outdoor unit, a gap is formed between a side edge portion (edge portion) of the casing and a curved surface portion of the heat exchanger, and a finger or the like may enter the gap or come into contact with the side edge portion of the rear panel. To prevent the entry of the finger or the like into the gap, there is proposed a method of bending the side edge portion of the rear panel (see, for example, Patent Literature 1). Patent Literature 1 discloses that the side edge portion of the rear panel, which is opposed to the curved surface portion, is bent inward (toward the heat exchanger side), to thereby narrow the gap formed between the side edge portion of the rear panel and the heat exchanger.

Citation List

Patent Literature

[0004] Patent Literature 1: JP 2012-87996 A

Summary of Invention

Technical Problem

[0005] By the way, there is a demand to develop a common structure for a bottom plate of the casing so that an L-shaped heat exchanger and a flat heat exchanger may be mounted in the same way. When the flat heat exchanger is mounted on a panel having a side edge portion positioned at a curved surface portion of the heat exchanger as described in Patent Literature 1, a gap is formed between the panel and the heat exchanger. Therefore, there is a demand for a structure capable of securing safety even when the flat heat exchanger as well as the L-shaped heat exchanger is mounted.

[0006] The present invention has been made to solve the problem described above, and it is therefore an object of the present invention to provide, among other outdoor units on which an L-shaped heat exchanger or a flat heat exchanger may be mounted in the same way, an outdoor unit for an air-conditioning apparatus, which is capable of securing safety irrespective of whether the L-shaped heat exchanger or the flat heat exchanger is mounted.

Solution to Problem

[0007] According to one embodiment of the present invention, there is provided an outdoor unit for an air-conditioning apparatus, including: a casing having an opening formed at a rear surface side thereof; and a heat exchanger having a flat surface region formed into a planar shape, and being accommodated in the casing so that the flat surface region is exposed through the opening formed at the rear surface side of the casing. A side edge portion of the opening formed at the rear surface side is formed at a position opposed to the flat surface region, and is bent toward the heat exchanger side.

Advantageous Effects of Invention

[0008] According to the outdoor unit for an air-conditioning apparatus of the one embodiment of the present invention, the side edge portion of the casing is formed at a position opposed to the flat surface region of the heat exchanger, and is also bent inward. Thus, the safety can be secured irrespective of whether the L-shaped heat exchanger or the flat heat exchanger is mounted.

Brief Description of Drawings

[0009]

FIG. 1 is a schematic perspective view illustrating an outdoor unit for an air-conditioning apparatus according to an embodiment of the present invention.
FIG. 2 is a perspective view illustrating an example of a casing of the outdoor unit of FIG. 1.
FIG. 3 is a schematic perspective view illustrating an internal structure of the outdoor unit of FIG. 1 in a case where an L-shaped heat exchanger is mounted.
FIG. 4 is a schematic top view illustrating the internal structure of the outdoor unit of FIG. 1 in the case where the L-shaped heat exchanger is mounted.
FIG. 5A is a schematic view illustrating a region on the periphery of a rear surface portion of the outdoor unit of FIG. 4.
FIG. 5B is a schematic view illustrating a region on the periphery of a side edge portion of an opening of FIG. 5A.
FIG. 6 is a schematic perspective view illustrating an internal structure of the outdoor unit of FIG. 1 in a case where a flat heat exchanger is mounted.
FIG. 7 is a schematic top view illustrating the internal

structure of the outdoor unit of FIG. 1 in the case where the flat heat exchanger is mounted.

FIG. 8 is a perspective view illustrating another example of the casing of the outdoor unit of FIG. 1.

Description of Embodiment

[0010] Now, an outdoor unit for an air-conditioning apparatus according to an embodiment of the present invention is described in detail with reference to the drawings. FIG. 1 is a schematic perspective view illustrating the outdoor unit for an air-conditioning apparatus according to the embodiment of the present invention, and FIG. 2 is a perspective view illustrating an example of a casing 100A of an outdoor unit 100 of FIG. 1. The outdoor unit 100 for an air-conditioning apparatus of FIG. 1 is enclosed by the casing 100A, which is constructed of a top panel 1, an outer panel 2, a side panel 3, and a bottom plate 4. The top panel 1, the outer panel 2, and the side panel 3 are assembled onto the bottom plate 4. Flanges are formed on upper parts of the outer panel 2 and the side panel 3, and the top panel 1 is fixed to those flanges. A flange is similarly formed on the bottom plate 4, and the outer panel 2 and the side panel 3 are fixed to this flange with bolts or the like.

