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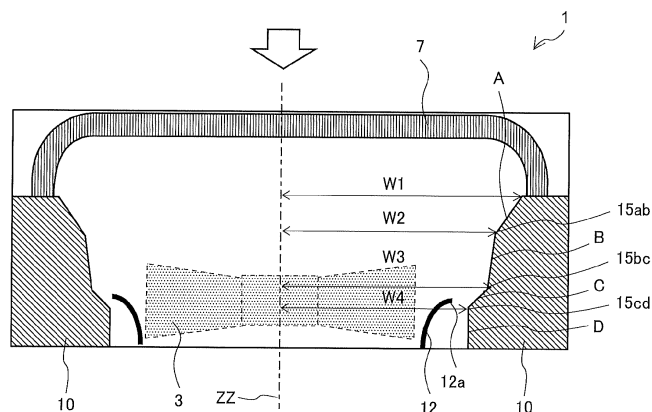
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(54) **OUTDOOR UNIT AND REFRIGERATION CYCLE DEVICE**

(57) An outdoor unit includes plural machine units, an air-sending device, and a heat exchanger. The machine units each accommodate a machine chamber storing a machine part. The air-sending device is installed in an air-sending chamber positioned between partition walls of the machine units, and is configured to provide an air flow. The heat exchanger is installed upstream of the air-sending device, and is configured to exchange heat between refrigerant and air sent by the air-sending device. At least one of the partition walls of the machine

units has a first region, a second region, and a third region. The first region is positioned close to the heat exchanger, and is inclined from a position close to the heat exchanger toward a rotation axis of the air-sending device. The second region is positioned downstream of the first region, and is inclined at an angle that is smaller than an angle of the first region. The third region is positioned downstream of the second region, and is inclined at an angle that is greater than the angle of the second region.

FIG. 6



Description

Technical Field

[0001] The present disclosure relates to an outdoor unit including a machine unit accommodating a machine chamber storing a machine part, and a refrigeration cycle apparatus.

Background Art

[0002] Some outdoor unit has been known that includes a machine unit accommodating a machine chamber storing a machine part. Patent Literature 1 discloses an outdoor unit with a pair of heat exchangers positioned upstream in the flow of air. Of the heat exchangers described in Patent Literature 1, one extends from the left to the back of the outdoor unit, and the other extends from the right to the back of the outdoor unit. A machine chamber storing a compressor is between the two heat exchangers. Patent Literature 2 discloses an outdoor unit including a U-shaped heat exchanger positioned upstream in the flow of air, and a fan that is bilaterally symmetric and positioned downstream in the flow of air, with a pair of machine chambers beside respective opposite ends of the fan. The machine chamber stores a compressor or other parts.

Citation List

Patent Literature

[0003]

Patent Literature 1: Japanese Unexamined Patent Application Publication No. 2002-267207

Patent Literature 2: Japanese Unexamined Patent Application Publication No. 6-213198

Summary of Invention

Technical Problem

[0004] In the outdoor unit disclosed in Patent Literature 1, the heat exchangers through which an air flow passes, and the machine chamber that blocks an air flow are installed upstream of the fan. As a result, a wake flow due to the machine chamber is generated. If turbulent air containing eddies flows in toward the leading edge of a blade of the fan, this may cause separation at the blade, and also may cause pressure fluctuations on the blade surface. This may result in energy loss and noise. In the outdoor unit disclosed in Patent Literature 2, the space between the wall surface of the blade and the wall surface of the machine chamber, which is the space positioned beside the fan, is small. In this regard, when the fan runs at a high air flow rate, an air flow is suctioned also from beside the blade. However, as the space between the

wall surface of the blade and the wall surface of the machine chamber is small, the suction of air is hindered, which results in reduced air flow rate. This deteriorates the characteristics of the fan, resulting in increased power consumption and generation of noise. One way to address this problem would be to increase the distance between the fan and the machine chamber. This approach, however, results in narrowing of the machine chamber and consequently reduced storage capacity for machine parts. It is thus desired to reduce power consumption and noise, and at the same time maintain the storage capacity for machine parts.

[0005] The present disclosure has been made to address the above-mentioned problem, and accordingly it is an object of the present disclosure to provide an outdoor unit and a refrigeration cycle apparatus that make it possible to reduce power consumption and noise, and at the same time maintain the storage capacity for machine parts.

Solution to Problem

[0006] An outdoor unit according to an embodiment of the present disclosure includes plural machine units, an air-sending device, and a heat exchanger. The machine units each accommodate a machine chamber storing a machine part. The air-sending device is installed in an air-sending chamber positioned between partition walls of the machine units, and is configured to provide an air flow. The heat exchanger is installed upstream of the air-sending device, and is configured to exchange heat between refrigerant and air sent by the air-sending device. At least one of the partition walls of the machine units has a first region, a second region, and a third region. The first region is positioned close to the heat exchanger, and is inclined from a position close to the heat exchanger toward a rotation axis of the air-sending device. The second region is positioned downstream of the first region, and is inclined at an angle that is smaller than an angle of the first region. The third region is positioned downstream of the second region, and is inclined at an angle that is greater than the angle of the second region.

Advantageous Effects of Invention

[0007] According to an embodiment of the present disclosure, the partition wall includes the first region, the second region, and the third region. The second region is inclined at an angle that is smaller than the angle of the first region. The flow of air flowing in toward the fan along the first region thus reaches a position close to the air-sending device without being hindered by the second region. This makes it possible to maintain the air flow rate of the air-sending device. Further, the third region is inclined at an angle that is greater than the angle of the second region. The machine chamber can be thus enlarged at a location corresponding to the third region. This makes it possible to reduce power consumption and

noise, and at the same time maintain the storage capacity for machine parts.

Brief Description of Drawings

[0008]

[Fig. 1] Fig. 1 is a circuit diagram of a refrigeration cycle apparatus 50 according to Embodiment 1 of the present disclosure.

[Fig. 2] Fig. 2 is a perspective view of an outdoor unit 1 according to Embodiment 1 of the present disclosure.

[Fig. 3] Fig. 3 is a perspective view of the outdoor unit 1 according to Embodiment 1 of the present disclosure with a panel group 2 removed.

[Fig. 4] Fig. 4 is a front view of the outdoor unit 1 according to Embodiment 1 of the present disclosure.

[Fig. 5] Fig. 5 is a top view of the outdoor unit 1 according to Embodiment 1 of the present disclosure with a top panel 2d seen through.

[Fig. 6] Fig. 6 is a sectional view of the outdoor unit 1 according to Embodiment 1 of the present disclosure.

[Fig. 7] Fig. 7 is a graph representing changes in the distance between a partition wall 14a of a machine unit 10 and a rotation axis ZZ according to Embodiment 1 of the present disclosure.

[Fig. 8] Fig. 8 is a graph representing the relationship between air flow rate and pressure that are provided by an air-sending device 3 according to Embodiment 1 of the present disclosure.

[Fig. 9] Fig. 9 is a sectional view of the outdoor unit 1 according to Embodiment 1 of the present disclosure.

[Fig. 10] Fig. 10 is a sectional view of an outdoor unit 1000 according to a comparative example.

[Fig. 11] Fig. 11 is a sectional view of an outdoor unit 100 according to Embodiment 2 of the present disclosure.

[Fig. 12] Fig. 12 is a sectional view of an outdoor unit 200 according to Embodiment 3 of the present disclosure.

[Fig. 13] Fig. 13 is a graph representing changes in the distance between the partition wall 14a of the machine unit 10 and the rotation axis ZZ according to Embodiment 3 of the present disclosure.

[Fig. 14] Fig. 14 is a sectional view of an outdoor unit 300 according to Embodiment 4 of the present disclosure.

[Fig. 15] Fig. 15 is a sectional view of an outdoor unit 400 according to Embodiment 5 of the present disclosure.

[Fig. 16] Fig. 16 is a front view of an outdoor unit 500 according to Embodiment 6 of the present disclosure.

