(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 4 012 285 A1

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
15.06.2022 Bulletin 2022/24

(21) Application number: **20865264.4**

(22) Date of filing: **14.09.2020**

(51) International Patent Classification (IPC):
F24F 11/65 *(2018.01)* ***F24F 11/755*** *(2018.01)*
F24F 11/79 *(2018.01)* ***F24F 11/81*** *(2018.01)*
F24F 11/83 *(2018.01)* ***F24F 120/10*** *(2018.01)*
F24F 120/12 *(2018.01)*

(52) Cooperative Patent Classification (CPC):
F24F 11/65; F24F 11/755; F24F 11/79; F24F 11/81; F24F 11/83; F24F 13/14; F24F 13/15

(86) International application number:
PCT/JP2020/034722

(87) International publication number:
WO 2021/054286 (25.03.2021 Gazette 2021/12)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **17.09.2019 JP 2019168560**

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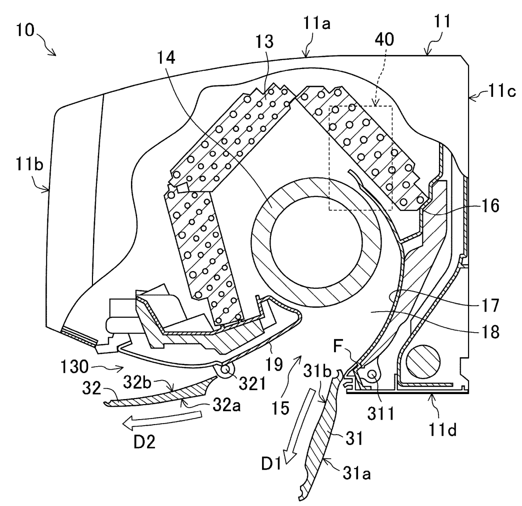
(54) INDOOR UNIT OF AIR CONDITIONER

(57) An air-conditioner indoor unit (10) is configured to be capable of changing the direction of an airflow that is blown out through a blow-out port (15). The air-conditioner indoor unit (10) includes a control unit (40) that switches between a normal mode and a wide mode. The control unit (40) extends at least vertically a range that is to be reached by the airflow in an air-conditioning target space in the wide mode compared with the normal mode and causes the air conditioning capacity of the wide mode to be lower than the air conditioning capacity of the normal mode.

FIG.4



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Description

Technical Field

[0001] The present disclosure relates to an indoor unit for an air conditioner.

Background Art

[0002] To avoid wind of an indoor unit for an air conditioner from hitting a person and generating a draft feeling, PTL 1 suggests using a circulation airflow and a perpendicular airflow as airflows for uniform air conditioning of the entirety of a room without causing a person to feel wind.

Citation List

Patent Literature

[0003] PTL 1: WO 2017/043492 A1

Summary of Invention

Technical Problem

[0004] However, the indoor unit for an air conditioner in PTL 1 performs air conditioning by circulating an airflow in the entirety of a room and thus is not suitable for heating and cooling the body of a user immediately. For uniform air conditioning of the entirety of a room by the indoor unit for an air conditioner in PTL 1, layout, furniture arrangement, the installation place of the indoor unit for an air conditioner, and the like are limited.

[0005] An object of the present disclosure is to make it possible to cool and heat the body of a user immediately while suppressing a draft feeling.

Solution to Problem

[0006] A first aspect of the present disclosure is an indoor unit for an air conditioner, the indoor unit being configured to be installed in an air-conditioning target space and to be capable of changing a direction of an airflow that is blown out through a blow-out port (15). The indoor unit includes a control unit (40) configured to switch between a normal mode and a wide mode. The control unit (40) is configured to extend at least vertically a range that is to be reached by the airflow in the air-conditioning target space in the wide mode compared with the normal mode and to cause an air conditioning capacity of the wide mode to be lower than an air conditioning capacity of the normal mode.

[0007] In the first aspect, since the air conditioning capacity is lowered in the wide mode compared with the normal mode, it is possible to immediately heat and cool the body of a user with a spread airflow while suppressing a draft feeling by lowering the velocity of wind that hits the user.

[0008] A second aspect of the present disclosure is the indoor unit for an air conditioner in the first aspect in which the control unit (40) is configured to switch to the normal mode when the wide mode has been continued for a predetermined period or more during cooling.

[0009] In the second aspect, it is possible to suppress occurrence of condensation in the indoor unit for an air conditioner during cooling.

[0010] A third aspect of the present disclosure is the indoor unit for an air conditioner in the first or second aspect in which the control unit (40) is configured to switch between the normal mode and the wide mode based on presence/absence of a person inside and outside of a range that is to be reached by the airflow of the wide mode in the air-conditioning target space.

[0011] In the third aspect, it is possible to perform appropriate air conditioning on the basis of a presence state of a person in the air-conditioning target space.

[0012] A fourth aspect of the present disclosure is the indoor unit for an air conditioner in any one of the first to third aspects, the indoor unit further including a heat exchanger (13) that is configured to exchange heat with air that is taken in from the air-conditioning target space to thereby regulate a temperature of the air, the control unit (40) being configured to cause a temperature of at least a portion of the heat exchanger (13) in the wide mode during cooling to be lower than a dew temperature in the air-conditioning target space.

[0013] In the fourth aspect, it is possible to perform cooling while dehumidifying.

[0014] A fifth aspect of the present disclosure is the indoor unit for an air conditioner in any one of the first to fourth aspects in which the control unit (40) is configured to vary a blow-out velocity of the airflow in the wide mode.

[0015] In the fifth aspect, it is possible to blow out an airflow similar to a comfortable natural wind.

Brief Description of Drawings

[0016]

[Fig. 1] Fig. 1 is a sectional view of an indoor unit for an air conditioner according to an embodiment during operation stop.

[Fig. 2] Fig. 2 is a sectional view of the indoor unit for an air conditioner according to an embodiment during operation in an upward blowing mode.

[Fig. 3] Fig. 3 is a sectional view of the indoor unit for an air conditioner according to an embodiment during operation in an oblique blowing mode.

[Fig. 4] Fig. 4 is a sectional view of the indoor unit for an air conditioner according to an embodiment during operation in a wide mode.

[Fig. 5] Fig. 5 is a sectional view of the indoor unit for an air conditioner according to an embodiment during operation in a downward blowing mode.

[Fig. 6] Fig. 6 is a diagram illustrating a difference between the wide mode and a normal mode in the indoor unit for an air conditioner according to an embodiment.

[Fig. 7] Fig. 7 is a graph showing one example of a wind velocity distribution of an airflow that is blown out in the wide mode in the indoor unit for an air conditioner according to an embodiment.

[Fig. 8] Fig. 8 is a graph showing one example of a wind velocity distribution of an airflow that is blown out in the normal mode in the indoor unit for an air conditioner according to an embodiment.

[Fig. 9] Fig. 9 is a sectional view of an indoor unit for an air conditioner according to a modification during operation in the wide mode.

Description of Embodiments

[0017] Hereinafter, an embodiment of the present disclosure will be described with reference to the drawings. The following embodiment is presented as a substantially preferable example and does not intend to limit the present invention, applications thereof, or the range of the use thereof.

<<Embodiment>>

<Configuration of Indoor Unit for Air Conditioner>

[0018] Fig. 1 is a sectional view of an air-conditioner indoor unit (10) according to the present embodiment during operation stop. Fig. 2 is a sectional view of the air-conditioner indoor unit (10) during operation.

[0019] The air-conditioner indoor unit (10) is of a wall-mount type to be installed on a side wall in an air-conditioning target space. The air-conditioner indoor unit (10) mainly includes a body casing (11), a heat exchanger (13), a fan (14), a bottom frame (16), and a control unit (40). An air-conditioner indoor unit (10) is configured to be capable of changing the direction of an airflow that is blown out through a blow-out port (15).

[0020] The body casing (11) has a top surface portion (11a), a front surface panel (11b), a back surface plate (11c), and a bottom surface plate (11d). In the inside of the body casing (11), the heat exchanger (13), the fan (14), the bottom frame (16), the control unit (40), and the like are housed.

[0021] The top surface portion (11a) is positioned at an upper portion of the body casing (11). An intake port (not illustrated) is provided at a front portion of the top surface portion (11a).

[0022] The front surface panel (11b) constitutes the front surface part of the air-conditioner indoor unit (10) and has a flat shape with no intake port. The upper end of the front surface panel (11b) is rotatably supported by the top surface portion (11a). Consequently, the front surface panel (11b) is movable in a hinge manner.

[0023] The heat exchanger (13) and the fan (14) are mounted on the bottom frame (16). The heat exchanger (13) exchanges heat with passing air to thereby regulate the temperature of the air. The heat exchanger (13) has an inverted V-shape in which both ends are bent downward in a side view. The fan (14) is positioned below the heat exchanger (13). The fan (14) is, for example, a cross-flow fan and causes air that is taken in from the inside of a room to pass through the heat exchanger (13) and then to be blown out into the inside of the room.

[0024] The bottom surface plate (11d) is provided with the blow-out port (15). The blow-out port (15) is a rectangular opening having long sides in the lateral direction (direction orthogonal to the sheet of Fig. 1).

