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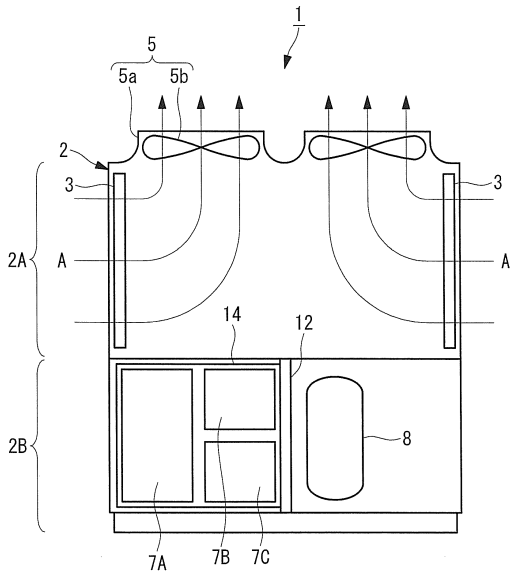
(54) OUTDOOR UNIT OF MULTIPLE AIR-CONDITIONING SYSTEM

(57) An outdoor unit (1) includes a housing (2) partitioned into a heat exchanger room (2A) in an upper part and a machine room (2B) in a lower part, a heat exchanger (3) installed along a peripheral surface of the heat exchanger room (2A), a cooling fan (5) installed on an upper surface of the housing (2), a plurality of electronic substrates (7A, 7B, and 7C) arranged in a plane along a front opening of the machine room (2B), a refrigerant compressor (8) installed beside the plurality of electronic substrates in the machine room (2B) at a position closer to the front opening, and an optional component installation space provided behind the electronic substrates (7A, 7B, and 7C) and the compressor (8) to house therein a group of less frequently maintained components. The electronic substrates (7A, 7B, and 7C) are attached to a substrate holder (14).

FIG. 4



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Description

BACKGROUND OF THE INVENTION

1. FIELD OF THE INVENTION

[0001] The present invention relates to an outdoor unit of a multiple air-conditioning system.

2. DESCRIPTION OF RELATED ART

[0002] As disclosed in Japanese Unexamined Patent Application, Publication No. 2005-127578, in a housing as an outer shell of an outdoor unit of a multiple air-conditioning system, which is installed on, for example, the roof of a building, a heat exchanger room that houses therein a heat exchanger is formed in an upper part, and a machine room that houses therein instruments such as a compressor and a plurality of electronic substrates (a control substrate, an inverter substrate, and a noise filter substrate, for example) is formed in a lower part.

[0003] A cooling fan is installed on an upper surface of the housing. When this cooling fan is actuated, external air is sucked into the heat exchanger room through the heat exchanger and externally ejected through the cooling fan. In this manner, the heat exchanger performs heat exchange with the external air.

[0004] Conventionally, the plurality of electronic substrates housed in the machine room are each housed on top of another in the thickness direction in a posture with its component mount surface facing in the vertical direction. With this configuration, when an inspection cover at a front face of the machine room is opened, only edge faces of the plurality of electronic substrates or the component mount surface of the closest electronic substrate is exposed. The machine room has such a layout that one or a plurality of compressors are installed adjacent to the unit of these stacked electronic substrates.

[0005] {PTL 1}
Japanese Unexamined Patent Application, Publication No. 2005-127578

BRIEF SUMMARY OF THE INVENTION

[0006] However, with the above-described arrangement in which the plurality of electronic substrates housed in the machine room are placed on top of another in the thickness direction in a posture with its component mount surface facing in the vertical direction, an electronic substrate on the top needs to be taken out to access to an electronic substrate arranged behind. In addition, simultaneous access is not possible to the component mount surfaces of the plurality of electronic substrates, leading to degraded maintainability.

[0007] When the air-conditioning capacity of the outdoor unit is changed, the capacity of the compressor or the number thereof needs to be changed, and accordingly, the capacity of the heat exchanger needs to be changed. This requires change of the whole components including the housing, resulting in increase in manufacturing cost.

[0008] Moreover, a large installation area of the outdoor unit is required so as to improve the air-conditioning capacity of the outdoor unit, which makes it difficult to perform change for the improvement in a small place such as the roof of a building, in which other instruments are arranged closer.

[0009] The present invention is intended to solve such problems, and it is an object of the present invention to provide an outdoor unit of a multiple air-conditioning system, which provides improved maintainability through improved accessibility to an electronic substrate and any other members in a machine room, achieves improvement in performance of the multiple air-conditioning system, and allows air-conditioning capacity to be easily changed.

[0010] The present invention provides the following means for solving the above-described problems.

[0011] An outdoor unit of a multiple air-conditioning system according to the present invention includes a housing partitioned into a heat exchanger room in an upper part and a machine room in a lower part, a heat exchanger installed along a peripheral surface of the heat exchanger room, a cooling fan installed on an upper surface of the housing, a plurality of electronic substrates arranged in a plane along a front opening of the machine room, a refrigerant compressor installed beside the electronic substrate in the machine room at a position closer to the front opening, and an optional component installation space provided behind the electronic substrates and the compressor to house therein a group of less frequently maintained components.

[0012] In the outdoor unit with the above-described configuration, the plurality of electronic substrates are arranged in a plane along the front opening of the machine room, and the compressor is installed beside the electronic substrates in the machine room at the position closer to the front opening. Thus, when the front opening of the machine room is opened, all of the electronic substrates and the compressor can be directly accessed from the front. This configuration can provide largely improved maintainability of the outdoor unit through improved accessibility to the electronic substrates and the compressor, which are most frequently accessed components.

[0013] Since the group of less frequently maintained components are housed in the optional component installation space provided behind the electronic substrates and the compressor, this configuration does not disrupt maintenance of the electronic substrates and the compressor, thereby achieving further improved maintainability of the outdoor unit.

