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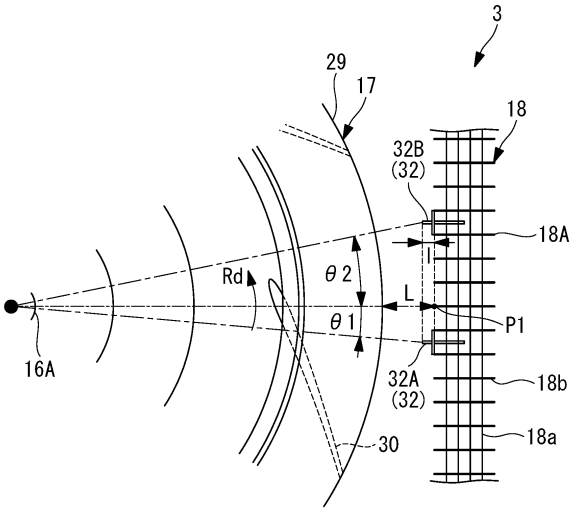
(54) **AIR CONDITIONER**

(57) To reduce blowing noise generated by blowing wind colliding against fins without significantly increasing a ventilation resistance. Provided is an air conditioner including: an indoor heat exchanger 18 that is disposed so as to surround an outer periphery of a turbofan 17; and a plurality of rectifying plates 32 that is attached to the indoor heat exchanger 18 on an inner peripheral side, in which the indoor heat exchanger 18 has a plurality of planar portions that is disposed along a plane that perpendicularly intersects a radial direction at a closest position P1 to the turbofan 17 and a plurality of curved portions that couples these planar portions, a first rectifying plate 32A is attached to the first planar portion 18A at a first predetermined position on an upstream side in a rotational direction Rd of the turbofan 17 beyond the closest position P1 while a second rectifying plate 32B is attached thereto at a second predetermined position on a downstream side in the rotational direction Rd of the turbofan 17 beyond the closest position P1, and the first rectifying plate 32A and the second rectifying plate 32B are disposed to be adjacent to each other.

FIG. 5



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Description

Technical Field

[0001] The present invention relates to an air conditioner provided with a plurality of rectifying plates attached to a heat exchanger on an inner peripheral side.

Background Art

[0002] In the related art, a ceiling buried-type air conditioner with a fin tube-shaped heat exchanger provided in the surroundings of a centrifugal fan is known (see PTL 1, for example).

[0003] The air conditioner disclosed in PTL 1 is adapted such that three wind guide plates are disposed at each of centers inside four sides of a rectangular heat exchanger. The wind guide plates are formed into a curved shape inclined in a direction opposite to a rotational direction of the centrifugal fan and expanding inward. The air conditioner according to PTL 1 is adapted to cause blowing wind to flow into narrow spaces of the three wind guide plates to change an orientation of the blowing wind to the direction of fins, thereby reducing blowing noise generated by the blowing wind colliding against the fins.

Citation List

Patent Literature

[0004] PTL 1: Japanese Unexamined Patent Application, Publication No. 2001-99436

Summary of Invention

Technical Problem

[0005] However, the air conditioner according to PTL 1 has the three wind guide plates disposed at each of the centers inside the four sides of the rectangular heat exchanger. Also, the wind guide plates are formed into the curved shape inclined in the direction opposite to the rotational direction of the centrifugal fan and expanding inward. Thus, disposing the wind guide plates lead to a significant increase in ventilation resistance.

[0006] The present invention is made in view of such circumstances, and an object thereof is to provide an air conditioner capable of reducing blowing noise generated by blowing wind colliding against fins without significantly increasing a ventilation resistance.

Solution to Problem

[0007] In order to solve the aforementioned problem, an air conditioner according to the present invention employs the following means.

[0008] An air conditioner according to an aspect of the present invention includes: a fan that causes air flowing in along an axial direction of a rotational shaft to flow out in a radial direction that intersects the axial direction; a heat exchanger that is disposed so as to surround an outer periphery of the fan and has a heat transfer pipe and a plurality of fins attached to the heat transfer pipe; and a plurality of rectifying plates that is attached to the heat exchanger on an inner peripheral side, extends along an axial line that is parallel to the rotational shaft, and linearly projects toward the rotational shaft, the heat exchanger has a plurality of planar portions that is disposed along a plane that perpendicularly intersects the radial direction at a closest position to the fan, and a plurality of curved portions that couples the plurality of planar portions, a first rectifying plate out of the rectifying plates is attached to at least any of the plurality of planar portions at a first predetermined position on an upstream side in a rotational direction of the fan beyond the closest position while a second rectifying plate out of the rectifying plates is attached thereto at a second predetermined position on a downstream side in the rotational direction of the fan beyond the closest position, and the first rectifying plate and the second rectifying plate are disposed to be adjacent to each other.

[0009] According to the air conditioner of an aspect of the present invention, the first rectifying plate is attached to at least any one of the plurality of planar portions of the heat exchanger at the first predetermined position on the upstream side in the rotational direction of the fan beyond the closest position to the fan. Thus, a velocity component of the blowing wind in the rotational direction is reduced due to turbulence generated by the first rectifying plate before reaching the closest position, and blowing noise generated by the blowing wind colliding against fins at the closest position is reduced.

[0010] Also, according to the air conditioner of an aspect of the present invention, the second rectifying plate is attached to at least any one of the plurality of planar portions of the heat exchanger at the second predetermined position on the downstream side in the rotational direction of the fan beyond the closest position to the fan. Thus, rising of the velocity component of the blowing wind in the rotational direction again on the downstream side in the rotational direction of the fan beyond the closest position is curbed, and blowing noise generated by the blowing wind colliding against the fins is reduced.

[0011] Further, according to the air conditioner of an aspect of the present invention, the rectifying plates have a shape extending along the axial line that is parallel to the rotational shaft of the fan and linearly projecting toward the rotational shaft, and a ventilation resistance is thus reduced as compared with a case in which the rectifying plates are formed into a curved shape that is inclined in the direction opposite to the rotational direction of the fan and expands inward. Also, since the first rectifying plate and the second rectifying plate are disposed to be adjacent to each other on the upstream side and the downstream side in the rotational direction of the fan with the closest position sandwiched therebetween, a

ventilation resistance is reduced as compared with a case in which three rectifying plates including the closest position are disposed.