[0025] A first wind-direction regulating plate (31) that changes the direction of an airflow (hereinafter may be referred to as blow-out air) blown out through the blow-out port (15) is rotatably mounted along the long side of the blow-out port (15) on the side of the back surface plate (11c). The first wind-direction regulating plate (31) may be constituted by one plate that has a length substantially the same as the length of the blow-out port (15) and that is not divided. The first wind-direction regulating plate (31) is driven by a motor (not illustrated) and is capable of not only changing the direction of blow-out air but also opening and closing the blow-out port (15). The first wind-direction regulating plate (31) can take a plurality of orientations having different inclination angles.

[0026] A second wind-direction regulating plate (32) is provided along the long side of the blow-out port (15) on the side of the front surface panel (11b). The second wind-direction regulating plate (32) may be constituted by one plate that has a length substantially the same as the length of the blow-out port (15) and that is not divided. The second wind-direction regulating plate (32) can be caused by a motor (not illustrated) to take a plurality of orientations having different inclination angles in the front-rear direction. During operation stop, the second wind-direction regulating plate (32) is housed in a housing portion (130) provided at the bottom surface plate (11d).

[0027] The blow-out port (15) is connected to the inside of the body casing (11) by a blow-out flow path (18). The blow-out flow path (18) is formed along a back-surface-side scroll (17) of the bottom frame (16) from the blow-out port (15). The back-surface-side scroll (17) is a partition wall that constitutes a portion of the bottom frame (16) and is curved to face the fan (14). A terminal end (F) of the back-surface-side scroll (17) is positioned in the vicinity of the peripheral edge of the blow-out port (15). The body casing (11) is provided with a front-surface-side scroll (19) that faces the back-surface-side scroll (17) with the blow-out flow path (18) therebetween.

[0028] When the fan (14) is operated, indoor air is taken in through the intake port of the top surface portion (11a) by the fan (14) via the heat exchanger (13) and is blown out from the fan (14) through the blow-out port (15) via the blow-out flow path (18). The air that passes through the blow-out flow path (18) moves forward along the back-surface-side scroll (17) and is sent in the tangential direction of the terminal end (F) of the back-surface-side scroll (17).

[0029] The control unit (40) is positioned on the side of the heat exchanger (13) and the fan (14) when, for example, the body casing (11) is viewed from the front of the front surface panel (11b). The control unit (40) performs switching of blow-out modes, which will be described later, control of the number of rotations of the fan (14), control of the operation of the first wind-direction regulating plate (31) and the second wind-direction regulating plate (32), control of the temperature of the heat exchanger (13), and the like.

[0030] Although not illustrated, a perpendicular wind-direction regulating plate may be provided at a portion in the blow-out flow path (18) closer to the fan (14) than the first wind-direction regulating plate (31). The perpendicular wind-direction regulating plate has a plurality of blade pieces and a coupling rod that couples the plurality of blade pieces. By the motor (not illustrated) causing the coupling rod to reciprocate horizontally in the longitudinal direction of the blow-out port (15), the plurality of blade pieces swing leftward and rightward with respect to a state perpendicular to the longitudinal direction.

<Configuration and Operation of First Wind-Direction Regulating Plate>

[0031] An outer surface (31a) of the first wind-direction regulating plate (31) is completed to be on the extension of the outer surface of the bottom surface plate (11d) in a state in which the first wind-direction regulating plate (31) closes the blow-out port (15). An inner surface (31b) (refer to Fig. 2) of the first wind-direction regulating plate (31) is completed to be substantially parallel to the outer surface (31a).

[0032] A rotary shaft (311) of the first wind-direction regulating plate (31) is provided at the peripheral edge of the blow-out port (15) on the side of the back surface plate (11c) (at a position below the back-surface-side scroll (17)). The base portion of the first wind-direction regulating plate (31) and the rotary shaft (311) are coupled together with a predetermined interval kept therebetween. The rotary shaft (311) is coupled to a rotary shaft of a motor (not illustrated) fixed to the body casing (11).

[0033] By the rotary shaft (311) rotating counterclockwise in the front view in Fig. 1, the tip portion of the first wind-direction regulating plate (31) is moved away from the blow-out port (15), thereby opening the blow-out port (15). Conversely, by the rotary shaft (311) rotating clockwise in the front view in Fig. 1, the tip portion of the first wind-direction regulating plate (31) is moved to approach the blow-out port (15), thereby closing the blow-out port (15).

[0034] In a state in which the first wind-direction regulating plate (31) opens the blow-out port (15), the blow-out air blown out through the blow-out port (15) flows substantially along the inner surface (31b) of the first wind-direction regulating plate (31). In other words, the wind direction of an airflow that is blown out substantially in the tangential direction of the terminal end (F) of the back-surface-side scroll (17) is changed by the first wind-direction regulating plate (31).

<Configuration and Operation of Second Wind-Direction Regulating Plate>

[0035] An outer surface (32a) of the second wind-direction regulating plate (32) is completed to be on the extension of the outer surface of the bottom surface plate (11d) in a state in which the second wind-direction regulating plate (32) is housed in the housing portion (130). An inner surface (32b) of the second wind-direction regulating plate (32) is completed to be along the surface of the housing portion (130).

[0036] A rotary shaft (321) of the second wind-direction regulating plate (32) is provided at the peripheral edge of the blow-out port (15) on the side of the front surface panel (11b) (in the vicinity of the terminal end of the front-surface-side scroll (19)). In other words, the second wind-direction regulating plate (32) is provided to be continuous with the front-surface-side scroll (19). The base portion of the second wind-direction regulating plate (32) and the rotary shaft (321) are coupled together. The rotary shaft (321) is coupled to a rotary shaft of a motor (not illustrated) fixed to the body casing (11).

[0037] By the rotary shaft (321) rotating counterclockwise in the front view in Fig. 1, the tip portion of the second wind-direction regulating plate (32) is separated from the housing portion (130). Conversely, by the rotary shaft (321) rotating clockwise in the front view in Fig. 1, the tip portion of the second wind-direction regulating plate (32) is caused to approach the housing portion (130) and is eventually housed in the housing portion (130).

<Direction Control of Blow-Out Air>

[0038] In any of cooling operation, heating operation, dehumidifying operation, humidifying operation, and air-blowing operation, the air-conditioner indoor unit (10) can switch the blow-out modes among, for example, an "upward blowing mode", an "oblique blowing mode", a "wide mode", and a "downward blowing mode" by controlling the first wind-direction regulating plate (31), the second wind-direction regulating plate (32), and the like.

[0039] In the following description, the "upward blowing mode", the "oblique blowing mode", and the "downward blowing mode" may be collectively referred to as the "normal mode". Types of the blow-out modes and blow-out directions can be selected by a user via a remote controller or the like or can be set by the control unit (40) automatically.

[0040] Fig. 2 to Fig. 5 are sectional views in each of which the air-conditioner indoor unit (10) is operated in the "upward blowing mode", the "oblique blowing mode", the "wide mode", or the "downward blowing mode".

[0041] In the "upward blowing mode", as illustrated in Fig. 2, the control unit (40) rotates the first wind-direction regulating plate (31) to a position at which the inner surface (31b) of the first wind-direction regulating plate (31) is directed downward slightly obliquely relative to the horizontal direction and rotates the second wind-direction regulating plate (32) to a position at which the outer surface (32a) of the second wind-direction regulating plate (32) is directed upward slightly obliquely relative to the horizontal direction. Consequently, the airflow that is blown out through the blow-out port (15) moves forward along a ceiling in the air-conditioning target space by passing between the first wind-direction regulating plate (31) and the second wind-direction regulating plate (32) and becomes a circulation airflow that circulates in the entirety of the inside of the room.

[0042] In the "oblique blowing mode", as illustrated in Fig. 3, the control unit (40) rotates the first wind-direction regulating plate (31) to a position at which the inner surface (31b) of the first wind-direction regulating plate (31) is directed substantially in the tangential direction of the terminal end (F) of the back-surface-side scroll (17) and rotates the second wind-direction regulating plate (32) to a position at which the outer surface (32a) of the second wind-direction regulating plate (32) is directed substantially in the horizontal direction. Consequently, the airflow that is blown out through the blow-out port (15) moves forward obliquely downward as it is by passing between the first wind-direction regulating plate (31) and the second wind-direction regulating plate (32). In the "oblique blowing mode", the volume of the blow-out air can be maximum.

[0043] In the "wide mode", as illustrated in Fig. 4, the control unit (40) rotates the first wind-direction regulating plate (31) to a position at which the inner surface (31b) of the first wind-direction regulating plate (31) is directed slightly downward relative to the tangential direction of the terminal end (F) of the back-surface-side scroll (17) and rotates the second wind-direction regulating plate (32) to a position at which the outer surface (32a) of the second wind-direction regulating plate (32) is directed downward slightly obliquely relative to the horizontal direction. Consequently, the airflow that is blown out through the blow-out port (15) moves obliquely downward by being divided due to the Coanda effect into an airflow D1 that moves forward along the inner surface (31b) of the first wind-direction regulating plate (31) and an airflow D2 that moves forward along the outer surface (32a) of the second wind-direction regulating plate (32). In other words, the airflow is downwardly extended by the first wind-direction regulating plate (31), and the airflow is extended upwardly by the second wind-direction regulating plate (32). As a result, it is possible in the "wide mode" to extend at least vertically a range that is to be reached by the airflow in the air-conditioning target space, compared with the other "normal mode".