[Fig. 17] Fig. 17 is a front view of an outdoor unit

500a according to a modification of Embodiment 6 of the present disclosure.

[Fig. 18] Fig. 18 is a perspective view of an air-sending device 603 according to Embodiment 7 of the present disclosure.

[Fig. 19] Fig. 19 is a sectional view of an outdoor unit 600 according to Embodiment 7 of the present disclosure.

[Fig. 20] Fig. 20 is a sectional view of an outdoor unit 700 according to Embodiment 8 of the present disclosure.

[Fig. 21] Fig. 21 is a sectional view of an outdoor unit 800 according to Embodiment 9 of the present disclosure.

[Fig. 22] Fig. 22 is a sectional view of an outdoor unit 900 according to Embodiment 10 of the present disclosure.

Description of Embodiments

Embodiment 1

[0009] Embodiments of an outdoor unit and a refrigeration cycle apparatus according to the present disclosure will be described below with reference to the drawings.

Fig. 1 is a circuit diagram of a refrigeration cycle apparatus 50 according to Embodiment 1 of the present disclosure. As illustrated in Fig. 1, the refrigeration cycle apparatus 50, which is an air-conditioning apparatus configured to condition air in an indoor space, includes an outdoor unit 1 and an indoor unit 1a. The outdoor unit 1 includes a compressor 8, a flow switching device 22, a heat exchanger 7, an air-sending device 3, and an expansion unit 23. The indoor unit 1a includes an indoor heat exchanger 24 and an indoor air-sending device 25.

[0010] The compressor 8, the flow switching device 22, the heat exchanger 7, the expansion unit 23, and the indoor heat exchanger 24 are connected by a pipe to form a refrigerant circuit 21. The compressor 8 suctions refrigerant at a low temperature and low pressure, and compresses the suctioned refrigerant into a high-temperature and high-pressure state. The flow switching device 22 switches the flows of refrigerant in the refrigerant circuit 21. The flow switching device 22 is, for example, a four-way valve. The heat exchanger 7 exchanges heat between, for example, outdoor air and refrigerant. The heat exchanger 7 is used as a condenser during cooling operation, and is used as an evaporator during heating operation.

[0011] The air-sending device 3 sends outdoor air to the heat exchanger 7. The expansion unit 23 is a pressure-reducing valve or expansion valve that causes refrigerant to be reduced in pressure and expand. The expansion unit 23 is, for example, an electronic expansion valve whose opening degree is adjusted. The indoor heat exchanger 24 exchanges heat between, for example, indoor air and refrigerant. The indoor heat exchanger 24 is used as an evaporator during cooling operation, and

is used as a condenser during heating operation. The indoor air-sending device 25 sends indoor air to the indoor heat exchanger 24.

(Operation Mode: Cooling Operation)

[0012] The following describes operation modes of the refrigeration cycle apparatus 50. Cooling operation will be described first. In cooling operation, refrigerant suctioned into the compressor 8 is compressed by the compressor 8 and discharged from the compressor 8 in a high-temperature and high-pressure gaseous state. The refrigerant in a high-temperature and high-pressure gaseous state discharged from the compressor 8 passes through the flow switching device 22 into the heat exchanger 7, which is used as a condenser. In the heat exchanger 7, the refrigerant condenses and liquefies in heat exchange with outdoor air sent by the air-sending device 3. The condensed refrigerant in a liquid state flows into the expansion unit 23. In the expansion unit 23, the refrigerant is expanded and decreased in pressure, and turns into two-phase gas-liquid refrigerant at a low temperature and low pressure. The refrigerant in a two-phase gas-liquid state then flows into the indoor heat exchanger 24, which is used as an evaporator. In the indoor heat exchanger 24, the refrigerant evaporates and gasifies in heat exchange with indoor air sent by the indoor air-sending device 25. At this time, the indoor air is cooled, and thus cooling is performed in the indoor space. The low-temperature and low-pressure gaseous refrigerant that has evaporated passes through the flow switching device 22 and is suctioned into the compressor 8.

(Operation Mode: Heating Operation)

[0013] Heating operation will be described below. In heating operation, refrigerant suctioned into the compressor 8 is compressed by the compressor 8 and discharged from the compressor 8 in a high-temperature and high-pressure gaseous state. The refrigerant in a high-temperature and high-pressure gaseous state discharged from the compressor 8 passes through the flow switching device 22 into the indoor heat exchanger 24, which is used as a condenser. In the indoor heat exchanger 24, the refrigerant condenses and liquefies in heat exchange with indoor air sent by the indoor air-sending device 25. At this time, the indoor air is heated, and thus heating is performed in the indoor space. The condensed refrigerant in a liquid state flows into the expansion unit 23. In the expansion unit 23, the refrigerant is expanded and decreased in pressure, and turns into two-phase gas-liquid refrigerant at a low temperature and low pressure. The refrigerant in a two-phase gas-liquid state then flows into the heat exchanger 7, which is used as an evaporator. In the heat exchanger 7, the refrigerant evaporates and gasifies in heat exchange with outdoor air sent by the air-sending device 3. The low-temperature and low-pressure gaseous refrigerant that has evaporat-

ed passes through the flow switching device 22 and is suctioned into the compressor 8.

[0014] Fig. 2 is a perspective view of the outdoor unit 1 according to Embodiment 1 of the present disclosure.

As illustrated in Fig. 2, the outdoor unit 1 includes a panel group 2, a fan guard 5, and internal components 18. The panel group 2 forms a housing that defines the exterior of the outdoor unit 1. The panel group 2 includes a bottom panel 2c, a front panel 2a, two side panels 2b, and a top panel 2d. The bottom panel 2c is a plate-like part placed on the ground, floor, or other surfaces. The front panel 2a is a plate-like part provided to one edge of the bottom panel 2c and having an air outlet 4 used as an opening through which air blows. Each of the two side panels 2b is a plate-like part provided to another edge of the bottom panel 2c to close a side portion of the outdoor unit 1. The top panel 2d is provided to the upper ends of the two side panels 2b and the upper end of the front panel 2a to close the top of the outdoor unit 1. The fan guard 5 is attached over the air outlet 4, and is in a mesh-like form. The fan guard 5 reduces contact of foreign matter with the internal components 18. An air flow 6 flows from around the back of the outdoor unit 1 toward the front of the outdoor unit 1.

[0015] Fig. 3 is a perspective view of the outdoor unit 1 according to Embodiment 1 of the present disclosure with the panel group 2 removed. As illustrated in Fig. 3, the internal components 18 include two machine units 10, the heat exchanger 7, a support 20, the air-sending device 3, and a bell mouth 12. The two machine units 10 extend vertically from opposite ends of the bottom panel 2c, and each accommodate a machine chamber 10a that stores a machine part. In Embodiment 1, the compressor 8 is stored in the machine chamber 10a of one of the machine units 10, and a controller 9 is stored in the machine chamber 10a of the other machine unit 10. The machine chamber 10a of each machine unit 10 stores, in addition to the above-mentioned parts, a pipe through which refrigerant passes, the expansion unit 23, and other parts. The heat exchanger 7 has a U-shape. The heat exchanger 7 is installed upstream of the air-sending device 3, and is configured to exchange heat between refrigerant and air. The back of the outdoor unit 1 has an air inlet 4a through which air is suctioned. The heat exchanger 7 is installed at the air inlet 4a.

[0016] The support 20 extends vertically along the heat exchanger 7 from the bottom panel 2c, and supports a motor 11 of the air-sending device 3. The air-sending device 3 is installed in an air-sending chamber 13 positioned between partition walls 14a defining the inner portions of the two machine units 10. The air-sending device 3 is, for example, a propeller fan including the motor 11, a shaft 11a, a boss 11b, and a blade 11c. The motor 11 rotationally drives the blade 11c, and is supported by the support 20. The shaft 11a rotates as the motor 11 rotates. The boss 11b is attached to the distal end of the shaft 11a, and holds the blade 11c between the boss 11b and the motor 11 to avoid dislodging of the blade 11c. The blade 11c is attached to the shaft 11a. The blade 11c is

rotated by the motor 11 and the shaft 11a to blow out, from the air outlet 4, air suctioned through the air inlet 4a.