[0012] In this manner, according to the air conditioner of the aspect of the present invention, it is possible to reduce blowing noise generated by blowing wind colliding against fins without significantly increasing a ventilation resistance.

[0013] In the air conditioner according to an aspect of the present invention, the first predetermined position may be such a position that an angle formed between the radial direction passing through the closest position of the planar portions and the radial direction passing through a distal end of the first rectifying plate falls within a range of equal to or greater than 3 degrees and equal to or less than 7 degrees. More preferably, the first predetermined position may be such a position that the angle is 5 degrees.

[0014] In this manner, it is possible to appropriately reduce a velocity component of the blowing wind in the rotational direction at the closest position.

[0015] In the air conditioner according to an aspect of the present invention, the second predetermined position may be such a position that an angle formed between the radial direction passing through the closest position of the planar portions and the radial direction passing through a distal end of the second rectifying plate falls within a range of equal to or greater than 15 degrees and equal to or less than 20 degrees.

[0016] In this manner, it is possible to appropriately curb rising of the velocity component of the blowing wind in the rotational direction again on the downstream side in the rotational direction of the fan beyond the closest position.

[0017] In the air conditioner according to an aspect of the present invention, in a case in which a distance in the radial direction between the fan at the closest position of the planar portions to which the first rectifying plate and the second rectifying plate are attached and the heat exchanger is defined as L, and a projecting length of the first rectifying plate toward the rotational shaft is defined as l, $L/l \geq 3.5$ and $l \geq 7$ mm may be satisfied.

[0018] By setting the distance L between the fan and the heat exchanger in the radial direction to be equal to or greater than 3.5 times the projecting length 1 of the first rectifying plate toward the rotational shaft, it is possible to sufficiently curb an increase in ventilation resistance due to the first rectifying plate. By setting 1 to be equal to or greater than 7 mm, it is possible to cause the first rectifying plate to appropriately generate turbulence and to reduce the velocity component of the blowing wind in the rotational direction at the closest position.

Advantageous Effects of Invention

[0019] According to the present invention, it is possible to provide an air conditioner capable of reducing blowing noise generated by blowing wind colliding against fins without significantly increasing a ventilation resistance.

Brief Description of Drawings

[0020]

[Figure 1] Figure 1 is a perspective view of an air conditioner according to an embodiment of the present invention.

[Figure 2] Figure 2 is a vertical sectional view of an indoor unit of the air conditioner illustrated in Figure 1.

[Figure 3] Figure 3 is a view of a fan and an indoor heat exchanger illustrated in Figure 2 when seen from the side of an opening.

[Figure 4] Figure 4 is a partially enlarged view of the indoor heat exchanger and a rectifying plate illustrated in Figure 2.

[Figure 5] Figure 5 is a partially enlarged view in the vicinity of a closest position of a first planar portion illustrated in Figure 3.

[Figure 6] Figure 6 is a graph illustrating a sound pressure level of noise generated by the indoor unit.

Description of Embodiments

[0021] Hereinafter, an embodiment of an air conditioner 1 according to the present invention will be described with reference to drawings.

[0022] Figure 1 illustrates a perspective view of the ceiling buried-type air conditioner 1 according to the embodiment, and Figure 2 illustrates a vertical sectional view thereof. Here, an example of the ceiling buried-type air conditioner 1 in which one indoor unit 3 is connected to an outdoor unit 2 is illustrated.

[0023] The air conditioner 1 is used with the indoor unit 3 suspended from an indoor ceiling or the like and connected to the outdoor unit 2 placed outdoor via a refrigerant pipe 4 and an electric wiring 5. In the outdoor unit 2, machines such as a refrigerant compressor 6, an outdoor heat exchanger 7, an outdoor fan 8, a control box 9, and a four-way selector valve, which is not illustrated, are placed. The outdoor unit 2 configures a refrigerating cycle along with an indoor heat exchanger 18 provided on the side of the indoor unit 3, which will be described later, and has a function of adjusting a refrigerant to be supplied to the indoor unit 3.

[0024] The indoor unit 3 includes a cabinet 10 with an opened lower portion and a substantially quadrangular ceiling panel 11 attached to the lower portion of the cabinet 10. At a lower part inside the cabinet 10, a bellmouth 13 forming an air suction port 12 and a drain pan 14 are placed, and a part of the drain pan 14 forms an air duct 15. Also, a turbofan 17 driven and rotated by a fan motor 16 is placed at a central part of the ceiling panel of the cabinet 10, and the indoor heat exchanger 18 folded and formed into a quadrangular shape is placed in a secured manner on the ceiling panel side via a bracket, which is

not illustrated, so as to surround the outer periphery of the turbofan 17.

[0025] Inside the cabinet 10, an air passage 19 that guides indoor air to the turbofan 17 via the bellmouth 13 forming the air suction port 12 and causes air, the pressure of which has been raised by the turbofan 17, which has blown out in the radial direction, to be distributed to the air duct 15 formed by an inner surface of the cabinet 10 and an outer peripheral surface of the drain pan 14 through the indoor heat exchanger 18 disposed so as to surround the outer periphery thereof is configured.

[0026] The quadrangular ceiling panel 11 is provided with along rectangular-shaped air outlets 20 from which conditioned wind blows out along four sides thereof such that the air outlets 20 communicate with the air duct 15, and the ceiling panel 11 also includes an opening 21 for suctioning the indoor air provided at the center thereof. The opening 21 is provided with a suction grille 23 with an air filter 22 and the like placed therein so as to be freely raised and lowered via a wire 24 or the like as illustrated in Figure 1. Also, a wind direction adjustment louver 25 for adjusting a wind direction of the conditioned wind blowing out of the air outlets 20 is placed at each of the air outlets 20 so as to be able to individually swing.

