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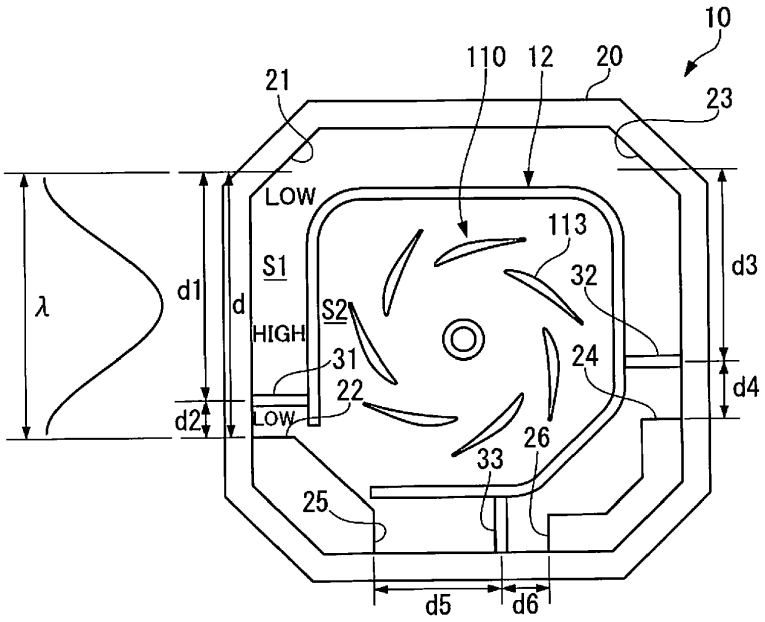
(54) AIR CONDITIONER UNIT

(57) To provide an air conditioner unit that makes it possible to suppress noise increase caused by resonance. An air conditioner unit (10) includes: a fan (11) that includes an impeller (110) and a motor (11M); a heat exchanger (12) to which the fan (11) blows air; and a housing (20) configured to house the fan (11) and the heat exchanger (12). A gap (S2) located on windward side of the heat exchanger (12) and a gap (S1) located on leeward side of the heat exchanger (12) are partitioned by partition walls (31, 32, 33) that protrude from the heat exchanger (12) to the windward side and the leeward side.

FIG. 4



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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a unit constituting an air conditioner.

Description of the Related Art

[0002] A heat exchanger and a centrifugal fan that blows air toward the heat exchanger are disposed in a housing of an indoor unit of an air conditioner. In the air conditioner of a type installed in a ceiling, indoor air is sucked into the fan from a region at a center of a housing panel having a rectangular shape in a planar view. The air pressurized by an impeller of the fan is blown to the heat exchanger surrounding the impeller, and the air that has passed through the heat exchanger is blown off to the room from blow-off ports at four sides of the housing panel in four directions.

[0003] In JP 2013-96601 A, a wall is disposed near a corner of a housing between an inner wall of the housing surrounding a heat exchanger and an outer peripheral part of the heat exchanger in order to reduce NZ sound caused by pressure fluctuation of the air at the corner in the housing. The NZ sound is noise that occurs at a frequency determined depending on a rotation speed of the fan and the number of blades.

[0004] Noise of some types occurs irrespective of the rotation speed of the fan and the number of blades.

[0005] If the pressure fluctuation generated from the impeller resonates in the housing, the resonance causes increase in sound pressure of noise irrespective of the rotation speed of the impeller. The resonance may occur at a plurality of frequencies dispersed in a wide frequency band.

[0006] Disposing of the wall near the corner of the housing as disclosed in JP 2013-96601 A is effective to reduce the NZ noise; however, it is difficult to sufficiently suppress noise increase caused by the resonance in some cases.

[0007] Accordingly, an object of the present invention is to provide an air conditioner unit that makes it possible to suppress noise increase caused by resonance.

SUMMARY OF THE INVENTION

[0008] An air conditioner unit according to the present invention is a unit constituting an air conditioner, and the air conditioner unit includes: a fan including an impeller and a driving section configured to drive the impeller; a heat exchanger to which the fan blows air; and a housing configured to house the fan and the heat exchanger.

[0009] Further, in the present invention, a gap located on windward side of the heat exchanger and a gap located on leeward side of the heat exchanger are each partitioned by a partition wall that protrudes from the heat exchanger to the windward side and the leeward side.

[0010] In the air conditioner unit according to the present invention, a distance from the partition wall to each of walls located on both sides (both surface sides) of the partition wall is preferably not equivalent to n times of a half of a wavelength of a predetermined selected frequency, where n is a natural number (1, 2, 3, ...).

[0011] In the air conditioner unit according to the present invention, the distance is preferably not equivalent to any of 1/2 wavelength, 1 wavelength, 3/2 wavelengths, and 2 wavelengths of the selected frequency.

[0012] In the air conditioner unit according to the present invention, the partition wall is preferably located between the walls facing each other with a distance in between, the distance being equivalent to n times of the half of the wavelength of the selected frequency.

[0013] In the air conditioner unit according to the present invention, a plurality of pairs of walls facing each other with a distance in between, the distance being equivalent to n times of the half of the wavelength of the selected frequency, are included. The partition wall is located between the walls in each of the pairs. Distances from one of the plurality of partition walls to the walls that are respectively located on both sides of the one partition wall are different from any of distances from each of the other partition walls to the walls that are located on both sides of each of the other partition walls.

[0014] In the air conditioner unit according to the present invention, the distance from the partition wall to the wall facing the partition wall is preferably varied in a height direction of the housing.

[0015] In the air conditioner unit according to the present invention, the distance from the partition wall to the wall facing the partition wall is preferably varied in a planar view of the housing.

[0016] In the air conditioner unit according to the present invention, the housing preferably has a substantially rectangular shape in a planar view, the gap partitioned by the partition wall is preferably linearly provided along sides of the housing, and at least one of the walls disposed to sandwich the partition wall is preferably located at a corner of the housing.

[0017] In the air conditioner unit according to the present invention, the partition wall is preferably made up of a sound absorbing material that absorbs sound waves.

[0018] According to the present invention, the gap on the windward side of the heat exchanger and the gap on the leeward side are partitioned by the partition wall, which makes it possible to suppress noise amplification caused by resonance. Further, pressure fluctuation propagated from the impeller is divided by the partition wall, which reduces the wavelength at which the resonance occurs and shifts the frequency to higher side. Accordingly, the frequency of the generated sound is dispersed. This makes it possible to suppress propagation of the pressure fluctuation of the same frequency to reduce noise.