[0011] Further, the outer panel 2 has such a shape that a front surface portion 2A, a side surface portion 2B, and a rear surface portion 2C are molded integrally with each other. In this case, the rear surface portion 2C is configured to cover a part of a rear surface side of the casing 100A, and an opening 100B for exposing a heat exchanger 10 is formed at the rear surface side of the casing 100A. Note that, to enhance ventilation of the heat exchanger 10, the width of the opening 100B is set larger than the width of the rear surface portion 2C.

[0012] The casing 100A has such a structure that an L-shaped heat exchanger 10 having a flat surface region 10a, a curved surface region 10b, and a side surface region 10c as illustrated in FIGS. 2 to 5 and a flat heat exchanger 210 formed only of a flat surface region as illustrated in FIGS. 6 to 8 may be mounted in the same way. That is, the casing 100A has a common structure so that the L-shaped heat exchanger 10 and the flat heat exchanger 210 may be mounted on the bottom plate 4 in the same way. Now, description is separately given of a case where the L-shaped heat exchanger 10 is mounted and a case where the flat heat exchanger 210 is mounted.

[0013] First, description is given of the case where the L-shaped heat exchanger 10 is mounted as the heat exchanger of the outdoor unit 100. FIG. 3 is a schematic perspective view illustrating an internal structure of the outdoor unit 100 having the L-shaped heat exchanger 10 mounted thereon, and FIG. 4 is a schematic top view illustrating the internal structure of the outdoor unit 100 of FIG. 3. As illustrated in FIGS. 3 and 4, the inner part of the outdoor unit 100 is partitioned by a separator 5 into a fan chamber WR and a machine chamber MR. A compressor 6, a refrigerant pipe 7, an electrical component box (control box) 8, and the like are arranged at the machine chamber MR side, whereas the L-shaped heat exchanger 10, a fan 11, and the like are provided at the fan chamber WR side. Note that, the compressor 6 and the L-shaped heat exchanger 10 are mounted on the bottom plate 4.

[0014] The compressor 6 is configured to suck a refrigerant, compress the refrigerant into a high-temperature and high-pressure state, and to send the refrigerant into a refrigerant circuit through the refrigerant pipe 7. The electrical component box (control box) 8 is configured to accommodate control means for controlling an operation of the outdoor unit 100.

[0015] The L-shaped heat exchanger 10 is configured to exchange heat between outdoor air and the refrigerant. The L-shaped heat exchanger 10 functions as an evaporator during a heating operation, and as a condenser during a cooling operation. The L-shaped heat exchanger 10 includes, for example, heat transfer pipes for allowing the refrigerant to pass therethrough, and fins for increasing the area of heat transfer between the outdoor air and the refrigerant flowing through the heat transfer pipes. In addition, the L-shaped heat exchanger 10 has the flat surface region 10a, the curved surface region 10b, and the side surface region 10c. In the casing 100A, the flat surface region 10a of the L-shaped heat exchanger 10 is exposed through the opening 100B formed at the rear surface side of the casing 100A, and the side surface region 10c of the L-shaped heat exchanger 10 is arranged so as to be opposed to the side surface portion 2B of the outer panel 2. Note that, ventilation holes 2X for enhancing ventilation of air to the side surface region 10c are formed in the side surface portion 2B (see FIGS. 1 and 2). Note that, a clearance is secured between the side surface portion 2B of the outer panel 2 and the side surface region 10c of the L-shaped heat exchanger 10, to thereby prevent contact therebetween. Further, at a front surface side of the L-shaped heat exchanger 10, the fan 11 for sending air is held by a fan holding portion 20.

[0016] FIG. 5A is a schematic view illustrating a region on the periphery of the rear surface portion of the outdoor unit 100 of FIG. 4, and FIG. 5B is a schematic view illustrating a region on the periphery of a side edge portion 2D of FIG. 5A. As illustrated in FIGS. 5A and 5B, the side edge portion 2D of the opening 100B formed at the rear surface side is bent toward the flat surface region 10a side of the L-shaped heat exchanger 10, to thereby narrow a gap between the side edge portion 2D and the flat surface region 10a of the L-shaped heat exchanger 10. Specifically, a clearance between the rear surface portion 2C and the flat surface region 10a is set so that the rear surface portion 2C and the flat surface region 10a are arranged away from each other by a distance D1, whereas a distance D10 between the side edge portion 2D and the flat surface region 10a is shorter than the distance D1 (D1 >D10). Note that, the bending part is formed so

that the distance D10 ranges, for example, from 5 mm to 10 mm. Further, the ventilation is enhanced as the area in which the rear surface portion 2C and the flat surface region 10a are opposed to each other is smaller, and hence the side edge portion 2D may be formed at a boundary 10x between the flat surface region 10a and the curved surface region 10b.