[0027] The turbofan 17 is configured of a main plate 27 including a hub 26 for securing a rotational shaft 16A of the fan motor 16 provided at the center, a shroud 29 for forming a fluid flow path 28 disposed to face the main plate 27, and a plurality of blades 30 disposed between the shroud 29 and the main plate 27. The turbofan 17 on the side of the shroud 29 is disposed to face the air suction port 12 of the bellmouth 13, a part of the bellmouth 13 overlaps the inner periphery of the shroud 29, and a recirculating path 31 is formed therebetween for circulating a part of the blowing wind of the turbofan 17 from a gap of the overlapping portion between the bellmouth 13 and the shroud 29 to the side of an inner surface 29A of the shroud 29 along a rear surface of the bellmouth 13.

[0028] The turbofan 17 is a fan that rotates about the rotational shaft 16A of the fan motor 16 and causes air flowing in along the axial direction of the rotational shaft 16A to flow out in the radial direction that intersects the axial direction of the rotational shaft 16A. Here, the axial direction of the rotational shaft 16A conforms to the vertical direction while the radial direction that intersects the axial direction conforms to the horizontal direction.

[0029] Here, the indoor heat exchanger 18 will be described with reference to Figure 3. Figure 3 is a diagram of the turbofan 17 and the indoor heat exchanger 18 illustrated in Figure 2 when seen from the opening 21.

[0030] As illustrated in Figure 3, the indoor heat exchanger 18 is disposed to surround the outer periphery of the turbofan 17 and has a heat transfer pipe 18a and a plurality of fins 18b attached to the heat transfer pipe 18a. As illustrated in Figure 3, the indoor heat exchanger 18 has a first planar portion 18A, a second planar portion 18B, a third planar portion 18C, a fourth planar portion 18D, a fifth planar portion 18E, a first curved portion 18F, a second curved portion 18G, a third curved portion 18H, and a fourth curved portion 181.

[0031] The first planar portion 18A is a portion disposed along a plane that perpendicularly intersects the radial direction at a closest position P1 to the blades 30 of the turbofan 17. The second planar portion 18B is a portion disposed along a plane that perpendicularly intersects the radial direction at a closest position P2 to the blades 30 of the turbofan 17. The third planar portion 18C is a portion disposed along a plane that perpendicularly intersects the radial direction at a closest position P3 to the blades 30 of the turbofan 17. The fourth planar portion 18D is a portion disposed along a plane that perpendicularly intersects the radial direction at a closest position P3 to the blades 30 of the turbofan 17. The fifth planar portion 18E is a portion disposed along a plane that perpendicularly intersects the radial direction at a closest position P5 to the blades 30 of the turbofan 17.

[0032] The first curved portion 18F is a portion that couples the first planar portion 18A to the second planar portion 18B, the second curved portion 18G is a portion that couples the second planar portion 18B to the third planar portion 18C, the third curved portion 18H is a portion that couples the third planar portion 18C to the fourth planar portion 18D, and the fourth curved portion 181 is a portion that couples the fourth planar portion 18D to the fifth planar portion 18E.

[0033] Next, a plurality of rectifying plates 32 attached to the indoor heat exchanger 18 on the inner peripheral side will be described with reference to Figs. 2 to 5. Figure 4 is a partially enlarged view of the indoor heat exchanger 18 and the rectifying plates 32 illustrated in Figure 2. Figure 5 is a partially enlarged view in the vicinity of the closest position P1 of the first planar portion 18A in Figure 3.

[0034] As illustrated in Figure 2, a rectifying plate 32 extending along an axial line X1 that is parallel to the rotational shaft 16A and a rectifying plate 32 extending along an axial line X2 that is parallel to the rotational shaft 16A are attached to the indoor heat exchanger 18 on the inner peripheral side.

[0035] As illustrated in Figure 3, two rectifying plates 32 are attached to the first planar portion 18A on the inner peripheral side, two rectifying plates 32 are attached to the second planar portion 18B on the inner peripheral side, and two rectifying plates 32 are attached to the third planar portion 18C on the inner peripheral side. One rectifying plate 32 is attached to the fourth planar portion 18D on the inner peripheral side, and one rectifying plate 32 is attached to the fifth planar portion 18E on the inner peripheral side.

[0036] As illustrated in Figure 4, each rectifying plate 32 has a base portion 32a disposed along a plane that perpendicularly intersects the radial direction of the turbofan 17, a plate portion 32b linearly projecting from the base portion 32a toward the rotational shaft 16A, a pair of holding portions 32c projecting from the base portion 32a in the direction opposite to the plate portion 32b, and

a support portion 32d projecting from the base portion 32a in the direction opposite to the plate portion 32b. Each rectifying plate 32 is attached to the indoor heat exchanger 18 by causing the pair of holding portions 32c to hold the heat transfer pipe 18a in a state in which the heat transfer pipe 18a is caused to support the support portion 32d.

[0037] As illustrated in Figure 4, the upper end of the base portion 32a of each rectifying plate 32 conforms to the upper end of each fin 18b of the indoor heat exchanger 18 in a state in which the rectifying plate 32 is attached to the indoor heat exchanger 18. With such a positional relationship, an operator can easily attach the rectifying plate 32 to the indoor heat exchanger 18 by positioning the rectifying plate 32 such that the upper end of the base portion 32a of the rectifying plate 32 conforms to the upper end of the fin 18b.

[0038] As illustrated in Figure 5, a rectifying plate 32A (first rectifying plate) and a rectifying plate 32B (second rectifying plate) are attached to the first planar portion 18A in a state in which the rectifying plate 32A and the rectifying plate 32B are disposed to be adjacent to each other. The rectifying plate 32A is attached to a first predetermined position on the upstream side in a rotational direction Rd of the turbofan 17. Here, the first predetermined position is such a position that an angle $\theta 1$ formed between the radial direction passing through the closest position P1 of the first planar portion 18A and the radial direction passing through the distal end of the rectifying plate 32A falls within a range of equal to or greater than 3 degrees and equal to or less than 7 degrees. It is further desirable that the first predetermined position be such a position that $\theta 1$ is 5 degrees. In this manner, it is possible to appropriately reduce a velocity component of the blowing wind from the turbofan 17 at the closest position P1 in the rotational direction Rd.