[0044] To cause an airflow not to easily separate from the back-surface-side scroll (17) and the front-surface-side scroll (19) when the airflow is blown out through the blow-out port (15), the first wind-direction regulating plate (31) and the second wind-direction regulating plate (32) may be provided such that the airflow can pass also along the outer surface (31a) of the first wind-direction regulating plate (31) and the inner surface (32b) of the second wind-direction regulating plate (32).

[0045] In the "downward blowing mode", as illustrated in Fig. 5, the control unit (40) rotates the first wind-direction regulating plate (31) to a position at which the inner surface (31b) of the first wind-direction regulating plate (31) is directed slightly obliquely toward the back surface plate (11c) relative to the vertically downward direction and rotates the second wind-direction regulating plate (32) to a position at which the outer surface (32a) of the second wind-direction regulating plate (32) is directed slightly obliquely toward the back surface plate (11c) relative to the vertically downward direction. Consequently, the airflow that is blown out through the blow-out port (15) moves forward along a side wall in the air-conditioning target space by passing between the first wind-direction regulating plate (31) and the second wind-direction regulating plate (32) and becomes a circulation airflow that circulates in the entirety of the inside of the room.

<Wide Mode>

[0046] Fig. 6 is a diagram illustrating a difference between the "wide mode" and the "normal mode ("oblique blowing mode")" in the air-conditioner indoor unit (10).

[0047] As illustrated in Fig. 6, when the air-conditioner indoor unit (10) is installed such that the position of the blow-out port (15) is at a position of 2 m high from the floor surface in the air-conditioning target space and when a person having a body length of 1.6 m stands at a position away from the blow-out port (15) by 1 m on the front side, the blow-out air hits only the upper body of the person in the "normal mode".

[0048] In contrast, it is possible in the "wide mode" to cause the blow-out air to hit the whole body of the person since the range that is to be reached by the blow-out air is extended vertically compared with the "normal mode".

[0049] In the "wide mode", the following state of the blow-out air is achieved by the control unit (40). This is on the premise that the width (short-side length) of the blow-out port (15) is 300 mm or less.

[0050] When (1) a range of 1600 mm high from a floor surface at a position away from the blow-out port (15) by any distance within a range of 1000 mm to 2000 mm on the front side is set as a reference height range,

[0051] (2) among three ranges obtained by equally dividing the reference height range into three in the height direction, the range positioned on the upper side is set as a first range, the range positioned on the lower side is set as a second range, and the range positioned in the middle is set as a third range, and

[0052] (3) the air-conditioner indoor unit (10) is provided on a side wall in the air-conditioning target space such that the center of the blow-out port (15) is at a position of 2000 mm above from the floor surface,

[0053] (4) an average wind velocity in the first range and an average wind velocity in the second range are substantially equal to each other, and an average wind velocity in the third range is less than 1.5 times of the average wind velocity in the first range.

[0054] The state of the blow-out air in the "wide mode" is achieved in a range of at least 1000 mm or more in a direction parallel to the long sides of the blow-out port (15). In the "wide mode", the average wind velocity in the third range is preferably equal to or more than 0.5 times and less than 1.1 times of the average wind velocity in the first range. In the "wide mode", an average wind velocity in the reference height range may be 0.5 m/s or more. In the "wide mode", the width of the blow-out port (15) may be 150 mm or less. In the "wide mode", a percentage of a turbulent flow region occupying the entirety of the blow-out air that is immediately after (in other words, in the vicinity of the blow-out port (15)) being blown out through the blow-out port (15) is preferably less than 30%.

[0055] Fig. 7 is a graph showing one example of a wind velocity distribution of an airflow that is blown out in the "wide mode" in the air-conditioner indoor unit (10). Fig. 8 is a graph showing one example of a wind velocity distribution of an airflow that is blown out in the "normal mode" in the air-conditioner indoor unit (10). The results in Fig. 7 and Fig. 8 show wind velocity distributions in the "first range", the "second range", and the "third range" when the air-conditioner indoor unit (10) is provided on a side wall in the air-conditioning target space such that the center of the blow-out port (15) is at a position of 2000 mm above from the floor surface with the above-described "reference height range" being set in a range of 1600 mm high from the floor surface at a position away from the blow-out port (15) by 1000 mm on the front side.

[0056] In the wind velocity distribution in Fig. 7, the average wind velocity in the reference height range is 0.76 m/s, and the average wind velocities in the first, second, and third ranges are 0.84 m/s, 0.85 m/s, and 0.61 m/s, respectively. Accordingly, the average wind velocity (0.84m /s) in the first range and the average wind velocity (0.85 m/s) in the second range are substantially equal to each other, and the average wind velocity (0.61 m/s) in the third range is about 0.73 times, which is less than 1.5 times, of the average wind velocity (0.84 m/s) in the first range. In other words, the "wide mode" is achieved.

[0057] In the wind velocity distribution in Fig. 8, the average wind velocity in the reference height range is 1.15 m/s, and the average wind velocities in the first, second, and third ranges are 0.97 m/s, 0.74 m/s, and 1.64 m/s, respectively. Accordingly, the average wind velocity (0.97 m/s) in the first range and the average wind velocity (0.74 m/s) in the second range differ from each other by 0.2 m/s or more, and the average wind velocity (1.64 m/s) in the third range is about 1.69 times, which is more than 1.5 times, of the average wind velocity (0.97 m/s) in the first range. In other words, the mode is not the "wide mode".

[0058] Comparing the "wide mode" with the "normal mode" when the capacity (air conditioning capacity) of the air-conditioner indoor unit (10) and the air volume (volume of the blow-out air) are the same therebetween, the area of the airflow (range in which blow-out air passes through in the height direction) is larger in the "wide mode", as illustrated in Fig. 6, and thus, the wind velocity (average wind velocity) of the blow-out air is small. Thus, for example, the "wide mode" can increase a feeling of warmth by suppressing a decrease in a feeling temperature due to a draft feeling during heating. Accordingly, when the same feeling temperature as that in the "normal mode" is obtained in the "wide mode" while maintaining the volume of the blow-out air to be the same, it is possible to cause the air conditioning capacity to be lower than that in the "normal mode" and to thereby, for example, further reduce the wind velocity of the blow-out air.

[0059] Thus, in the present embodiment, for example, when the state of air conditioning by the air-conditioner indoor unit (10) is stable, in other words, when the air conditioning load is relatively small, the control unit (40) causes the air conditioning capacity of the "wide mode" to be lower than the air conditioning capacity of the "normal mode" when switching from the "normal mode" to the "wide mode".

[0060] Specifically, in switching to the "wide mode", the control unit (40) may regulate the number of rotations of the fan (14), the number of rotations of a compressor of an outdoor unit (not illustrated), the opening degree of an electric valve, and the like so that the air conditioning capacity is lowered.

[0061] In the "wide mode", since the Coanda effect is used to extend the area of the airflow, separation of the airflow easily occurs on the inner surface (31b) of the first wind-direction regulating plate (31) and on the outer surface (32a) of the second wind-direction regulating plate (32). Therefore, condensation easily occurs during cooling as a result of contact between cool wind and room temperature air on the inner surface (31b) of the first wind-direction regulating plate (31) and on the outer surface (32a) of the second wind-direction regulating plate (32).

[0062] Thus, in the present embodiment, the control unit (40) may switch to the "normal mode" when the "wide mode" has been continued for a predetermined period or more during cooling. In this case, the air conditioning capacity of the "normal mode" may be increased to an air conditioning capacity at the time before switching to the "wide mode".

[0063] The "normal mode", in particular, the "upward blowing mode" and the "downward blowing mode" are suitable for heating and cooling the entirety of a room by a circulation airflow that circulates in the entirety of the inside of the room.

[0064] Thus, in the present embodiment, the air-conditioner indoor unit (10), a remote controller, or the like may be provided with a person detector, for example, a room occupancy sensor, and the control unit (40) may switch between the "normal mode" and the "wide mode" on the basis of presence/absence of a person inside and outside a range that is to be reached by the blow-out air of the "wide mode" in the air-conditioning target space. For example, when the number of persons in a room is two or more, the mode may be switched from the "wide mode" to the "normal mode". The mode may be switched to the "wide mode" when persons are present only in the "aforementioned range", and the mode may be switched to the "normal mode" when persons are present in both of the "aforementioned range" and the "other ranges". When the number of persons in a room has decreased, the mode may be switched from the "normal mode" to the "wide mode".

[0065] In the present embodiment, the control unit (40) may cause the temperature of at least a portion of the heat exchanger (13) to be lower than a dew temperature in the air-conditioning target space in the "wide mode" during cooling.

[0066] In the present embodiment, the control unit (40) may vary in the "wide mode" the blow-out velocity of the airflow as in, for example, the 1/f fluctuation and a wind-velocity jump. Specifically, the blow-out velocity of the airflow may be varied in a range of, for example, 0 to 0.5 m/s by changing the number of rotations of the fan (14), the angles of the first wind-direction regulating plate (31) and the second wind-direction regulating plate (32), the angles of the back-surface-side scroll (17) and the front-surface-side scroll (19), and the like.