[0017] Fig. 4 is a front view of the outdoor unit 1 according to Embodiment 1 of the present disclosure. Fig. 5 is a top view of the outdoor unit 1 according to Embodiment 1 of the present disclosure with the top panel 2d seen through. As illustrated in Figs. 4 and 5, the bell mouth 12 surrounds the air-sending device 3, and provides communication between the inside and outside of the outdoor unit 1. The alternate long and short dash line in Fig. 5 represents the center of a rotation axis ZZ of the air-sending device 3. Air is suctioned through the air inlet 4a positioned close to the heat exchanger 7, passes through the heat exchanger 7 and the air-sending device 3, and is blown out from the air outlet 4.

[0018] Fig. 6 is a sectional view of the outdoor unit 1 according to Embodiment 1 of the present disclosure, illustrating a section taken along A-A of Fig. 4. The line A-A along which the section is taken passes through the rotation axis ZZ of the air-sending device 3. As illustrated in Fig. 6, the distance between the partition wall 14a of one of the machine units 10 and the rotation axis ZZ is represented by a line segment perpendicular to the rotation axis ZZ of the air-sending device 3, and defined as distance W. The partition wall 14a has a first region A, a second region B, and a third region C. The first region A is a portion of the partition wall 14a positioned close to the heat exchanger 7 and inclined from a position close to the heat exchanger 7 toward the rotation axis ZZ of the air-sending device 3. The second region B is a portion of the partition wall 14a positioned downstream of the first region A and inclined at an angle that is smaller than the angle of the first region A. The third region C is a portion of the partition wall 14a positioned downstream of the second region B and inclined at an angle that is greater than the angle of the second region B. In Embodiment 1, the shapes of the opposite partition walls 14a are line-symmetric to each other across the rotation axis ZZ. That is, the distance W between one of the partition walls 14a and the rotation axis ZZ, and the distance W between the other partition wall 14a and the rotation axis ZZ are the same. This configuration allows the flow of air into the air-sending device 3 to be equalized in areas beside respective opposite ends of the air-sending device 3, thus reducing noise. Alternatively, the distance W between one of the partition walls 14a and the rotation axis ZZ, and the distance W between the other partition wall 14a and the rotation axis ZZ may be different.

[0019] The location at which the first region A and the second region B are connected is referred to as first change point 15ab. The location at which the second region B and the third region C are connected is referred to as second change point 15bc. Further, the location of the downstream end of the third region C is referred to as third change point 15cd. The area positioned downstream of the third change point 15cd is referred to as fourth region D. The distance between the upstream end of the first region A and the rotation axis ZZ is defined as

W1, the distance between the first change point 15ab and the rotation axis ZZ is defined as W2, the distance between the second change point 15bc and the rotation axis ZZ is defined as W3, and the distance between the third change point 15cd and the rotation axis ZZ is defined as W4.

[0020] The first change point 15ab, which is the upstream end of the second region B, is positioned upstream of the upstream end of the bell mouth 12. Air that is suctioned from beside the air-sending device 3 first flows along the first region A of the partition wall 14a, and then flows along the second region B of the partition wall 14a. As the first change point 15ab is located upstream of an upstream end 12a of the bell mouth 12, the air flows along the second region B before entering the bell mouth 12. This allows for sufficient space for air to flow before entering the bell mouth 12.

[0021] Fig. 7 is a graph representing changes in the distance between the partition wall 14a of the machine unit 10 and the rotation axis ZZ according to Embodiment 1 of the present disclosure. In Fig. 7, the horizontal axis represents position in the direction of the rotation axis ZZ from the upstream end of the partition wall 14a to the downstream end of the partition wall 14a. In Fig. 7, the vertical axis represents the distance W between the partition wall 14a of the one of the machine units 10 and the rotation axis ZZ. As illustrated in Fig. 7, the rate of change of the distance W in the second region B is less than the rate of change of the distance W in the first region A and the rate of change of the distance W in the third region C. That is, the rate of change in the space of the air-sending chamber 13 positioned in the second region B is less than the rate of change in the space of the air-sending chamber 13 positioned in the first region A and the rate of change in the space of the air-sending chamber 13 positioned in the third region C.

[0022] Fig. 8 is a graph representing the relationship between air flow rate and pressure that are provided by the air-sending device 3 according to Embodiment 1 of the present disclosure. In Fig. 8, the horizontal axis represents the air flow rate of the air-sending device 3, and the vertical axis represents the pressure of air sent by the air-sending device 3. As illustrated in Fig. 8, at an operating point (1) with low air flow rate and high pressure, air flowing in from the side portion of the outdoor unit 1 creates eddies on the spot. The air thus does not readily reach a location downstream of the air-sending device 3. By contrast, at an operating point (2) with high air flow rate and low pressure, air flowing in from the side portion of the outdoor unit 1 readily reaches a location downstream of the air-sending device 3. If, as in Embodiment 1, the air-sending device 3 is a propeller fan with the blade 11c extending out to a location upstream of the bell mouth 12, the air-sending device 3 suctiones air also from beside the air-sending device 3. In Embodiment 1, if the air-sending device 3 operates at the operating point (2) with high air flow rate and low pressure, the suction of air from beside the air-sending device 3 markedly in-

creases. In this regard, the greater the area of air passage through the heat exchanger 7 positioned upstream of the air-sending device 3, the smaller the resistance to air flow, which results in the state of the operating point (2).

[0023] Fig. 9 is a sectional view of the outdoor unit 1 according to Embodiment 1 of the present disclosure. As illustrated in Fig. 9, the air flow 6 passing through the heat exchanger 7 includes an air flow 6a, and air flows 6b and 6c. The air flow 6a flows in toward the air-sending device 3 in a direction parallel to the direction of the rotation axis of the air-sending device 3. The air flows 6b and 6c flow in toward the air-sending device 3 from beside the air-sending device 3 along the partition wall 14a. In Embodiment 1, the large area of air passage through the heat exchanger 7 results in an operational state with small resistance to air flow. In Embodiment 1, the partition wall 14a has the first region A, the second region B, and the third region C. The second region B is inclined at an angle that is smaller than the angle of the first region A. The flow of air flowing in toward the fan along the first region A thus reaches a position close to the fan without being hindered by the second region B. This makes it possible to maintain the air flow rate of the air-sending device 3. Further, the third region C is inclined at an angle that is greater than the angle of the second region B. The machine chamber 10a can be thus enlarged at a location corresponding to the third region C. This makes it possible to reduce power consumption and noise, and at the same time maintain the storage capacity for machine parts.

[0024] Fig. 10 is a sectional view of an outdoor unit 1000 according to a comparative example. As illustrated in Fig. 10, a partition wall 14a according to the comparative example is not divided into regions, and the space between the partition wall 14a and an air-sending device 3 is comparatively small. Consequently, air is not readily suctioned from beside the air-sending device 3, which leads to reduced air flow rate. This may make the air-sending device 3 unable to fully provide its inherent operating efficiency, leading to increased power consumption and increased noise. By contrast, in Embodiment 1, the partition wall 14a has the first region A, the second region B, and the third region C, and the second region B is inclined at an angle that is smaller than the angle of the first region A. This configuration allows the air-sending device 3 to suction air from beside the air-sending device 3 without hindering the air flow 6b. This results in increased air flow rate, leading to reduced power consumption and reduced noise. Further, no machine chamber 10a that blocks the air flow 6a exists upstream of the air-sending device 3. Thus, no wake flow containing eddies flows in toward the blade 11c. This helps to reduce energy loss caused by separation at the leading edge of the blade 11c, and reduce noise resulting from pressure fluctuations on the surface of the blade 11c.

Embodiment 2

[0025] Fig. 11 is a sectional view of an outdoor unit 100 according to Embodiment 2 of the present disclosure. Embodiment 2 differs from Embodiment 1 in that the second region B of the partition wall 14a is provided with projections 101. In Embodiment 2, features identical to those in Embodiment 1 will be denoted by the same reference signs to avoid repetitive description, and the following description will focus on differences from Embodiment 1.