[0017] As described above, the side edge portion 2D of the rear surface portion 2C of the outer panel 2 is bent toward the flat surface region 10a side so as to narrow the gap between the side edge portion 2D and the L-shaped heat exchanger 10. As a result, entry of a finger or the like into the gap can be prevented, thereby being capable of securing safety. Further, the side edge portion 2D is bent inward, and thus the safety can be secured without a need to coat the side edge portion 2D with a resin or the like even when the side edge portion 2D has a burr or the like.

[0018] Next, description is given of the case where the flat heat exchanger 210 is mounted as the heat exchanger of the outdoor unit 100. FIG. 6 is a schematic perspective view illustrating an internal structure of the outdoor unit 100 having the flat heat exchanger 210 mounted thereon, and FIG. 7 is a schematic top view illustrating the internal structure of the outdoor unit 100 of FIG. 1. Note that, in FIGS. 6 and 7, parts having the same structure as those of the outdoor unit 100 of FIGS. 3 to 5 are represented by the same reference symbols, and description thereof is therefore omitted herein.

[0019] In FIGS. 6 and 7, the flat heat exchanger 210 is formed into a flat plate shape, and is arranged at the rear surface side of the casing 100A so as to extend up to a connection portion (corner portion) between the side surface portion 2B and the rear surface portion 2C. Note that, the flat heat exchanger 210 may secure performance of an apparatus of a type having low heating and cooling capacity, and hence the flat heat exchanger 210 is mounted on the outdoor unit 100. On the other hand, the L-shaped heat exchanger 10 is mounted on an apparatus of a type required to have high heating and cooling capacity.

[0020] In this case, the flat heat exchanger 210 is arranged on the bottom plate 4 at the same position as the position where the flat surface region of the L-shaped heat exchanger 10 is arranged. Thus, the distance between the flat heat exchanger 210 and the side edge portion is equal to the distance between the flat surface region 10a of the L-shaped heat exchanger 10 and the side edge portion 2D. Thus, even when the bottom plate 4 has a common structure so that the L-shaped heat exchanger 10 or the flat heat exchanger 210 is mounted on the outdoor unit 100 in the same way, the gap is narrowed by the bending part of the side edge portion 2D, resulting in a gap corresponding to the distance D10 (=5 mm to 10 mm approximately) that the finger or the like does not enter.

[0021] Note that, when the flat heat exchanger 210 is mounted inside the outdoor unit 100, as illustrated in FIG. 8, it is preferred that the side surface portion 2B be formed into a flat plate shape with all the ventilation holes 2X being closed so as to prevent entry of foreign matter into the casing 100A. Those two types of side surface portion 2B or rear surface portion 2C are manufactured by controlling, in a molding step, formation of the ventilation holes 2X while using the same mold.

[0022] According to the embodiment described above, the side edge portion 2D of the opening 100B formed in the rear surface is formed at the position opposed to the flat surface region 10a, and is also bent toward the flat surface region 10a side so as to narrow the gap between the side edge portion 2D and the flat surface region 10a. As a result, the safety can reliably be secured even when the bottom plate 4 has a common structure so that any one of the heat exchangers 10 and 210 of different types is mounted. Further, when the L-shaped heat exchanger 10 is mounted, as long as the side edge portion 2D is formed at the boundary 10x between the flat surface region 10a and the curved surface region 10b of the L-shaped heat exchanger 10, the area closed by the rear surface portion 2C can be minimized.

[0023] The embodiment of the present invention is not limited to the embodiment described above. For example, FIG. 2 illustrates the case where the front surface portion 2A, the side surface portion 2B, and the rear surface portion 2C of the outer panel 2 are molded integrally with each other, but the front surface portion 2A, the side surface portion 2B, and the rear surface portion 2C may be assembled onto the bottom plate 4 in a state of being formed separately from each other. Also in this case, the side edge portion 2D of the rear surface portion 2C is arranged at the position opposed to the flat surface region 10a of the L-shaped heat exchanger 10.