[0019] Further, the position of the partition wall is determined such that the distance from the partition wall to each of the walls located on both sides of the partition wall is not equivalent to n times of the half of the wavelength of the predetermined frequency selected based on frequency analysis of the noise, etc. This makes it possible to prevent occurrence of resonance at the predetermined frequency to reduce noise.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020]

FIG. 1 is a cross-sectional diagram illustrating an air conditioner unit according to an embodiment of the present invention;
FIG. 2 is a perspective view illustrating an air conditioner unit according to a first embodiment as viewed from below;
FIG. 3 is a diagram illustrating a frequency analysis result of noise that occurs from the air conditioner unit before a partition wall is applied;
FIG. 4 is a plan view to explain a distance between a wall inside a housing and the partition wall;
FIG. 5A is a perspective view illustrating an air conditioner unit according to a second embodiment as viewed from below, and FIG. 5B is a schematic diagram illustrating a partition wall in the second embodiment as viewed from side;
FIG. 6 is a perspective view illustrating a modification of the second embodiment; and
FIG. 7 is a plan view illustrating another modification of the second embodiment.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0021] Some embodiments of the present invention are described below with reference to accompanying drawings.

[0022] In each of the embodiments described below, an air conditioner unit of the present invention is described with a four-direction blow-off type to be installed in a ceiling, as an example.

[First Embodiment]

[0023] An air conditioner unit 10 illustrated in FIG. 1 and FIG. 2 constitutes an air conditioner, together with an unillustrated outdoor unit and an unillustrated piping.

[0024] The air conditioner unit 10 includes a fan 11, a heat exchanger 12 to which the fan 11 blows air, and a housing 20 that houses the fan 11 and the heat exchanger 12.

[0025] The housing 20 has a substantially-rectangular box shape in a planar view. As illustrated in FIG. 2, four corners of the housing 20 are chamfered, and unillustrated hanging bolts are respectively disposed at portions offset by chamfering. The air conditioner unit 10 is to be installed in the ceiling of a room by the hanging bolts. Each of the four chamfered portions is referred to as a "corner" of the housing 20.

[0026] When the air conditioner unit 10 is installed in the ceiling, the housing 20 is positioned with its opening 201(FIG. 2) downward. A rectangular housing panel 13 (FIG. 1) that covers the opening 201 is provided on the housing 20. The housing panel 13 is detached from the housing 20 in FIG. 2.

[0027] A mesh-shaped suction port 131 through which air that is sucked into the fan 11 disposed inside the housing 20 passes is provided in a center region of the housing panel 13 (FIG. 1). A bell-mouth 14 is disposed on an inside of the housing panel 13. The bell-mouth 14 introduces, into the fan 11, indoor air sucked from the suction port 131.

[0028] Blow-off ports 132 through which the air that has passed through the heat exchanger 12 is blown off to four directions are respectively provided on four sides of the housing panel 13.

[0029] An unillustrated drain pan, a drain pump 15 (FIG. 2), and the like are disposed on the inside of the housing panel 13. The drain pan receives water condensed in the heat exchanger 12 and the like, and the drain pump 15 sucks the water accumulated in the drain pan.

[0030] The fan 11 includes an impeller 110 and a motor 11M that drives the impeller 110.

[0031] As illustrated in FIG. 1 and FIG. 2, the impeller 110 includes a main plate 112, a plurality of blades 113, and an annular shroud 114. The main plate 112 is connected to a shaft 111 to which rotational driving force is outputted from the motor 11M. The plurality of blades 113 are fixed to the main plate 112. The annular shroud 114 is coupled to the plurality of blades 113.

[0032] As illustrated in FIG. 2, the heat exchanger 12 is disposed in the housing 20 so as to surround the impeller 110. The heat exchanger 12 of a fin and tube type is connected to an unillustrated refrigerant circuit, and includes metal tubes 121 through which a refrigerant flows, and metal fins 122 that are thermally coupled to the tube 121. The heat exchanger 12 exchanges heat between the refrigerant flowing through the tubes 121 and the indoor air that passes through a gap between the fins 122.

[0033] The tubes 121 are each bent so as to surround the impeller 110. The tubes 121 are stacked in a plurality of stages in a height direction of the housing 20. The fins 122 are disposed in a direction orthogonal to a direction in which the tubes 121 extend, in the respective stages. The tubes 121 of the respective stages are coupled to one another by unillustrated U-shaped tubes, at both end parts 12A and 12B of a stacked body including the tubes 121 and the fins 122. A connection portions 20B and 20C that connect the refrigerant circuit and the tubes 121 are disposed between the end part 12A and the other end part 12B of the stacked body.

[0034] When the impeller 110 is rotated by the motor 11M (FIG. 1), the indoor air is sucked into the impeller 110, the sucked air is pressurized by the blades 113 with main use of centrifugal force, and the pressurized air is then pushed out toward the heat exchanger 12. The air that has passed between the fins 122 to the leeward side from an inner peripheral part 123 toward an outer peripheral part 124 of the heat exchanger 12 is blown off to the room through the blow-off ports 132 that communicate with a gap S1 between the heat exchanger 12 and the housing 20.

[0035] As illustrated in FIG. 2, the outer peripheral part 124 of the heat exchanger 12 is surrounded by an inner wall 202 of the housing 20. The gap S1 is provided between the outer peripheral part 124 and the inner wall 202. The gap S1 is linearly provided along the sides of the housing 20.

[0036] Further, a gap S2 is also provided between the inner peripheral part 123 of the heat exchanger 12 and an outer end 110A of the impeller 110.

[0037] The air conditioner unit 10 according to the present embodiment includes partition walls 3 (31 to 33) as main features. The partition walls 3 protrude from the heat exchanger 12 to windward side and to leeward side of the air blown by the impeller 110, so as to partition the gap S1 and the gap S2. The windward side of the heat exchanger 12 corresponds to the inner peripheral part 123 side of the heat exchanger 12. The leeward side of the heat exchanger 12 corresponds to the outer peripheral part 124 of the heat exchanger 12.

[0038] The partition walls 3 protrude inward from the inner peripheral part 123 of the heat exchanger 12, and also protrude outward from the outer peripheral part 124 of the heat exchanger 12.

[0039] FIG. 1 illustrates the partition walls 3 in a lattice pattern.

[0040] The partition walls 3 stand on a bottom part 203 of the housing 20 at which the motor 11M is disposed, in a posture along a direction connecting the windward side and the leeward side. The partition walls 3 partition the gap S1 and the gap S2 in a circumferential direction of the impeller 110.

[0041] The partition walls 3 are disposed in the housing 20, the heat exchanger 12, the housing panel 13, or the like by an appropriate method.

[0042] Each of the partition walls 3 may be formed in, for example, a rectangular shape without limitation, and may have an appropriate shape to partition the gap S1 or the gap S2. Each of the partition walls 3 may be formed of an appropriate material such as a metal material and a resin material to have an appropriate thickness as long as each of the partition walls 3 retains the predetermined position and the posture in a state of being supported by the installed members.