- Effects of Embodiment -

[0067] According to the air-conditioner indoor unit (10) of the present embodiment described above, the air conditioning capacity is lowered compared with the "normal mode" in the "wide mode" in which the range that is to be reached by an airflow blown out through the blow-out port (15) is extended to be larger than in the "normal mode". Thus, it is possible to immediately heat and cool the body of a user with a spread airflow that hits the whole body of the user while suppressing a draft feeling by lowering the velocity of the wind that hits the user.

[0068] In other words, even in an air conditioned environment in which a user feels a draft due to an airflow of the "normal mode", it is possible to directly heat and cool the body of the user with a spread airflow by causing the air conditioning capacity to be lower than in the "normal mode" while extending the area of the airflow by the "wide mode" without giving a draft feeling by lowering the velocity of wind that hits the user.

[0069] The airflow of the "wide mode" is an airflow that blows across not only a portion of the body of a user but also the whole body and thus improves the comfortable feeling of the user. By the airflow of the "wide mode" hitting the whole body of the user, a variation in the temperature distribution on the body of the user is reduced. The load on the body of the user is thus reduced.

[0070] In the "wide mode", the range that is to be reached by the airflow is extended to be larger than in the "normal mode" and thus is less likely to be limited by layout, furniture arrangement, the installation place of the air-conditioner indoor unit (10), and the like. In other words, even when an obstacle is present in the inside of a room, the airflow of the "wide mode" easily flows around the obstacle. The temperature variation in the room is thus small.

[0071] In the "wide mode", the wind velocity of the blow-out air is low compared with the "normal mode". It is thus possible to cause wind to be felt warm compared with when the wind velocity is high and thus possible to increase the feeling temperature even the blow-out temperature is the same.

[0072] When control is performed for adjusting the feeling temperature of the user in the "wide mode" in heating, the temperature of the heat exchanger (13) can be lowered, and thus, an energy saving effect is exerted.

[0073] It is possible not only during heating but also during cooling to suppress excessive cooling of the body of a person even when the blow-out temperature is low by using the "wide mode".

[0074] In the air-conditioner indoor unit (10) according to the present embodiment, by the control unit (40) switching to the "normal mode" when the "wide mode" has been continued for a predetermined period or more during cooling, it is possible to suppress occurrence of condensation in the air-conditioner indoor unit (10) during cooling.

[0075] In the air-conditioner indoor unit (10) according to the present embodiment, by the control unit (40) switching between the "normal mode" and the "wide mode" on the basis of presence/absence of a person inside and outside the range that is to be reached by the blow-out air of the "wide mode" in the air-conditioning target space, it is possible to perform appropriate air conditioning on the basis of a presence state of a person in the air-conditioning target space.

[0076] In the air-conditioner indoor unit (10) according to the present embodiment, by the control unit (40) causing the temperature of at least a portion of the heat exchanger (13) to be lower than a dew temperature in the air-conditioning target space in the "wide mode" during cooling, it is possible to perform cooling while dehumidifying.

[0077] In the air-conditioner indoor unit (10) according to the present embodiment, by the control unit (40) varying the velocity of the blow-out air in the "wide mode", it is possible to blow out an airflow similar to comfortable natural wind.

<Modification>

[0078] Fig. 9 is a sectional view of the air-conditioner indoor unit (10) according to the present modification during operation in the wide mode. In Fig. 9, the same components as those of the air-conditioner indoor unit (10) according to the aforementioned embodiment illustrated in Fig. 4 are given the same signs.

[0079] The air-conditioner indoor unit (10) according to the present modification illustrated in Fig. 9 mainly differs from the air-conditioner indoor unit (10) according to the aforementioned embodiment illustrated in Fig. 4 in that a third wind-direction regulating plate (33) is provided between the first wind-direction regulating plate (31) and the second wind-direction regulating plate (32) at the blow-out port (15) to realize the "wide mode". An outer surface (33a) of the third wind-direction regulating plate (33) faces the inner surface (31b) of the first wind-direction regulating plate (31), and an inner surface (33b) of the third wind-direction regulating plate (33) faces the second wind-direction regulating plate (32). The third wind-direction regulating plate (33) may be constituted by one plate that has a length substantially the same as the length of the blow-out port (15) and that is not divided.

[0080] A rotary shaft (331) of the third wind-direction regulating plate (33) is provided in the vicinity of the center of the blow-out port (15) in the short-side direction. The base portion of the third wind-direction regulating plate (33) and the rotary shaft (331) are coupled together. The rotary shaft (331) is coupled to a rotary shaft of a motor (not illustrated) fixed to the body casing (11). The third wind-direction regulating plate (33) can be caused by the motor to take a plurality of orientations having different inclination angles in the front-rear direction.

[0081] By the rotary shaft (331) rotating counterclockwise in the front view in Fig. 1, the tip portion of the third wind-direction regulating plate (33) is moved away from the blow-out port (15). Conversely, by the rotary shaft (331) rotating clockwise in the front view in Fig. 1, the tip portion of the third wind-direction regulating plate (33) is moved to approach the blow-out port (15).

[0082] In addition, in the air-conditioner indoor unit (10) according to the present modification illustrated in Fig. 9, to suppress separation of the airflow from the front-surface-side scroll (19), the Coanda effect is increased by increasing the curvature of the terminal end portion of the front-surface-side scroll (19), and the third wind-direction regulating plate (33) is disposed closer to the front-surface-side scroll (19) than the back-surface-side scroll (17) .

[0083] In addition, to suppress separation of the airflow from the first wind-direction regulating plate (31), the first wind-direction regulating plate (31) is spaced from the terminal end (F) of the back-surface-side scroll (17), and a passage for the airflow is provided along the outer surface (31a) of the first wind-direction regulating plate (31).

[0084] In the "wide mode" of the air-conditioner indoor unit (10) according to the present modification, the control unit (40) changes the angle of the third wind-direction regulating plate (33) such that the airflow that is blown out through the blow-out port (15) separates on the inner surface (33b) of the third wind-direction regulating plate (33) and that the airflow is divided into two at the tip portion of the third wind-direction regulating plate (33). To suppress separation of the airflow from the first wind-direction regulating plate (31), the control unit (40) gradually changes the angle of the first wind-direction regulating plate (31) to be, for example, "33° $\rightarrow$ 39° $\rightarrow$ 45°" or "50° $\rightarrow$ 55° $\rightarrow$ 60°" and changes the angle of the third wind-direction regulating plate (33) such that the tip portion of the third wind-direction regulating plate (33) is positioned close to the first wind-direction regulating plate (31).

[0085] In the present modification described above, it is also possible to obtain the same effects as those in the aforementioned embodiment. In the present modification, by adding the third wind-direction regulating plate (33), the airflow that is blown out through the blow-out port (15) is divided into two, and a configuration similar to a configuration in which two blow-out ports are provided is realized. In detail, in a configuration in which the second wind-direction regulating plate (32) is provided to be continuous with the front-surface-side scroll (19) and in which the first wind-direction regulating plate (31) and the third wind-direction regulating plate (33) are provided between the front-surface-side scroll (19) and the back-surface-side scroll (17), an airflow on the upper side is generated by the front-surface-side scroll (19) and the third wind-direction regulating plate (33), and an airflow on the lower side is generated by the back-surface-side scroll (17), the first wind-direction regulating plate (31), and the third wind-direction regulating plate (33). Consequently, it is possible to vertically extend the range that is to be reached by the airflow in the air-conditioning target space.

[0086] In the present modification, the blow-out air is extended vertically by three horizontal wind-direction regulating plates (horizontal flaps). As an alternative to this, the blow-out air may be extended vertically by four or more horizontal flaps.

<<Other Embodiments>>

[0087] In the embodiment and the modification described above, the air-conditioner indoor unit (10) has, as blow-out modes, the "upward blowing mode", the "oblique blowing mode", the "wide mode", and the "downward blowing mode" but may have different modes other than these modes additionally. Each of the "wide mode" and the other modes may have a plurality of sub-modes additionally. The range that is to be reached by the blow-out air of the "wide mode" in the air-conditioning target space may be movable in the height direction and the lateral direction (direction parallel to the long sides of the blow-out port (15)). The airflow that is blown out in the "wide mode" may be divided into two or more also in the lateral direction by providing a plurality of perpendicular wind-direction regulating plates such that the blow-out port (15) is demarcated into two or more regions in the long-side direction. Consequently, it is possible to extend the blow-out air also in the lateral direction and possible to reduce the variation in the wind velocity distribution of the blow-out air in the lateral direction.

[0088] In the embodiment and the modification described above, the air-conditioner indoor unit (10) is a wall-mount type to be installed on a side wall in an air-conditioning target space. However, as long as having the "wide mode" according to the present disclosure, the air-conditioner indoor unit (10) may be of a different type, for example, a ceiling pendant type, a floor installation type, or the like.

[0089] Embodiments and modifications have been described above. However, it should be understood that the forms and the details can be variously changed without departing from the gist and the scope of the claims. The above embodiments and the modifications may be combined together or replaced, as appropriate, provided that the functions of objects of the present disclosure are not lost. The wordings "first", "second", ... in the above description are used to distinguish the terms given these wordings from each other and do not intend to limit the numbers and the order of the terms.

Industrial Applicability

[0090] As described above, the present disclosure is useful for an indoor unit for an air conditioner.