[0014] In the above-described configuration, the plurality of electronic substrates may be attached to one substrate holder, and at least part of the weight of the substrate holder may be supported by a reinforcement

member provided across the front opening of the machine room.

[0015] Since the plurality of electronic substrates are attached to the substrate holder and the substrate holder is supported by the reinforcement member provided across the front opening of the machine room, the reinforcement member provided to the machine room also serves a support member for the substrate holder, and thus the plurality of electronic substrates can be supported without a complicated structure.

[0016] In the above-described configuration, an inverter substrate included in the plurality of electronic substrates may be arranged closer to the compressor. With this configuration, since the inverter substrate is arranged close to the compressor, noise generation can be reduced to achieve improvement in the performance of the multiple air-conditioning system.

[0017] In the above-described configuration, the substrate holder may be rotatable toward outside of the machine room by using the reinforcement member extending in a vertical direction as a rotation support member. With this configuration, the substrate holder supporting the plurality of electronic substrates can be opened and closed as a door at the front opening of the machine room. Thus, when the substrate holder is opened through rotation toward outside, maintenance of the group of components behind the electronic substrates can be performed without disconnecting connection among the electronic substrates, thereby achieving further improved maintainability of the outdoor unit.

[0018] In the above-described configuration, the heat exchanger room may be provided with the heat exchanger and the cooling fan only. With this configuration, when the cooling fan is actuated, external air sucked into the heat exchanger room through the heat exchanger is externally ejected through the cooling fan without being disturbed by any other members or the like. This achieves improvement in heat exchange efficiency through the heat exchanger and thus in the performance of the multiple air-conditioning system.

[0019] In the above-described configuration, the heat exchanger room may be separable from the machine room and replaceable with a heat exchanger room having a different height, and the heat exchanger may be replaceable with a heat exchanger having a different height.

[0020] With this configuration, the air-conditioning capacity of the outdoor unit can be easily changed by changing the capacity of the compressor or the number thereof, and replacing the heat exchanger room and the heat exchanger of the housing with those having larger heights, while increase in manufacturing cost due to the change of the air-conditioning capacity is minimized.

[0021] In addition, since there is no change in the size of the machine room in the housing, the above-described change of the air-conditioning capacity does not require change in the installation area of the outdoor unit. Accordingly, the change (in particular, increase) of the air-conditioning capacity can be easily performed in a small place such as the roof of a building.

[0022] As described above, an outdoor unit of a multiple air-conditioning system according to the present invention provides improved maintainability through improved accessibility to an electronic substrate and any other members in a machine room, achieves improvement in performance of the multiple air-conditioning system, and allows air-conditioning capacity to be easily changed.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0023]

FIG. 1 is a front view of an outdoor unit according to a first embodiment of the present invention.
FIG. 2 is a plan view of the outdoor unit in the direction of arrow II in FIG. 1.
FIG. 3 is a transverse sectional view of the outdoor unit taken along line III-III in FIG. 1.
FIG. 4 is a longitudinal sectional view of the outdoor unit taken along line IV-IV in FIG. 3.
FIG. 5 is a transverse sectional view of the outdoor unit, illustrating a substrate holder when rotated toward outside.
FIG. 6 is a longitudinal sectional view of an outdoor unit according to a second embodiment of the present invention.
FIG. 7 is a transverse sectional view of the outdoor unit taken along line VII-VII in FIG. 6.

DETAILED DESCRIPTION OF THE INVENTION

[0024] Embodiments of the present invention will be described below with reference to the accompanying drawings.

[First Embodiment]

[0025] FIG. 1 is a front view of an outdoor unit according to a first embodiment of the present invention. FIG. 2 is a plan view in the direction of arrow II in FIG. 1. FIG. 3 is a transverse sectional view of the outdoor unit taken along line III-III in FIG. 1. This outdoor unit 1 is employed in a multiple air-conditioning system that is used for air conditioning of, for example, a building, and in which a single outdoor unit is connected with a plurality of indoor units (not illustrated).

[0026] A housing 2 as an outer shell of the outdoor unit 1 includes a heat exchanger room 2A in an upper part of the housing 2, and a machine room 2B in a lower part of the housing 2. The heat exchanger room 2A is separable from the machine room 2B and replaceable with a heat exchanger room having a different height as described later. The heat exchanger room 2A houses therein a pair of heat exchangers 3. These heat exchangers 3 each

have an L shape in plan view (refer to FIG. 2), and are combined with each other to form a rectangular shape with these two L shapes along four peripheral surfaces of the heat exchanger room 2A.

[0027] For example, two of cooling fans 5 are installed on an upper surface of the housing 2 (heat exchanger room 2A). These cooling fans 5 each include a bell mouth 5a formed on the upper surface of the housing 2, and a fan blade 5b driven to rotate inside the bell mouth 5a by a motor (not illustrated).

[0028] The heat exchanger room 2A is provided with the heat exchangers 3 and the cooling fans 5 only as described above, with no other instruments provided therein. The machine room 2B houses therein a plurality of electronic substrates such as a control substrate 7A, an inverter substrate 7B, and a noise filter substrate 7C, a single compressor 8 configured to compress refrigerant, and various air-conditioning device components (not illustrated) such as a four-way valve, a check valve, an expansion valve, an oil separator, a receiver, and a gas-liquid separator.

[0029] The machine room 2B is provided with openable inspection covers 2L and 2R on a front surface thereof. As illustrated in FIG. 3, the inspection covers 2L and 2R are double rotatable covers or detachable covers fastened with, for example, bolts. The electronic substrates 7A, 7B, and 7C are arranged in a plane along a front opening of the machine room 2B behind the inspection cover 2L located on, for example, the left side in FIG. 1 (or the right side).