[0043] For example, the partition walls 3 each having a slit are provided on the bottom part 203 of the housing 20 and the heat exchanger 12 is inserted into the slits of the respective partition walls 3. This makes it possible to form the partition walls 3 that protrude from the heat exchanger 12 to the windward side and the leeward side.

[0044] The partition walls 3 each having the above-described slit may be provided on the inner wall 202 of the housing 20.

[0045] Each of the partition walls 3 does not necessarily have the slit. Plates respectively disposed on the windward and the leeward of the heat exchanger 12 may be assembled directly or with the tubes 121 and the fins 122 in between, to form each of the partition walls 3.

[0046] Although a clearance between the inner wall 202 and an outer end 3A located on the leeward side of each of the partition walls 3 is allowed, the partition walls 3 almost entirely partitions the gap S1 on the leeward side of the heat exchanger 12. Further, the gap S2 on the windward side of the heat exchanger 12 is also sufficiently partitioned by the partition walls 3 because an inner end 3B located on the windward side of each of the partition walls 3 is located near the outer end 110A of the impeller 110.

[0047] The air fed from the impeller 110 to its periphery includes pressure fluctuation. When the air is blown to the members around the impeller 110, aerodynamic sound occurs. In a case where resonance occurs in a space around the impeller 110, a sound pressure level is increased to cause large noise.

[0048] When the gap S2 on the windward side of the heat exchanger 12 and the gap S1 on the leeward side are sufficiently partitioned by the partition walls 3, it is possible to suppress noise amplification caused by the resonance. Further, when the pressure fluctuation propagated from the impeller 110 is divided by the partition walls 3, the wavelength at which the resonance occurs is shortened and the frequency is shifted to higher side, which disperses the frequency

of the generated sound. This makes it possible to reduce noise of a protruding frequency.

[0049] FIG. 3 illustrates results of frequency analysis of noise that occurs from the air conditioner unit before the partition walls 3 are applied, with different rotation speeds of the fan 11. A sound pressure level (SPL) in a vertical axis of FIG. 3 is a value that is obtained by performing acoustic feeling correction on a sound pressure level of the noise.

[0050] As illustrated in FIG. 3, the sound pressure level protrudes before and after a certain frequency (e.g., frequency f1) irrespective of rotation speeds A to C. In the example of FIG. 3, there are some frequencies at which the sound pressure level protrudes. It is inferred that the noise remarkably occurring irrespective of the rotation speed is caused by resonance.

[0051] When a dimension between the members located around the impeller 110 is matched with a wavelength of the pressure fluctuation generated from the impeller 110, resonance occurs. The phenomenon occurs irrespective of the rotation speed of the impeller 110.

[0052] The inner wall 202 at the corner of the housing 20 (hereinafter, referred to as corner wall) and a part facing the corner wall are present on the inside of the housing 20.

[0053] For example, as illustrated in FIG. 4, there are a corner wall 21 and a wall 22 facing the corner wall 21. The wall 22 is perpendicular to the inner wall 202. When a distance d between the walls 21 and 22 is matched with the wavelength of the pressure fluctuation that has propagated from the impeller 110 to the gap S1 through the heat exchanger 12, the resonance occurs. The distance is matched with the wavelength of the pressure fluctuation in a case where the distance d between the walls 21 and 22 is equivalent to n times (n is natural number) of a half of the wavelength of the pressure fluctuation, for example, in a case where the distance d is equivalent to 1/2 wavelength, 1 wavelength, 3/2 wavelengths, or 2 wavelengths of the pressure fluctuation.

[0054] FIG. 4 illustrates an example in which the distance d is equivalent to 1 wavelength (λ) of the pressure fluctuation propagated from the impeller 110. In this example, when the pressure is relatively high at a center of a space between the corner wall 21 and the wall 22, the pressure is relatively low at both end parts of the space. The distance d is equivalent to a distance from an average position of a pressure distribution near the corner wall 21 to the position of the wall 22.

[0055] Note that the refrigerant piping is housed in a space surrounded by the wall 22 and a wall 25.

[0056] The walls facing each other around the impeller 110 include, for example, a corner wall 23 and a wall 24, and the wall 25 and a wall 26, in addition to the corner wall 21 and the wall 22 described above. These walls 21 to 26 correspond to, for example, a portion of the inner wall 202 of the housing 20, a protrusion on the inside of the housing 20, a portion of a member disposed on the inside of the housing 20, and a part protruded from the outer peripheral part 124 or the inner peripheral part 123 of the heat exchanger 12. These walls 21 to 26 are distinguished from the partition walls 3 that protrude from the heat exchanger 12 to both of the windward side and the leeward side.

[0057] When there is a resonance frequency of the pressure fluctuation from the impeller 110 (e.g., FIG. 3), a resonance frequency that is dominant in influence to the noise is preferably selected, and the partition walls 3 are preferably disposed in order to avoid noise amplification caused by the resonance. Each of the partition walls 3 partitions the corresponding space between the facing walls so as to prevent the distance between the walls from being matched with the wavelength of the predetermined selected frequency. In other words, partitioning by the partition walls 3 eliminates the space having the dimension matched with the wavelength of the pressure fluctuation.

[0058] In a case where a plurality of resonance frequencies largely influencing noise are perceived, there may be a plurality of distances between the walls causing the resonance, respectively corresponding to the resonance frequencies.

[0059] In the present embodiment, sufficiently partitioning the gap on the windward side and the gap on the leeward side of the heat exchanger 12 by the partition walls 3 suppresses noise amplification caused by the resonance. In addition, the distance between the walls corresponding to each of the resonance frequencies is specified from relationship between the resonance frequencies indicated by the frequency analysis results of the noise of the air conditioner unit and the distance dimensions of the walls around the impeller 110, and each of the partition walls 3 is disposed between the walls.

[0060] The distance between the walls corresponding to the resonance frequency is specified by, for example, the following equation.

[0061] When the selected resonance frequency is f (e.g., 1 kHz), the wavelength is λ, and the speed of the sound is c (known), an equation $c = f\lambda$ is established. Accordingly, it is possible to find the wavelength of the resonance frequency and to specify the distance d between the walls matched with the wavelength from an equation $\lambda = c/f$. In the case where the wall is inclined with respect to a straight line connecting the facing walls 21 and 22, as with the corner wall 21, it is possible to consider the average position of the pressure distribution as a starting point of the distance d as described above. Alternatively, as a guide, a position at which a line extended from a width-direction center line of the gap (gap S1 in present embodiment) in which the walls 21 and 22 are located, abuts on the corner wall 21 may be considered as the starting point of the distance d.

[0062] The walls 21 to 26 are all located on the leeward side of the heat exchanger 12. If walls having the distance matched with the wavelength of the pressure fluctuation generated from the impeller 110 are present in the gap S2 on

the windward side of the heat exchanger 12, the partition wall 3 is preferably disposed between the walls in a similar manner.