[0024] Further, FIG. 5B illustrates the case where the side edge portion 2D is folded once, but the side edge portion 2D may be folded twice, or the folding part may be formed into such a U-shape that the folding part is curved out of contact with the rear surface portion 2C.

[0025] Still further, FIGS. 1 to 8 illustrate the case where the rear surface portion 2C side is formed into a flat plate shape, but ventilation holes may be formed so as to enhance ventilation.

Reference Signs List

[0026] 1 top panel, 2 outer panel, 2A front surface portion, 2B side surface portion, 2C rear surface portion, 2D side edge portion , 2X ventilation hole, 3 side panel, 4 bottom plate, 5 separator, 6 compressor, 7 refrigerant pipe, 8 electrical component box, 10 L-shaped heat exchanger, 10a flat surface region, 10b curved surface region, 10c side surface region, 10x boundary, 11 fan, 20 fan holding portion, 100 outdoor unit, 100A casing, 100B opening, 210 flat heat exchanger, D1, D10 distance, MR machine chamber, WR fan chamber

Claims

1. An outdoor unit for an air-conditioning apparatus, comprising:

   a casing having an opening formed at a rear surface side thereof; and
   a heat exchanger having a flat surface region formed into a planar shape, and being accommodated in the casing so that the flat surface region is exposed through the opening formed at the rear surface side of the casing,
   wherein a side edge portion of the opening formed at the rear surface side is formed at a position opposed to the flat surface region, and is bent toward the heat exchanger side.

2. An outdoor unit for an air-conditioning apparatus of claim 1, wherein the heat exchanger comprises an L-shaped heat exchanger having a curved surface region connected to the flat surface region, and a side surface region connected to the curved surface region.

3. An outdoor unit for an air-conditioning apparatus of claim 2, wherein the side edge portion is formed at a boundary between the curved surface region and the flat surface region of the L-shaped heat exchanger.

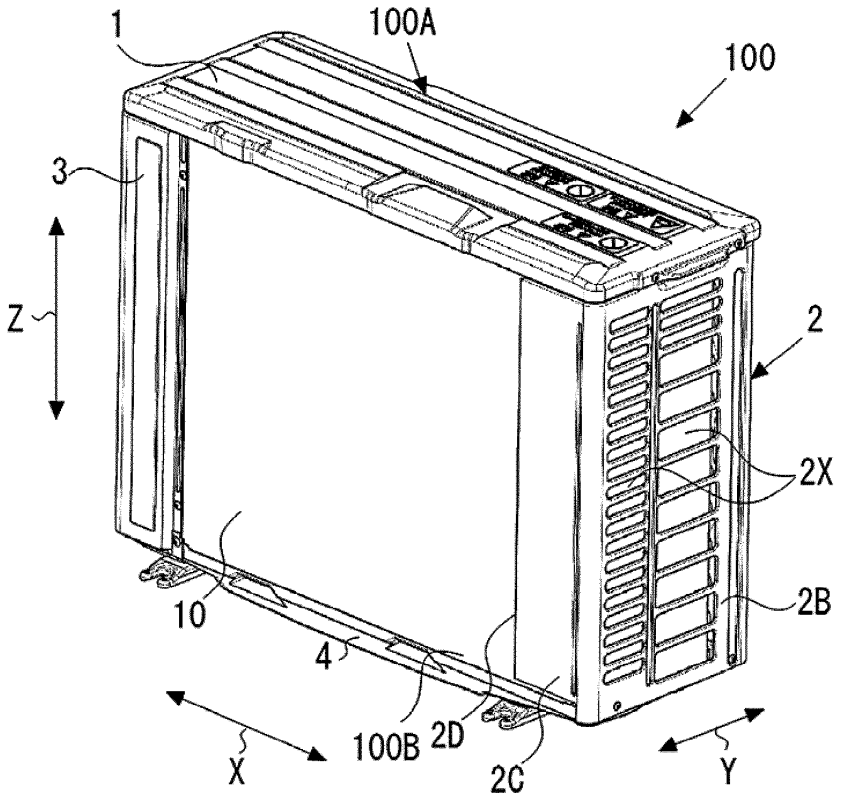
4. An outdoor unit for an air-conditioning apparatus of claim 2 or 3, wherein the casing has a ventilation hole formed in a side surface opposed to the side surface region.

