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(54) **OUTDOOR UNIT**

(57) Provided is an outdoor unit which is capable of improving air blowing characteristics without increasing the number of components, by increasing the dimension of a bell mouth in the axial direction. This outdoor unit is provided with: a body; a top plate (5) which covers the upper surface of the body, and which is made of sheet metal; a blower which is provided with a fan motor (22), and which is supported on the top plate (5); and a resin

bell mouth (4) which covers the circumference of the blower in a concentric manner. A motor base part of the fan motor (22) is directly affixed to the top plate (5). The center of a fan (21) is affixed to a rotating shaft (22a) of the fan motor (22). The whole of the fan (21) is positioned on the upper surface side of the top plate (5). The bell mouth (4) covers the circumference of the whole fan (21) in the axial direction.

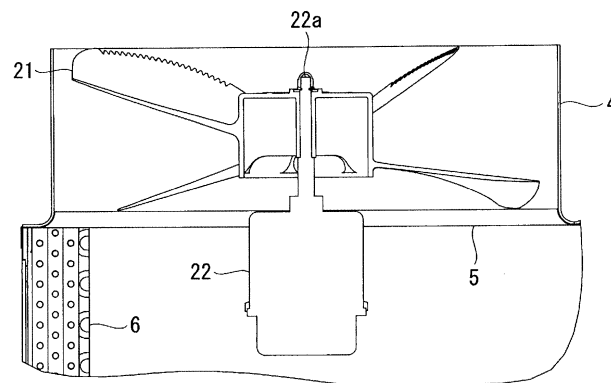


FIG. 4

Description

Technical Field

[0001] The present invention relates to an outdoor unit of an air conditioner.

Background Art

[0002] Outdoor units of air conditioners have conventionally been equipped with bell mouths to improve air blowing characteristics. The bell mouths are made of sheet metal or resin. A bell mouth made of sheet metal is formed through drawing of sheet metal, and it is thus difficult to produce a bell mouth of large dimension in the axial direction of rotation of a fan without causing cracking. On the other hand, a bell mouth made of resin requires a reinforcing frame, and the number of components is thus increased.

[0003] To improve performance of an outdoor unit and reduce cost, methods to change the configuration of a bell mouth are known (see PTLs 1 and 2).

[0004] PTL 1 discloses a configuration in which a bell mouth made of synthetic resin includes a fan ring disposed on the outer circumferential side of a fan and a skirt formed at the bottom edge of the fan ring and in which the fan ring is higher than the fan in the axial direction, thereby improving air blowing characteristics.

[0005] PTL 2 discloses a configuration in which a bell mouth and a motor base part of a motor for driving a blower are formed in an integrated manner, thereby reducing the number of components.

Citation List

Patent Documents

[0006]

PTL 1: JP 2010-127594 A

PTL 2: JP H10-300130 A

Summary of Invention

Problem to be Solved by the Invention

[0007] Unfortunately, the bell mouth disclosed in PTL 1 above is made of synthetic resin, and a motor base part is thus supported by a frame. This creates a problem of increasing the number of components.

[0008] The bell mouth disclosed in PTL 2 above is formed through deep drawing of a side plate made of sheet metal and cannot thus have a large dimension in the axial direction, creating a problem of a disadvantage in air blowing characteristics.

[0009] As described above, the bell mouth disclosed in each of PTLs above cannot have a large dimension in the axial direction while preventing an increase in the

number of components.

[0010] In light of the foregoing, an object of the present invention is to provide a configuration of an outdoor unit capable of improving air blowing characteristics without increasing the number of components, by increasing the dimension of a bell mouth in the axial direction.

Solution to Problem

[0011] An outdoor unit of the present invention employs the following solutions to solve the problems described above.

[0012] That is, an outdoor unit according to an aspect of the present invention includes: a blower including a fan and a fan motor driving the fan; a bell mouth connected with the blower and made of resin; and a top plate supporting the blower and made of sheet metal.

[0013] The top plate made of sheet metal has a strength higher than a resin top plate. Accordingly, the top plate made of sheet metal can prevent an increase in the number of components such as a reinforcing frame. Furthermore, the resin bell mouth allows a forming method that makes it difficult to cause cracking even in manufacturing bell mouths of large dimension in the axial direction to be employed. By using the bell mouth of large dimension in the axial direction, the air blowing characteristics of the outdoor unit are improved.

[0014] By combining the top plate made of sheet metal and the bell mouth made of resin, the outdoor unit can be configured to have both of the above-described advantages.

[0015] Note that a bell mouth formed to be integrated with a fan guard may be used.

[0016] In an outdoor unit according to an aspect of the present invention, a motor base part that supports the fan motor is affixed directly to the top plate.

[0017] The motor base part of the fan motor is affixed directly to the metal top plate, so that no reinforcing frame for supporting the motor base part is required to be mounted, resulting in reduction in the number of components.

[0018] In an outdoor unit according to an aspect of the present invention, the whole fan is positioned on an upper surface side of the top plate.

[0019] The whole fan is positioned on the upper surface side of the top plate, so that the fan and a heat exchanger are mounted in different places. This configuration can increase the outer diameter of the fan with no limitations imposed by the heat exchanger on the upper surface of the top plate, and can leave a large space for mounting the heat exchanger below the top plate.

[0020] Furthermore, the whole fan can be housed in the bell mouth, and the air blowing characteristics are thus improved.