[0063] The positions of the respective partition walls 31 to 33 are described in more detail.

[0064] When the partition wall 31 is disposed between the corner wall 21 and the wall 22, the space between the corner wall 21 and the wall 22 is divided by the partition wall 31. At this time, distances d1 and d2 from the partition wall 31 to the respective walls 21 and 22 located on both surface sides of the partition wall 31 are both made not equivalent to n times of the half of the wavelength of the selected frequency of the pressure fluctuation propagated from the impeller 110. In this case, the position of the partition wall 31 is determined with, as an upper limit, 2 wavelengths that remarkably influences noise. In other words, the position of the partition wall 31 is determined such that both of the distances d1 and d2 are not equivalent to any of 1/2 wavelength, 1 wavelength, 3/2 wavelengths, and 2 wavelengths of the frequency selected by the frequency analysis.

[0065] The position of the partition wall 32 disposed between the corner wall 23 and the wall 24 is also determined such that distances d3 and d4 from the partition wall 32 to the walls 23 and 24 located on both surface sides of the partition wall 32 are both not equivalent to any of 1/2 wavelength, 1 wavelength, 3/2 wavelengths, and 2 wavelengths of the selected frequency of the pressure fluctuation propagated from the impeller 110.

[0066] Likewise, the position of the partition wall 33 disposed between the wall 25 and the wall 26 is also determined such that distances d5 and d6 from the partition wall 33 to the walls 25 and 26 located on both surface sides of the partition wall 33 are both not equivalent to any of 1/2 wavelength, 1 wavelength, 3/2 wavelengths, and 2 wavelengths of the selected frequency of the pressure fluctuation propagated from the impeller 110.

[0067] In the present embodiment, a plurality of pairs of facing walls (21 and 22, 23 and 24, and 25 and 26) are present around the impeller 110, and the partition walls 31 to 33 partition between the walls in the respective pairs. Disposing the partition walls 31 to 33 forms the spaces from each of the partition walls to the walls located on both sides of each of the partition walls, namely, the space with the distance d1 and the space with the distance d2, the space with the distance d3 and the space with the distance d4, and the space with the distance d5 and the space with the distance d6. To prevent generation of the pressure fluctuation with the same wavelength and the same frequency in these spaces, the distances d1, d2, d3, d4, d5, and d6 of the respective spaces are preferably made different from one another.

[0068] In other words, the distance d1 is different from all of the distances d2, d3, d4, d5, and d6. The distance d2 is different from all of the distances d1, d3, d4, d5, and d6. The same applies to the other distances, and description of the other distances is accordingly omitted.

[0069] According to the present embodiment described above, the partition walls 31 to 33 that protrude from the heat exchanger 12 to the windward side and the leeward side are disposed between the facing walls around the impeller 110, which makes it possible to suppress noise amplification caused by occurrence of resonance. In addition, the partition walls 31 to 33 are disposed by selecting the appropriate positions between the walls located around the impeller 110 so as not to form the space with the dimension matched with the wavelength of the predetermined selected wavelength largely influencing noise. Therefore, it is possible to more surely suppress the noise amplification caused by resonance.

[0070] Further, the distances d1, d2, d3, d4, d5, and d6 of the respective spaces that appear on both sides of the partition walls 31 to 33 caused by installation of the partition walls 31 to 33, are also made different from one another. This makes it possible to prevent occurrence of the resonance of the same frequency with the same wavelength. In other words, it is possible to prevent occurrence of the resonance caused by the partition walls 31 to 33, and to secure effect of noise suppression.

[Second Embodiment]

[0071] Next, a second embodiment of the present invention is described with reference to FIG. 5A and FIG. 5B.

[0072] In the following, matters different from the first embodiment are mainly described.

[0073] In the second embodiment, partition walls 4 (41 and 42) that protrude from the heat exchanger 12 to the windward side and the leeward side are inclined with respect to the height direction of the housing 20.

[0074] Accordingly, as illustrated by arrows in FIG. 5B, a distance from each of the partition walls 4 to the walls (25 and 26) located on both sides of each of the partition walls 4 is varied in the height direction of the housing 20.

[0075] Also in the second embodiment, the partition walls 4 sufficiently partition the gap S2 on the windward side of the heat exchanger 12 and the gap S1 on the leeward side, which makes it possible to suppress noise amplification caused by the resonance. In addition, the pressure fluctuation propagated from the impeller 110 is divided by the partition walls 4, which shortens the wavelength and shifts the frequency to higher side. This makes it possible to suppress propagation of the pressure fluctuation of the same frequency and to reduce noise.

[0076] In addition, each of the partition walls 4 inclined with respect to the height direction of the housing 20 varies, in the height direction, the distance between the walls facing each other around the impeller 110. Therefore, even if resonance is caused by the distance from the partition wall 41 (or 42) to the walls on both side of the partition wall 41 (or 42), it is possible to disperse the resonance frequencies, and to suppress the propagation of the pressure fluctuation

of the same frequency to reduce noise.

[0077] In place of each of the inclined partition walls 4, a partition wall 5 illustrated in FIG. 6 may be used. The partition wall 5 has a wave shape so as to protrude alternately toward the both-side walls (one wall 22 is only illustrated) of the gap that is partitioned by the partition wall 5. Using the partition wall 5 makes it possible to disperse the frequencies of the resonance caused by the distance from the partition wall 5 to the wall (e.g., 22), and to suppress the propagation of the pressure fluctuation of the same frequency to reduce noise.

[0078] Similar effect are achievable by inclining the inner wall of the housing 20 or the walls 21 to 26 disposed in the housing 20 in the height direction or forming the inner wall of the housing 20 or the walls 21 to 26 in a wave shape, in place of achieving the effect of varying the distance between the partition wall and the facing wall by the shape of the partition wall 4 (FIG. 5) or the partition wall 5 (FIG. 6) described above.

[0079] Further, as illustrated in FIG. 7, making distances between the walls different from each other in a planar view of the housing 20 makes it possible to achieve similar effects.

[0080] In an example illustrated in FIG. 7, a partition wall 6 is inclined with respect to a direction connecting the wall 25 and the wall 26, which varies distances from the partition wall 6 to the respective walls 25 and 26 on the both sides of the partition wall 6, in the direction connecting the walls 25 and 26.

[0081] In this case, the corner wall 21 is also inclined with respect to a direction connecting the wall 21 and the partition wall 31, as with the partition wall 6. Therefore, the distance between the corner wall 21 and the partition wall 31 is varied in the direction connecting the walls 21 and 31. The same applies to relationship of the corner wall 23 and the partition wall 32.