5. An outdoor unit for an air-conditioning apparatus of claim 1, wherein the heat exchanger comprises a flat heat exchanger formed into a flat plate shape.

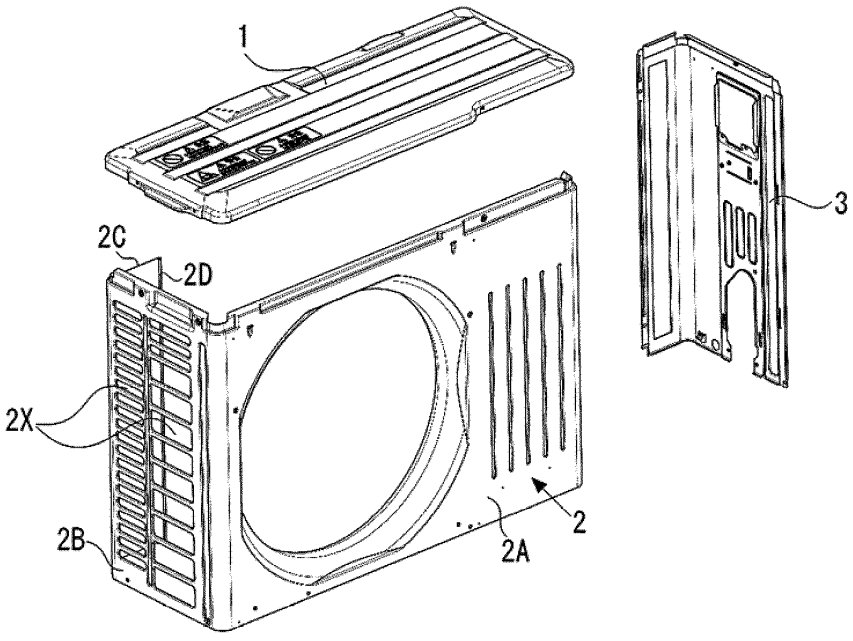
6. An outdoor unit for an air-conditioning apparatus of claim 5, wherein the casing has a side surface formed of a flat plate for blocking ventilation of air.

7. An outdoor unit for an air-conditioning apparatus of any one of claims 1 to 6, wherein the casing has a rear surface portion for covering a part of the rear surface side, and
   wherein the rear surface portion has a ventilation hole formed therein.