[0021] In an outdoor unit according to an aspect of the present invention, the top plate includes a tapered portion rising on an inner side of the bell mouth and overlapping with the bell mouth; the tapered portion is constituted by

a curved surface having a gradually decreasing inner diameter; and a tip portion is formed at a tip end of the tapered portion and is connected from below the bell mouth.

[0022] The top plate includes the tapered portion rising on the inner side of the bell mouth, so that the secondary moment of a cross-sectional area of the top plate at a portion supporting the bell mouth is greater than a case of a flat top plate. Accordingly, the top plate has increased strength for the bending moment at the portion supporting the bell mouth.

[0023] Furthermore, the tapered portion is constituted by a curved surface having a gradually decreasing inner diameter and can thus be connected with the bell mouth without making the air flow turbulent. On the other hand, in a range in which the tapered portion overlaps with the bell mouth, the bell mouth does not come into contact with the air flow, so that no limitation on the shape of the bell mouth is required.

[0024] In an outdoor unit according to an aspect of the present invention, the top plate and the bell mouth include inner surfaces coming into contact with each other and continuously connected.

[0025] The top plate and the bell mouth have such inner surfaces coming into contact with each other as to be continuously connected, so that the inner surfaces provide a smooth flow path, resulting in suppression of loss of the air flow.

[0026] In an outdoor unit according to an aspect of the present invention, the bell mouth includes a notch portion disposed at a portion connected with the tip portion, the notch portion having a shape in conformance to a shape of the tip portion.

[0027] The bell mouth includes the notch portion that is disposed at the portion connected with the tip portion of the top plate and that has a shape in conformance to the shape of the tip portion, so that the bell mouth can be readily positioned in assembling. Furthermore, the bell mouth and the top plate can be readily connected with each other with the inner surfaces continuous.

[0028] In an outdoor unit according to an aspect of the present invention, the outdoor unit includes a fixing part disposed on a horizontal surface of the top plate and connecting the top plate with the bell mouth; the top plate is connected with the bell mouth by using the fixing part and the tip portion; an overlapping portion is formed between the fixing part and the tip portion, the bell mouth and the tapered portion overlapping with each other at the overlapping portion; and the overlapping portion includes a gap defined between the top plate and the bell mouth.

[0029] With the configuration in which the fixing part is provided that is disposed on the horizontal surface of the top plate and that connects the top plate with the bell mouth, in which the top plate is connected with the bell mouth by using the fixing part and the tip portion, in which the overlapping portion is formed between the fixing part and the tip portion where the bell mouth and the tapered

portion overlapping with each other, and in which the overlapping portion includes the gap defined between the top plate and the bell mouth, even if moisture enters a space between the top plate and the bell mouth, the moisture remains at the overlapping portion in a sufficiently small amount in comparison to the volume of the gap. This reduces a risk of damage on the bell mouth if the moisture freezes.

[0030] In an outdoor unit according to an aspect of the present invention, the fixing part includes a plurality of fixing parts; and a communicating gap is defined between the fixing parts adjacent to each other and between the top plate and the bell mouth, and communicates with the gap.

[0031] The fixing part includes the plural fixing parts, and the communicating gap is defined between the fixing parts adjacent to each other and between the top plate and the bell mouth, and communicates with the gap of the overlapping portion. This configuration allows water discharged from the gap of the overlapping portion to be guided through the communicating gap to the outside of the bell mouth. This can further reduce a risk of damage on the bell mouth when the moisture freezes.

Advantageous Effect of Invention

[0032] The air blowing characteristics can be improved without increasing the number of components, by increasing the dimension of the bell mouth in the axial direction.

Brief Description of Drawings

[0033]

FIG. 1 is a perspective view of an outdoor unit according to an embodiment of the present invention. FIG. 2 is a perspective view of a blower used in the outdoor unit in FIG. 1.

FIG. 3 is a side view of the blower used in the outdoor unit in FIG. 1.

FIG. 4 is a vertical cross-sectional view of the blower used in the outdoor unit in FIG. 1.

FIG. 5 is a top view of a top plate used in the outdoor unit in FIG. 1.

FIG. 6 is a side view of the top plate used in the outdoor unit in FIG. 1.

FIG. 7A is a cross-sectional view of a tapered portion and its vicinity, taken along the line A-A in FIG. 2, and FIG. 7B is a partially enlarged vertical cross-sectional view of a fixing part and its vicinity in the vicinity of the tapered portion.

FIG. 8 is a cross-sectional view of a fixing part of an outdoor unit according to a modified example.

Description of Embodiments

[0034] An embodiment of an outdoor unit according to

the present invention will be described below with reference to the drawings.

[0035] FIG. 1 illustrates the embodiment of the present invention.

[0036] As illustrated in the same drawing, an outdoor unit 1 of the present embodiment includes a body 11, a top plate 5 covering the upper surface of the body 11 and made of sheet metal, a blower 2 supported on the top plate 5, and bell mouths 4 made of resin. The outdoor unit 1 is connected with an indoor unit (not illustrated) via refrigerant piping (not illustrated).

[0037] In the body 11, a heat exchanger, a fan motor, a control box, and the like are disposed.

[0038] As illustrated in FIG. 2, two bell mouths 4 are disposed on the top plate 5, and a fan 21 is housed in each of the bell mouths 4. Note that the number of the bell mouths 4 is two in the present embodiment but may be one or three or more.