[0082] Irrespective of intentionality, the distance between the facing walls is varied in the direction connecting the walls, which makes it possible to disperse the frequencies of the resonance caused by the distance between the walls, and to suppress the propagation of the pressure fluctuation of the same frequency to reduce noise.

[0083] The partition walls 3 to 6 described in the respective embodiments may be made up of a sound absorbing material that absorbs sound waves.

[0084] Such a sound absorbing material absorbs and attenuates the pressure fluctuation of the air around the impeller 110, which makes it possible to contribute to noise suppression. For example, the sound absorbing material may be bonded to the surface of each of the partition walls 3, or each of the partition walls 3 may be formed of the sound absorbing material as a whole. Examples of the sound absorbing material include a sponge formed of a urethane resin, and a sound absorbing resin.

[0085] Other than the above, the configurations of the above-described embodiments may be selected or appropriately modified without departing from the scope of the present invention.

[0086] The present invention is applicable to various kinds of air conditioner units including an outdoor unit as long as the gap S2 on the windward side of the heat exchanger 12 and the gap S1 on the leeward side are provided.

Reference Signs List

[0087]

3, 31 to 33	Partition wall
4, 41, 42	Partition wall
5, 6	Partition wall
3A	Outer end
3B	Inner end
10	Air conditioner unit
11	Fan
11M	Motor (driving section)
12	Heat exchanger
12A	End part
12B	End part
13	Housing panel
14	Bell-mouth
15	Drain pump
20	Housing
20B, 20C	Connection portion
21	Corner wall
22	Wall
23	Corner wall
24	Wall

25	Wall
26	Wall
110	Impeller
110A	Outer end
111	Shaft
112	Main plate
113	Blade
114	Shroud
121	Tube
122	Fin
123	Inner peripheral part
124	Outer peripheral part
131	Suction port
132	Blow-off port
201	Opening
202	Inner wall
203	Bottom part
d1, d2, d3, d4, d5, d6	Distance
S1	Gap
S2	Gap

Claims

1. An air conditioner unit (10) that constitutes an air conditioner, comprising:

a fan (11) including an impeller (110) and a driving section (11M) configured to drive the impeller;
a heat exchanger (12) to which the fan blows air; and
a housing (20) configured to house the fan and the heat exchanger, wherein
a gap (S2) located on windward side of the heat exchanger and a gap (S1) located on leeward side of the heat exchanger are partitioned by a partition wall (31, 32, 33) that protrudes from the heat exchanger to the windward side and the leeward side.

2. The air conditioner unit according to claim 1, wherein a distance from the partition wall (31, 32, 33) to each of walls located on both sides of the partition wall is not equivalent to n times of a half of a wavelength of a predetermined selected frequency.

3. The air conditioner unit according to claim 2, wherein the distance is not equivalent to 1/2 wavelength, 1 wavelength, 3/2 wavelengths, and 2 wavelengths of the selected frequency.

4. The air conditioner unit according to claim 2 or 3, wherein the partition wall (31, 32, 33) is located between the walls facing each other with a distance in between, the distance being equivalent to n times of the half of the wavelength of the selected frequency.

5. The air conditioner unit according to any one of claims 2 to 4, wherein
a plurality of pairs of walls facing each other with a distance in between, the distance being equivalent to n times of the half of the wavelength of the selected frequency, are included,
the partition wall (31, 32, 33) is located between the walls in each of the pairs, and
distances from one of the plurality of partition walls to the walls that are respectively located on both sides of the one partition wall are different from any of distances from each of the other partition walls to the walls that are located on both sides of each of the other partition walls.

6. The air conditioner unit according to any one of claims 2 to 5, wherein the distance from the partition wall to the wall facing the partition wall is varied in a height direction of the housing.

7. The air conditioner unit according to any one of claims 2 to 6, wherein the distance from the partition wall pairs of walls to the wall facing the partition wall is varied in a planar view of the housing.

8. The air conditioner unit according to any one of claims 2 to 7, wherein
the housing (20) has a substantially rectangular shape in a planar view,
the gap (S1) partitioned by the partition wall is linearly provided along sides of the housing, and
at least one of the walls disposed to sandwich the partition wall is located at a corner of the housing.

9. The air conditioner unit according to any one of claims 1 to 8, wherein the partition wall (31, 32, 33) is made up of a sound absorbing material that absorbs sound waves.