[0030] The compressor 8 is installed facing to the front opening of the machine room 2B behind the inspection cover 2R on, for example, the right side in FIG. 1 (or the left side), and is arranged beside the electronic substrates 7A, 7B, and 7C. In the present embodiment, the compressor 8 is installed adjacent to the electronic substrates 7A, 7B, and 7C, but there may be provided a space between the compressor 8 and the electronic substrates 7A, 7B, and 7C, for example.

[0031] Optional component installation spaces 10L and 10R are formed behind the electronic substrates 7A, 7B, and 7C and the compressor 8. These optional component installation spaces 10L and 10R house therein a group of components less frequently maintained than the electronic substrates 7A, 7B, and 7C and the compressor 8, replacement components (spare parts), tools, inspection devices, and the like.

[0032] As illustrated in FIGS. 3 to 5, a central support member 12 (reinforcement member) having a rectangular column extending in the vertical direction is provided across the front opening of the machine room 2B at, for example, a central part thereof. This central support member 12 supports the weight of the heat exchanger room 2A, together with a peripheral wall of the machine room 2B and a partition 12a dividing the inside of the machine room 2B into two parts.

[0033] The plurality of electronic substrates 7A, 7B, and 7C arranged in a plane along the front opening of the machine room 2B as described above are fixed or detachably attached to a substrate holder 14 formed in, for example, a box shape. The inverter substrate 7B is arranged closer to the compressor 8. At least part of the weight of the substrate holder 14 holding the electronic substrates 7A, 7B, and 7C in this manner is supported by the central support member 12.

[0034] Specifically, as illustrated in, for example, FIG. 5, one vertical side of the substrate holder 14 is pivoted to the central support member 12 through a hinge 15. With this configuration, the substrate holder 14 is supported rotatably toward outside of the machine room 2B by using the central support member 12 as a rotation support member. A free end side of the substrate holder 14 is releasably fixed to the wall of the machine room 2B through a releasable fixing unit (not illustrated). The weight of the free end side of the substrate holder 14 is supported by the releasable fixing unit when the substrate holder 14 is locked. The substrate holder 14 has a rotation angle of 90° or larger, preferably near 180°, so that the optional component installation space 10L is fully opened.

[0035] With this configuration, as illustrated in FIG. 5, when the inspection cover 2L of the machine room 2B is opened (or removed), the substrate holder 14 can be rotated toward the outside (front side) to allow free access to the optional component installation space 10L behind. The substrate holder 14 may be detachably supported as a whole by the central support member 12 instead of being rotatably supported.

[0036] In the outdoor unit 1 configured as described above, when the compressor 8 is actuated to compress refrigerant and the cooling fans 5 are actuated, external air is sucked into the heat exchanger room 2A through the heat exchangers 3 and externally ejected through the cooling fans 5 (bell mouths 5a) as illustrated by arrow A in FIG. 4. Accordingly, heat exchange is performed between the heat exchangers 3 and the external air, so that compression refrigerant flowing inside the heat exchangers 3 is compressed or evaporated.

[0037] In the outdoor unit 1, the plurality of electronic substrates 7A, 7B, and 7C are arranged in a plane along the front opening of the machine room 2B, and the compressor 8 is installed beside the electronic substrates 7A, 7B, and 7C in the machine room 2B at a position closer to the front opening. Thus, when the inspection covers 2L and 2R in the front opening of the machine room 2B are opened, all of the electronic substrates 7A, 7B, and 7C and the compressor 8 can be directly accessed from the front. This configuration provides improved maintainability of the outdoor unit 1 through improved accessibility to the electronic substrates 7A, 7B, and 7C and the compressor 8, which are most frequently accessed.

[0038] The outdoor unit 1 has the structure that the plurality of electronic substrates 7A, 7B, and 7C are attached to the substrate holder 14, and the substrate holder 14 is supported by the central support member 12 provided across the central part of the front opening of

the machine room 2B. With this configuration, the central support member 12 provided to the machine room 2B also serves as a support member for the substrate holder 14, and thus the plurality of electronic substrates 7A, 7B, and 7C can be supported without a complicated structure. In addition, the substrate holder 14 does not need to be robustly formed and thus can be formed in a lightweight and simple structure. The substrate holder 14 may be formed as, for example, a simple board.

[0039] In the outdoor unit 1, the substrate holder 14 is rotatable toward outside of the machine room 2B by using the central support member 12 (hinge 15) as a rotation support member. With this configuration, the substrate holder 14 supporting the plurality of electronic substrates 7A, 7B, and 7C can be opened and closed as a door at the front opening of the machine room 2B. Thus, when the substrate holder 14 is opened through rotation toward outside, maintenance of a group of components arranged in the optional component installation space 10L behind the electronic substrates 7A, 7B, and 7C can be performed without disconnecting connection among the electronic substrates 7A, 7B, and 7C, thereby achieving further improved maintainability of the outdoor unit 1.

[0040] In the outdoor unit 1, the inverter substrate 7B is arranged on the substrate holder 14 at a position closer to the compressor 8. With this configuration, since the inverter substrate 7B is arranged close to the compressor 8, noise generation can be reduced so as to achieve improvement in the performance of the multiple air-conditioning system.

[0041] In the outdoor unit 1, the heat exchanger room 2A is provided with the heat exchangers 3 and the cooling fans 5 only. With this configuration, when the cooling fans 5 are actuated, external air sucked into the heat exchanger room 2A through the heat exchangers 3 is externally ejected through the cooling fans 5 in a smooth manner without being disturbed by any other members or the like. This achieves improvement in heat exchange efficiency through the heat exchangers 3 and thus in the performance of the multiple air-conditioning system.