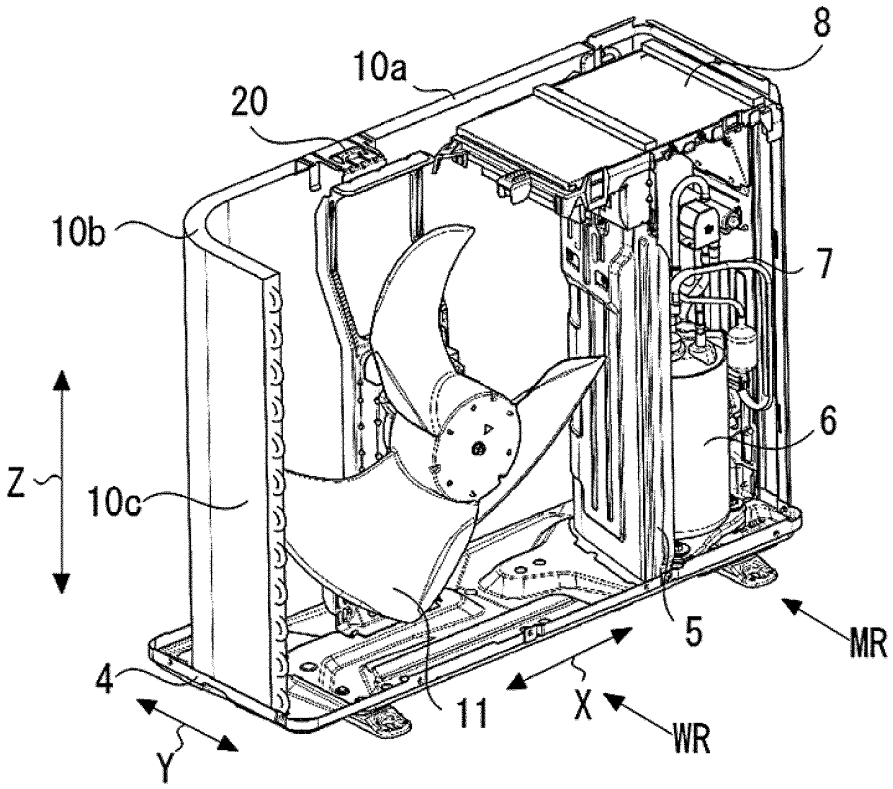
F I G. 1



F I G. 2



F I G. 3


8
10a
20
10b
7
6
Z
10c
5
MR
4
11
X
WR
Y

F I G. 4

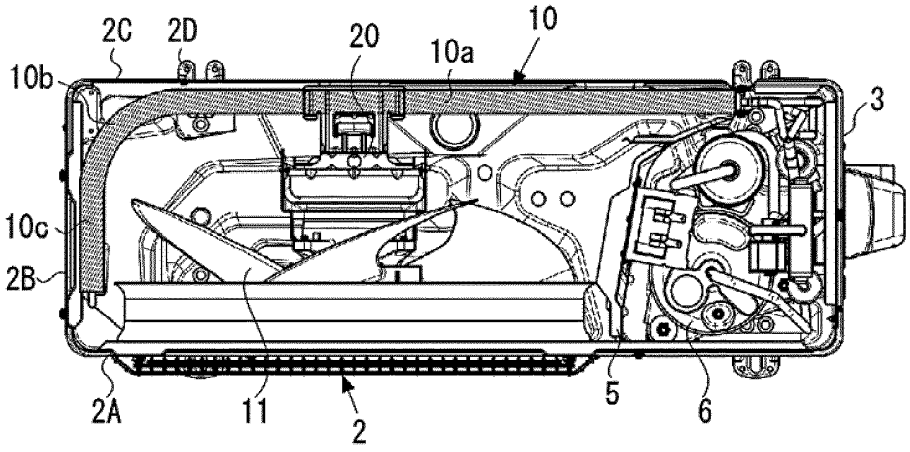

2C