[0026] As illustrated in Fig. 11, the second regions B of the opposite partition walls 14a are each provided with two projections 101. This makes it possible to improve the strength of the partition wall 14a. Although the projections 101 are provided in Embodiment 2, alternatively, recesses may be provided. In Embodiment 2, to apply the distance between one of the partition walls 14a and the rotation axis ZZ to the graph illustrated in Fig. 7, the distance connecting the rotation axis ZZ and a position on each projection 101 closest to the air-sending chamber 13 is only required to be defined as the distance W. In this case, the distance W corresponding to a location with no projection 101 is not seen on the graph.

Embodiment 3

[0027] Fig. 12 is a sectional view of an outdoor unit 200 according to Embodiment 3 of the present disclosure. As illustrated in Fig. 12, Embodiment 3 differs from Embodiment 1 in that the partition wall 14a has curves. In Embodiment 3, features identical to those in Embodiment 1 will be denoted by the same reference signs to avoid repetitive description, and the following description will focus on differences from Embodiment 1.

[0028] Fig. 13 is a graph representing changes in the distance between the partition wall 14a of the machine unit 10 and the rotation axis ZZ according to Embodiment 3 of the present disclosure. In Fig. 13, the horizontal axis represents position in the direction of the rotation axis from the upstream end of the partition wall 14a to the downstream end of the partition wall 14a. In Fig. 13, the vertical axis represents the distance W between the partition wall 14a of one of the machine units 10 and the rotation axis ZZ. As illustrated in Fig. 13, the first, second, and third regions A, B, and C of the partition wall 14a are all curved in shape. The first region A has an upwardly convex shape, the second region B has a downwardly convex shape, and the third region C has an upwardly convex shape. That is, the direction of convexity reverses into the opposite direction at the first change point 15ab and at the second change point 15bc. The degree of inclination of the partition wall 14a is evaluated by using a line segment 218 connecting change points with each other.

Embodiment 4

[0029] Fig. 14 is a sectional view of an outdoor unit 300 according to Embodiment 4 of the present disclosure. In Embodiment 4, the second change point 15bc, which is the downstream end of the second region B, is positioned downstream of the upstream end 12a of the bell mouth 12, and the downstream end of the second region B is shifted downstream in comparison to Embodiment 1. As illustrated in Fig. 14, the air flow 6c to be suctioned from beside the air-sending device 3 flows along the wall surface of the bell mouth 12. Accordingly, to increase the flow rate of air to be sent, the space beside the air-sending device 3 is only required to be enlarged in areas where air flows before entering the bell mouth 12. Further, at locations downstream of the bell mouth 12, reducing the distance W does not affect the air flow rate of the air-sending device 3. Therefore, the above-mentioned configuration makes it possible to increase the volume of the machine chamber 10a of the machine unit 10 positioned further outward than is the bell mouth 12.

Embodiment 5

[0030] Fig. 15 is a sectional view of an outdoor unit 400 according to Embodiment 5 of the present disclosure. As illustrated in Fig. 15, in Embodiment 5, the upstream end 12a of the bell mouth 12 is positioned between the first change point 15ab, which is the upstream end of the second region B, and the second change point 15bc, which is the downstream end of the second region B. Therefore, both the effect provided by Embodiment 1 and the effect provided by Embodiment 4 can be achieved at the same time.

Embodiment 6

[0031] Fig. 16 is a sectional view of an outdoor unit 500 according to Embodiment 6 of the present disclosure. Embodiment 6 differs from Embodiment 1 in that the first region A, the second region B, and the third region C are provided in a portion of the partition wall 14a. In Embodiment 6, features identical to those in Embodiment 1 will be denoted by the same reference signs to avoid repetitive description, and the following description will focus on differences from Embodiment 1.

[0032] As illustrated in Fig. 16, as seen from the rotation axis ZZ, the first region A, the second region B, and the third region C are provided only in a range R representing a portion of the partition wall 14a corresponding to a portion of the bell mouth 12 from the upstream end to the downstream end. That is, the first region A, the second region B, and the third region C are provided in a portion of the partition wall 14a that faces the bell mouth 12. The air-sending chamber 13 is only required to be enlarged only at a location where the air-sending device 3 suction air. Accordingly, in Embodiment 6, the first region A, the second region B, and the third region C are

provided only in the range R representing a portion of the partition wall 14a corresponding to a portion of the bell mouth 12 from the upper end to the lower end. Consequently, at locations remote from the air-sending device 3, the machine chamber 10a of the machine unit 10 can be enlarged. This makes it possible to improve air-sending performance without an increase in the overall size of the outdoor unit 500.

[0033] Fig. 17 is a front view of an outdoor unit 500a according to a modification of Embodiment 6 of the present disclosure. As illustrated in Fig. 17, opposite machine units 510 may communicate with each other at a location below the downstream end of the bell mouth 12. As a result, wires, pipes, or other arrangements connecting devices installed in the opposite machine units 510 can be stored in the communicating portion.

Embodiment 7

[0034] Fig. 18 is a perspective view of an air-sending device 603 according to Embodiment 7 of the present disclosure. Embodiment 7 differs from Embodiment 1 in that the air-sending device 3 is a centrifugal fan. In Embodiment 7, features identical to those in Embodiment 1 will be denoted by the same reference signs to avoid repetitive description, and the following description will focus on differences from Embodiment 1.

[0035] As illustrated in Fig. 18, the air-sending device 603 is a centrifugal fan. This makes it possible to improve the heat transfer performance of the heat exchanger 7 of an outdoor unit 600 to address situations where, because of an increase in the resistance to air flow, the pressure-increasing capacity of a propeller fan would fail to provide sufficient air flow rate. The air-sending device 603 includes a main plate 611, a shroud 612, plural blades 613 sandwiched between the main plate 611 and the shroud 612, and a boss 614. The boss 614 and the motor 11 (not illustrated) are connected. As the air-sending device 603 rotates, the air-sending device 603 suction air from areas close to the shroud 612, and blows air outward.

[0036] Fig. 19 is a sectional view of the outdoor unit 600 according to Embodiment 7 of the present disclosure. As illustrated in Fig. 19, a leading edge 613a at the entrance of the blade 613 is positioned further outward than is an inner peripheral end 12b of the bell mouth 12. Thus, air is suctioned at a high velocity in areas close to the outer periphery of the bell mouth 12. As with Embodiments 1 to 6, with the outdoor unit 600, the presence of a large space at the entrance of the bell mouth 12 helps to ensure sufficient air flow into the bell mouth 12. In Fig. 19, as with Embodiment 5, the upstream end 12a of the bell mouth 12 is positioned between the upstream end of the second region B and the downstream end of the second region B. Therefore, also in Embodiment 7, the effect provided by Embodiment 1 and the effect of Embodiment 4 can be both achieved at the same time.

[0037] Although the foregoing description of Embodi-

ments 1 to 7 is directed to an exemplary case where the shapes of the opposite partition walls 14a are line-symmetric to each other across the rotation axis ZZ, the shapes of the opposite partition walls 14a may not be line-symmetric to each other across the rotation axis ZZ. In this case, the distance W between one of the partition walls 14a and the rotation axis ZZ and the distance W between the other partition wall 14a and the rotation axis ZZ differ from each other. The following description will be directed to an exemplary case where the shapes of the opposite partition walls 14a are not line-symmetric to each other across the rotation axis ZZ.

Embodiment 8

[0038] Fig. 20 is a sectional view of an outdoor unit 700 according to Embodiment 8 of the present disclosure. In Embodiment 8, the partition wall 14a of one of machine units 710 is not inclined but has a flat surface. In this case as well, at the partition wall 14a of the machine unit 10 that has the first region A, the second region B, and the third region C, the same effects as those of Embodiments 1 to 7 can be obtained.