[0039] As illustrated in FIG. 3, the blower 2 includes fan motors 22 driving the fans 21. The fan motors 22 are each supported by a motor base part 7. The motor base part 7 includes legs 7a each composed of a rod-like member bent to substantially have an L shape. One end of each of the legs 7a is affixed to the top plate 5, and the other end of the leg 7a is affixed to the fan motor 22 side. That is, the fan motor 22 is affixed directly to the top plate 5 via the motor base part 7.

[0040] As illustrated in FIG. 4, a rotating shaft 22a of the fan motor 22 extends in the vertical direction. The rotating shaft 22a is fitted at the rotation center of the fan 21. The whole fan 21 is positioned on the upper surface side of the top plate 5, and the bell mouth 4 covers the circumference of the whole fan 21 in the axial direction of rotation. By operating the blower 2, air passing through a heat exchanger 6 in the outdoor unit 1 is discharged upward from the blower 2.

[0041] As illustrated in FIG. 5 and FIG. 6, the top plate 5 has circular holes for placing the blower 2, and a tapered portion 5a protruding upward is formed along the edge of each of the holes.

[0042] FIGS. 7A and 7B illustrate a portion where the bell mouth 4 and the top plate 5 are connected with each other.

[0043] As illustrated in FIG. 7A, the top plate 5 includes the tapered portion 5a rising on the inner side of the bell mouth 4 and overlapping with the bell mouth 4. The tapered portion 5a is constituted by a curved surface having an inner diameter gradually decreasing in the axial direction (the upward direction in the same drawing).

[0044] In the inner circumferential surface of the bell mouth 4, a notch portion 4b is formed having a shape in conformance to the shape of a tip portion 5b positioned at the tip end of the tapered portion 5a. By fitting the tip portion 5b to the notch portion 4b, the tapered portion 5a is connected to a lower portion of the bell mouth 4 at a certain position. In this connection position, the bell mouth 4 and the top plate 5 have inner surfaces that come into contact with air flow generated by the blower

2 and that are formed into a continuously connected shape.

[0045] As a region inclined from the vicinity of the notch portion 4b toward the vicinity of a fixing part 8, an overlapping portion 4a is formed so that the bell mouth 4 and the tapered portion 5a overlap each other.

[0046] As illustrated in FIG. 7B, the bell mouth 4 and the top plate 5 are connected with each other by using the fixing part 8 disposed on a horizontal surface positioned on the outer circumferential side of the tapered portion 5a. At the fixing part 8, the top plate 5 rises in a convex manner on the bell mouth side to form a top plate fixing portion 5c, and a bell mouth fixing portion 4c and the top plate fixing portion 5c are affixed by using a fixing bolt 8a.

[0047] At the overlapping portion 4a, a gap 9 is defined between the bell mouth 4 and the top plate 5. This gap 9 has such a size that, even if moisture in the atmosphere condenses and accumulates as drained water, and if the drained water freezes and expands its volume, the drained water does not cause deformation of the bell mouth 4.

[0048] Furthermore, between adjacent fixing parts 8 (see FIG. 2), a communicating gap is defined in some position in the circumferential direction of the outer circumference of the bell mouth 4. The communicating gap allows communication between the gap 9 and the outside on the outer circumferential side of the bell mouth 4.

[0049] The outdoor unit 1 having the above-described configuration operates in the following manner.

[0050] The fan motors 22 rotate the fans 21, and air thus flows into the body 11 from the outside of the outdoor unit 1. The air flowing into the body 11 passes through the heat exchanger 6, so that heat exchange is performed between the air and a refrigerant flowing in a heat transfer pipe of the heat exchanger 6. The air after the heat exchange moves to the fans 21 positioned above and is discharged from an upper portion of the outdoor unit 1 to the outside while being regulated by the bell mouths 4.

[0051] According to this embodiment, the following advantageous effects are achieved.

[0052] The top plate 5 is made of sheet metal and thus has strength higher than a resin top plate. Accordingly, an increase in the number of components such as a reinforcing frame can be prevented.

[0053] Furthermore, the bell mouths 4 are made of resin, so that a forming method that is difficult to cause a crack even in manufacturing bell mouths of large dimension in the axial direction can be employed. By using the bell mouths 4 of large dimension in the axial direction, the air blowing characteristics of the blower 2 are improved.

[0054] The motor base parts 7 of the fan motors 22 are affixed directly to the metal top plate 5, so that no reinforcing frame for supporting the motor base parts 7 is required to be mounted, resulting in reduction in the number of components.

[0055] The whole of each of the fans 21 is positioned

on the upper surface side of the top plate 5, so that the fan 21 and the heat exchanger 6 are mounted in different places. This configuration can increase the outer diameter of the fan 21 with no limitations imposed by the heat exchanger 6 on the upper surface of the top plate 5, and can leave a large space for mounting the heat exchanger 6 below the top plate 5.

[0056] Furthermore, the whole fan 21 can be housed in the bell mouth 4, and the air blowing characteristics are thus improved.

[0057] The top plate 5 includes the tapered portions 5a rising on the inner sides of the bell mouths 4, so that the secondary moment of a cross-sectional area of the top plate 5 at portions supporting the bell mouths 4 is greater than a case of a flat top plate. Accordingly, the top plate 5 has increased strength for the bending moment at the portions supporting the bell mouths 4.

[0058] Furthermore, the tapered portions 5a are each constituted by a curved surface having an inner diameter gradually decreasing in the axial direction and can thus be connected with the bell mouths 4 without making the air flow turbulent. On the other hand, at the overlapping portions 4a at which the bell mouths 4 overlap with the tapered portions 5a, the bell mouths 4 do not come into contact with the air flow, so that no limitation on the shape of the bell mouths 4 is required.