Reference Signs List

[0091]

10	air-conditioner indoor unit
11	body casing
11a	top surface portion
11b	front surface panel
11c	back surface plate
11d	bottom surface plate
13	heat exchanger
14	fan
15	blow-out port
16	bottom frame
17	back-surface-side scroll
18	blow-out flow path
19	front-surface-side scroll
31	first wind-direction regulating plate
31a	outer surface
31b	inner surface
311	rotary shaft
32	second wind-direction regulating plate
32a	outer surface
32b	inner surface
321	rotary shaft
33	third wind-direction regulating plate
33a	outer surface
33b	inner surface
331	rotary shaft
40	control unit
130	housing portion

Claims

1. An indoor unit for an air conditioner, the indoor unit being configured to be installed in an air-conditioning target space and to be capable of changing a direction of an airflow that is blown out through a blow-out port (15), the indoor unit comprising:

   a control unit (40) configured to switch between a normal mode and a wide mode,
   wherein the control unit (40) is configured to extend at least vertically a range that is to be reached by the airflow in the air-conditioning target space in the wide mode compared with the normal mode and to cause an air conditioning capacity of the wide mode to be lower than an air conditioning capacity of the normal mode.

2. The indoor unit for an air conditioner according to claim 1,
   wherein the control unit (40) is configured to switch to the normal mode when the wide mode has been continued for a predetermined period or more during cooling.

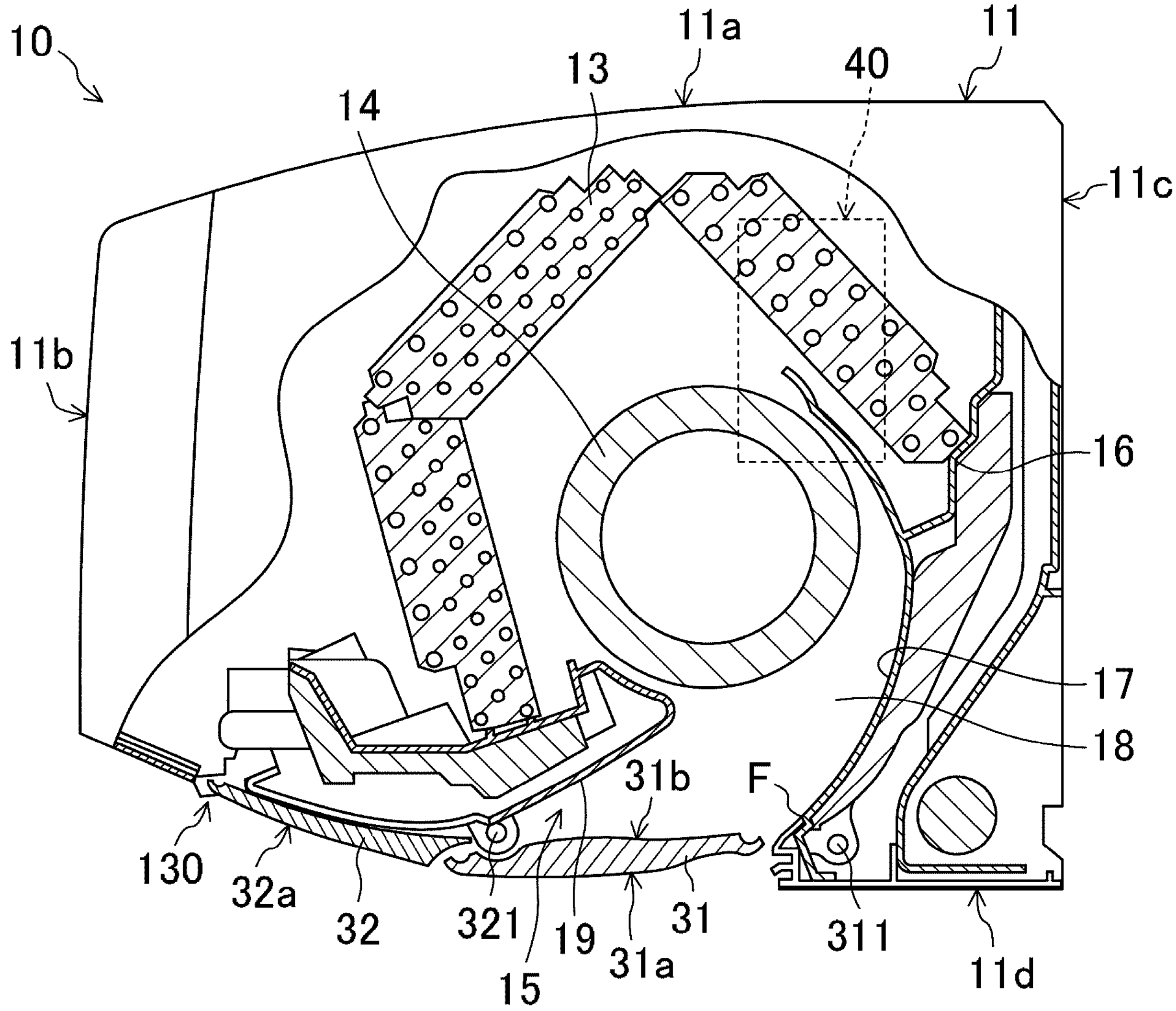
3. The indoor unit for an air conditioner according to claim 1 or claim 2,
   wherein the control unit (40) is configured to switch between the normal mode and the wide mode based on presence/absence of a person inside and outside of a range that is to be reached by the airflow of the wide mode in the air-conditioning target space.

4. The indoor unit for an air conditioner according to any one of claims 1 to 3, the indoor unit further comprising:

   a heat exchanger (13) that is configured to exchange heat with air that is taken in from the air-conditioning target space to thereby regulate a temperature of the air,
   wherein the control unit (40) is configured to cause a temperature of at least a portion of the heat exchanger (13) in the wide mode during cooling to be lower than a dew temperature in the air-conditioning target space.

5. The indoor unit for an air conditioner according to any one of claims 1 to 4,
   wherein the control unit (40) is configured to vary a blow-out velocity of the airflow in the wide mode.

FIG.1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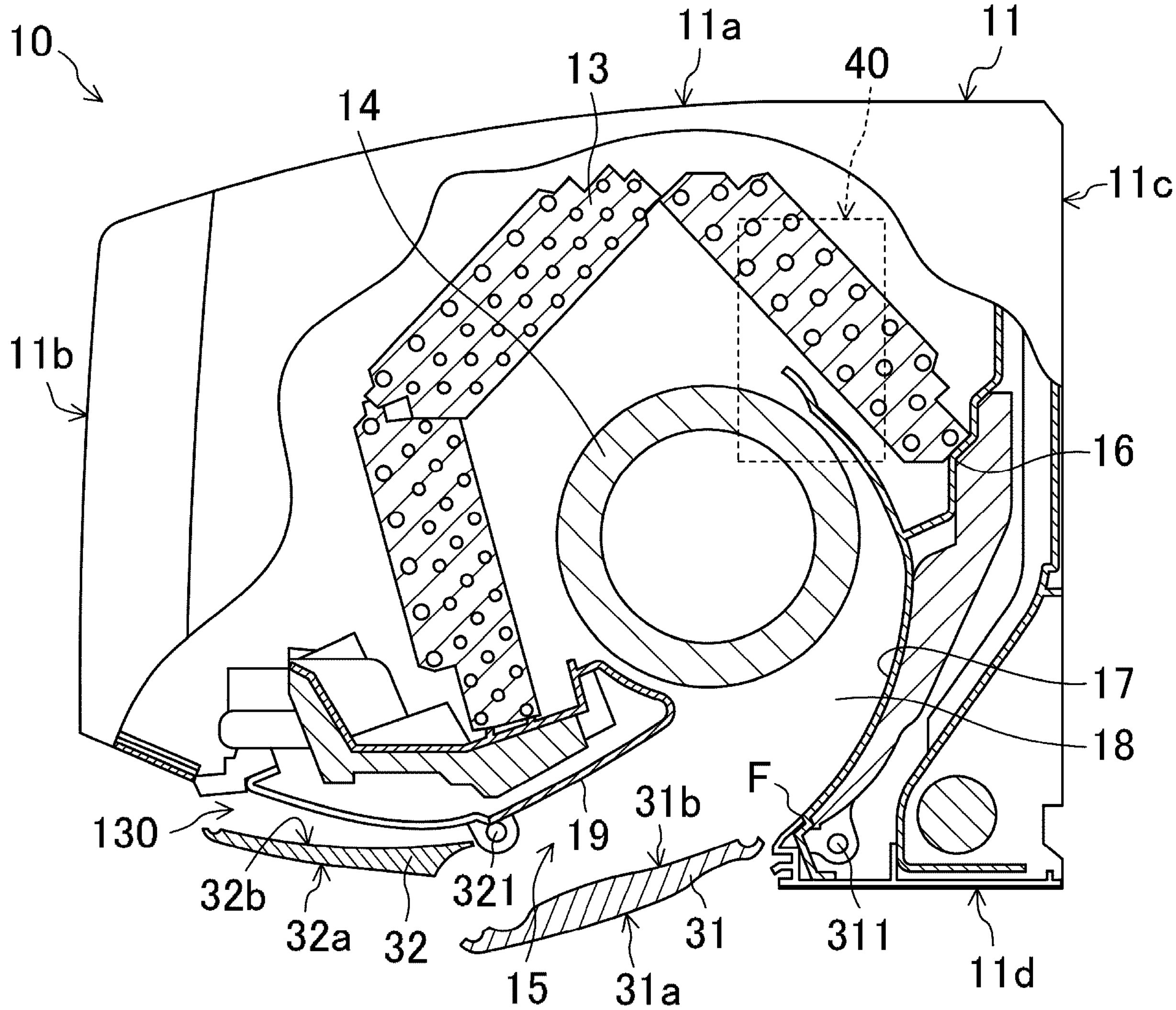
31a
31
311
11d