[0039] The rectifying plate 32B is attached to a second predetermined position on the downstream side in the rotational direction Rd of the turbofan 17. Here, the second predetermined position is such a position that an angle $\theta 2$ formed between the radial direction passing through the closest position P1 of the first planar portion 18A and the radial direction passing through the distal end of the rectifying plate 32B falls within a range of equal to or greater than 15 degrees and equal to or less than 20 degrees. In this manner, it is possible to appropriately curb raising of the velocity component of the blowing wind in the rotational direction Rd again on the downstream side in the rotational direction Rd of the turbofan 17 beyond the closest position P1.

[0040] In Figure 5, the distance L is a distance between the turbofan 17 at the closest position P1 of the first planar portion 18A to which the rectifying plate 32A and the rectifying plate 32B are attached and the indoor heat exchanger 18 in the radial direction. Also, the distance 1 is the projecting length of the rectifying plate 32A and the rectifying plate 32B toward the rotational shaft 16A. In the present embodiment, the distance L and the distance l satisfy the relationships of Equation (1) and Equation (2) below.

$$L/1 \geq 3.5 \quad (1)$$

$$1 \geq 7 \text{ mm} \quad (2)$$

[0041] Equation (1) is a condition for curbing an increase in ventilation resistance due to the rectifying plate 32A. Also, Equation (2) is a condition for reducing the velocity component of the blowing wind from the turbofan 17 in the rotational direction Rd at the closest position P1.

[0042] Note that although the two rectifying plates 32 attached to the first planar portion 18A have been described above, the two rectifying plates 32 attached to the second planar portion 18B also have disposition similar to that of the two rectifying plates 32 attached to the first planar portion 18A. Also, the two rectifying plates 32 attached to the third planar portion 18C also have deposition similar to that of the two rectifying plates 32 attached to the first planar portion 18A.

[0043] Note that the two rectifying plates 32 are attached to each of the first planar portion 18A, the second planar portion 18B, and the third planar portion 18C while one rectifying plate 32 is attached to each of the fourth planar portion 18D and the fifth planar portion 18E. This is because the lengths of the fourth planar portion 18D and the fifth planar portion 18E are shorter than the lengths of the first planar portion 18A, the second planar portion 18B, and the third planar portion 18C, and the amounts of velocity components of the blowing wind at the closest positions P4 and P5 in the rotational direction Rd are small.

[0044] Next, a sound pressure level of noise generated by the indoor unit 3 of the air conditioner 1 according to the present embodiment and a comparative example thereof will be described. Figure 6 is a graph illustrating a sound pressure level of noise generated by the indoor unit 3 according to the present embodiment. In Figure 6, the solid line represents a sound pressure level in a case in which the plurality of rectifying plates 32 is disposed at the indoor heat exchanger 18 on the inner peripheral side as illustrated in Figure 3 according to the present embodiment, and the dashed line represents a sound pressure level in a case in which all of the plurality of rectifying plates 32 illustrated in Figure 3 are not disposed. Figure 6 illustrates a relationship between a 1/3 octave band center frequency (Hz) and a sound pressure level (dB).

[0045] As illustrated in the experiment result in Figure 6, the air conditioner 1 according to the present embodiment has a lower sound pressure level in a high frequency region (2 kHz to 4 kHz) that is likely to be recognized as noise as compared with the comparative example. The reason for this is considered to be because the rec-

tifying plates 32 are attached to the first predetermined position on the upstream side in the rotational direction Rd of the turbofan 17 beyond the closest positions P1, P2, and P3 and the velocity component of the blowing wind in the rotational direction Rd is thus reduced due to turbulence generated by the rectifying plates 32 before reaching the closest positions P1, P2, and P3.

[0046] The reason is also considered to be because the rectifying plates 32 are attached to the second predetermined position on the downstream side in the rotational direction Rd of the turbofan 17 beyond the closest positions P1, P2, and P3 to the turbofan 17, and the raising of the velocity component of the blowing wind in the rotational direction Rd again is thus curbed on the downstream side in the rotational direction Rd of the turbofan 17 beyond the closest positions P1, P2, and P3.

[0047] Actions and effects achieved by the air conditioner 1 according to the present embodiment described above will be described.

[0048] According to the air conditioner 1 of the present embodiment, the rectifying plates 32 are attached to the first predetermined position on the upstream side in the rotational direction Rd of the turbofan 17 beyond the closest positions P1, P2, and P3 to the blades 30 of the turbofan 17 at each of the first planar portion 18A, the second planar portion 18B, and the third planar portion 18C of the indoor heat exchanger 18. Thus, the velocity component of the blowing wind in the rotational direction Rd is reduced due to turbulence generated by the rectifying plates 32 before reaching the closest positions P1, P2, and P3, and blowing noise generated by the blowing wind colliding against the fins 18b at the closest positions P1, P2, and P3 is reduced.

[0049] Here, the first predetermined position is such a position that the angle $\theta 1$ formed between the radial direction passing through the closest position P1 (P2, P3) of the first planar portion 18A (the second planar portion 18B, the third planar portion 18C) and the radial direction passing through the distal end of the rectifying plate 32A falls within a range of equal to or greater than 3 degrees and equal to or less than 7 degrees. More preferably, the first predetermine position is such a position that the angle $\theta 1$ is 5 degrees.

[0050] Also, according to the air conditioner 1 of the present embodiment, the rectifying plates 32 are attached to the first planar portion 18A, the second planar portion 18B, and the third planar portion 18C of the indoor heat exchanger 18 at the second predetermine position on the downstream side in the rotational direction Rd of the turbofan 17 beyond the closest positions P1, P2, and P3 to the blades 30 of the turbofan 17. Thus, the raising of the velocity component of the blowing wind in the rotational direction Rd again is curbed on the downstream side in the rotational direction Rd of the turbofan 17 beyond the closest positions P1, P2, and P3, and blowing noise generated by the blowing wind colliding against the fins 18b is thus reduced.