[Second Embodiment]

[0042] FIG. 6 is a longitudinal sectional view of an outdoor unit according to a second embodiment of the present invention. FIG. 7 is a transverse sectional view of the outdoor unit taken along line VII-VII in FIG. 6. This outdoor unit 21 is identical to the outdoor unit 1 according to the first embodiment except that two compressors 8A and 8B are provided and the heat exchanger room 2A and the heat exchangers 3 have heights different from those in the first embodiment. In the following, any component having an identical configuration is denoted by an identical reference numeral, and duplicate description thereof will be omitted.

[0043] In the outdoor unit 21, the heat exchanger room 2A is separable from the machine room 2B similarly to the outdoor unit 1 according to the first embodiment, but the height H1 of the heat exchanger room 2A and the height H2 of the heat exchangers 3 are set to be larger than those in the outdoor unit 1 according to the first embodiment. The air-conditioning capacity of the outdoor unit 21 can be easily improved with this configuration in which the two compressors 8A and 8B are provided and the height H1 of the heat exchanger room 2A of the housing 2 and the height H2 of the heat exchangers 3 are set to be larger.

[0044] In this case, almost no change is required for the machine room 2B and any other component, and thus increase in manufacturing cost due to the change of the air-conditioning capacity can be minimized. The outdoor unit 1 according to the first embodiment can be upgraded to the outdoor unit 21 according to the second embodiment. The capacity of the single compressor 8 may be increased instead of providing the two compressors 8A and 8B.

[0045] In addition, since there is no change in the size of the machine room 2B in the housing 2, the above-described change of the air-conditioning capacity does not lead to change in the installation area of the outdoor unit 21 from the installation area of the outdoor unit 1 according to the first embodiment. Accordingly, the change (in particular, increase) of the air-conditioning capacity can be easily performed in a small place such as the roof of a building.

[0046] As described above, the outdoor units 1 and 21 of the multiple air-conditioning system according to the present embodiments provide improved maintainability through improved accessibility to the electronic substrates 7A, 7B, and 7C and any other members in the machine room 2B, achieve improvement in the performance of the multiple air-conditioning system, and allow the air-conditioning capacity to be easily changed.

[0047] The present invention is not limited to configurations in the above-described embodiments, but may be changed or modified as appropriate. Any embodiments with such a change or modification are included in the scope of the present invention. For example, the shape of the housing 2 (the heat exchanger room 2A and the machine room 2B) and the proportion of the sizes of components are not limited to those in the above-described embodiments.

[0048] Additionally, the number of cooling fans 5 and the relative positional relation between the electronic substrates 7A, 7B, and 7C and the compressor 8 are not limited to those in the above-described embodiments. For example, the positions of the electronic substrates 7A, 7B, and 7C and the compressor 8 may be horizontally interchanged, a compressor may be disposed between a plurality of electronic substrates, or an electronic substrate may be disposed between a plurality of compressors.

[0049] Moreover, the partition 12a may be removed to integrate the optional component installation spaces 10L and 10R, or a plurality of central support members 12 and a plurality of partitions 12a may be provided.

[Reference Sign(s) List]

[0050]

1, 21	outdoor unit of multiple air-conditioning system
2	housing
2A	heat exchanger room
2B	machine room
3	heat exchanger
5	cooling fan
7A, 7B, 7C	electronic substrate (7B: inverter substrate)
8, 8A, 8B	compressor
10L, 10R	optional component installation space
12	central support member (reinforcement member)
14	substrate holder
15	hinge
H1, H2	heights of heat exchanger room and heat exchanger

Claims

1. An outdoor unit of a multiple air-conditioning system (1, 21), the outdoor unit comprising:

a housing (2) partitioned into a heat exchanger room (2A) in an upper part and a machine room (2B) in a lower part;
a heat exchanger (3) installed along a peripheral surface of the heat exchanger room (2A);
a cooling fan (5) installed on an upper surface of the housing (2);
a plurality of electronic substrates (7A, 7B, 7C) arranged in a plane along a front opening of the machine room (2B) ;
a refrigerant compressor (8, 8A, 8B) installed beside the electronic substrates in the machine room (2B) at a position closer to the front opening; and
an optional component installation space (10L, 10B) provided behind the electronic substrates (7A, 7B, 7C) and the compressor (8, 8A, 8B) to house therein a group of less frequently maintained components.

2. The outdoor unit of a multiple air-conditioning system (1, 21) according to claim 1, wherein the plurality of electronic substrates (7A, 7B, 7C) are attached to one substrate holder (14), and at least part of the weight of the substrate holder (14) is supported by a reinforcement member (12) provided across the front opening of the machine room (2B).

3. The outdoor unit of a multiple air-conditioning system (1, 21) according to claim 1 or 2, wherein an inverter substrate (7B) included in the plurality of electronic substrates is arranged closer to the compressor (8, 8A, 8B).

4. The outdoor unit of a multiple air-conditioning system (1, 21) according to claim 2 or 3, wherein the substrate holder (14) is rotatable toward outside of the machine room (2B) by using the reinforcement member (12) extending in a vertical direction as a rotation support member.

5. The outdoor unit of a multiple air-conditioning system (1, 21) according to any one of claims 1 to 4, wherein the heat exchanger room (2A) is provided with the heat exchanger (3) and the cooling fan (5) only.

6. The outdoor unit of a multiple air-conditioning system (1, 21) according to any one of claims 1 to 5, wherein the heat exchanger room (2A) is separable from the machine room (2B) and replaceable with a heat exchanger room (2A) having a different height, and the heat exchanger (3) is replaceable with a heat exchanger (3) having a different height.