FIG.2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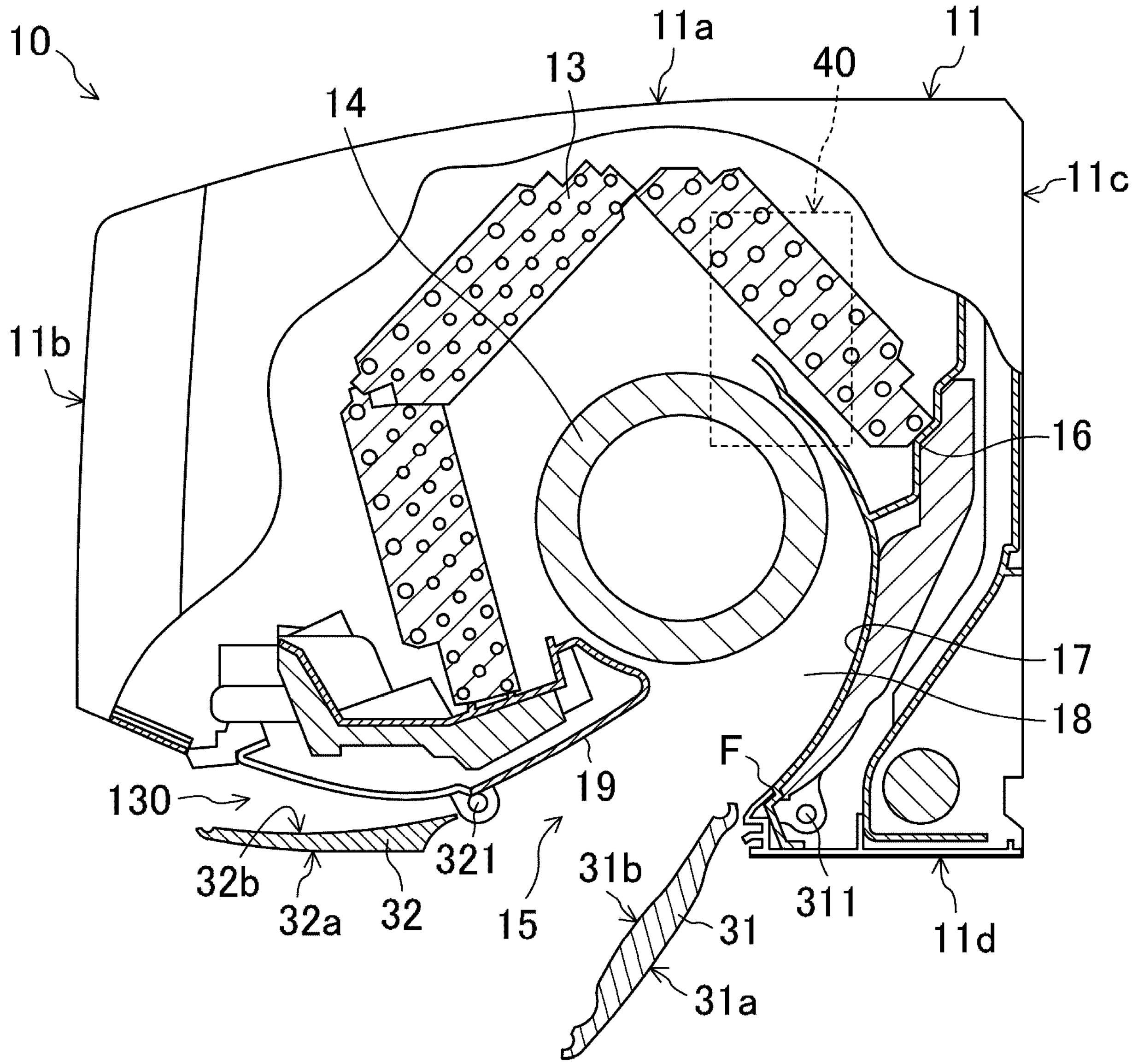
31a
11d

FIG.3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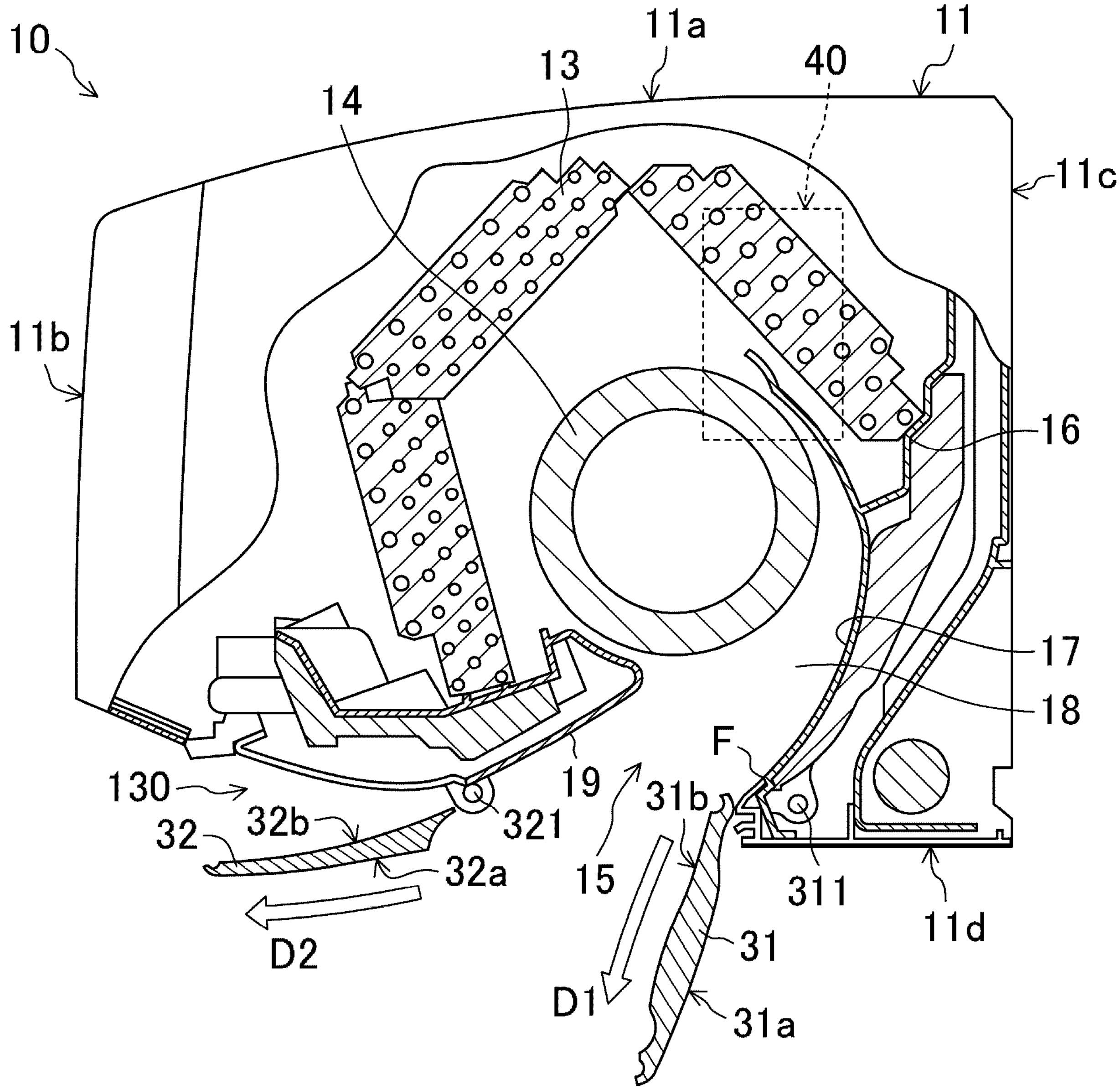
11d
31a