2D
20
10a
10
10b
3
10c
2B
2A
11
2
5
6

FIG. 5A

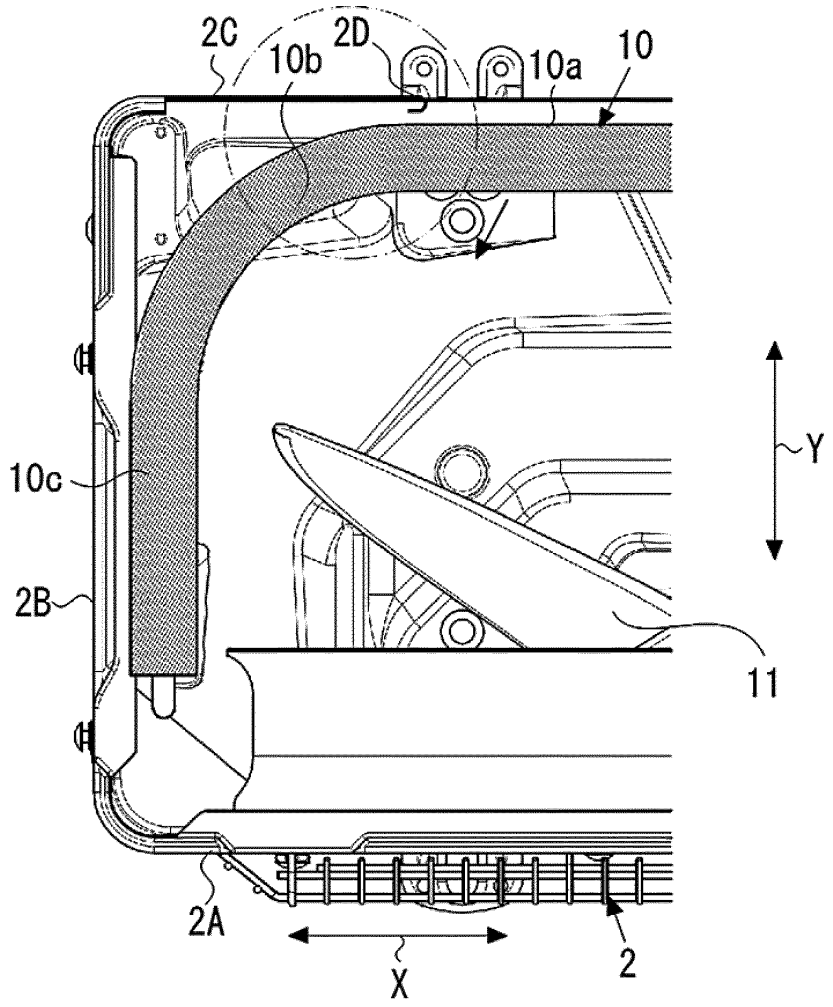
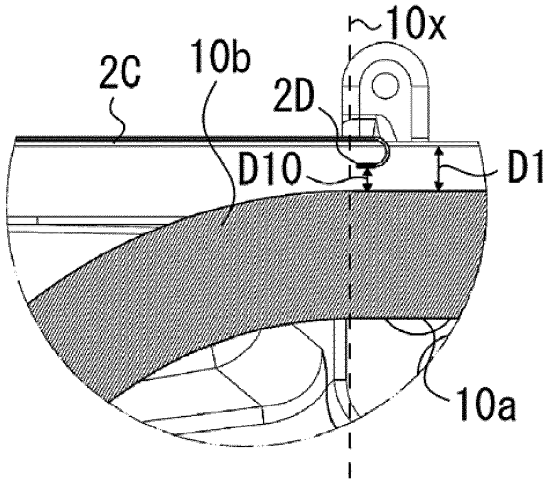
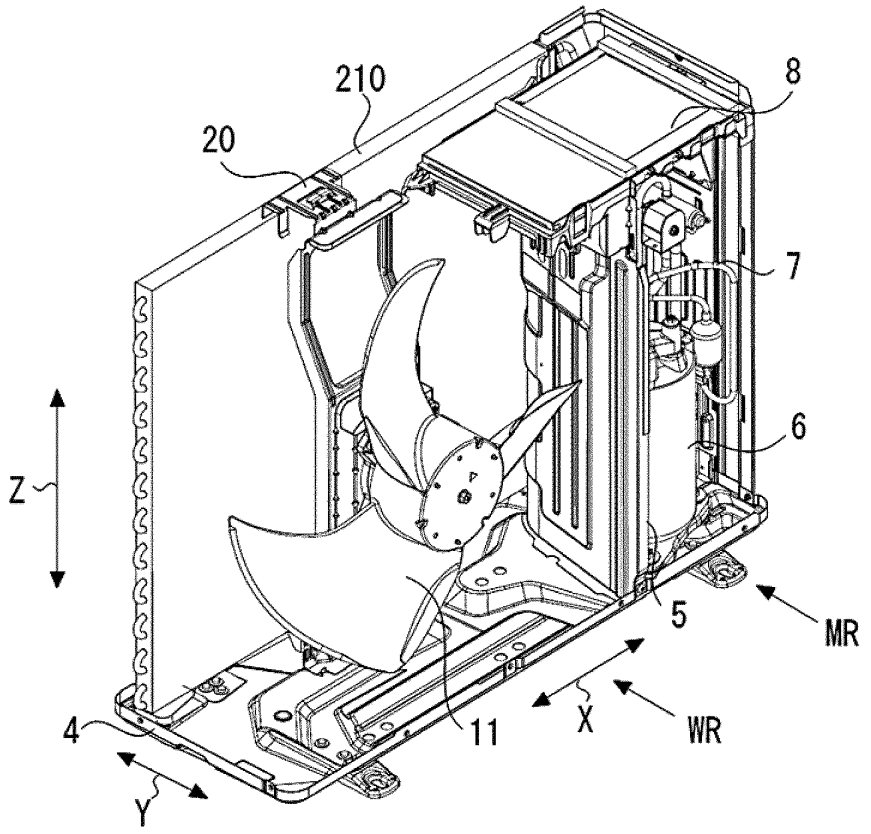