FIG. 1

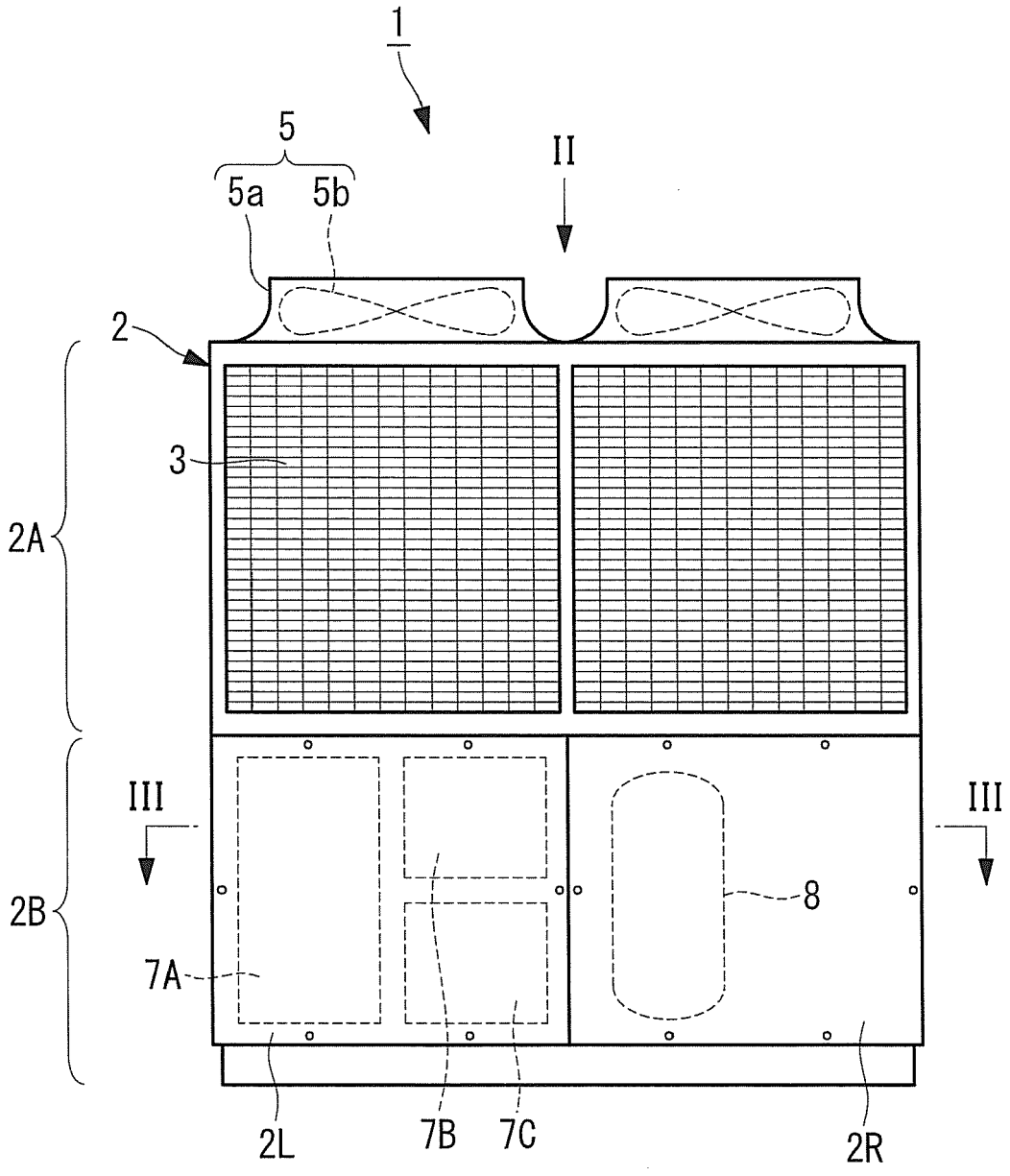


FIG. 2

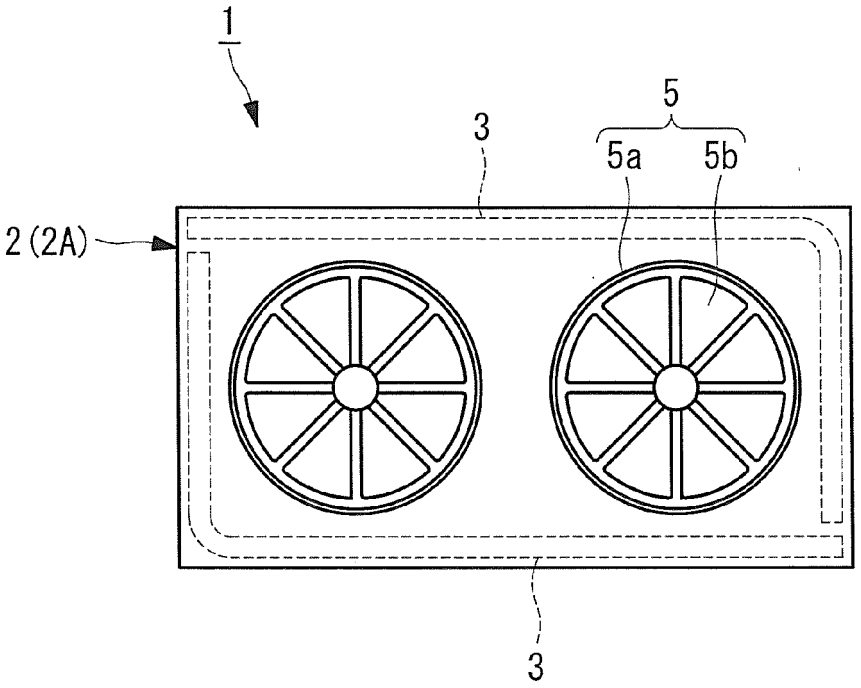


FIG. 3

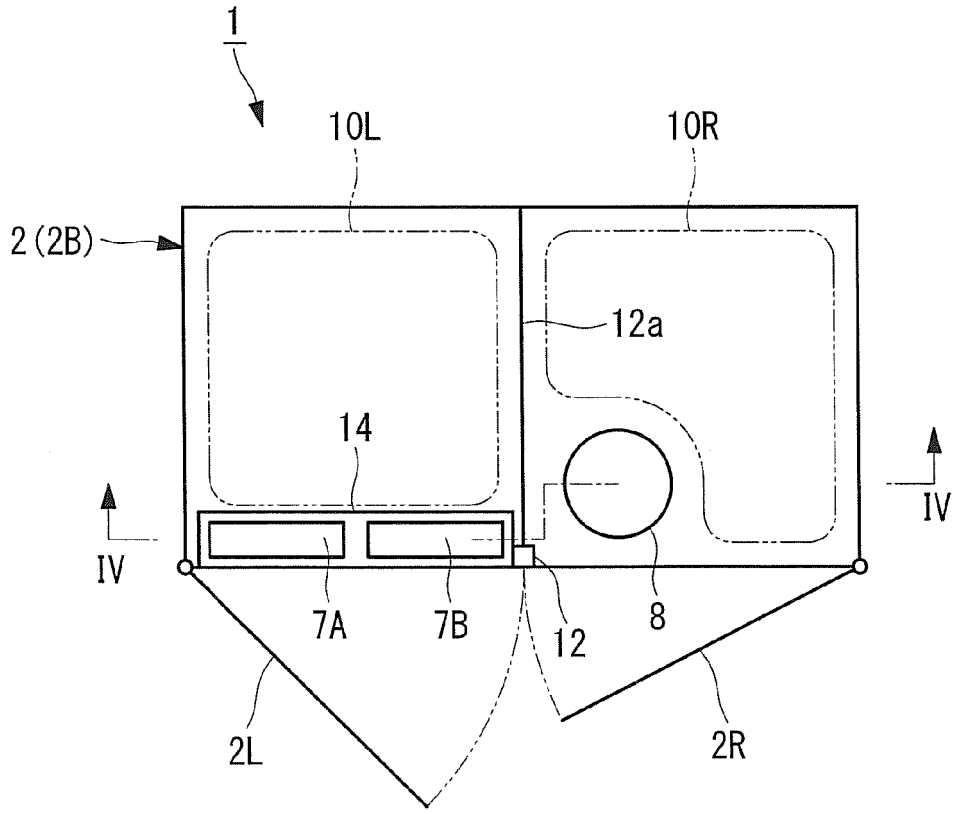


FIG. 4

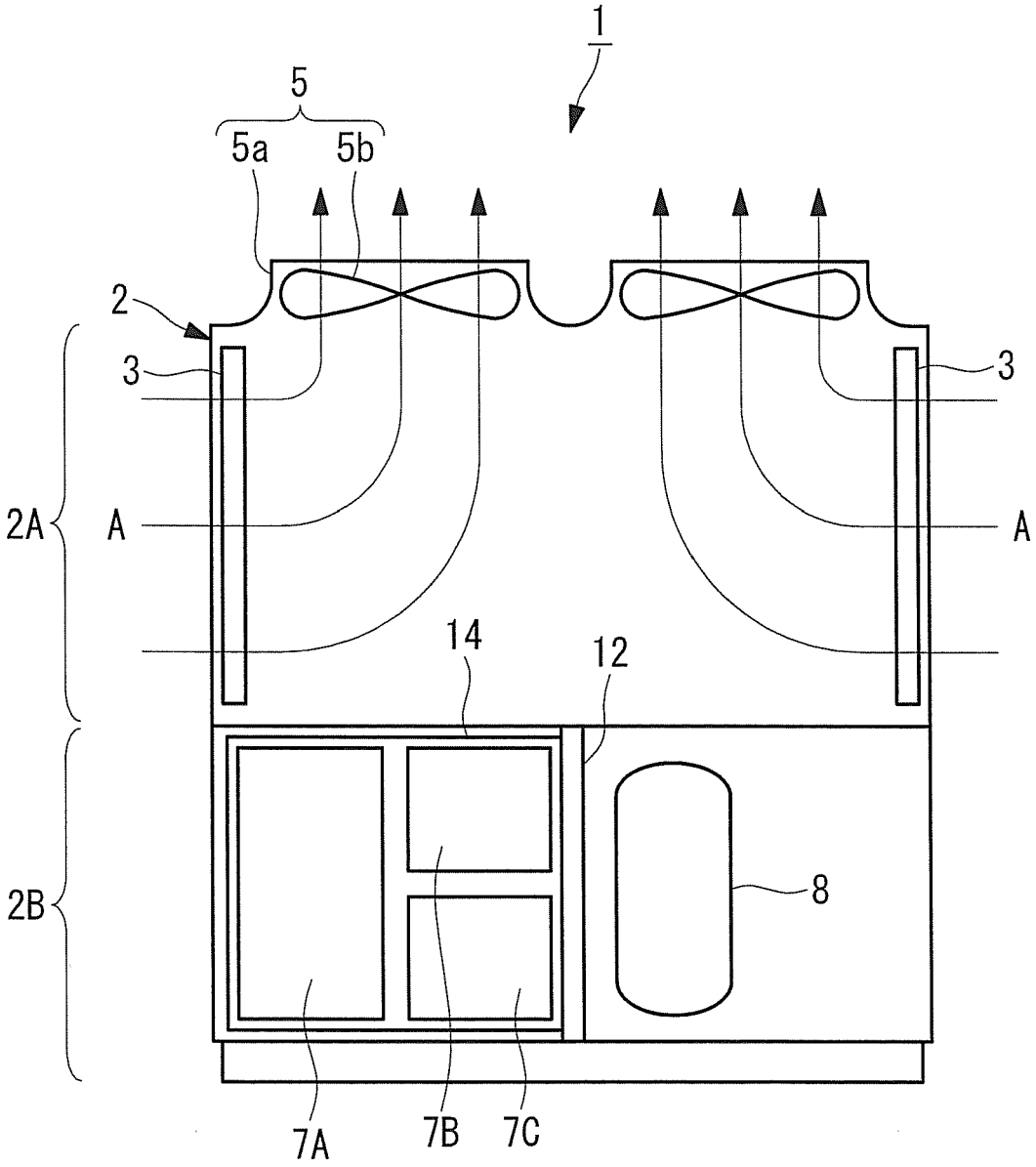


FIG. 5

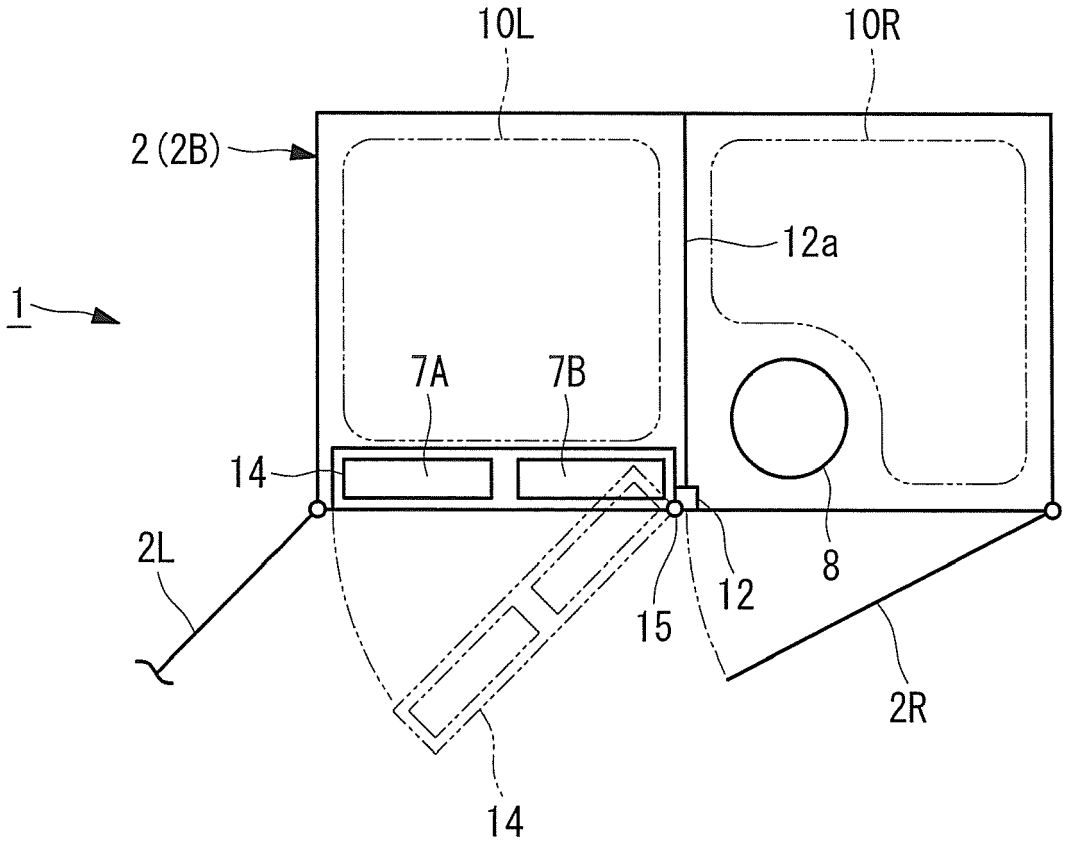


FIG. 6

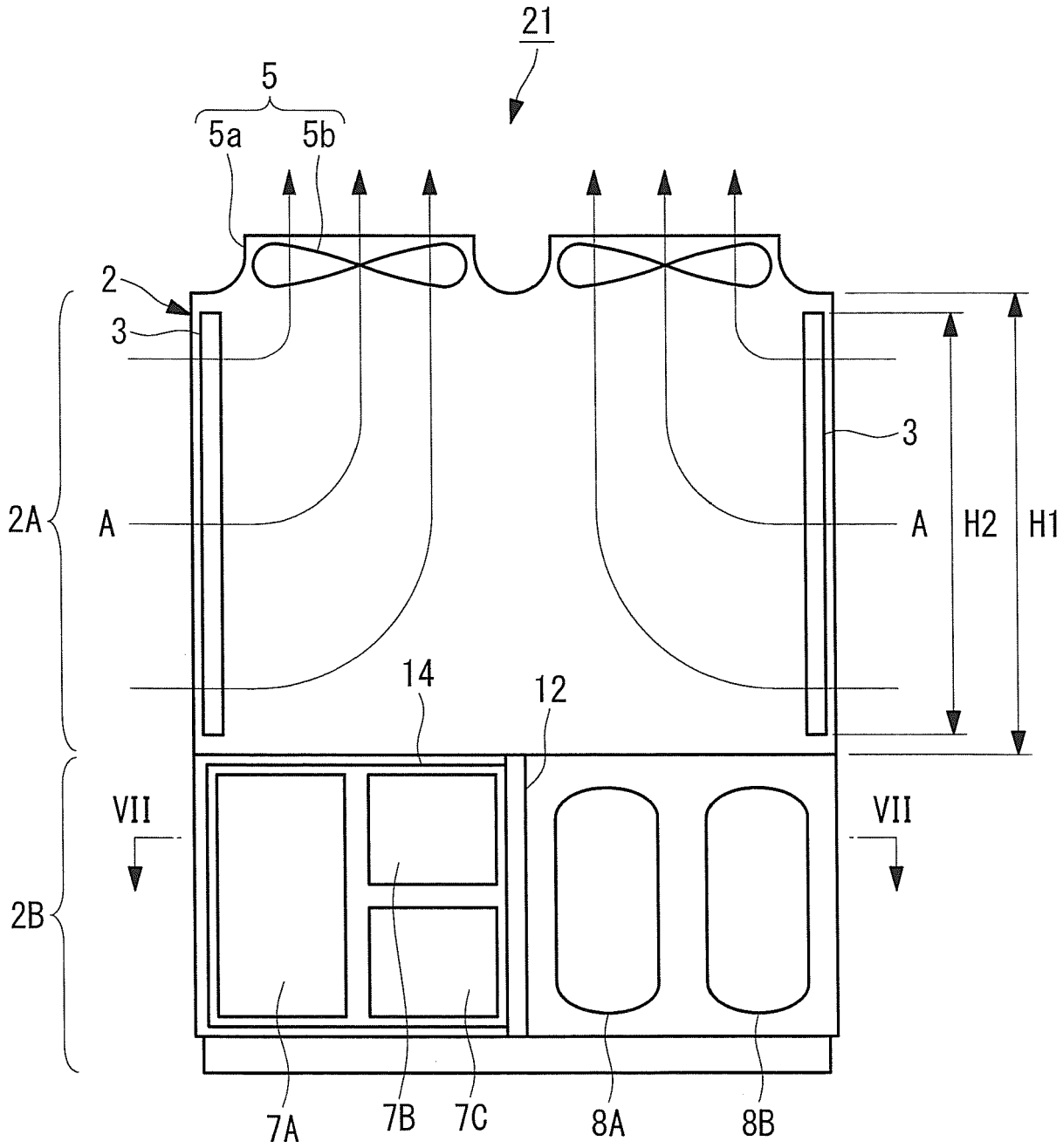
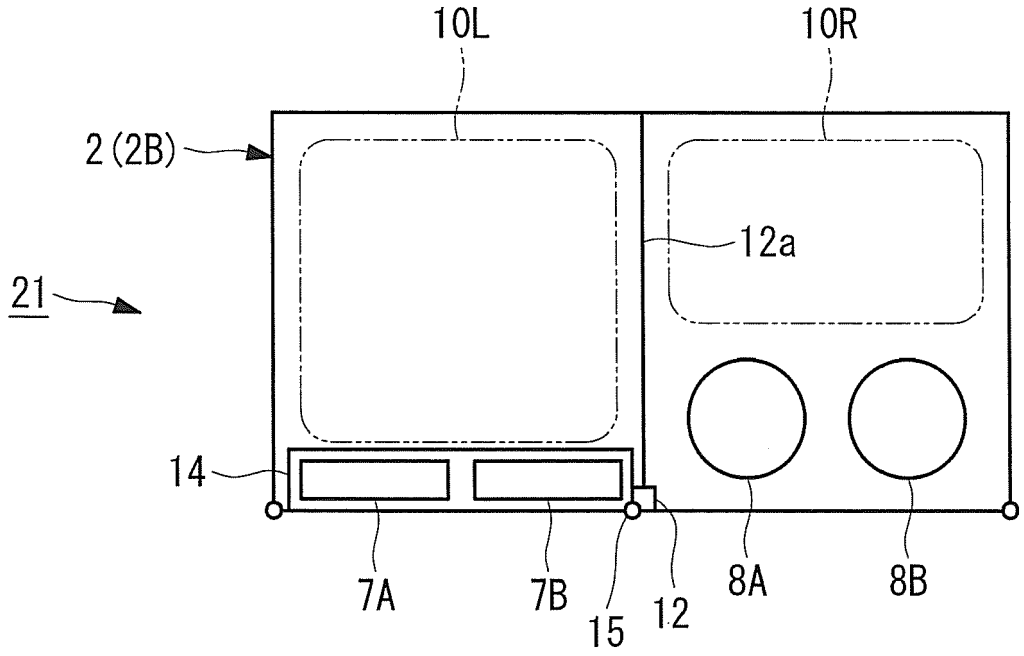


FIG. 7



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EUROPEAN SEARCH REPORT