FIG.4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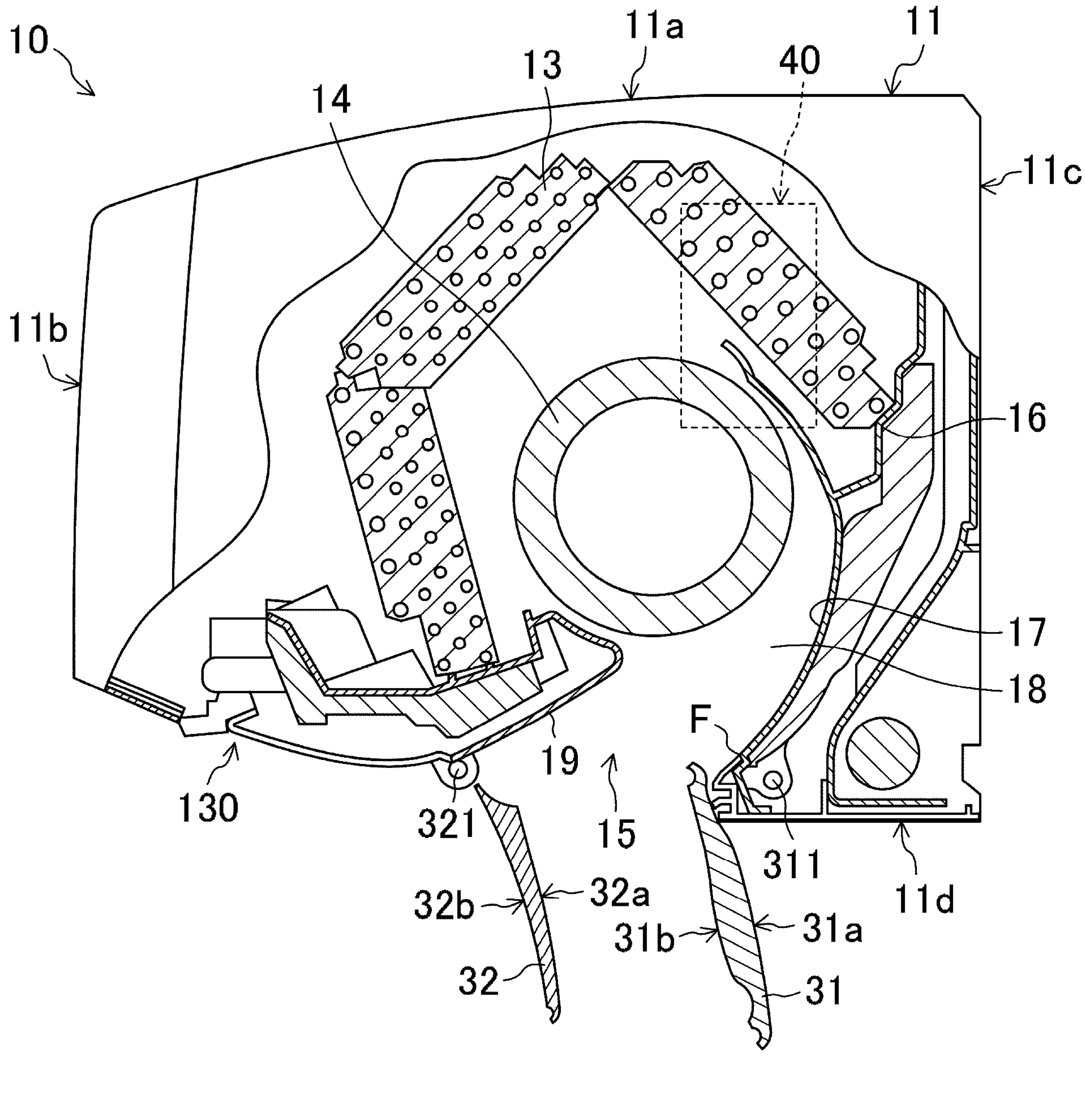
32a
15
11d
31
D2
D1
31a

FIG.5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31b
31a
32
31

FIG.6

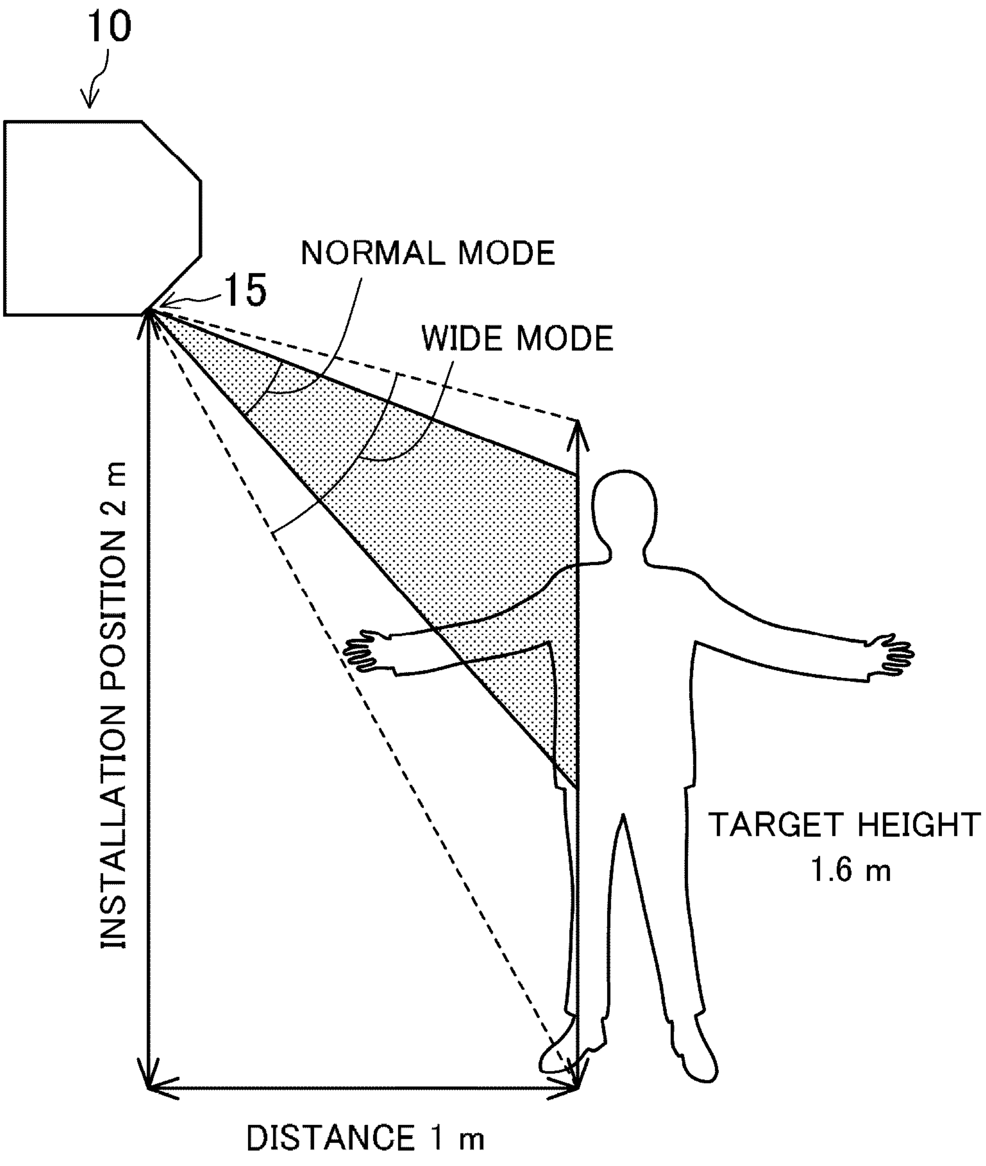

10
15
NORMAL MODE
WIDE MODE
INSTALLATION POSITION 2 m
TARGET HEIGHT
1.6 m
DISTANCE 1 m

FIG.7

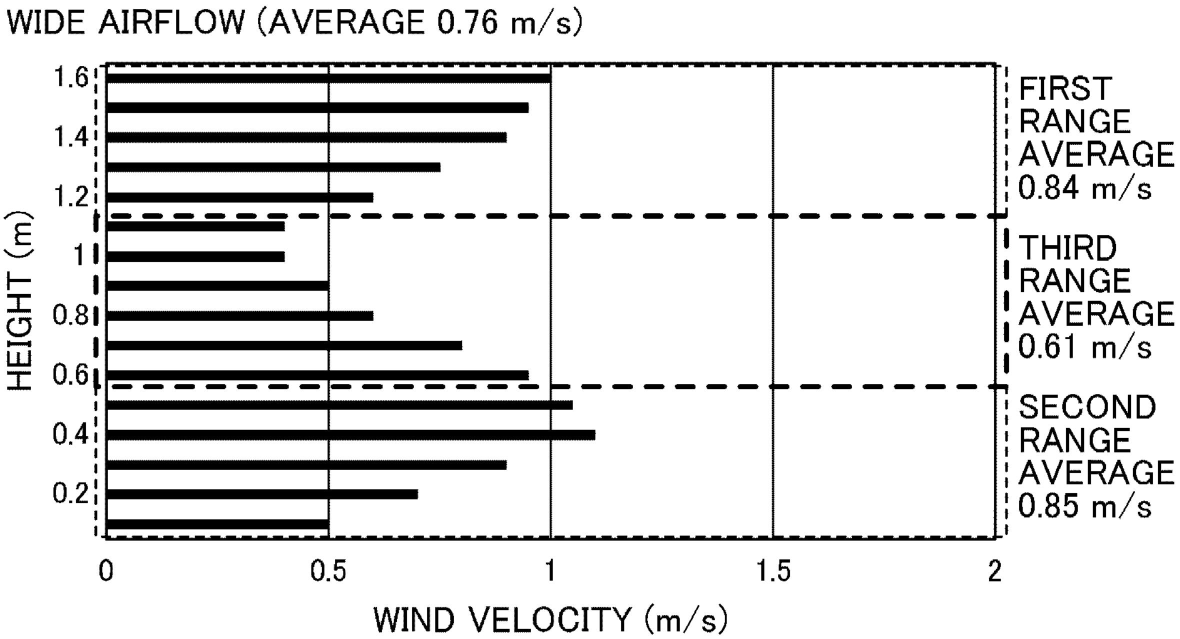
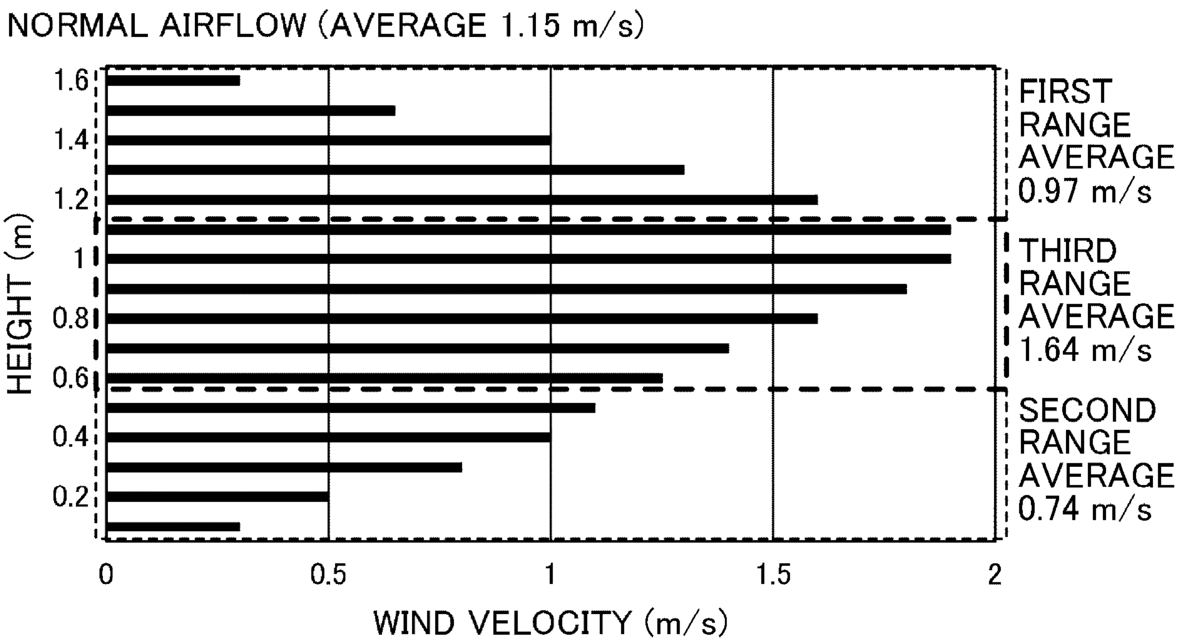