[0051] Here, the second predetermined position is such a position that the angle $\theta 2$ formed between the radial direction passing through the closest position P1 (P2, P3) of the first planar portion 18A (the second planar portion 18B, the third planar portion 18C) and the radial direction passing through the distal end of the rectifying plate 32B falls within a range of equal to or greater than 15 degrees and equal to or less than 20 degrees.

[0052] Further, according to the air conditioner 1 of the present embodiment, the rectifying plates 32 have shapes extending along the axial lines X1 and X2 that are parallel to the rotational shaft 16A of the turbofan 17 and linearly projecting toward the rotational shaft 16A, and a ventilation resistance is thus reduced as compared with a case in which the rectifying plates 32 are formed into a curved shape inclined in the direction opposite to the rotational direction Rd of the turbofan 17 and expanding inward. Also, the two rectifying plates 32 are disposed to be adjacent to each other on the upstream side and the downstream side in the rotational direction Rd of the turbofan 17 with the closest positions P1, P2, and P3 sandwiched therebetween, and the ventilation resistance is thus reduced as compared with a case in which three rectifying plates including the closest positions P1, P2, and P3 are disposed.

[0053] In this manner, according to the air conditioner 1 of the present embodiment, it is possible to reduce blowing noise generate by blowing wind colliding against the fins 18b without significantly increasing a ventilation resistance.

[0054] In the air conditioner 1 according to the present embodiment, in a case in which the distance between the turbofan 17 at the closest position P1 (P2, P3) to the first planar portion 18A (the second planar portion 18B, the third planar portion 18C) to which the rectifying plate 32A and the rectifying plate 32B are attached and the indoor heat exchanger 18 in the radial direction is defined as L, and the projecting length of the rectifying plate 32A toward the rotational shaft 16A is defined as l, $L/l \geq 3.5$ and $l \geq 7$ mm are satisfied.

[0055] By setting the distance L between the turbofan 17 and the indoor heat exchanger 18 in the radial direction to be equal to or greater than 3.5 times the projecting length l of the rectifying plate 32A and the rectifying plate 32B toward the rotational shaft 16A, it is possible to sufficiently curb an increase in ventilation resistance due to the rectifying plate 32A and the rectifying plate 32B. By setting l to be equal to or greater than 7 mm, it is possible to cause the rectifying plate 32A to appropriately generate turbulence and to reduce the velocity component of the blowing wind in the rotational direction Rd at the closest position P1 (P2, P3).

Reference Signs List

[0056]

1	Air conditioner
2	Outdoor unit

3	Indoor unit
4	Refrigerant pipe
5	Electric wiring
6	Refrigerant compressor
7	Outdoor heat exchanger
8	Outdoor fan
9	Control box
10	Cabinet
11	Ceiling panel
12	Air suction port
13	Bellmouth
14	Drain pan
15	Air duct
16	Fan motor
16A	Rotational shaft
17	Turbofan
18	Indoor heat exchanger
18a	Heat transfer pipe
18b	Fin
18A	First planar portion
18B	Second planar portion
18C	Third planar portion
18D	Fourth planar portion
18E	Fifth planar portion
18F	First curved portion
18G	Second curved portion
18H	Third curved portion
181	Fourth curved portion
19	Air passage
20	Air outlet
21	Opening
22	Air filter
23	Suction grille
24	Wire
25	Wind direction adjustment louver
26	Hub
27	Main plate
28	Fluid flow path
29	Shroud
30	Blade
31	Recirculating path
32, 32A, 32B	Rectifying plate
32a	Base portion
32b	Plate portion

Claims

1. An air conditioner comprising:

a fan that causes air flowing in along an axial direction of a rotational shaft to flow out in a radial direction that intersects the axial direction;
a heat exchanger that is disposed so as to surround an outer periphery of the fan and has a heat transfer pipe and a plurality of fins attached to the heat transfer pipe; and
a plurality of rectifying plates that is attached to the heat exchanger on an inner peripheral side, extends along an axial line that is parallel to the rotational shaft, and linearly projects toward the rotational shaft,
wherein the heat exchanger has

a plurality of planar portions that is disposed along a plane that perpendicularly intersects the radial direction at a closest position to the fan, and
a plurality of curved portions that couples the plurality of planar portions,

a first rectifying plate out of the rectifying plates is attached to at least any of the plurality of planar portions at a first predetermined position on an upstream side in a rotational direction of the fan beyond the closest position while a second rectifying plate out of the rectifying plates is attached thereto at a second predetermined position on a downstream side in the rotational direction of the fan beyond the closest position, and
the first rectifying plate and the second rectifying plate are disposed to be adjacent to each other.

2. The air conditioner according to claim 1, wherein the first predetermined position is such a position that an angle formed between the radial direction passing through the closest position of the planar portions and the radial direction passing through a distal end of the first rectifying plate falls within a range of equal to or greater than 3 degrees and equal to or less than 7 degrees.

3. The air conditioner according to claim 2, wherein the first predetermined position is such a position that an angle formed between the radial direction passing through the closest position of the planar portions and the radial direction passing through the distal end of the first rectifying plate is 5 degrees.

4. The air conditioner according to any one of claims 1 to 3, wherein the second predetermined position is such a position that an angle formed between the radial direction passing through the closest position of the planar portions and the radial direction passing through a distal end of the second rectifying plate falls within a range of equal to or greater than 15 degrees and equal to or less than 20 degrees.

5. The air conditioner according to any one of claims 1 to 4, wherein in a case in which a distance in the radial direction between the fan at the closest position of the planar portions to which the first rectifying plate and the second rectifying plate are attached and the heat exchanger is defined as L, and a projecting length of the first rectifying plate toward the

rotational shaft is defined as l, $L/l \geq 3.5$ and $l \geq 7$ mm are satisfied.