[0059] The top plate 5 and the bell mouth 4 have such inner surfaces coming into contact with each other as to be continuously connected, so that the inner surfaces provide a smooth flow path, resulting in suppression of loss of the air flow.

[0060] The bell mouths 4 each include the notch portion 4b that is disposed at a portion connected with the tip portion 5b of the top plate 5 and that has a shape in conformance to the shape of the tip portion 5b, so that the bell mouth 4 can be readily positioned in assembling. Furthermore, the bell mouth 4 and the top plate 5 can be readily connected with each other with the inner surfaces continuous.

[0061] The top plate 5 and the bell mouth 4 come into contact with each other only at the fixing part 8 (the top plate fixing portion 5c and the bell mouth fixing portion 4c) and an inner surface connection portion (the tip portion 5b and the notch portion 4b), and the gap 9 is left at the overlapping portion 4a. With this configuration, even if moisture enters a space between the top plate 5 and the bell mouth 4, the moisture remains only in a sufficiently small amount in comparison to the volume of the gap 9, which reduces a risk of damage on the bell mouth 4 if the moisture freezes.

[0062] Note that the shape of the bell mouth 4 at the overlapping portion 4a may be modified as illustrated in FIG. 8. FIG. 8 is a partial cross-sectional view of a portion corresponding to FIG. 7A. As illustrated in FIG. 8, at the overlapping portion 4a, the bell mouth 4 extends to have a horizontal surface from the vicinity of the notch portion 4b to a space above the vicinity of the fixing part 8 and has a cylindrical curved surface formed vertically from

the space above the vicinity of the fixing part 8 to the vicinity of the fixing part 8. This configuration defines a gap 9 between the overlapping portion 4a and the tapered portion 5a.

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Reference Signs List

[0063]

- | | |
|----|------------------------------|
| 10 | 1 Outdoor unit |
| | 2 Blower |
| | 4 Bell mouth |
| | 4a Overlapping portion |
| | 4b Notch portion |
| 15 | 4c Bell mouth fixing portion |
| | 5 Top plate |
| | 5a Tapered portion |
| | 5b Tip portion |
| | 5c Top plate fixing portion |
| 20 | 6 Heat exchanger |
| | 7 Motor base part |
| | 7a Leg |
| | 8 Fixing part |
| | 8a Fixing bolt |
| 25 | 11 Body |
| | 21 Fan |
| | 22 Fan motor |
| | 22a Rotating shaft |

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Claims

1. An outdoor unit comprising:

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- a blower including a fan and a fan motor driving the fan;
- a bell mouth connected with the blower and made of resin; and
- a top plate supporting the blower and made of sheet metal.

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2. The outdoor unit according to claim 1, wherein a motor base part that supports the fan motor is affixed directly to the top plate.

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3. The outdoor unit according to claim 1 or 2, wherein the whole fan is positioned on an upper surface side of the top plate.

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4. The outdoor unit according to any one of claims 1 to 3, wherein:

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- the top plate includes a tapered portion rising on an inner side of the bell mouth and overlapping with the bell mouth;
- the tapered portion is constituted by a curved surface having a gradually decreasing inner diameter; and

a tip portion is formed at a tip end of the tapered portion and is connected from below the bell mouth.

5. The outdoor unit according to claim 4, wherein the top plate and the bell mouth include inner surfaces coming into contact with each other and continuously connected. 5

6. The outdoor unit according to claim 4 or 5, wherein the bell mouth includes a notch portion disposed at a portion connected with the tip portion, the notch portion having a shape in conformance to a shape of the tip portion. 10

7. The outdoor unit according to any one of claims 4 to 6, wherein: 15

the outdoor unit includes a fixing part disposed on a horizontal surface of the top plate and connecting the top plate with the bell mouth; 20
the top plate is connected with the bell mouth by using the fixing part and the tip portion;
an overlapping portion is formed between the fixing part and the tip portion, the bell mouth and the tapered portion overlapping with each other at the overlapping portion; and 25
the overlapping portion includes a gap defined between the top plate and the bell mouth.

8. The outdoor unit according to claim 7, wherein: 30

the fixing part includes a plurality of fixing parts; and
a communicating gap is defined between the fixing parts adjacent to each other and between the top plate and the bell mouth, and communicates with the gap. 35