FIG. 1

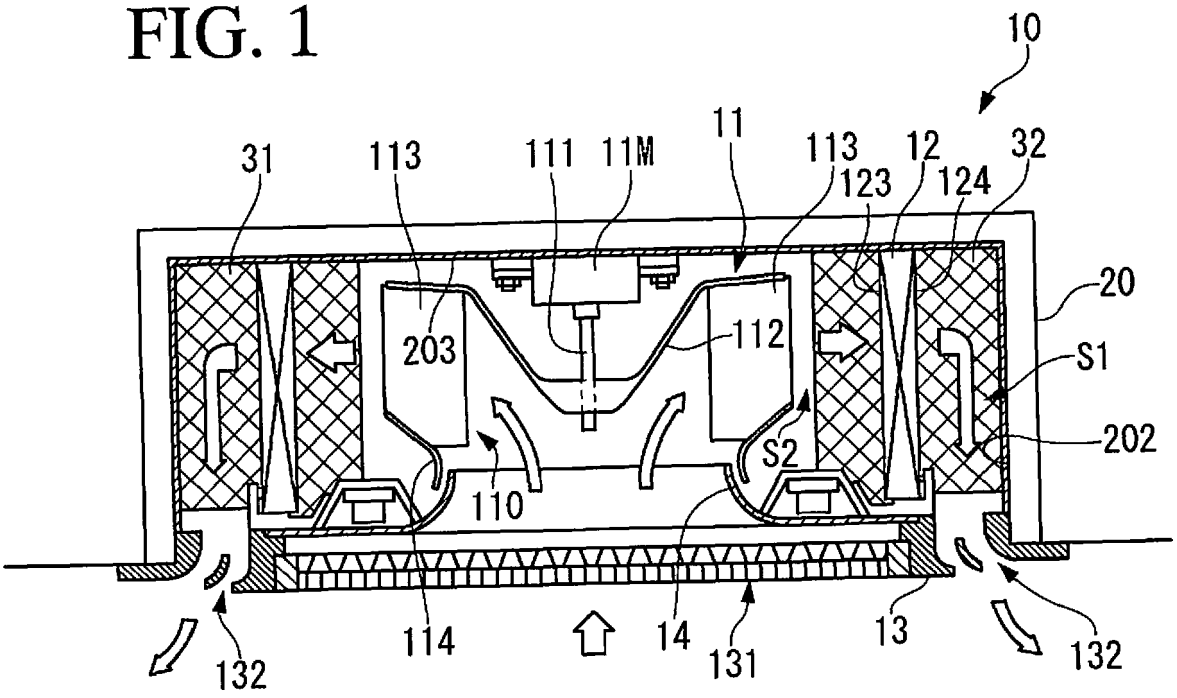

10
11
31
113
111
11M
113
12
32
123
124
20
203
112
S1
202
S2
110
114
14
131
13
132
132

FIG. 2

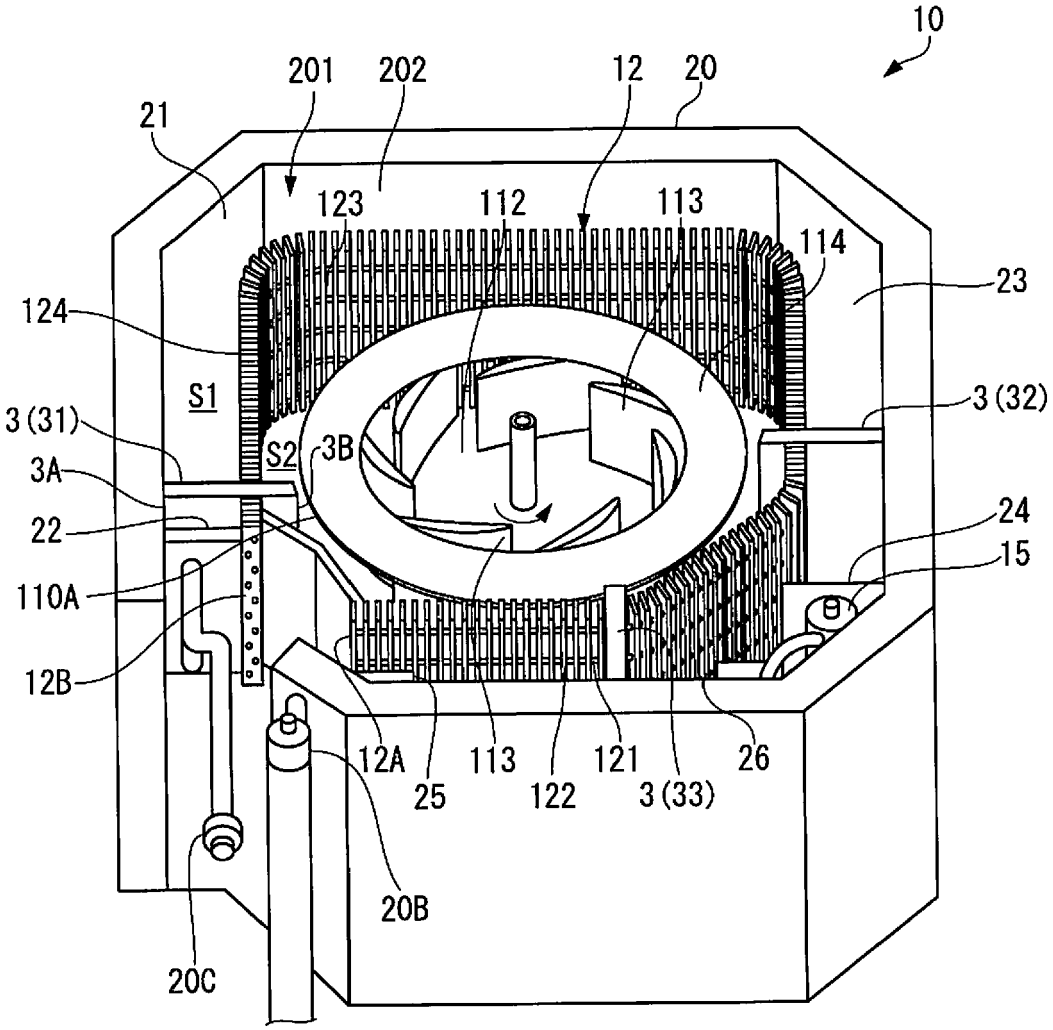

10
201
202
12
20
21
123
112
113
114
23
124
S1
3 (31)
3A
22
110A
12B
S2
3B
3 (32)
24
15
12A
25
113
122
121
3 (33)
26
20B
20C