WIDE AIRFLOW (AVERAGE 0.76 m/s)
HEIGHT (m)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0.5
1
1.5
2
WIND VELOCITY (m/s)
FIRST RANGE AVERAGE 0.84 m/s
THIRD RANGE AVERAGE 0.61 m/s
SECOND RANGE AVERAGE 0.85 m/s

FIG.8


NORMAL AIRFLOW (AVERAGE 1.15 m/s)
HEIGHT (m)
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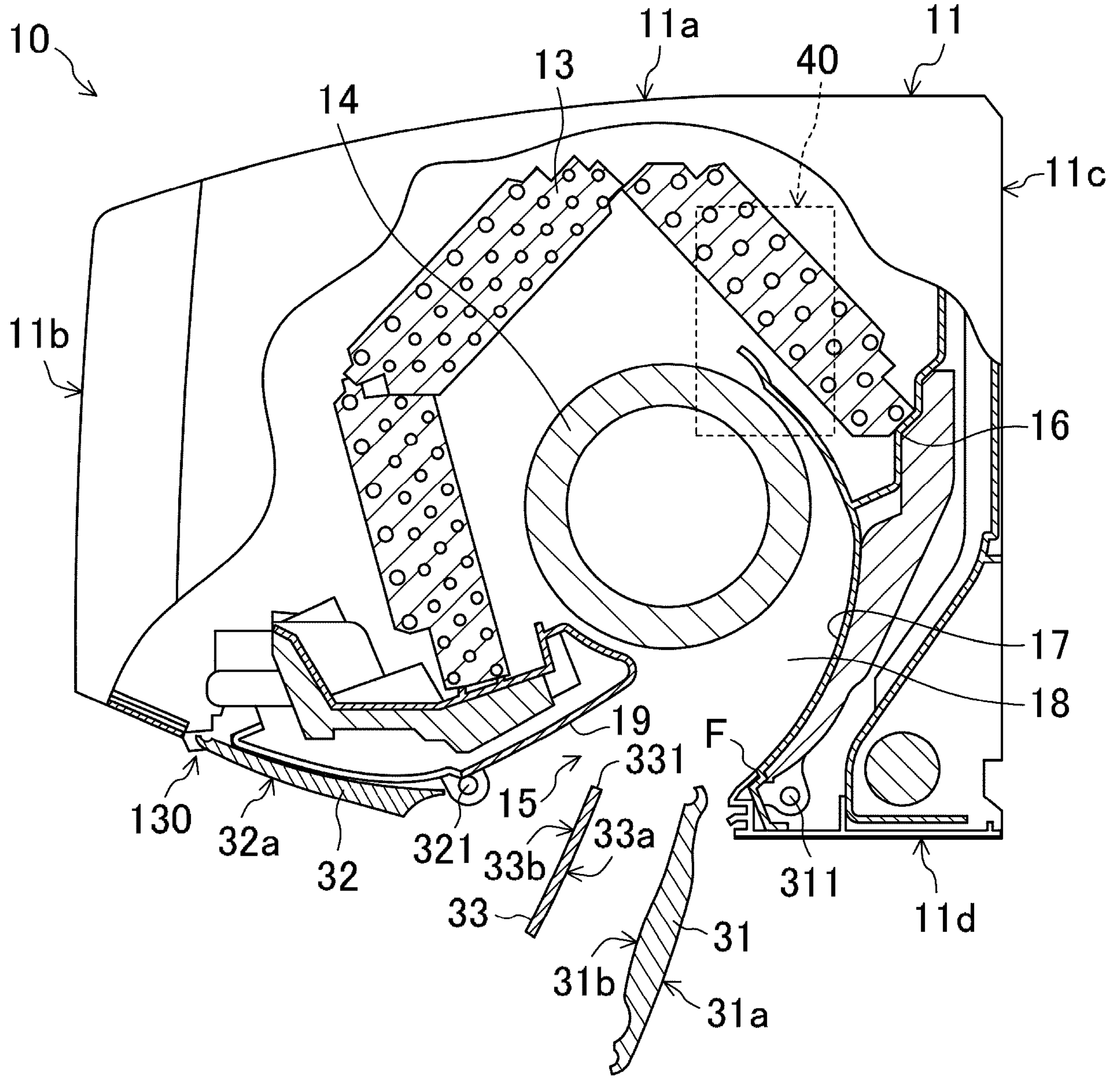
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0.5
1
1.5
2
WIND VELOCITY (m/s)
FIRST RANGE AVERAGE 0.97 m/s
THIRD RANGE AVERAGE 1.64 m/s
SECOND RANGE AVERAGE 0.74 m/s

FIG.9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33b
311
33
11d
31
31b
31a

INTERNATIONAL SEARCH REPORT

International application No. PCT/JP2020/034722

A. CLASSIFICATION OF SUBJECT MATTER

F24F 11/65(2018.01)i; F24F 11/755(2018.01)i; F24F 11/79(2018.01)i; F24F 11/81(2018.01)i; F24F 11/83(2018.01)i; F24F 120/10(2018.01)n; F24F 120/12(2018.01)n

FI: F24F11/79; F24F11/83; F24F11/81; F24F11/65; F24F11/755; F24F120/10; F24F120/12

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)

F24F11/65; F24F11/755; F24F11/79; F24F11/81; F24F11/83; F24F120/10; F24F120/12

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	1971-2020
Registered utility model specifications of Japan	1996-2020
Published registered utility model applications of Japan	1994-2020

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.
X Y	JP 2017-067401 A (DAIKIN INDUSTRIES, LTD.) 06 April 2017 (2017-04-06) paragraphs [0027]-[0148], fig. 1-12D	1-2 3-5
Y	JP 2013-238397 A (MITSUBISHI ELECTRIC CORP.) 28 November 2013 (2013-11-28) paragraphs [0025]-[0030], fig. 5-6	3-5
Y	JP 2003-021386 A (MITSUBISHI ELECTRIC CORP.) 24 January 2003 (2003-01-24) paragraph [0052], fig. 7	4-5
Y	JP 2013-137162 A (DAIKIN INDUSTRIES, LTD.) 11 July 2013 (2013-07-11) paragraphs [0142]-[0147]	5

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
23 October 2020 (23.10.2020)	02 November 2020 (02.11.2020)

Name and mailing address of the ISA/	Authorized officer
Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Telephone No.

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

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2020/034722

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
JP 2017-067401 A	06 Apr. 2017	EP 3358266 A1 paragraphs [0027]-[0148], fig. 1-12D AU 2016331555 A CN 108139103 A ES 2744075 T	
JP 2013-238397 A	28 Nov. 2013	(Family: none)	
JP 2003-021386 A	24 Jan. 2003	(Family: none)	
JP 2013-137162 A	11 Jul. 2013	WO 2013/099896 A1 paragraphs [0063]-[0065]	

Form PCT/ISA/210 (patent family annex) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

Patent documents cited in the description

- WO 2017043492 A1 **[0003]**