Embodiment 9

[0039] Fig. 21 is a sectional view of an outdoor unit 800 according to Embodiment 9 of the present disclosure. In Embodiment 9, the partition wall 14a of one of machine units 810 has only the second region B and the third region C, and does not have the first region A. In this case as well, at the partition wall 14a of the machine unit 10 that has the first region A, the second region B, and the third region C, the same effects as those of Embodiments 1 to 7 can be obtained.

Embodiment 10

[0040] Fig. 22 is a sectional view of an outdoor unit 900 according to Embodiment 10 of the present disclosure. In Embodiment 10, one of the machine units 10 is not in contact with a heat exchanger 907. In this case as well, at the partition wall 14a of the machine unit 10 that has the first region A, the second region B, and the third region C, the same effects as those of Embodiments 1 to 7 can be obtained.

[0041] Although the foregoing description of the embodiments is directed to an exemplary case where the outdoor unit is the outdoor unit of an air-conditioning apparatus, the outdoor unit may be the outdoor unit of a refrigeration cycle apparatus such as a water heater and a refrigeration apparatus.

Reference Signs List

[0042] 1 outdoor unit 1a indoor unit 2 panel group 2a front panel 2b side panel 2c bottom panel 2d top panel 3 air-sending device 4 air outlet 4a air inlet 5 fan guard

6, 6a, 6b, 6c air flow 7 heat exchanger 8 compressor 9 controller 10 machine unit 10a machine chamber 11 motor 11a shaft 11b boss 11c blade 12 bell mouth 12a upstream end 13 air-sending chamber 14a partition wall 15ab first change point 15bc second change point 15cd third change point 18 internal components 20 support 21 refrigerant circuit 22 flow switching device 23 expansion unit 24 indoor heat exchanger 25 indoor air-sending device 50 refrigeration cycle apparatus 100 outdoor unit 101 projection 200 outdoor unit 218 line segment 300 outdoor unit 400 outdoor unit 500 outdoor unit 500a outdoor unit 510 machine unit 600 outdoor unit 603 air-sending device 611 main plate 612 shroud 613 blade 613a leading edge 614 boss 700 outdoor unit 710 machine unit 800 outdoor unit 810 machine unit 900 outdoor unit 907 heat exchanger 1000 outdoor unit A first region B second region C third region

Claims

1. An outdoor unit, comprising:

a plurality of machine units each accommodating a machine chamber storing a machine part; an air-sending device installed in an air-sending chamber positioned between partition walls of the plurality of machine units, and configured to provide an air flow; and a heat exchanger installed upstream of the air-sending device and configured to exchange heat between refrigerant and air sent by the air-sending device, at least one of the partition walls of the plurality of machine units having a first region positioned close to the heat exchanger and inclined from a position close to the heat exchanger toward a rotation axis of the air-sending device, a second region positioned downstream of the first region and inclined at an angle that is smaller than an angle of the first region, and a third region positioned downstream of the second region and inclined at an angle that is greater than the angle of the second region.

2. The outdoor unit of claim 1, wherein the air-sending device has an upstream end positioned to face the second region.

3. The outdoor unit of claim 1 or 2, further comprising a bell mouth surrounding the air-sending device, wherein the second region has an upstream end positioned upstream of an upstream end of the bell mouth.

4. The outdoor unit of claim 3, wherein the second region has a downstream end positioned downstream

of the upstream end of the bell mouth.

5. The outdoor unit of claim 3 or 4, wherein the first region, the second region, and the third region are provided in a portion of the partition wall, the portion facing the bell mouth as seen from the rotation axis.
6. A refrigeration cycle apparatus, comprising the outdoor unit of any one of claims 1 to 5.