FIG. 1

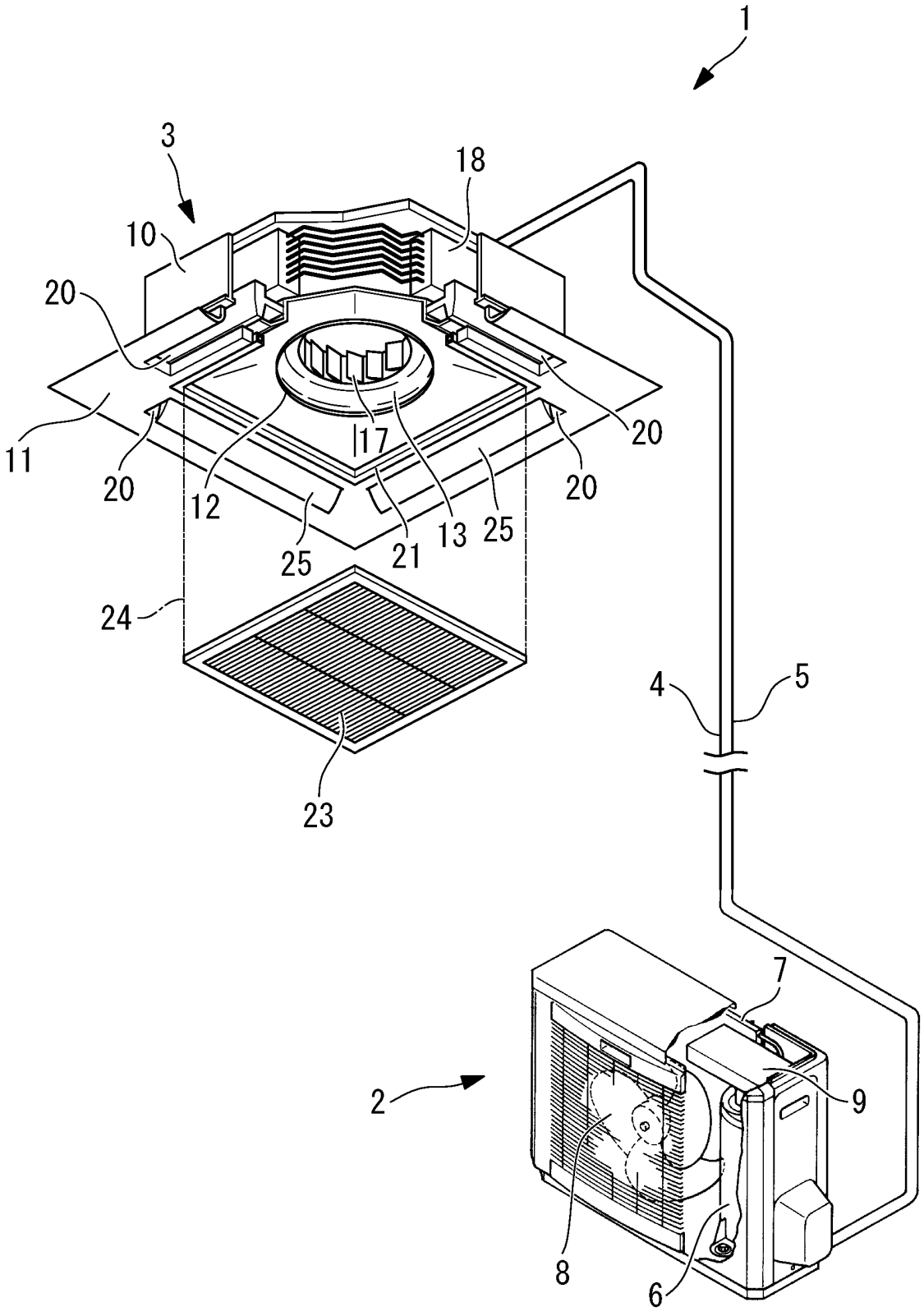


FIG. 2

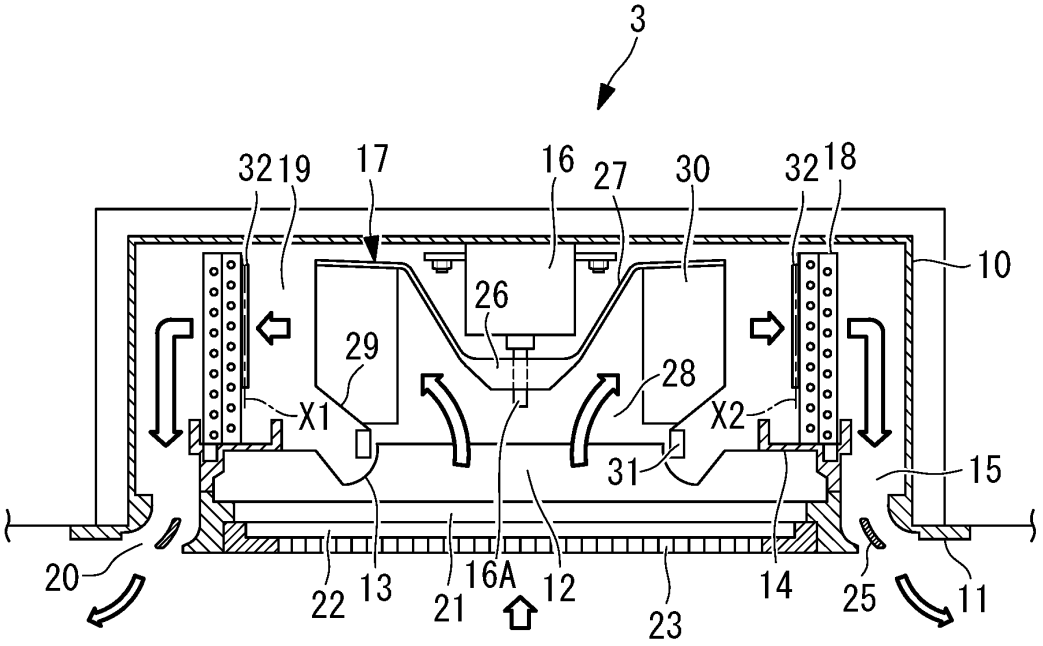

3
32
19
17
16
27
30
32
18
10
26
29
28
X1
X2
31
15
20
22
13
21
16A
12
23