FIG. 3

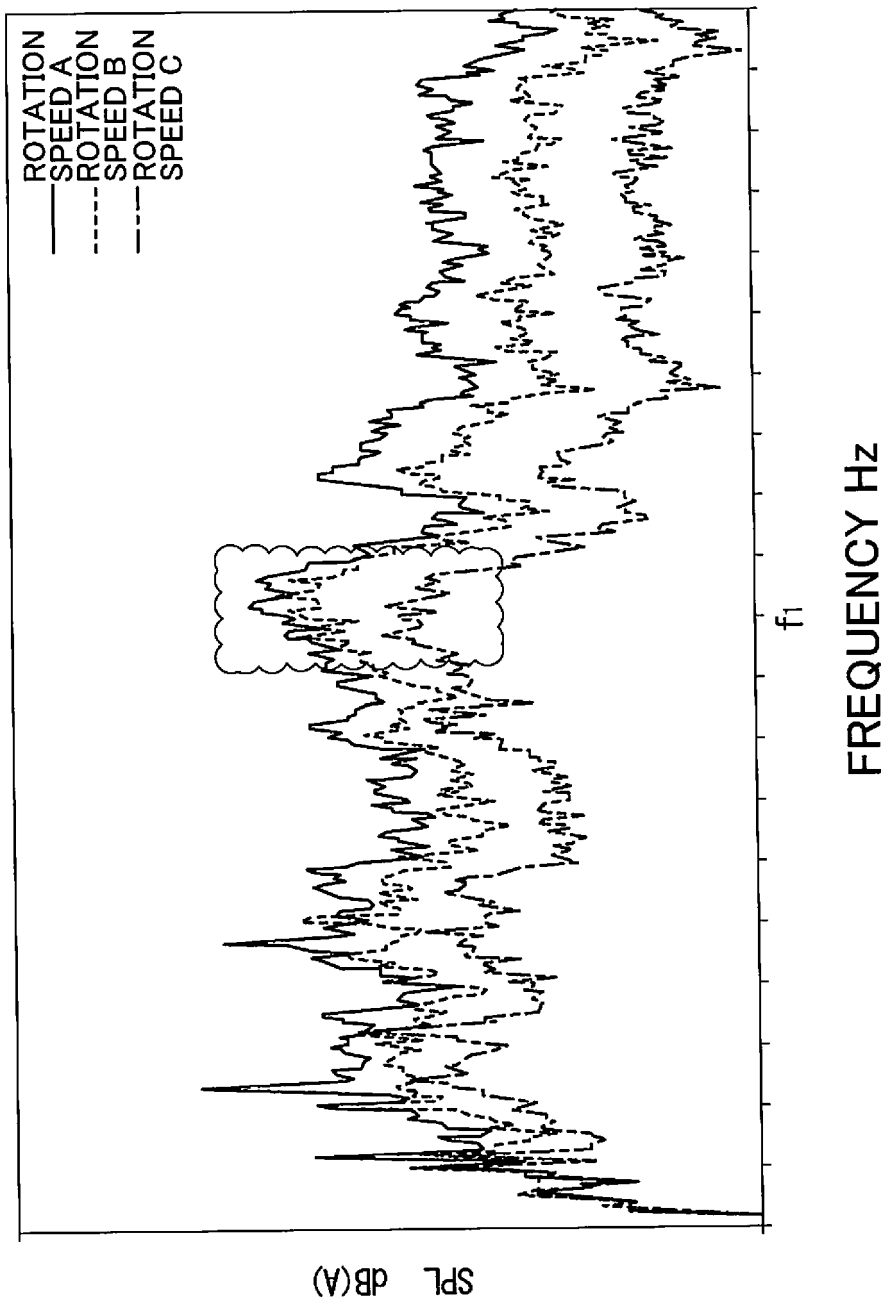

ROTATION SPEED A
ROTATION SPEED B
ROTATION SPEED C
SPL dB(A)
FREQUENCY Hz
f1

FIG. 4

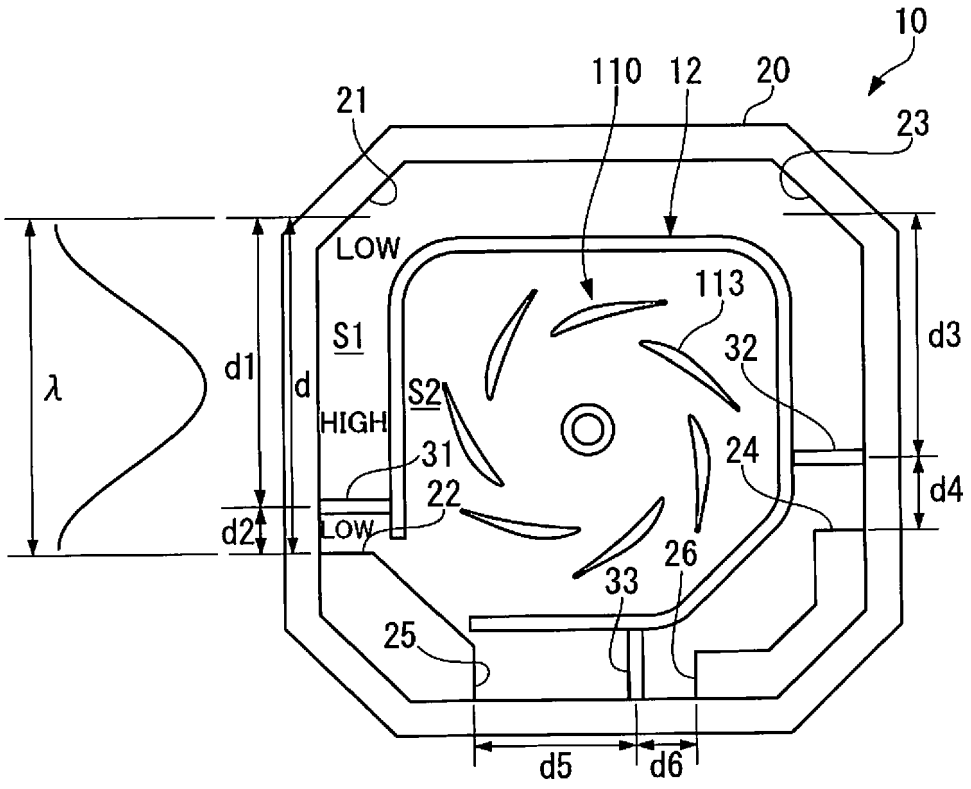

10
110
12
20
21
23
LOW
S1
HIGH
S2
113
32
24
31
22
LOW
26
33
25
λ
d1
d
d2
d3
d4
d5
d6