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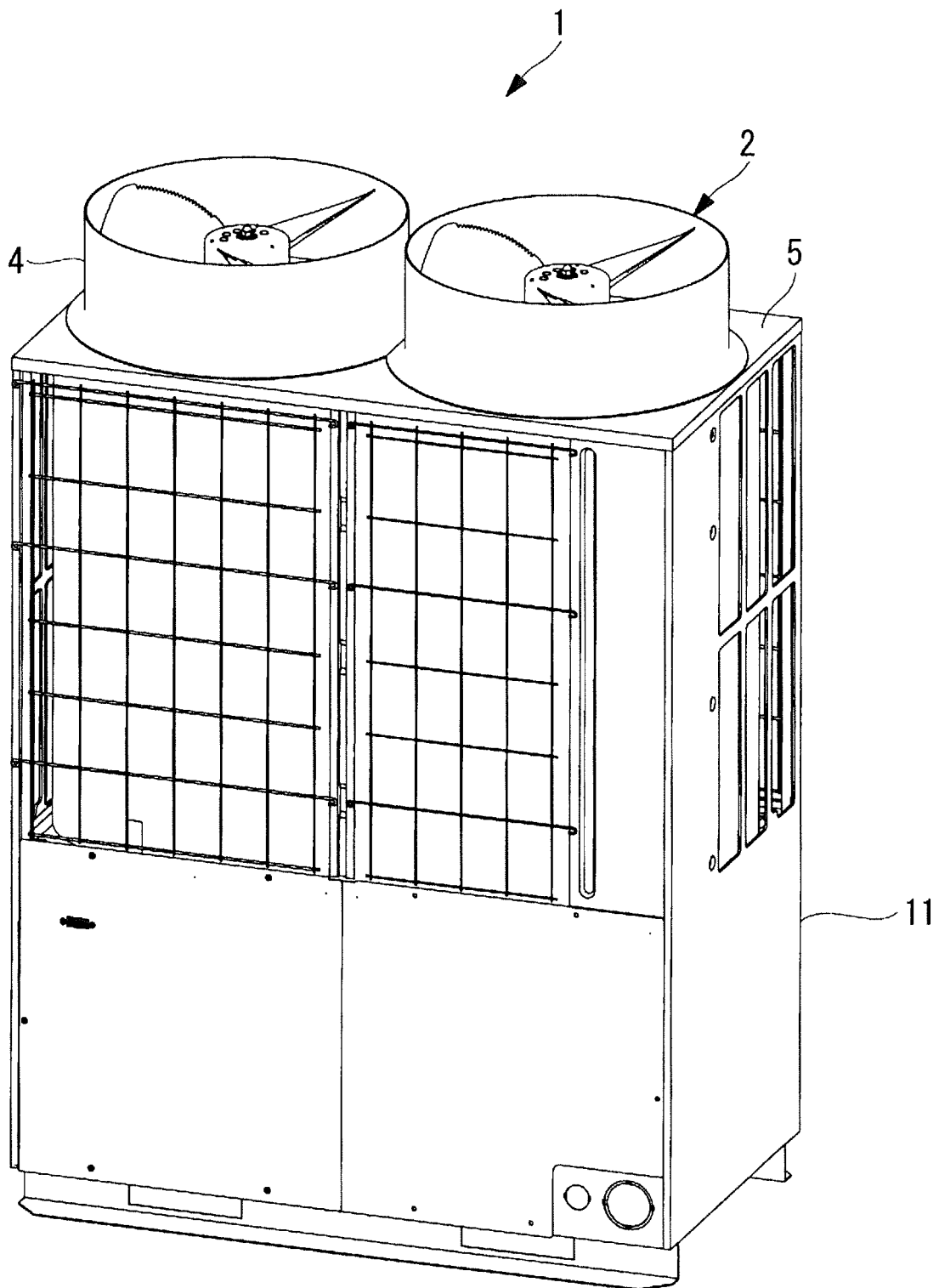