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FIG. 1

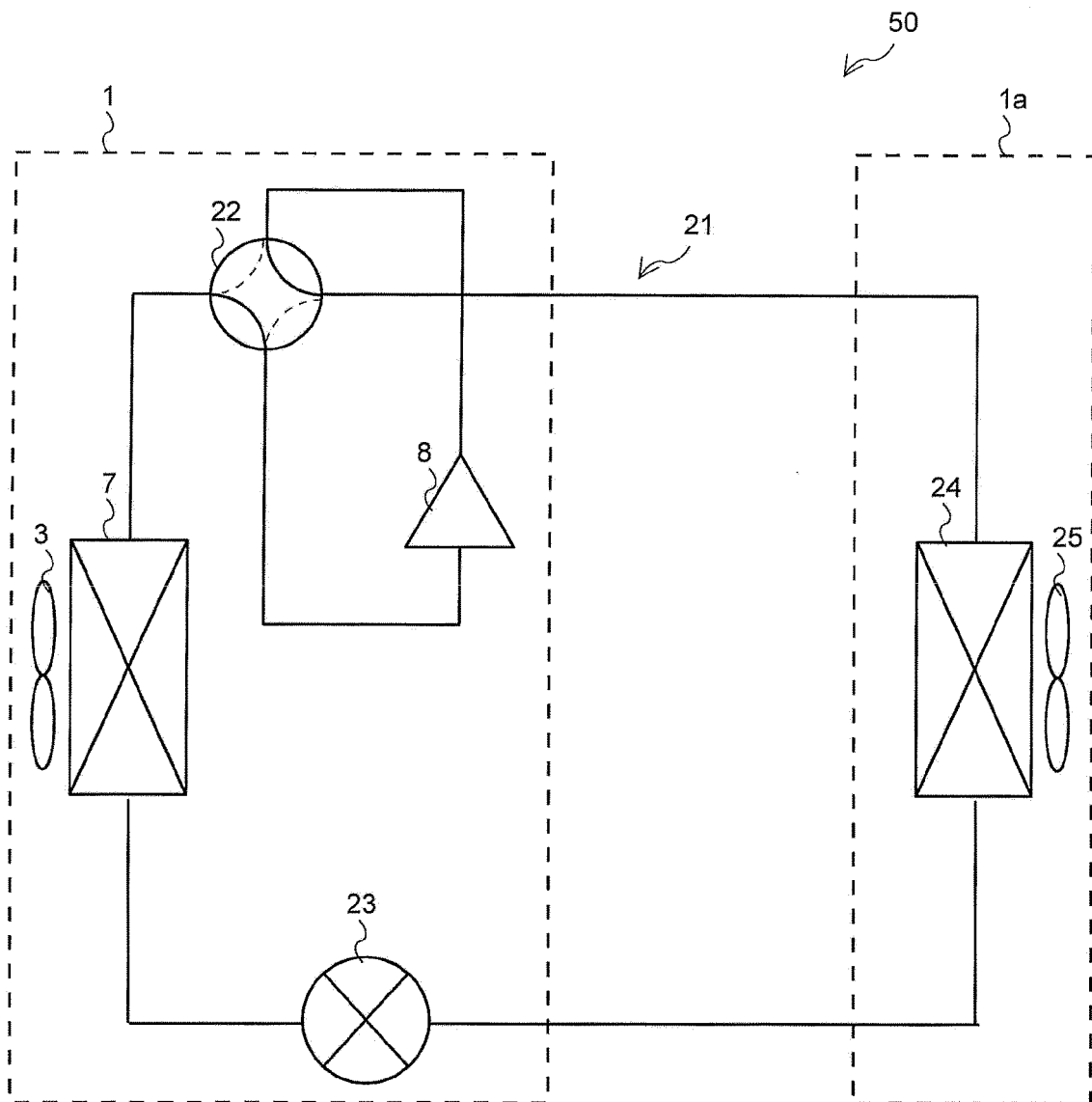


FIG. 2

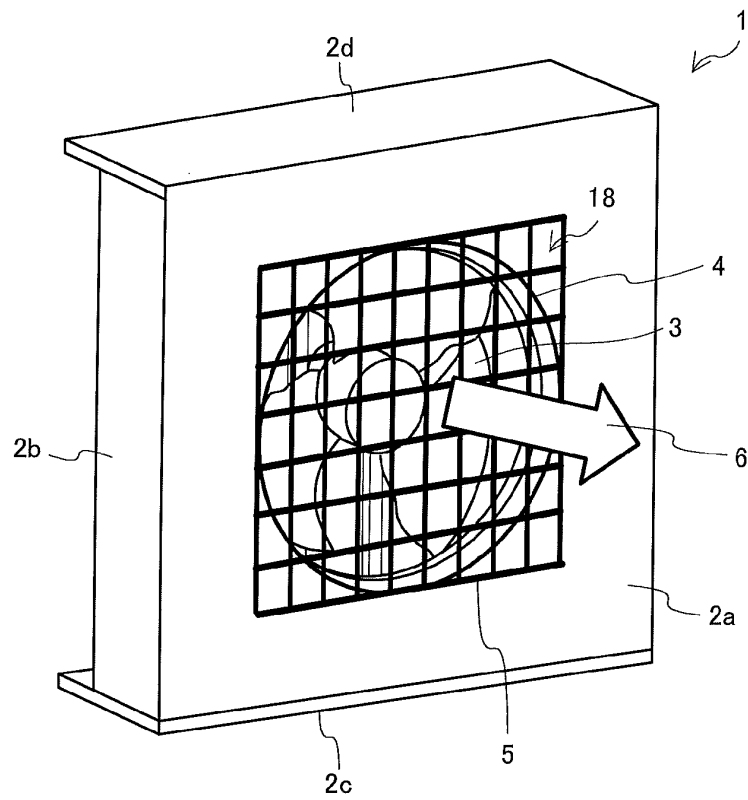


FIG. 3

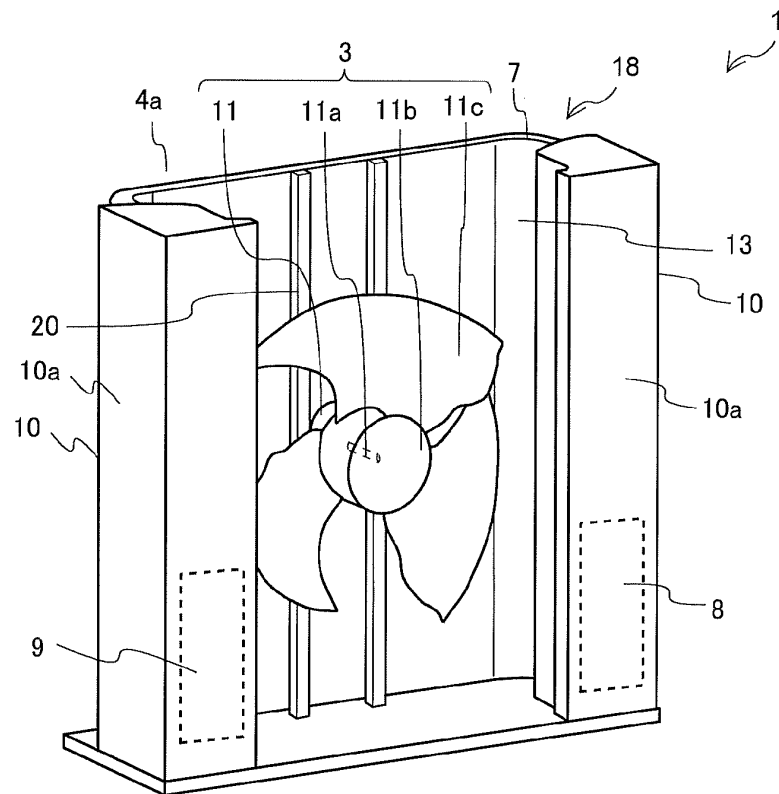


FIG. 4

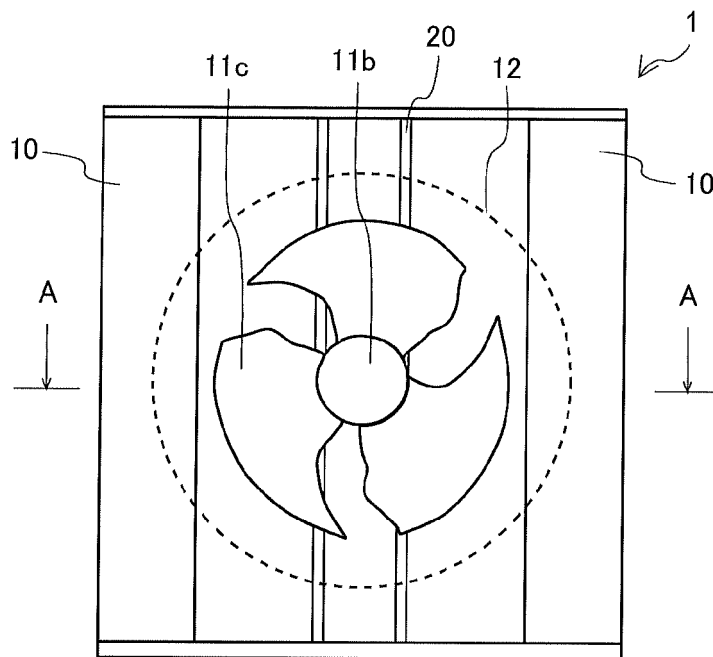