14
25
11

FIG. 3

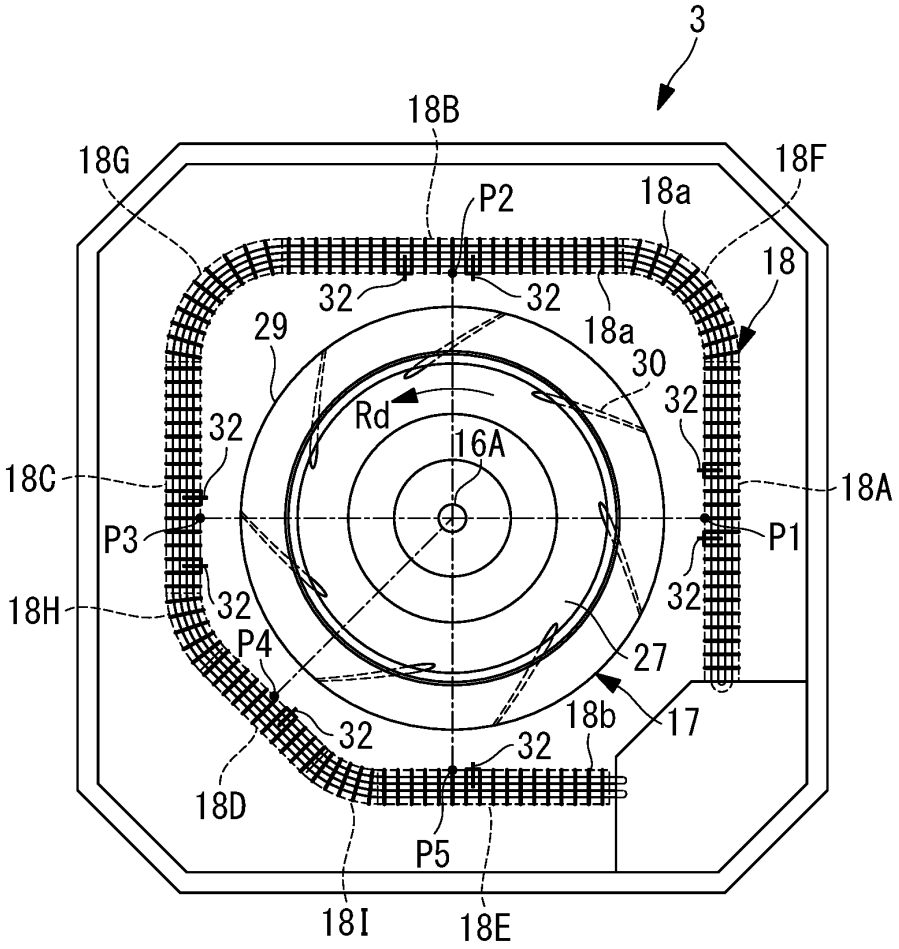

3
18B
18G
18F
P2
18a
18
32
32
18a
29
30
32
Rd
16A
32
18C
18A
P3
P1
32
18H
32
P4
27
18b
17
32
32
18D
P5
18I
18E

