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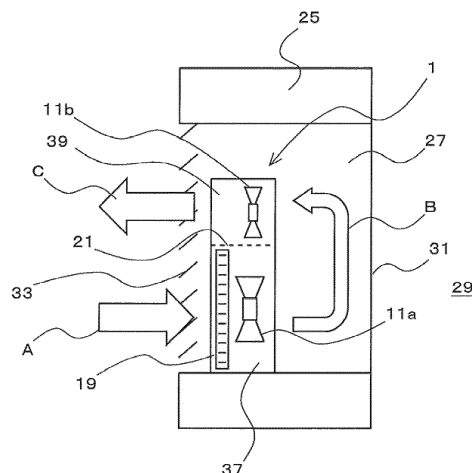
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(54) **OUTDOOR MACHINE FOR FREEZING CYCLE APPARATUS**

(57) An outdoor unit of a refrigeration cycle apparatus to be installed in an external-wall internal space of a structure includes a casing, a heat exchanger accommodated in the casing, a first air-sending device configured to cause air to pass through the heat exchanger and discharge the air to the external-wall internal space, a second air-sending device configured to suck the air dis-

charged to the external-wall internal space by the first air-sending device and discharge the air to an outside of the structure, and a divider that divides an inside of the casing into a first air passage and a second air passage. The heat exchanger and the first air-sending device are disposed in the first air passage. The second air-sending device is disposed in the second air passage.

FIG. 3



Description

Technical Field

[0001] The present invention relates to a wall-embedded outdoor unit of a refrigeration cycle apparatus to be installed in an external wall of a structure, such as a building.

Background Art

[0002] Examples of wall-embedded outdoor units of a refrigeration cycle apparatus known in the art disclosed in Patent Literature 1 include an air-conditioning outdoor unit having an air inlet and an air outlet arranged on the same surface of a main body such that the air outlet is located above the air inlet. The outdoor unit disclosed in Patent Literature 1 includes a heat exchanger and an air-sending device located above the heat exchanger. The outdoor unit is configured such that air sucked into the air inlet by driving the air-sending device is subjected to heat exchange in the heat exchanger and is then blown from the air outlet by the air-sending device. In other words, the outdoor unit disclosed in Patent Literature 1 is configured such that the air blown from the air outlet and the air sucked into the air inlet flow in opposite directions.

Citation List

Patent Literature

[0003] Patent Literature 1: Japanese Unexamined Patent Application Publication No. 3-213928

Summary of Invention

Technical Problem

[0004] The outdoor unit disclosed in Patent Literature 1 is provided with an air passage inside the outdoor unit such that the air sucked into the air inlet is directed in an opposite direction and is then blown from the air outlet. Such a configuration increases aerodynamic resistance to air flowing inside the outdoor unit. The increase in aerodynamic resistance results in an increase in noise inside the outdoor unit. Disadvantageously, the outdoor unit disclosed in Patent Literature 1 fails to ensure quietness. To improve the air-sending performance of the air-sending device in the outdoor unit disclosed in Patent Literature 1, the air-sending device has to be increased in size. To improve the heat exchange performance of the heat exchanger in the outdoor unit disclosed in Patent Literature 1, the heat exchanger has to be increased in size. Consequently, it is difficult to achieve both reduction in size of the outdoor unit and improvement in performance of the outdoor unit.

[0005] The present invention aims to overcome the

above-described disadvantages and aims to provide an outdoor unit of a refrigeration cycle apparatus capable of ensuring quietness and achieving both reduction in size of the outdoor unit and improvement in performance of the outdoor unit.

Solution to Problem

[0006] An embodiment of the present invention provides an outdoor unit of a refrigeration cycle apparatus to be installed in an external-wall internal space of a structure. The outdoor unit includes a casing, a heat exchanger accommodated in the casing, a first air-sending device configured to cause air to pass through the heat exchanger and discharge the air to the external-wall internal space, a second air-sending device configured to suck the air discharged to the external-wall internal space by the first air-sending device and discharge the air to an outside of the structure, and a divider that divides an inside of the casing into a first air passage and a second air passage. The heat exchanger and the first air-sending device are disposed in the first air passage. The second air-sending device is disposed in the second air passage.

Advantageous Effects of Invention

[0007] According to an embodiment of the present invention, it is unnecessary to provide an air passage for directing a flow of air subjected to heat exchange in an opposite direction inside the outdoor unit. Thus, the outdoor unit can ensure quietness and can also be reduced in size. Furthermore, the flow of air subjected to heat exchange does not stagnate inside the outdoor unit, leading to improvement in performance of the outdoor unit. Consequently, an embodiment of the present invention can provide the outdoor unit of a refrigeration cycle apparatus capable of ensuring quietness and achieving both reduction in size of the outdoor unit and improvement in performance of the outdoor unit.

Brief Description of Drawings

[0008]

[Fig. 1] Fig. 1 is a schematic front view illustrating an exemplary structure of an outdoor unit 1 of a refrigeration cycle apparatus according to Embodiment 1 of the present invention.

[Fig. 2] Fig. 2 is a schematic rear view illustrating the exemplary structure of the outdoor unit 1 of a refrigeration cycle apparatus according to Embodiment 1 of the present invention.

[Fig. 3] Fig. 3 is a schematic diagram illustrating an installed state of the outdoor unit 1 of a refrigeration cycle apparatus according to Embodiment 1 of the present invention in an external wall 25 of a building.

[Fig. 4] Fig. 4 is a schematic diagram illustrating an installed state of the outdoor unit 1 of a refrigeration

cycle apparatus according to Embodiment 1 of the present invention in the external wall 25 of the building and an installed state of an indoor unit 50 connected to the outdoor unit 1 by a refrigerant pipe 45. [Fig. 5] Fig. 5 is a schematic front view illustrating an exemplary structure of an outdoor unit 1 of a refrigeration cycle apparatus according to Embodiment 2 of the present invention. [Fig. 6] Fig. 6 is a schematic rear view illustrating the exemplary structure of the outdoor unit 1 of a refrigeration cycle apparatus according to Embodiment 2 of the present invention.