FIG. 5

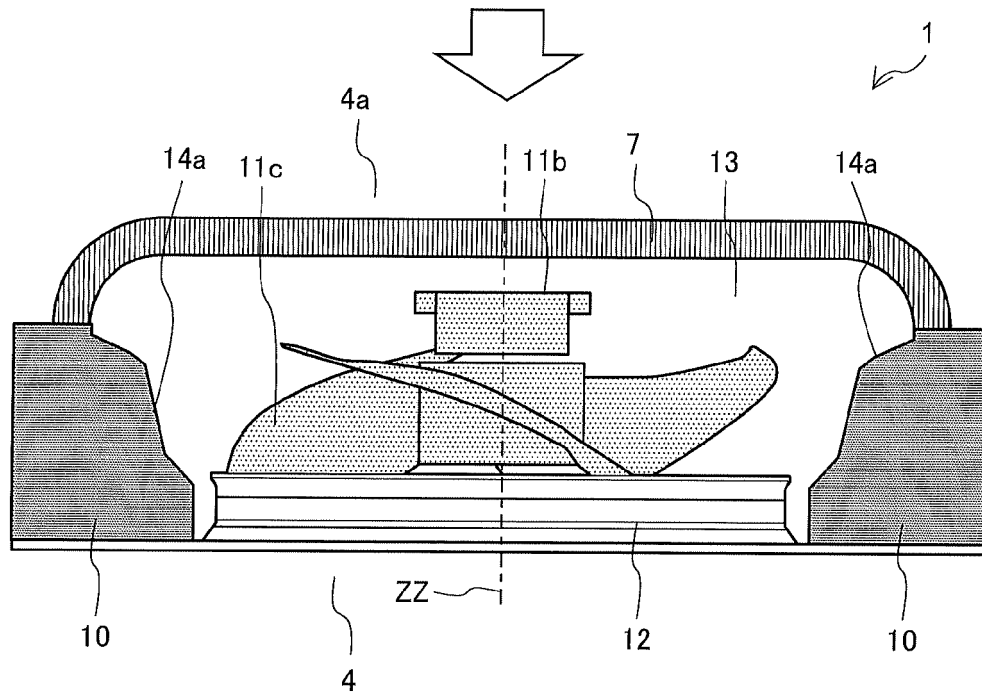


FIG. 6

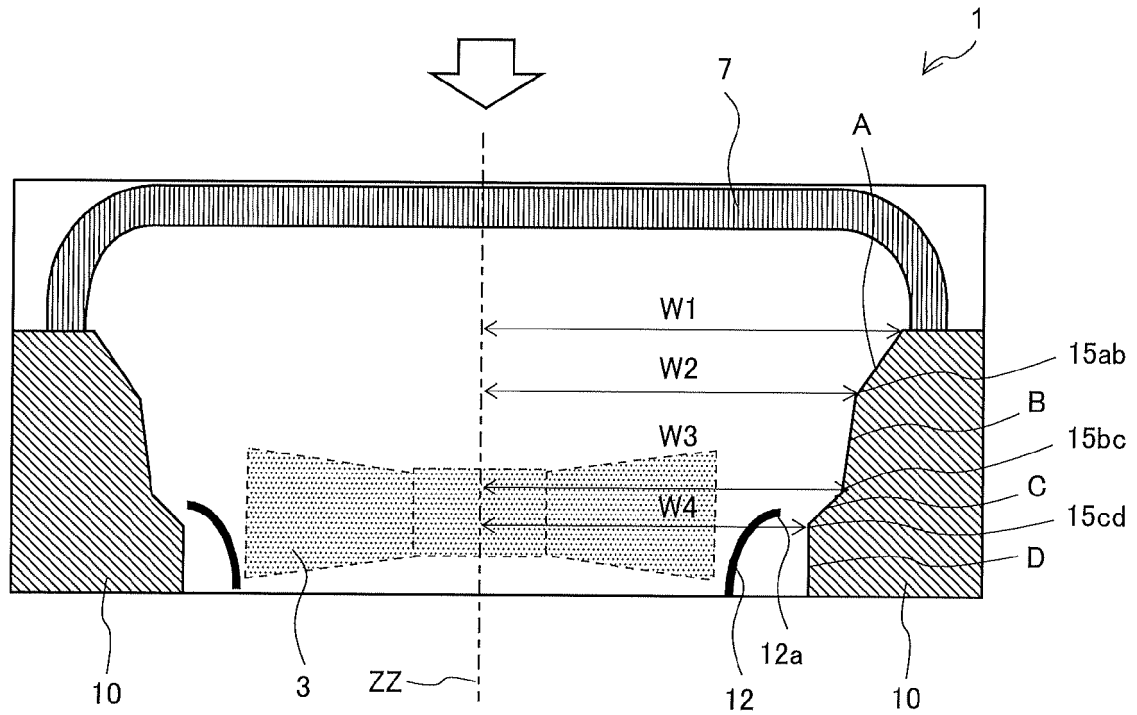


FIG. 7

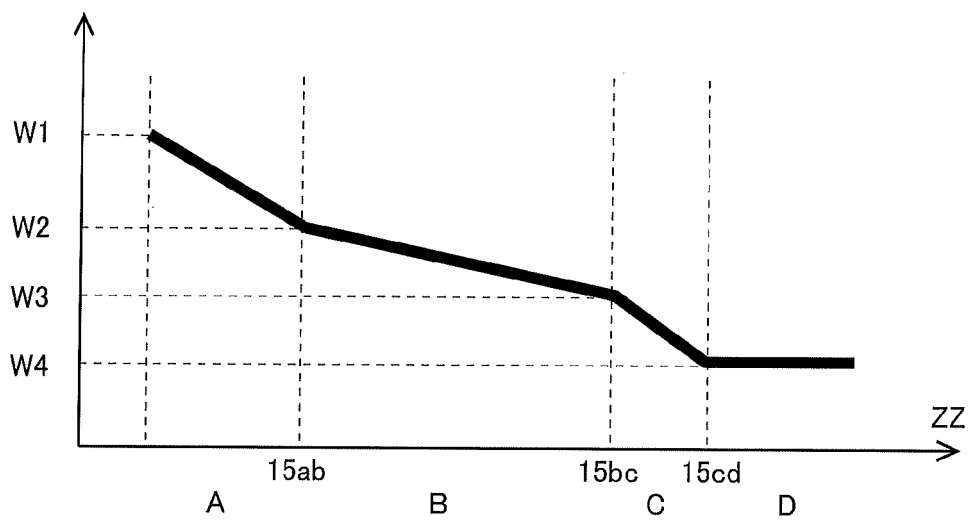


FIG. 8

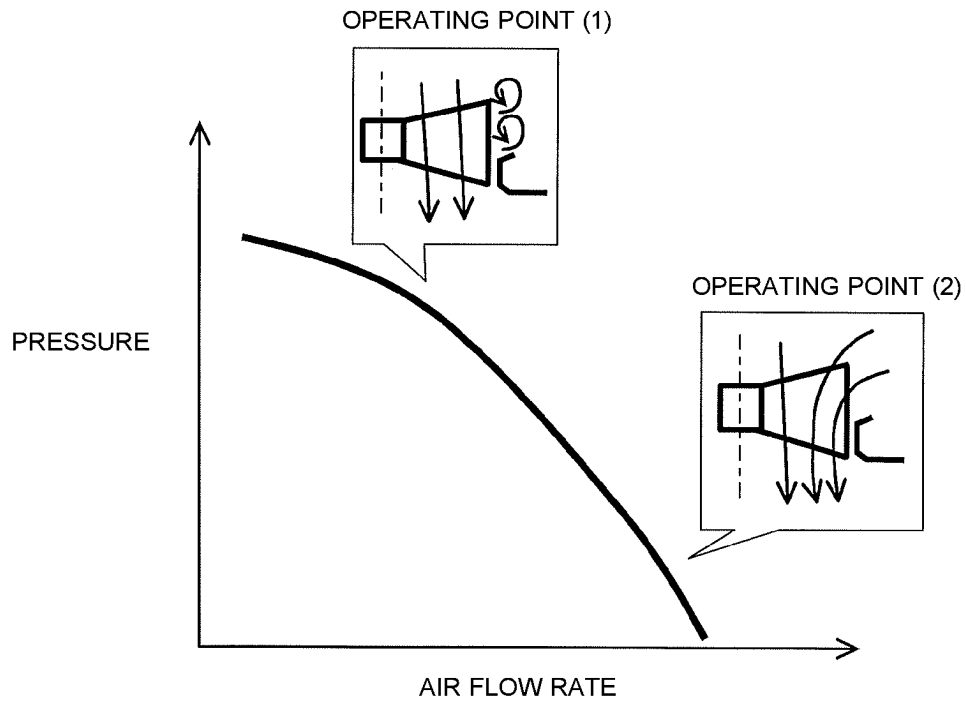


FIG. 9