Application Number
EP 16 20 2014

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	JP 2005 098625 A (TOSHIBA CARRIER KK) 14 April 2005 (2005-04-14) * paragraph [0045]; claim 1; figures 1,2,5 *	1-6	INV. F24F13/20 F24F1/10 F24F1/16 F24F1/22
X	JP 2009 068750 A (SANYO ELECTRIC CO) 2 April 2009 (2009-04-02)	1-3,5,6	F24F1/46
Y	* paragraphs [0004], [0013], [0017], [0018]; figures 2,3 *	4	
Y	JP 2012 215305 A (MITSUBISHI ELECTRIC CORP) 8 November 2012 (2012-11-08) * paragraph [0004]; figure 3 *	4	
Y	JP 2010 121859 A (FUJITSU GENERAL LTD) 3 June 2010 (2010-06-03) * paragraph [0012]; figures 1,7,8 *	4	

TECHNICAL FIELDS SEARCHED (IPC)

F24F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	2 May 2017	Degen, Marcello

CATEGORY OF CITED DOCUMENTS

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EPO FORM 1503 03.82 (P04C01)

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02-05-2017

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2005098625 A	14-04-2005	JP 4373167 B2	25-11-2009
		JP 2005098625 A	14-04-2005
JP 2009068750 A	02-04-2009	JP 5097487 B2	12-12-2012
		JP 2009068750 A	02-04-2009
JP 2012215305 A	08-11-2012	JP 5669650 B2	12-02-2015
		JP 2012215305 A	08-11-2012
JP 2010121859 A	03-06-2010	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2005127578 A **[0002] [0005]**