Description of Embodiments

Embodiment 1

[0009] An outdoor unit 1 of a refrigeration cycle apparatus according to Embodiment 1 of the present invention will be described. Fig. 1 is a schematic front view illustrating an exemplary structure of the outdoor unit 1 of a refrigeration cycle apparatus according to Embodiment 1. As illustrated in Fig. 1, the outdoor unit 1 is constructed as a thin-type, wall-embedded outdoor unit having a cuboidal appearance.

[0010] Note that the relative dimensions and shapes of components in the following figures including Fig. 1 may differ from the actual relative dimensions and shapes of the components. In the following figures, the same or similar components are denoted by the same reference signs, or the reference signs for the same or similar components are omitted. In the following description, the positional relationship between the components of the outdoor unit 1 in the front-rear direction, the left-right direction, or the up-down direction, in principle, is the positional relationship in a state where the outdoor unit 1 is placed in position ready to be used. The term "front surface" of the outdoor unit 1 refers to an outer surface positioned on an indoor side when the outdoor unit 1 is installed on a wall of a structure such that the outdoor unit 1 can be used. The term "rear surface" of the outdoor unit 1 refers to an outer surface positioned on an outdoor side when the outdoor unit 1 is installed on the wall of the structure such that the outdoor unit 1 can be used. The term "left surface" or "right surface" of the outdoor unit 1 refers to a left outer surface or a right outer surface of the outdoor unit 1 when the outdoor unit 1 is viewed from the front.

[0011] As illustrated in Fig. 1, the outdoor unit 1 includes a casing 1a, a first front panel 3, and a second front panel 5 such that the front panels are arranged on the front of the casing 1a. The front panels constitute a front outer surface of the casing 1a of the outdoor unit 1. An internal space of the outdoor unit 1 is divided into left and right compartments by a first divider 7. The first front panel 3 is formed as a panel that covers the left compartment. The second front panel 5 is formed as a panel that covers the front of the right compartment. The first front

panel 3 and the second front panel 5 are fixed by, for example, screws. The front panels can be formed as service panels that allow access to the inside of the outdoor unit 1 for maintenance. Each of the first front panel 3 and the second front panel 5 is formed as, for example, a sheet metal panel.

[0012] The first front panel 3 has a first vent 9a and second vents 9b. The first vent 9a is disposed such that air inside the outdoor unit 1 can be discharged to the outside by driving and rotating a first air-sending device 11a. Each of the second vents 9b is disposed such that air outside the outdoor unit 1 can be sucked into the outdoor unit 1 by driving and rotating a second air-sending device 11b. In Fig. 1, one first vent 9a is disposed in lower part of the first front panel 3, and two second vents 9b are horizontally aligned above the first vent 9a. The first vent 9a and the second vents 9b can each have, for example, a circular shape that is the same as the shape of the opening of a corresponding one of rectifier bell mouths surrounding the first air-sending device 11a and the second air-sending devices 11b. Each of the first vent 9a and the second vents 9b can be covered with a ventilation cover. The rectifier bell mouths and the ventilation covers are not illustrated in the following figures including Fig. 1.

[0013] The first air-sending device 11a and the second air-sending devices 11b are disposed in the left compartment of the internal space, divided by the first divider 7, of the outdoor unit 1. The left compartment serves as an air-sending-device chamber. The left compartment, where the first air-sending device 11a and the second air-sending devices 11b are disposed, of the internal space of the outdoor unit 1 divided by the first divider 7 will be referred to as an air-sending-device chamber. Each of the first air-sending device 11a and the second air-sending devices 11b is constructed as an axial fan, such as a propeller fan. The first air-sending device 11a and the second air-sending devices 11b are disposed so that, in the outdoor unit 1, the direction of an air current produced by driving the first air-sending device 11a is opposite to the direction of an air current produced by driving the second air-sending devices 11b.

[0014] The right compartment of the internal space of the outdoor unit 1 divided by the first divider 7 serves as a machine chamber. As illustrated in, for example, Fig. 1, the machine chamber accommodates a compressor 13 serving as fluid machinery that compresses sucked low-pressure refrigerant and discharges the refrigerant as high-pressure refrigerant. The compressor 13 is constructed as, for example, a rotary compressor or a scroll compressor. The machine chamber may accommodate other components included in the outdoor unit 1, for example, an accumulator, an oil separator, a refrigerant flow switching device, a liquid receiver, and a pressure reducing device.

[0015] Fig. 2 is a schematic rear view illustrating the exemplary structure of the outdoor unit 1 of a refrigeration cycle apparatus according to Embodiment 1. As illustrat-

ed in Fig. 2, a first rear panel 15, a second rear panel 17, and a heat exchanger 19 are disposed on the rear of the casing 1a of the outdoor unit 1. These components constitute a rear outer surface of the casing 1a of the outdoor unit 1. The air-sending-device chamber of the outdoor unit 1 is divided into upper and lower compartments by a second divider 21. The first rear panel 15 is formed as a panel that covers the upper compartment of the air-sending-device chamber. The lower compartment of the air-sending-device chamber accommodates the first air-sending device 11a and the heat exchanger 19 horizontally facing the first air-sending device 11a. The second rear panel 17 covers the machine chamber of the outdoor unit 1. Each of the first rear panel 15 and the second rear panel 17 is formed as, for example, a sheet metal panel fixed by, for example, screws or soldering.

[0016] The first rear panel 15 has a plurality of air outlets 23. The air outlets 23 are disposed so that the air sucked into the outdoor unit 1 through the second vents 9b can be discharged to the outside by driving and rotating the second air-sending devices 11b. In Fig. 2, two air outlets 23 are horizontally aligned. Similarly to the second vents 9b, the air outlets 23 can each have, for example, a circular shape that is the same as the shape of the opening of the rectifier bell mouth surrounding each of the second air-sending devices 11b. Each of the air outlets 23 can be covered with an outlet cover.