FIG. 5A

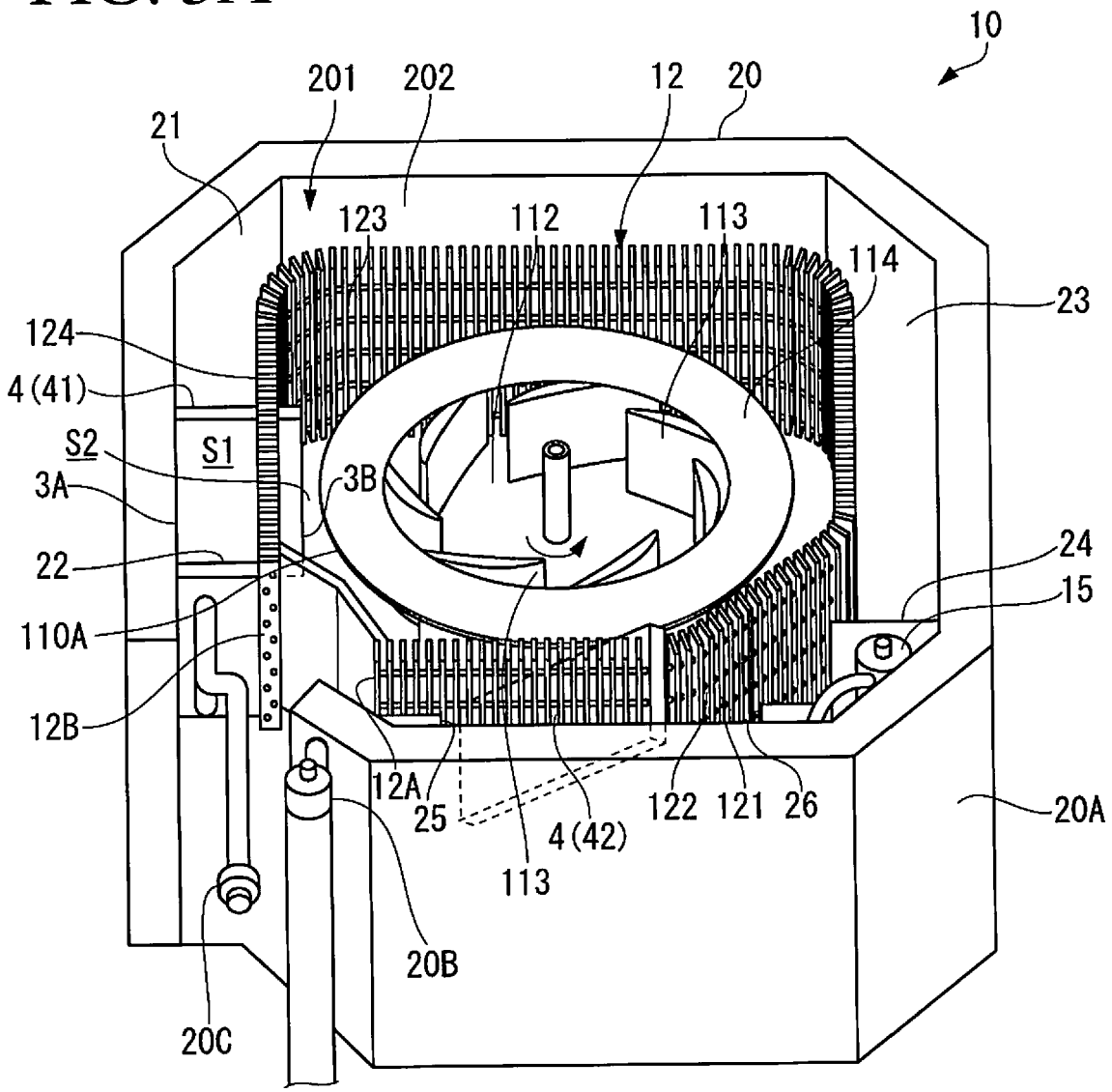

10
201
202
12
20
21
123
112
113
114
23
124
4(41)
S2
S1
3A
3B
22
24
15
110A
12B
12A
25
4(42)
122
121
26
20A
113
20B
20C

FIG. 5B

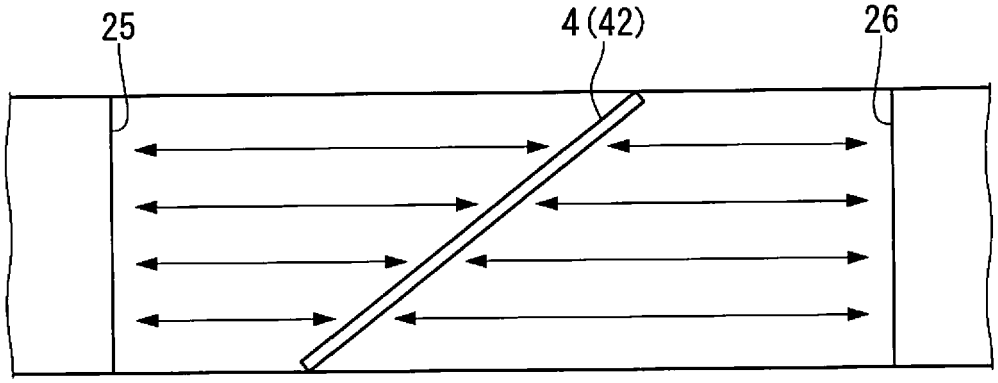

25
4(42)
26

FIG. 6

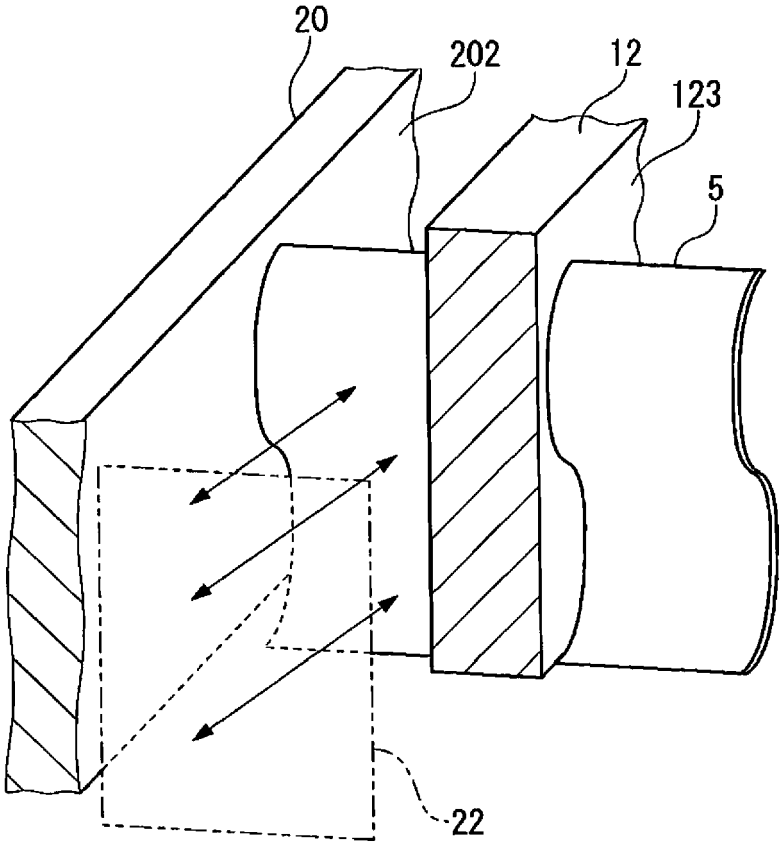
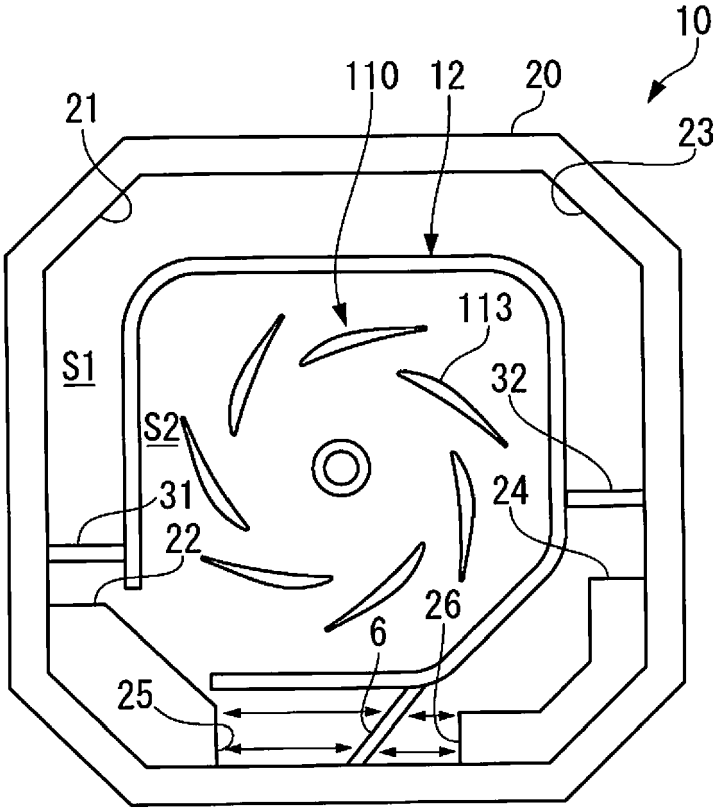


FIG. 7



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EUROPEAN SEARCH REPORT

Application Number
EP 18 15 4857

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	27 June 2018	Lienhard, Dominique

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