FIG. 4

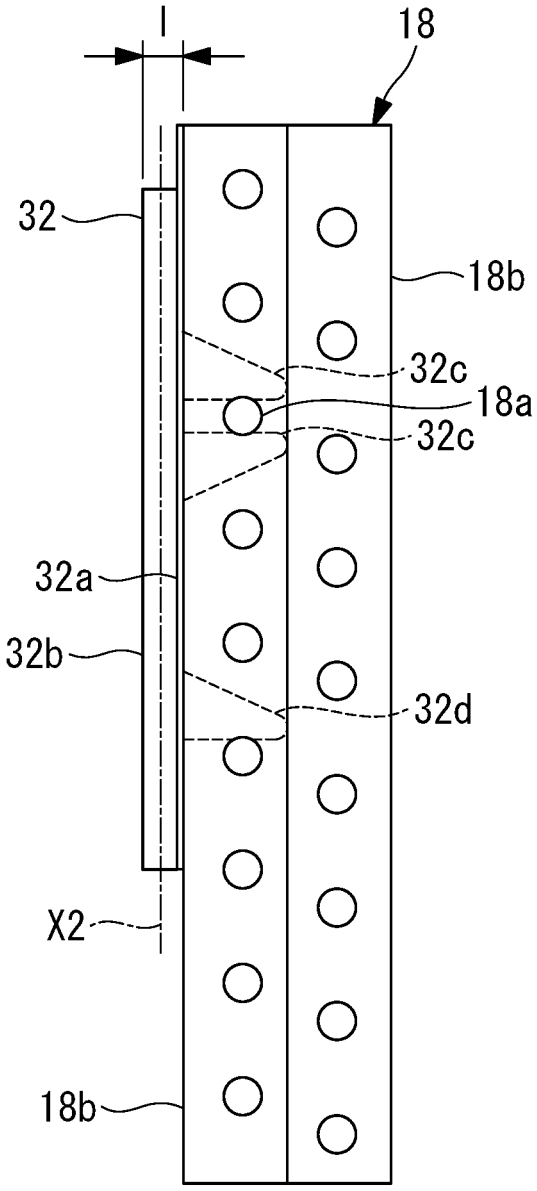


FIG. 5

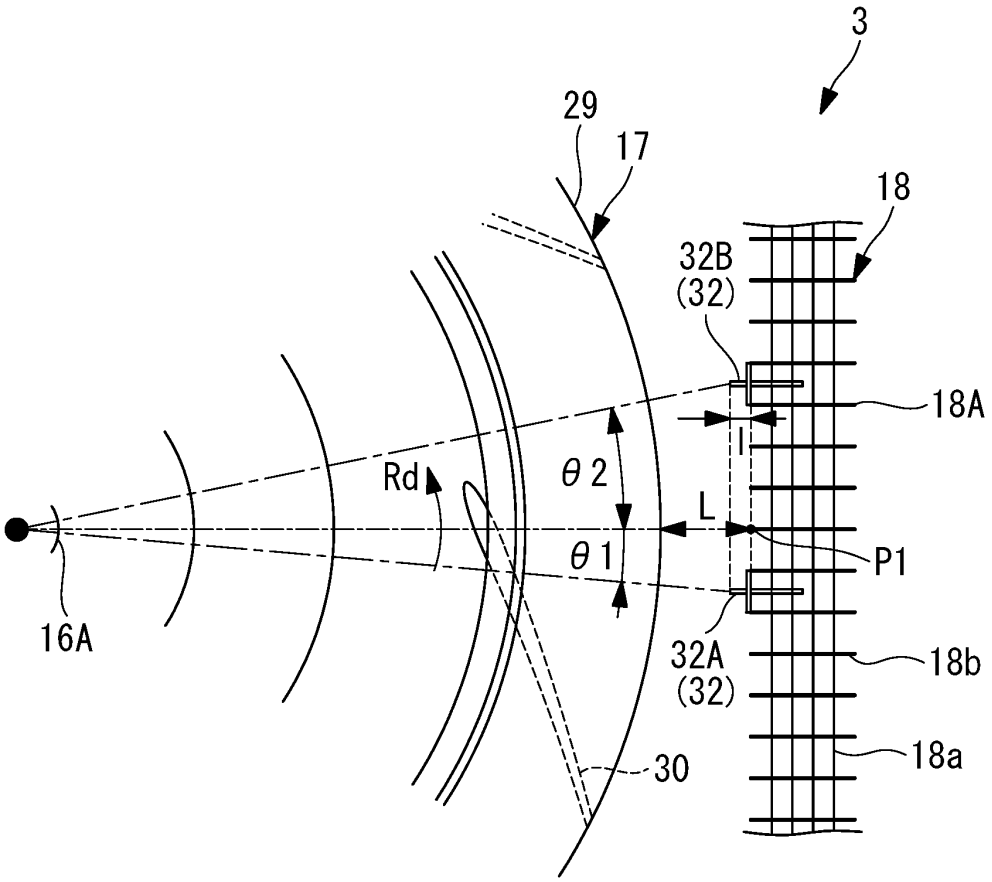
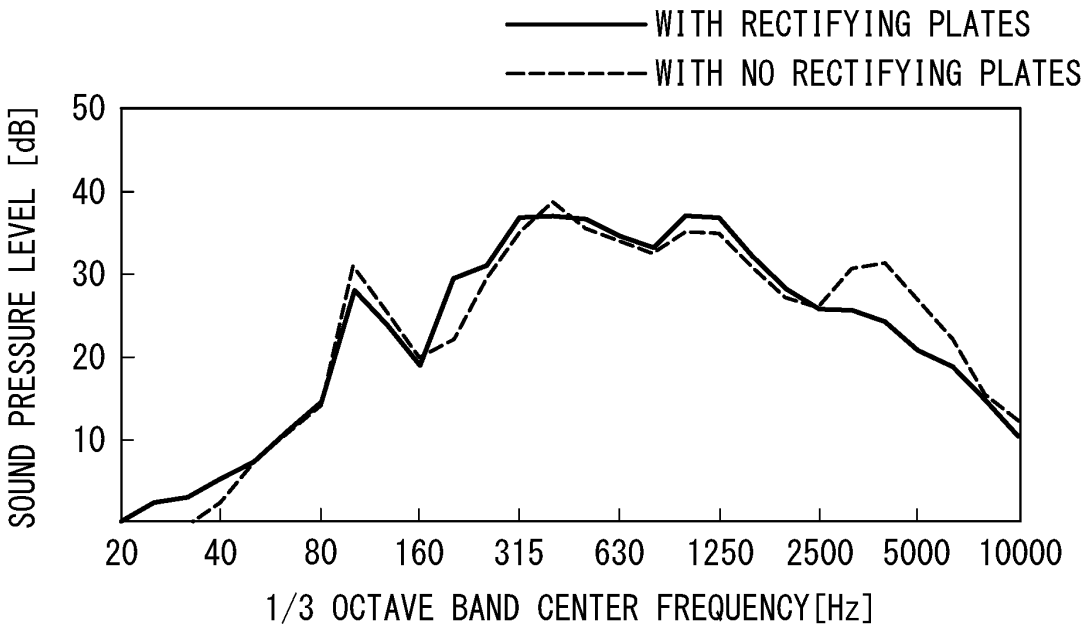

3
29
17
18
32B
(32)
18A
l
θ 2
Rd
L
θ 1
P1
16A
32A
(32)
18b
18a
30

FIG. 6


WITH RECTIFYING PLATES
WITH NO RECTIFYING PLATES
SOUND PRESSURE LEVEL [dB]
50
40
30
20
10
20
40
80
160
315
630
1250
2500
5000
10000
1/3 OCTAVE BAND CENTER FREQUENCY[Hz]

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2018/041713

A. CLASSIFICATION OF SUBJECT MATTER
Int. Cl. F24F1/00(2011.01)i, F24F13/08(2006.01)i, F24F13/20(2006.01)i, F24F13/24(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)
Int. Cl. F24F1/00, F24F13/08, F24F13/20, F24F13/24

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 5-187649 A (MITSUBISHI ELECTRIC CORP.) 27 July 1993, paragraphs [0009]-[0013], fig. 1-4 (Family: none)	1-5
Y	JP 60-30921 A (HITACHI, LTD.) 16 February 1985, page 2, left column, line 14 to right column, line 10, fig. 3-5 (Family: none)	1-5

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

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
27.12.2018	15.01.2019
Name and mailing address of the ISA/ Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

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Patent documents cited in the description

- JP 2001099436 A **[0004]**