[0017] The heat exchanger 19 can be constructed as, for example, a finned-tube heat exchanger including a plurality of fins arranged parallel to one another and heat transfer tubes extending through the plurality of fins. The heat exchanger 19 may be flat-shaped or may be U-shaped or L-shaped when the heat exchanger 19 is viewed from above. The heat exchanger 19 acts as a condenser in a cooling operation in which cooling energy is provided to, for example, an indoor unit connected to the outdoor unit 1, and acts as an evaporator in a heating operation in which heating energy is provided to, for example, the indoor unit. The condenser may be referred to as a radiator and the evaporator may be referred to as a cooler when the refrigeration cycle apparatus is an air-conditioning apparatus.

[0018] The fan diameter of the first air-sending device 11a is determined in consideration of, for example, the outer dimensions of the heat exchanger 19. The fan diameter of each of the second air-sending devices 11b or the number of the second air-sending devices 11b installed is determined so that air subjected to heat exchange in the heat exchanger 19 can be discharged to the outside with a sufficient flow rate.

[0019] An installed state of the outdoor unit 1 of a refrigeration cycle apparatus according to Embodiment 1 will be described below with reference to Figs. 3 and 4.

[0020] Fig. 3 is a schematic diagram illustrating an installed state of the outdoor unit 1 of a refrigeration cycle apparatus according to Embodiment 1 in an external wall 25 of a building. Fig. 4 is a schematic diagram illustrating an installed state of the outdoor unit 1 of a refrigeration

cycle apparatus according to Embodiment 1 in the external wall 25 of the building and an installed state of an indoor unit 50 connected to the outdoor unit 1 by a refrigerant pipe 45. Figs. 3 and 4 schematically illustrate an internal structure of the outdoor unit 1 viewed from the left side of the outdoor unit 1.

[0021] As illustrated in Fig. 3, the external wall 25 of the building has an external-wall internal space 27 that is a recess opening to the outside of the building. Specifically, the external-wall internal space 27 is formed in the external wall 25 of the building such that a wall 31 is at least interposed between the external-wall internal space 27 and an indoor space 29. A grille 33 is attached to an opening of the external-wall internal space 27 such that the building has a good appearance and ventilation can be achieved.

[0022] As illustrated in Figs. 3 and 4, the outdoor unit 1 is disposed in the external-wall internal space 27 such that the front surface of the casing 1a of the outdoor unit 1 is directed toward the indoor space 29. As illustrated in Fig. 4, the wall 31 included in the external wall 25 of the building has a maintenance door 35 so that the external-wall internal space 27 is accessible to a service technician for the outdoor unit 1. As described above, the first front panel 3 or the second front panel 5 disposed on the front of the casing 1a of the outdoor unit 1 can be formed as a service panel. As the first front panel 3 or the second front panel 5 is formed as a service panel, the service technician for the outdoor unit 1 can open the maintenance door 35 in the indoor space 29, approach the outdoor unit 1, remove the service panel, and have access to the inside of the outdoor unit 1. As the service panel is directed toward the indoor space 29, the service technician can have access to the outdoor unit 1 from the indoor space 29 and readily perform maintenance work, such as additional adjustment of the amount of refrigerant, replacement of components of a control board, and maintenance and inspection of pipe connections or wire connections. Dangerous work outside the building can be avoided.

[0023] As illustrated in Figs. 3 and 4, the air-sending-device chamber inside the outdoor unit 1 is divided into the upper and lower compartments by the second divider 21 as described above. A first air passage 37 in which the heat exchanger 19 and the first air-sending device 11a are disposed is provided under the second divider 21. A second air passage 39 in which the second air-sending devices 11b are disposed is provided above the second divider 21.

[0024] As illustrated in Fig. 4, the outdoor unit 1 is connected through the refrigerant pipe 45 to the indoor unit 50 that supplies cooling energy or heating energy to the indoor space 29. For example, when the refrigeration cycle apparatus is an air-conditioning apparatus, in the cooling operation, low-temperature and low-pressure two-phase refrigerant is supplied from the outdoor unit 1 to the indoor unit 50 through the refrigerant pipe 45, the refrigerant exchanges heat with indoor air in an indoor

side heat exchanger in the indoor unit 50, and cooling energy is supplied to the indoor space 29. In the heating operation, high-temperature and high-pressure gas-phase refrigerant is supplied from the outdoor unit 1 to the indoor unit 50 through the refrigerant pipe 45, the refrigerant exchanges heat with the indoor air in the indoor side heat exchanger in the indoor unit 50, and heating energy is supplied to the indoor space 29. Although the indoor unit 50 is constructed as a ceiling-embedded indoor unit in Fig. 4, the indoor unit 50 may be constructed as, for example, a floor-standing indoor unit. Furthermore, a plurality of the indoor units 50 may be disposed in the indoor space 29.

[0025] A flow of air to be subjected to heat exchange in the outdoor unit 1 of a refrigeration cycle apparatus when the outdoor unit 1 is being driven will be described below. In Figs. 3 and 4, the air flow during driving of the outdoor unit 1 of a refrigeration cycle apparatus is indicated by open block arrows denoted by reference signs A, B, and C.

[0026] When the outdoor unit 1 is driven, the first air-sending device 11a is driven and rotated, so that outdoor air is caused to pass through the first air passage 37 in the outdoor unit 1 as indicated by reference sign A. The outdoor air then passes through the heat exchanger 19. While passing through the heat exchanger 19, the outdoor air exchanges heat with the refrigerant flowing inside the heat exchanger 19. The air subjected to heat exchange in the heat exchanger 19 is discharged from the first vent 9a disposed in the first front panel 3 to the external-wall internal space 27. The rotation of the second air-sending devices 11b causes the air discharged to the external-wall internal space 27 to flow in the external-wall internal space 27 as indicated by reference sign B. The air is then sucked into the second air passage 39 in the outdoor unit 1 through the second vents 9b disposed in the first front panel 3. The rotation of the second air-sending devices 11b causes the air sucked through the second vents 9b to be discharged from the air outlets 23 disposed in the first rear panel 15 as indicated by reference sign C.