FIG. 5B



F I G. 6



F I G. 7

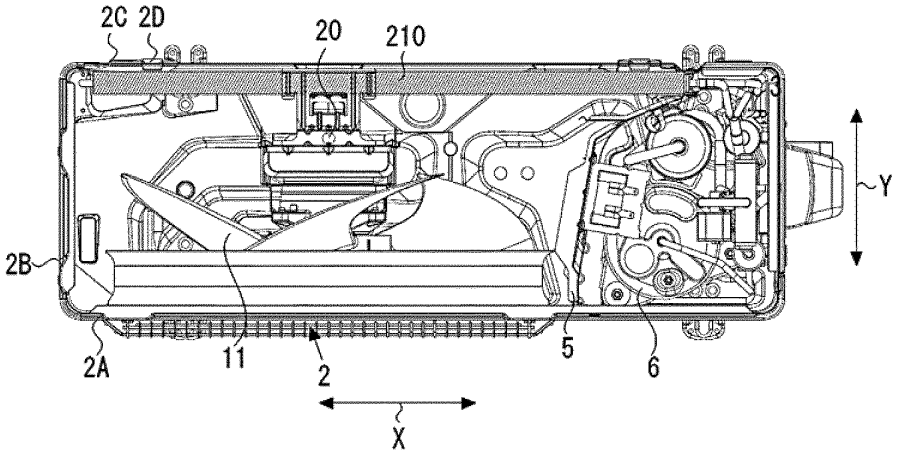
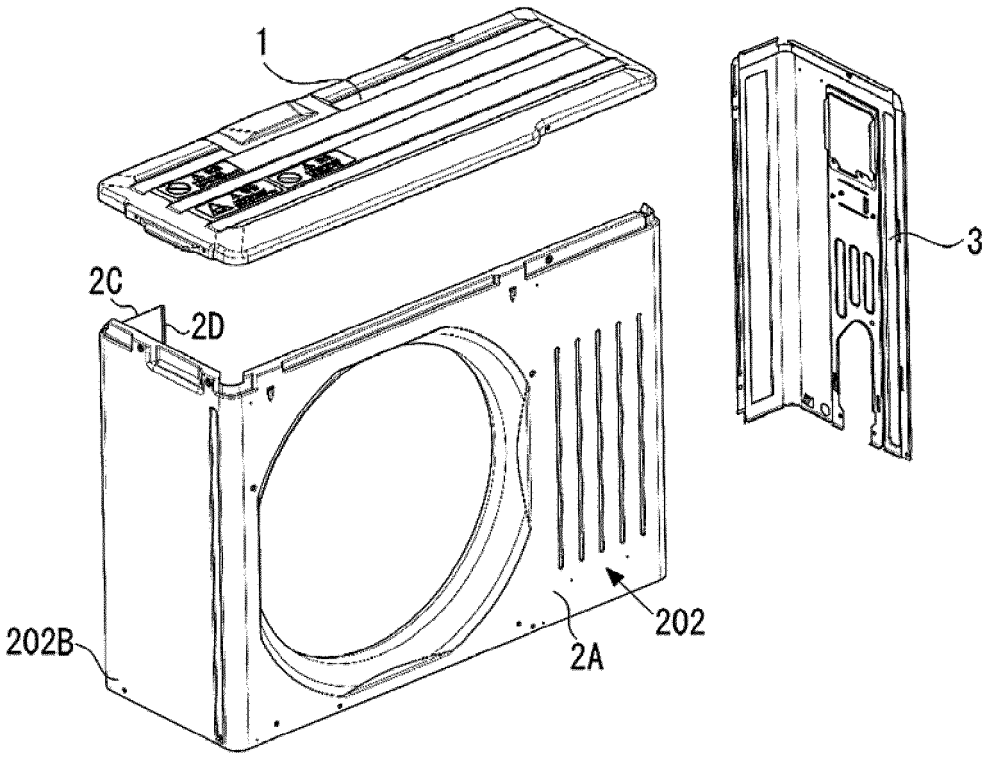


FIG. 8



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2013/073148

A. CLASSIFICATION OF SUBJECT MATTER
F24F1/56(2011.01)i, *F24F1/18*(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)
F24F1/56, F24F1/18

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.
Y	JP 2012-87996 A (Mitsubishi Electric Corp.), 10 May 2012 (10.05.2012), paragraphs [0013] to [0018]; fig. 1 to 6 (Family: none)	1-7
Y	JP 9-303826 A (Funai Electric Co., Ltd.), 28 November 1997 (28.11.1997), paragraphs [0020] to [0030]; fig. 1 to 4 (Family: none)	1-7
Y	JP 6-249466 A (Mitsubishi Heavy Industries, Ltd.), 06 September 1994 (06.09.1994), paragraph [0002]; fig. 2 (Family: none)	5-7

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

* Special categories of cited documents:
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
12 November, 2013 (12.11.13)	26 November, 2013 (26.11.13)
Name and mailing address of the ISA/ Japanese Patent Office	Authorized officer
Facsimile No.	Telephone No.

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2013/073148

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 9-196414 A (Fujitsu General Ltd.), 31 July 1997 (31.07.1997), paragraph [0012]; fig. 1 (Family: none)	7

Form PCT/ISA/210 (continuation of second sheet) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2012087996 A **[0004]**