FIG. 1

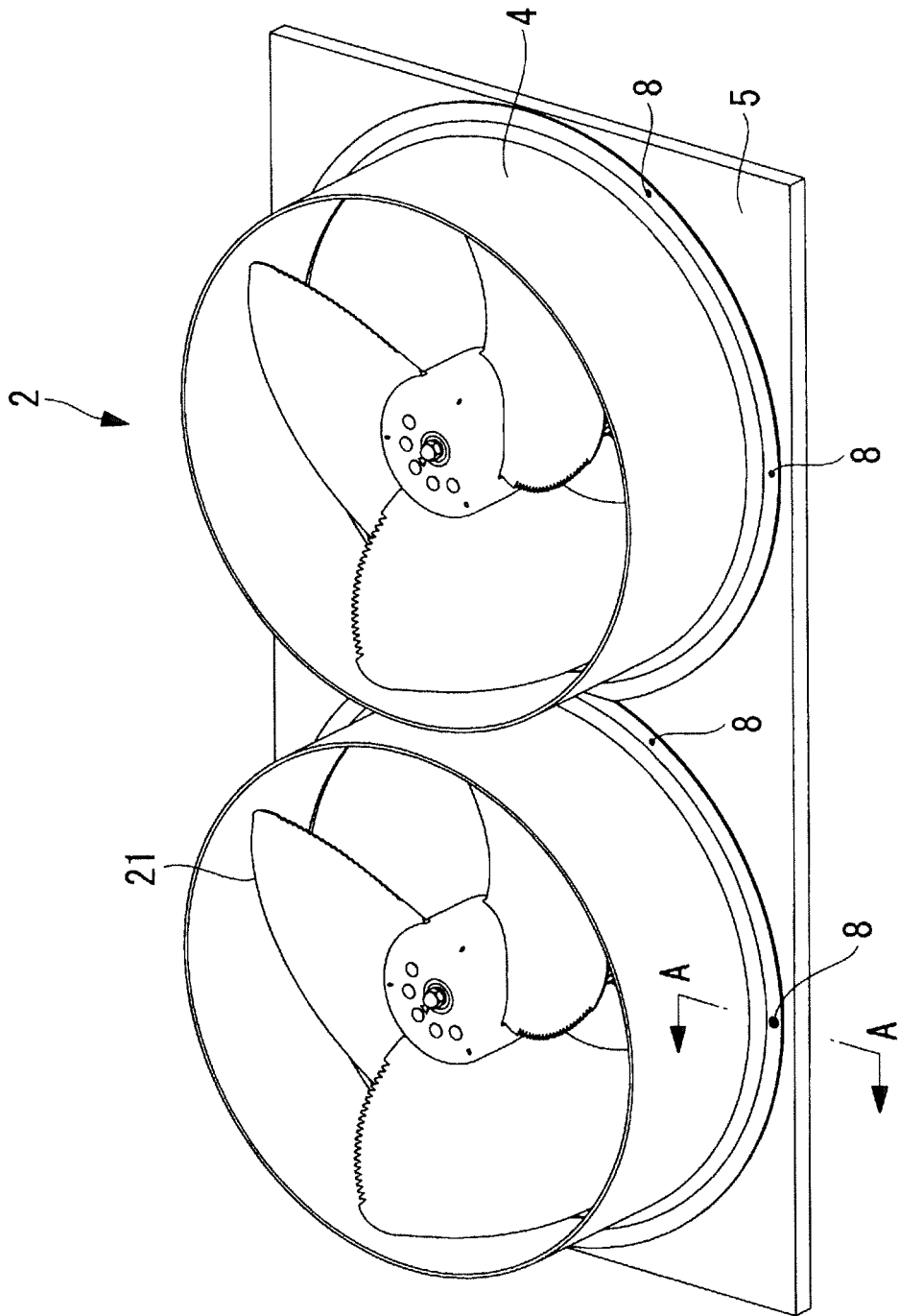


FIG. 2

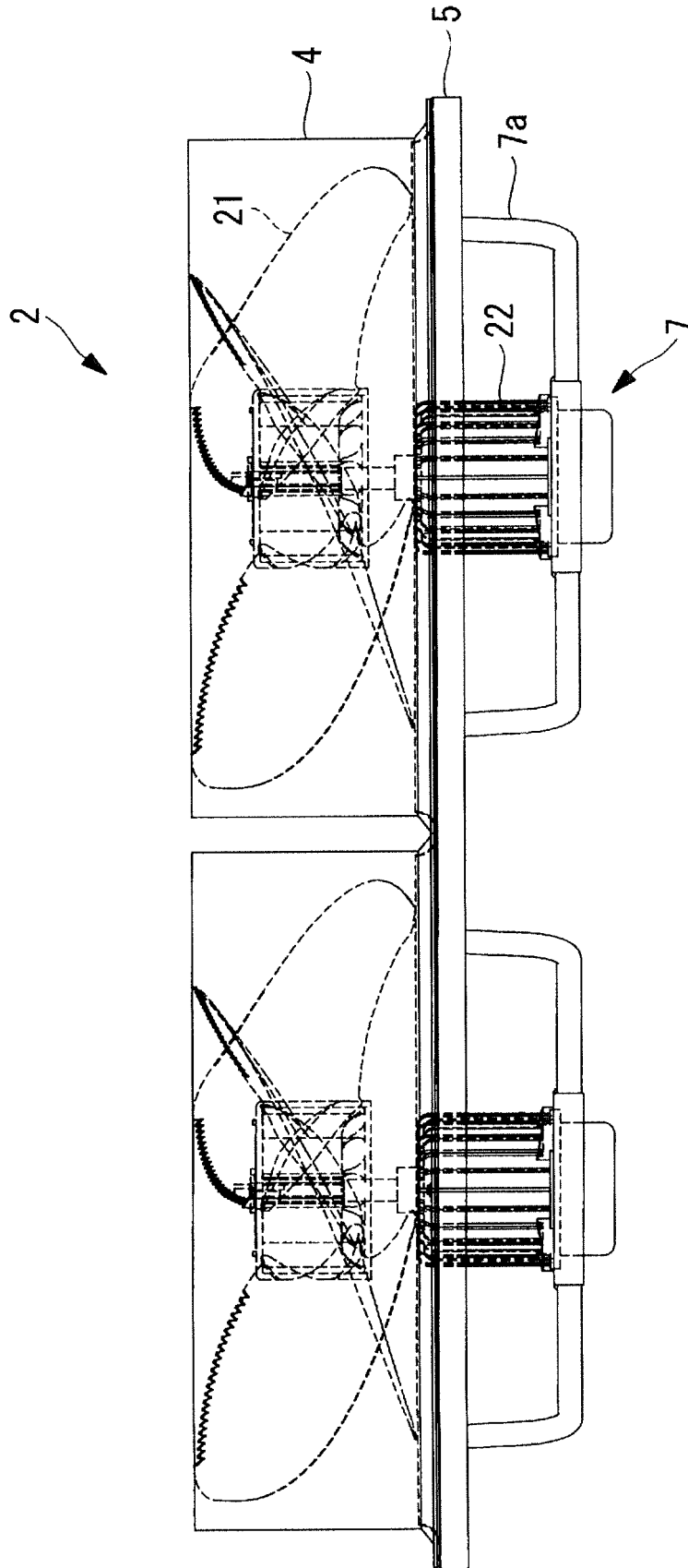


FIG. 3

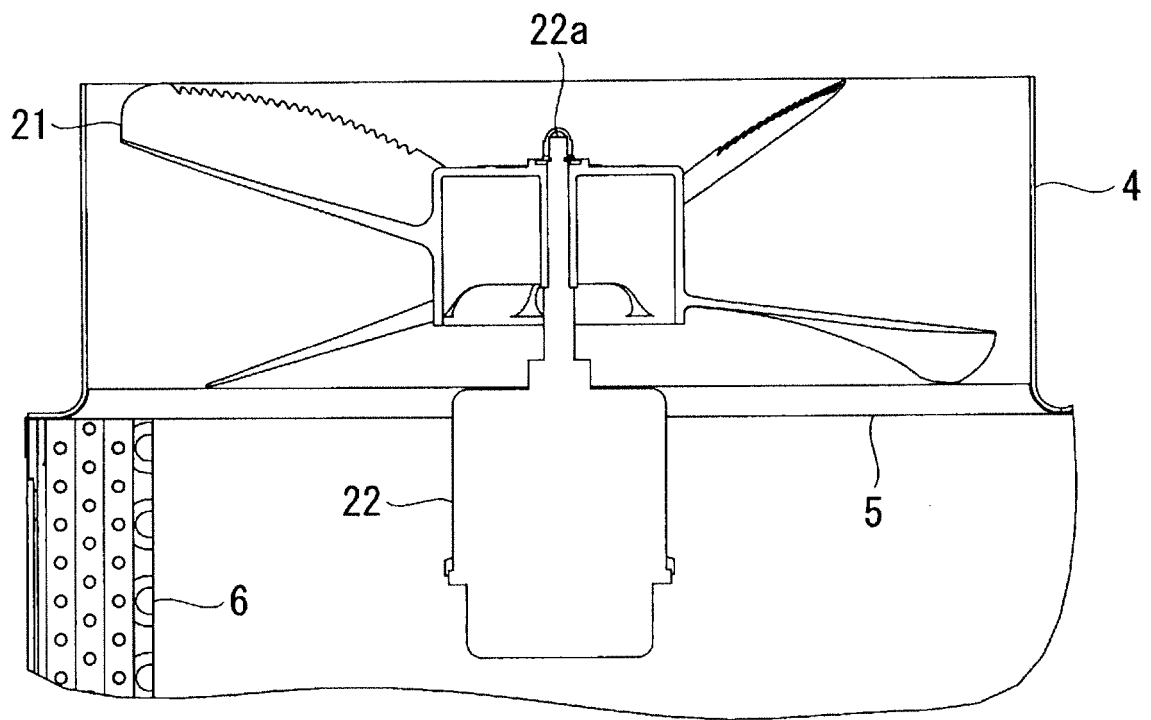


FIG. 4

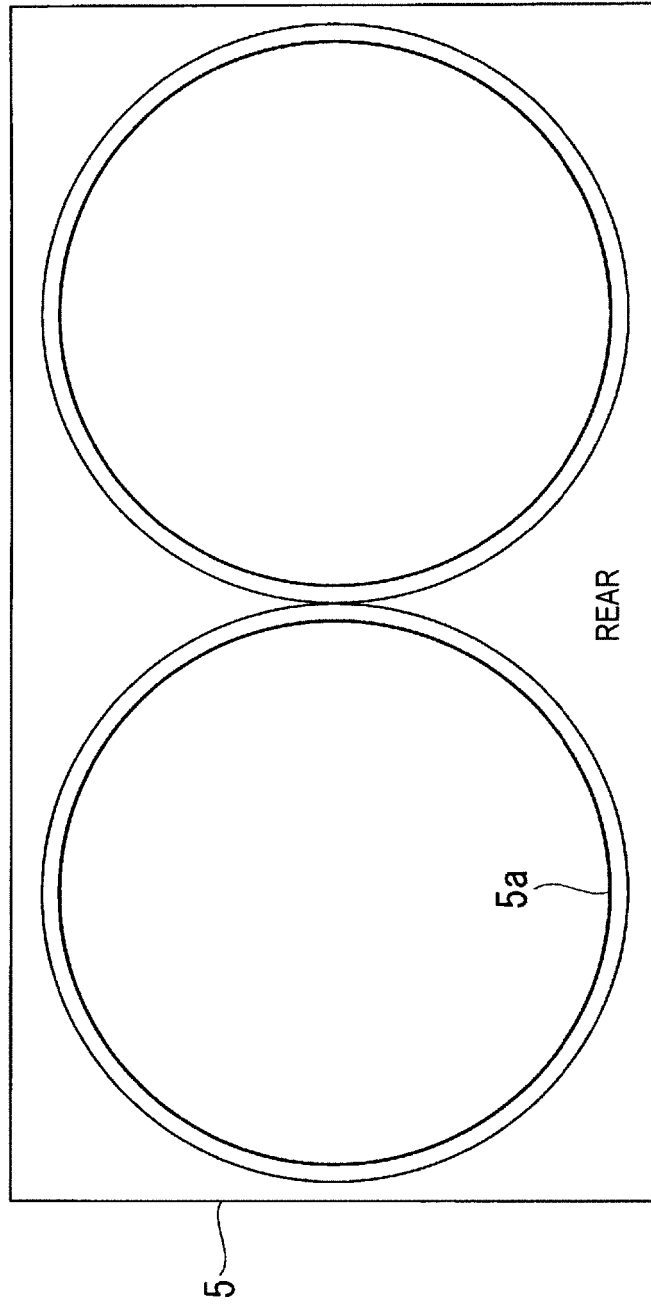


FIG. 5

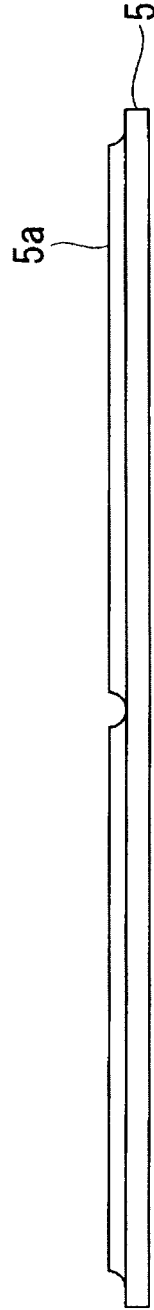


FIG. 6

FIG. 7A

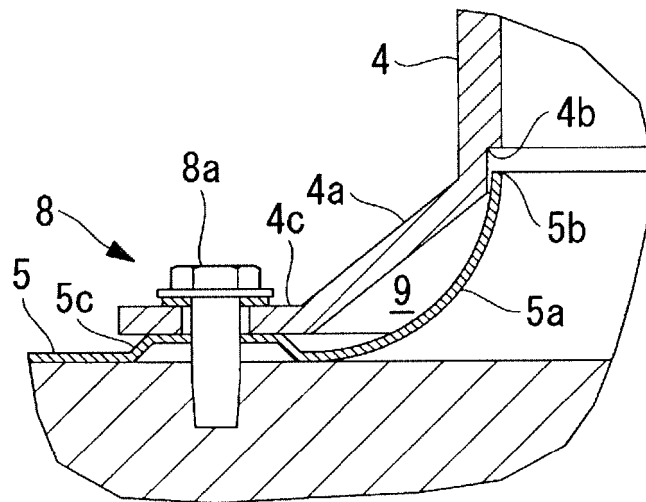
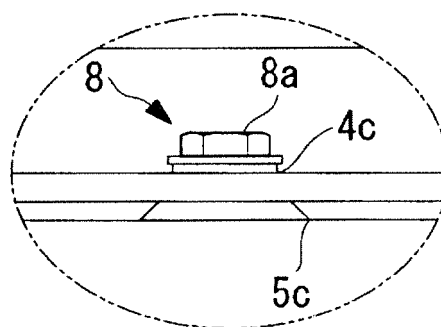


FIG. 7B



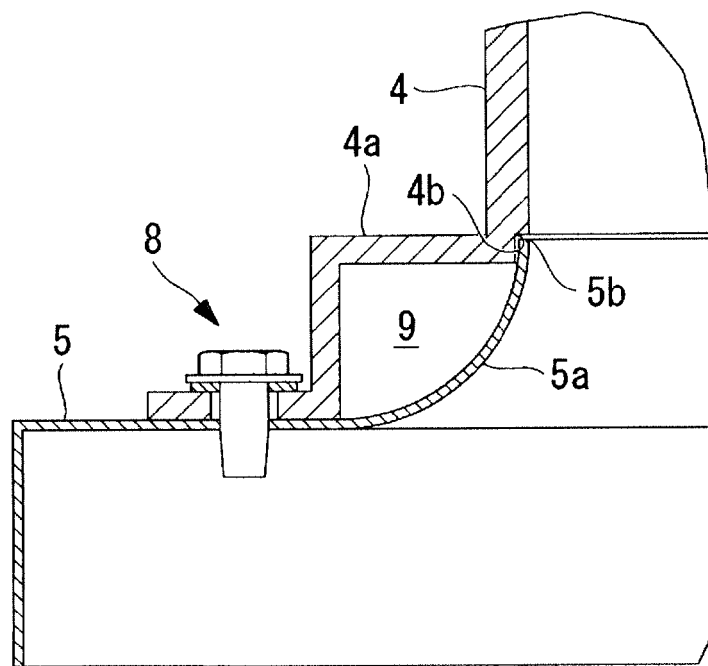


FIG. 8

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2018/008201

A. CLASSIFICATION OF SUBJECT MATTER

Int.Cl. F24F1/38 (2011.01) i, F04D29/54 (2006.01) i, F24F1/50 (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)

Int.Cl. F24F1/38, F04D29/54, F24F1/50

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Published examined utility model applications of Japan 1922-1996