[0027] As described above, the outdoor unit 1 of a refrigeration cycle apparatus according to Embodiment 1, which is installed in the external-wall internal space 27 of a structure, such as a building, includes the casing 1a, the heat exchanger 19 accommodated in the casing 1a, the first air-sending device 11a that causes air to pass through the heat exchanger 19 and discharges the air to the external-wall internal space 27, the second air-sending devices 11b that suck the air discharged to the external-wall internal space 27 by the first air-sending device 11a and discharge the air to the outside of the structure, and the divider that is the second divider 21 that divides an inside of the casing 1a into the first air passage 37 in which the heat exchanger 19 and the first air-sending device 11a are disposed and the second air passage 39 in which the second air-sending devices 11b are disposed.

[0028] In Embodiment 1, the air subjected to heat exchange in the outdoor unit 1 is discharged to the external-wall internal space 27 through the first air passage 37. The air discharged to the external-wall internal space 27 is discharged to the outside of the structure through the second air passage 39 separated from the first air passage 37 by the second divider 21. In Embodiment 1, it is unnecessary to provide an air passage for directing the flow of air subjected to heat exchange in the opposite direction in the outdoor unit 1. Thus, the outdoor unit 1 can ensure quietness and can be reduced in size. In addition, the flow of air subjected to heat exchange does not stagnate inside the outdoor unit 1. This configuration leads to improvement in performance of the outdoor unit 1, thus enhancing the stability and reliability of the outdoor unit 1 during operation. With the configuration in Embodiment 1, consequently, the outdoor unit 1 of a refrigeration cycle apparatus can ensure quietness and achieve both reduction in size and improvement in performance.

[0029] In addition, as the flow of air subjected to heat exchange does not stagnate inside the outdoor unit 1 of a refrigeration cycle apparatus according to Embodiment 1, the rotation frequency of the first air-sending device 11a can be reduced, resulting in a reduction in energy consumption of the outdoor unit 1.

[0030] In the outdoor unit 1 of a refrigeration cycle apparatus according to Embodiment 1, the second air passage 39 can be located above the first air passage 37. Such a configuration can reduce or eliminate a short circuit phenomenon in which air discharged from the second air passage 39 to the outside of the structure is again sucked into the first air passage 37.

[0031] In the outdoor unit 1 of a refrigeration cycle apparatus according to Embodiment 1, the casing 1a can include a service panel exemplified by the first front panel 3 or the second front panel 5 disposed on the side of the indoor space of the structure. In some cases, the outdoor unit 1 has to be installed in the external-wall internal space 27 of the external wall 25 that divides the indoor space 29 from an outdoor space, because no place cannot be prepared to install the outdoor unit 1. In some cases, for reasons of appearance of a structure, the outdoor unit 1 has to be installed in the external-wall internal space 27 of the external wall 25 that divides the indoor space 29 from the outdoor space. The above-described configuration allows access to the external-wall internal space 27 from the indoor space 29 and enables installation of the outdoor unit 1 and maintenance work for the outdoor unit 1, such as maintenance and inspection, when the outdoor unit 1 has to be installed in the external-wall internal space 27 of the external wall 25 that divides the indoor space 29 from the outdoor space. Consequently, this configuration can enhance the working efficiency of maintenance of the outdoor unit 1.

Embodiment 2

[0032] Embodiment 2 of the present invention will be described with reference to Figs. 5 and 6. Fig. 5 is a schematic front view illustrating an exemplary structure of an outdoor unit 1 of a refrigeration cycle apparatus according to Embodiment 2. Fig. 6 is a schematic rear view illustrating the exemplary structure of the outdoor unit 1 of a refrigeration cycle apparatus according to Embodiment 2.

[0033] Embodiment 2 relates to a modification of Embodiment 1 described above. As illustrated in Fig. 5, the outdoor unit 1 has an internal space that is divided into upper and lower compartments by a second divider 21. The lower compartment of the internal space of the outdoor unit 1 is further divided into left and right compartments by a first divider 7.

[0034] The lower right compartment of the internal space of the outdoor unit 1 is covered by a second front panel 5. The lower right compartment serves as a machine chamber accommodating, for example, a compressor. As illustrated in Fig. 6, the rear of the machine chamber is covered by a second rear panel 17.

[0035] The lower left compartment of the internal space of the outdoor unit 1 is covered by a third front panel 55 having a first vent 9a. The lower left compartment accommodates a first air-sending device 11a. The lower left compartment of the internal space of the outdoor unit 1 corresponds to the first air passage 37 in Embodiment 1 described above. In Fig. 5, the lower left compartment accommodates one first air-sending device 11a. As illustrated in Fig. 6, the lower left compartment of the internal space of the outdoor unit 1 further accommodates a heat exchanger 19 disposed on the side of the rear of the outdoor unit 1.

[0036] The upper compartment of the internal space of the outdoor unit 1 is covered by a fourth front panel 60 having second vents 9b. The upper compartment accommodates second air-sending devices 11b. The upper compartment of the internal space of the outdoor unit 1 corresponds to the second air passage 39 in Embodiment 1 described above. In Fig. 5, the upper compartment accommodates three second air-sending devices 11b. As illustrated in Fig. 6, the rear of the upper compartment of the internal space of the outdoor unit 1 is covered by a first rear panel 15 having a plurality of air outlets 23.

[0037] As described above, the outdoor unit 1 of a refrigeration cycle apparatus according to Embodiment 2 is configured such that a casing 1a includes the machine chamber that is a space that accommodates a compressor 13, and the second air passage is disposed above the machine chamber. Such a configuration allows an increase in the number of the second air-sending devices 11b that can be disposed in the second air passage 39, thus enhancing the efficiency with which air subjected to heat exchange is discharged.

Other Embodiments

[0038] The present invention is not limited to Embodiment 1 described above. Various changes and modifications of the present invention may be made without departing from the spirit and scope of the present invention. For example, the embodiments described above are also applicable to refrigeration cycle apparatuses other than an air-conditioning apparatus, for example, a heat pump water heater. Reference Signs List

[0039] 1 outdoor unit 1a casing 3 first front panel 5 second front panel 7 first divider 9a first vent 9b second vent 11a first air-sending device 11b second air-sending device 13 compressor 15 first rear panel 17 second rear panel 19 heat exchanger 21 second divider 23 air outlet 25 external wall 27 external-wall internal space 29 indoor space 31 wall 33 grille 35 maintenance door 37 first air passage 39 second air passage 45 refrigerant pipe 50 indoor unit 55 third front panel 60 fourth front panel

Claims

1. An outdoor unit of a refrigeration cycle apparatus, the outdoor unit being to be installed in an external-wall internal space of a structure, the outdoor unit comprising:
 - a casing;
 - a heat exchanger accommodated in the casing;
 - a first air-sending device configured to cause air to pass through the heat exchanger and discharge the air to the external-wall internal space;
 - a second air-sending device configured to suck the air discharged to the external-wall internal space by the first air-sending device and discharge the air to an outside of the structure; and
 - a divider that divides an inside of the casing into a first air passage and a second air passage, the heat exchanger and the first air-sending device being disposed in the first air passage, the second air-sending device being disposed in the second air passage.
2. The outdoor unit of a refrigeration cycle apparatus of claim 1, wherein the second air passage is located above the first air passage.
3. The outdoor unit of a refrigeration cycle apparatus of claim 2, wherein the casing includes a machine chamber that serves as a space accommodating a compressor, and wherein the second air passage is located above the machine chamber.
4. The outdoor unit of a refrigeration cycle apparatus of any one of claims 1 to 3, wherein the casing in-

cludes a service panel disposed on a side of an indoor space of the structure.