Published unexamined utility model applications of Japan 1971-2018

Registered utility model specifications of Japan 1996-2018

Published registered utility model applications of Japan 1994-2018

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 2007-93048 A (HITACHI, LTD.) 12 April 2007, paragraphs [0001]-[0037], fig. 1-6 (Family: none)	1-3
A		4-8
Y	JP 2010-32138 A (HITACHI APPLIANCES, INC.) 12 February 2010, paragraphs [0023]-[0039], fig. 1-8 (Family: none)	1-3
A		4-8
A	JP 2017-57772 A (MITSUBISHI HEAVY INDUSTRIES, LTD.) 23 March 2017, paragraphs [0001]-[0032], fig. 1-5 (Family: none)	1-8
A	JP 2007-212045 A (DAIKIN INDUSTRIES, LTD.) 23 August 2007, paragraphs [0005]-[0007], [0011], [0052], [0071], fig. 1-9 (Family: none)	1-8
A	US 2009/0193831 A1 (KIM, Junghoon) 06 August 2009, paragraphs [0001]-[0052], fig. 1-11 & EP 2085709 A1 & KR 10-2009-0083737 A & CN 101498501 A	1-8
A	US 2010/0175407 A1 (LG ELECTRONICS INC.) 15 July 2010, paragraphs [0001]-[0057], fig. 1-6 & WO 2010/079911 A2 & EP 2206976 A2 & KR 10-2010-0082612 A & CN 102272532 A & ES 2616557 T	1-8

☐ 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
17 April 2018 (17.04.2018)Date of mailing of the international search report
01 May 2018 (01.05.2018)Name and mailing address of the ISA/
Japan Patent Office
3-4-3, Kasumigaseki, Chiyoda-ku,
Tokyo 100-8915, Japan

Authorized officer

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Patent documents cited in the description

- JP 2010127594 A [0006]
- JP H10300130 A [0006]