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FIG. 1

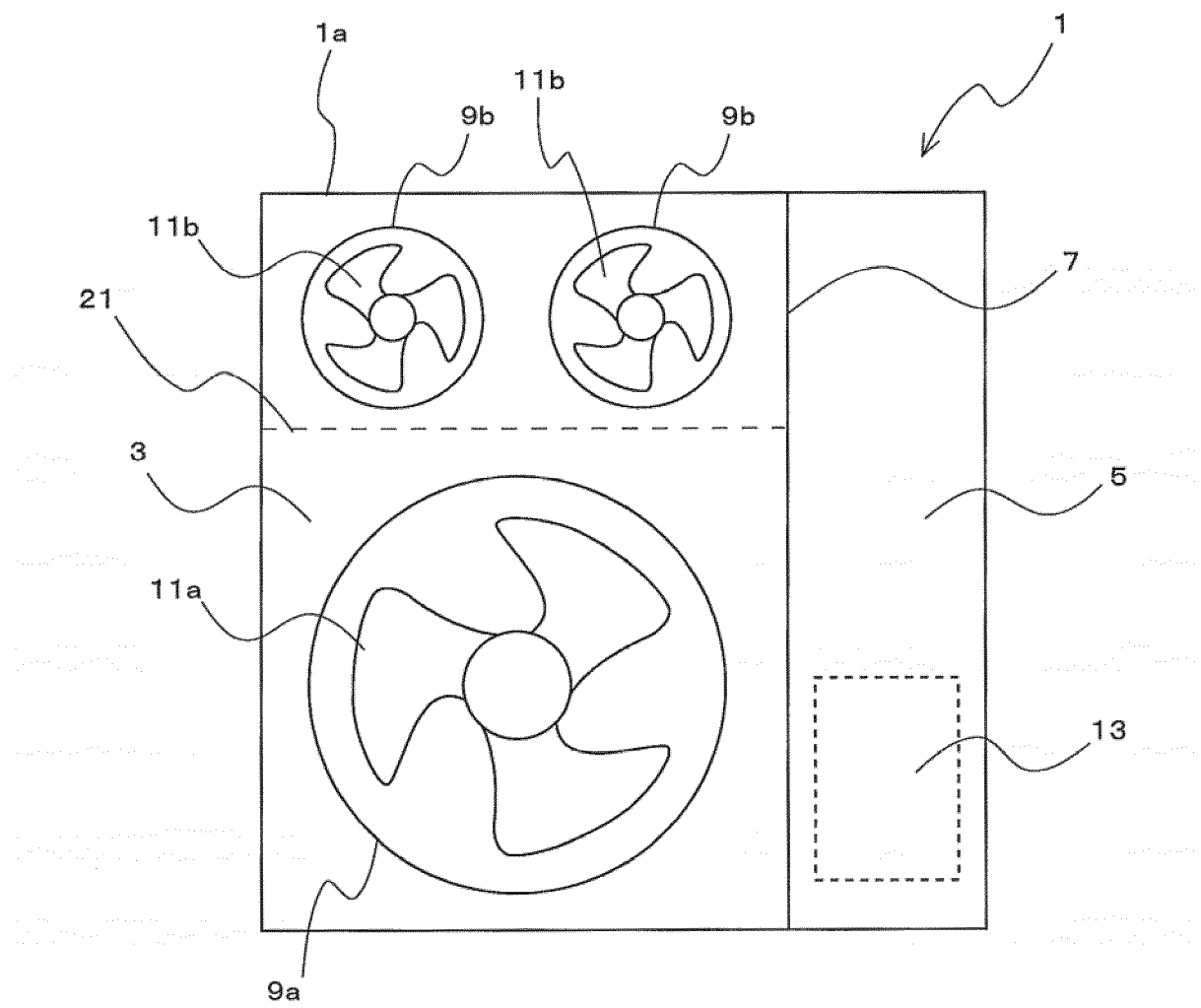


FIG. 2

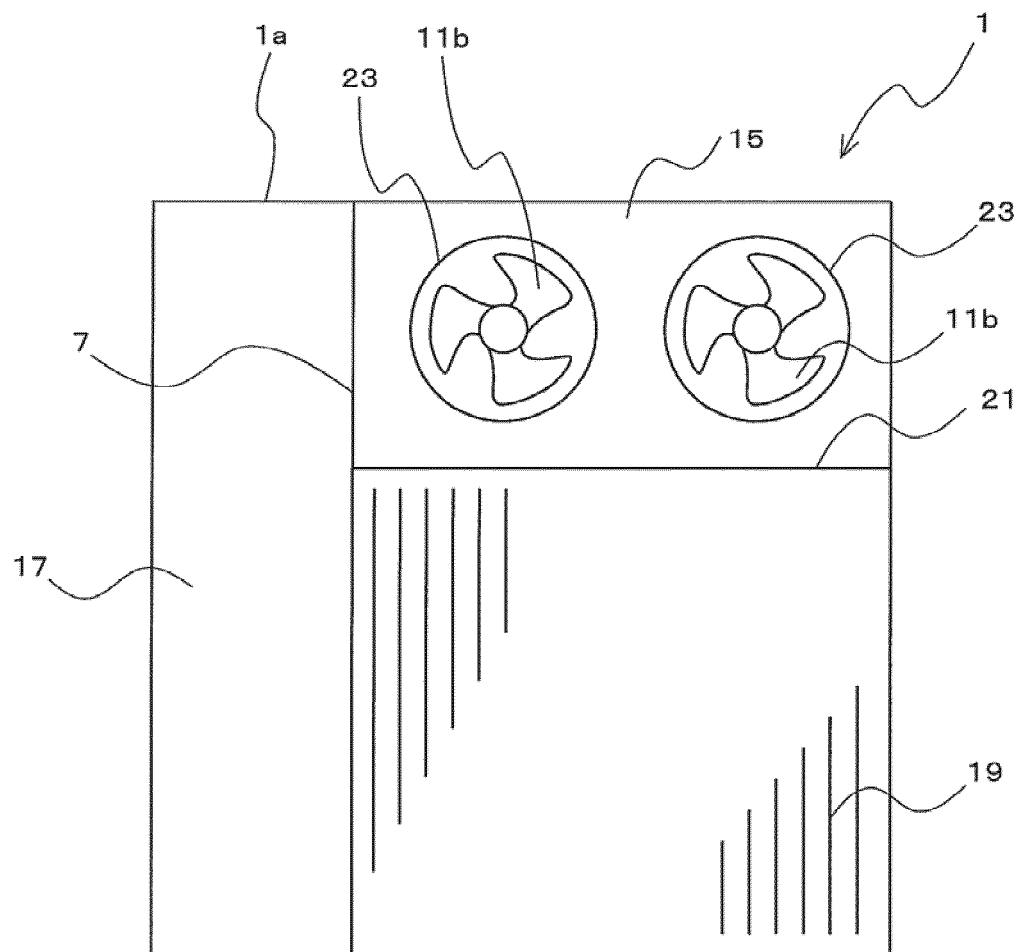


FIG. 3

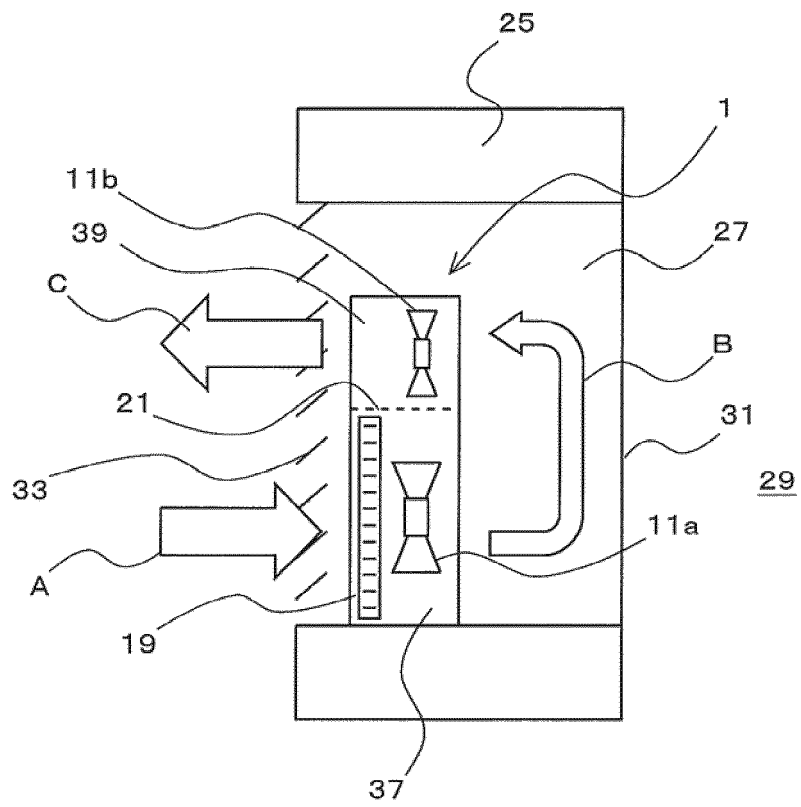


FIG. 4

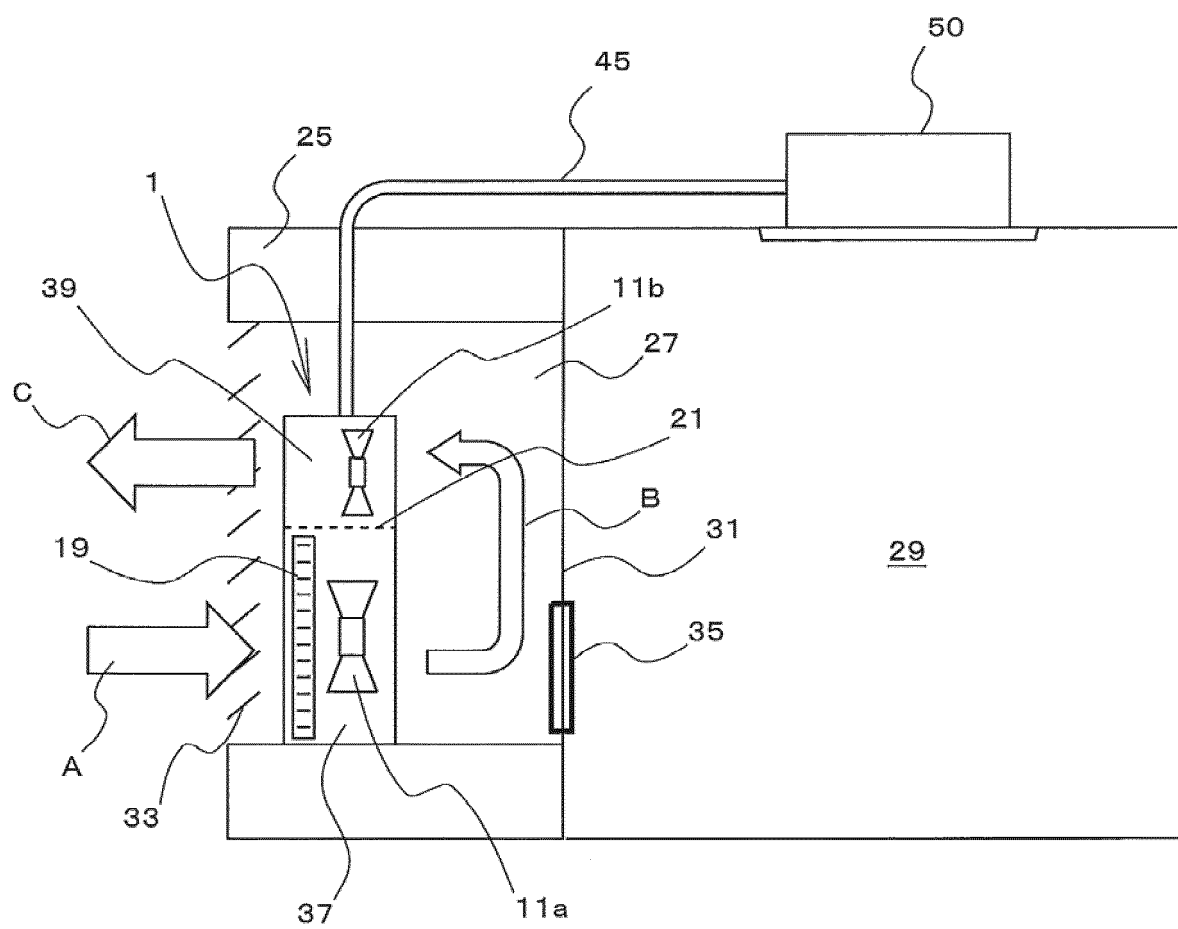


FIG. 5

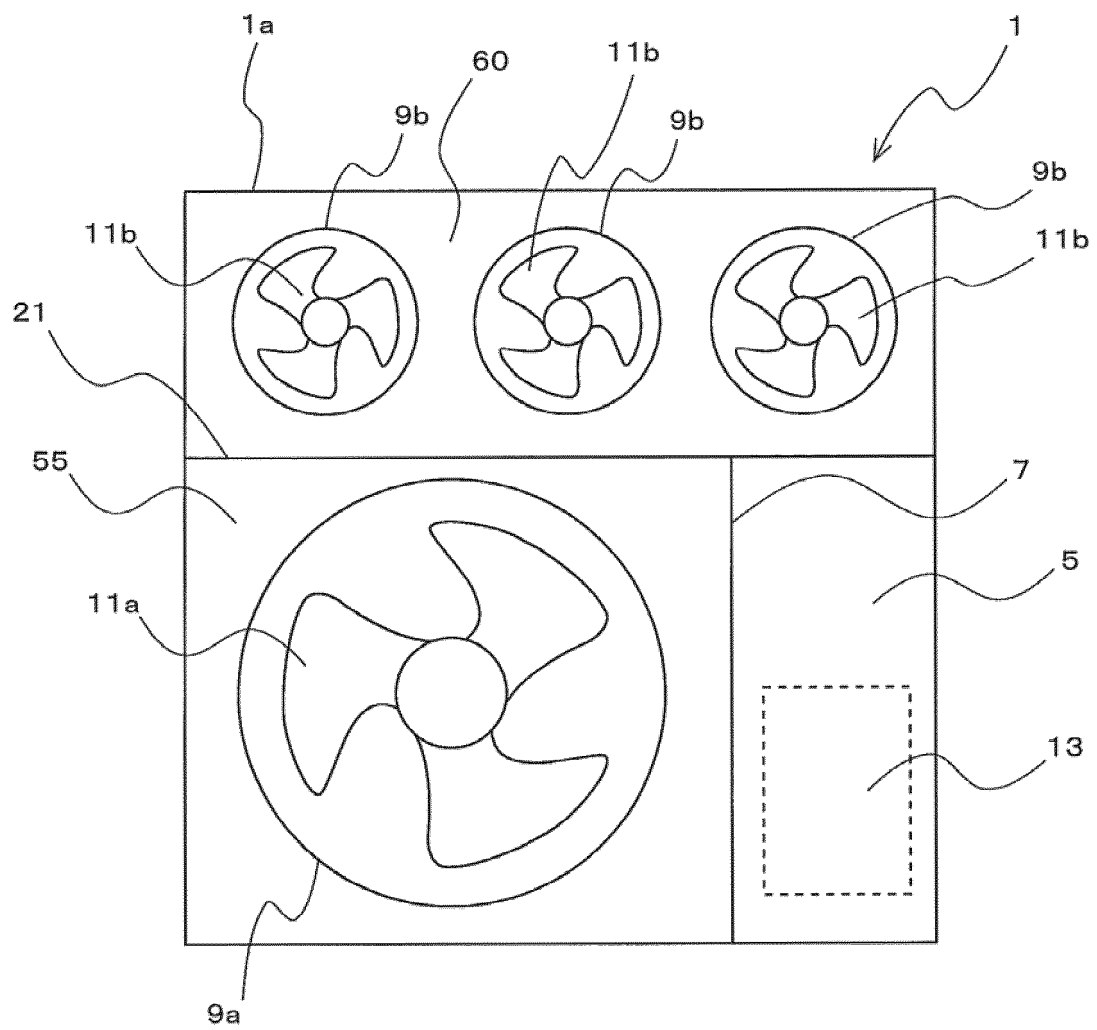
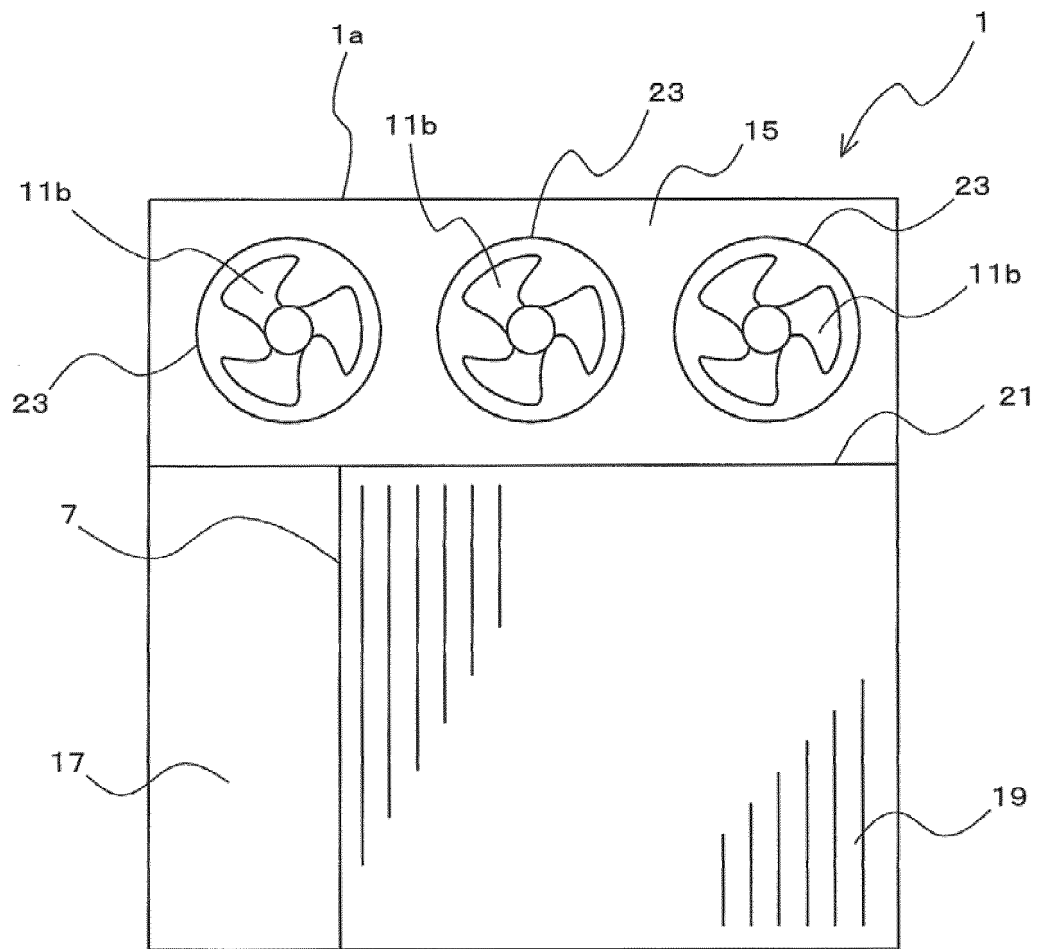


FIG. 6



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2015/085586

A. CLASSIFICATION OF SUBJECT MATTER

F24F1/52(2011.01)i, F24F1/62(2011.01)i, F25B1/00(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)

F24F1/52, F24F1/62, F25B1/00

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 1996-2016

Kokai Jitsuyo Shinan Koho 1971-2016 Toroku Jitsuyo Shinan Koho 1994-2016

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 5641130 B2 (Fuji Electric Co., Ltd.), 17 December 2014 (17.12.2014), paragraphs [0020] to [0051]; fig. 1 (Family: none)	1-4
A	JP 2015-17721 A (Yugen Kaisha Aqua Tekku), 29 January 2015 (29.01.2015), paragraphs [0044] to [0048]; fig. 1 to 4 (Family: none)	1-4

☒ 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 February 2016 (29.02.16)Date of mailing of the international search report
08 March 2016 (08.03.16)Name and mailing address of the ISA/
Japan Patent Office
3-4-3, Kasumigaseki, Chiyoda-ku,
Tokyo 100-8915, Japan

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2015/085586

C (Continuation).	DOCUMENTS CONSIDERED TO BE RELEVANT	
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 60429/1988(Laid-open No. 163737/1989) (Daikin Industries, Ltd.), 15 November 1989 (15.11.1989), specification, page 2, line 3 to page 3, line 17; page 7, line 15 to page 8, line 13; fig. 4 to 5 (Family: none)	1-4
A	JP 8-85455 A (Hitachi, Ltd.), 02 April 1996 (02.04.1996), paragraphs [0005] to [0017]; fig. 1 to 2 (Family: none)	1
A	JP 6-109283 A (Matsushita Seiko Co., Ltd.), 19 April 1994 (19.04.1994), paragraphs [0012] to [0021]; fig. 1 to 2 (Family: none)	1-4
A	JP 4-143533 A (Daikin Industries, Ltd.), 18 May 1992 (18.05.1992), page 6, upper right column, line 13 to page 7, lower right column, line 11; fig. 1 to 4 (Family: none)	1-4
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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 3213928 A [0003]