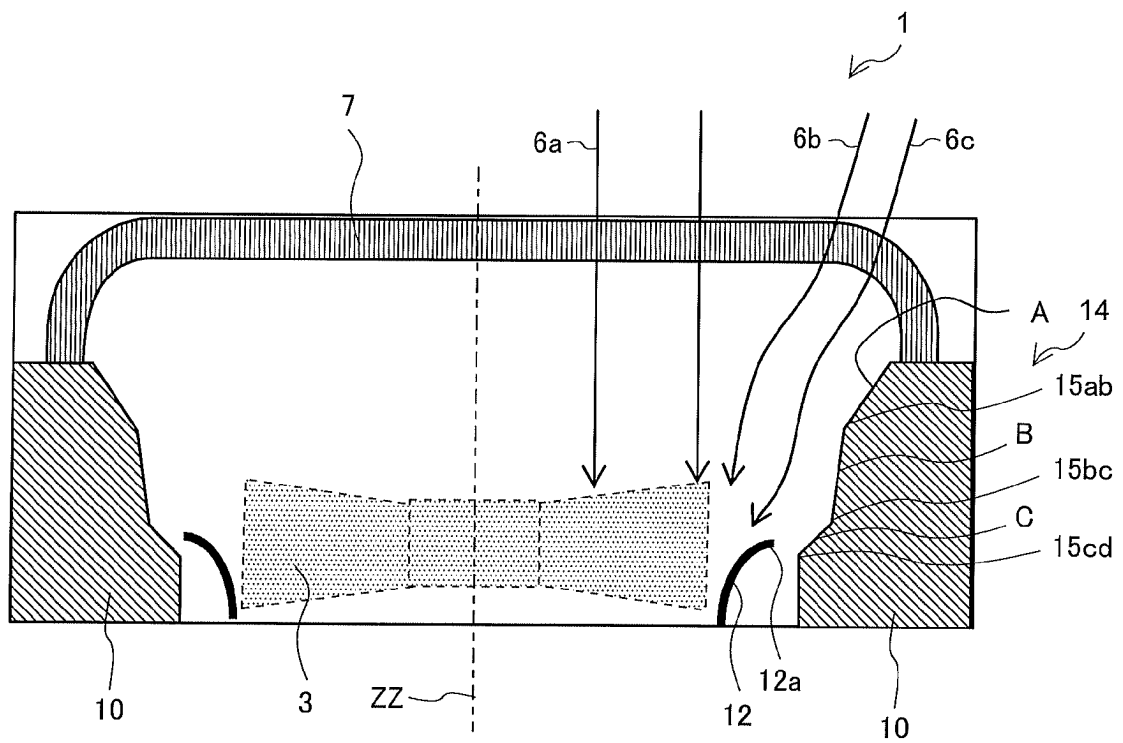


FIG. 10

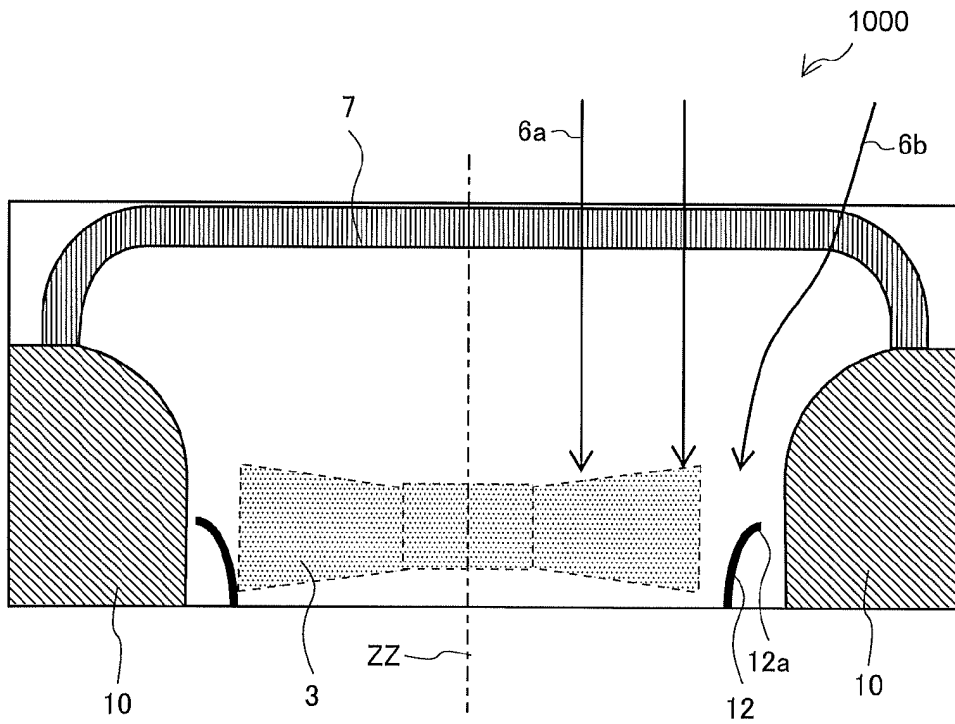


FIG. 11

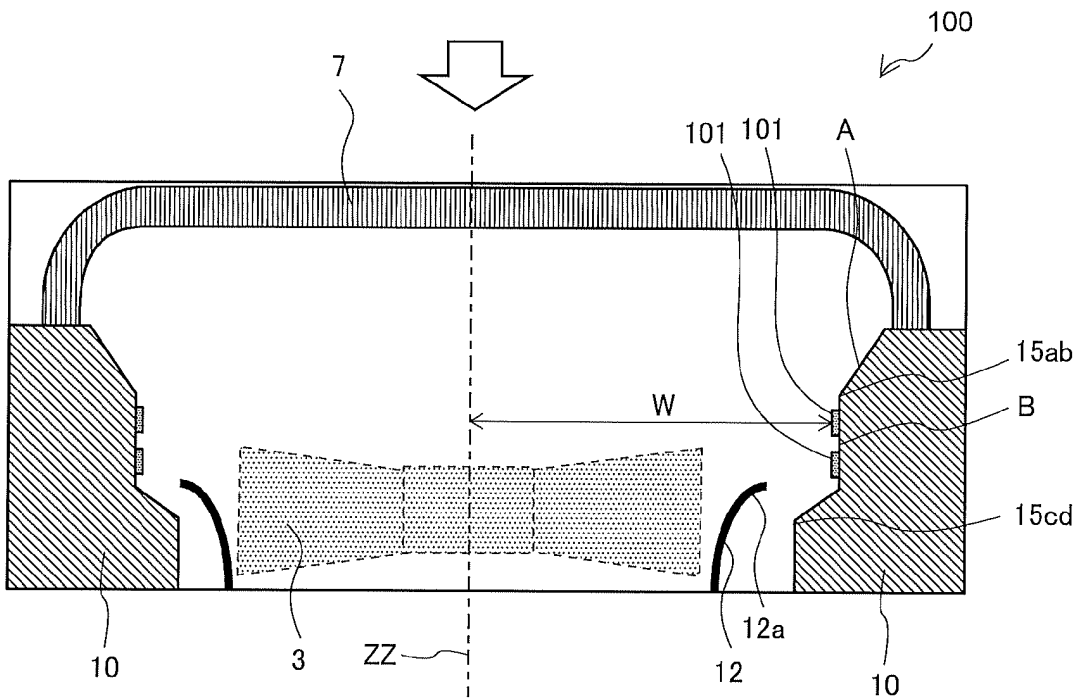


FIG. 12

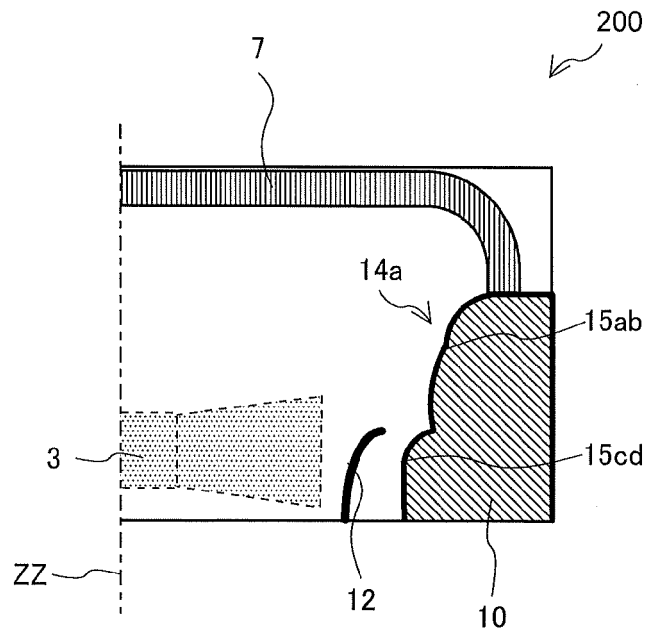


FIG. 13

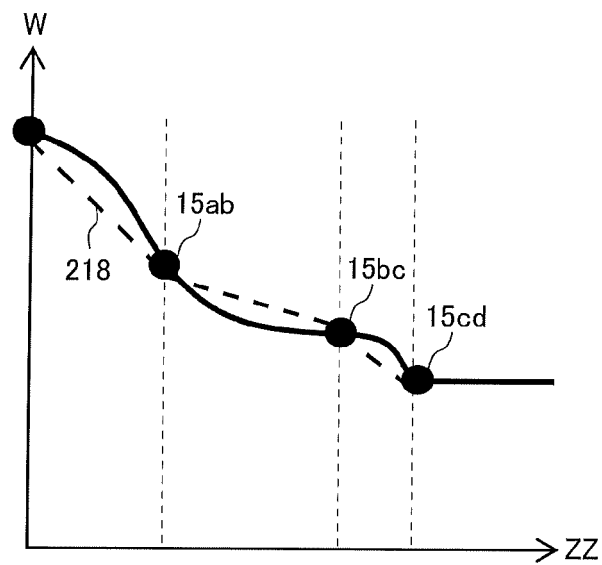


FIG. 14

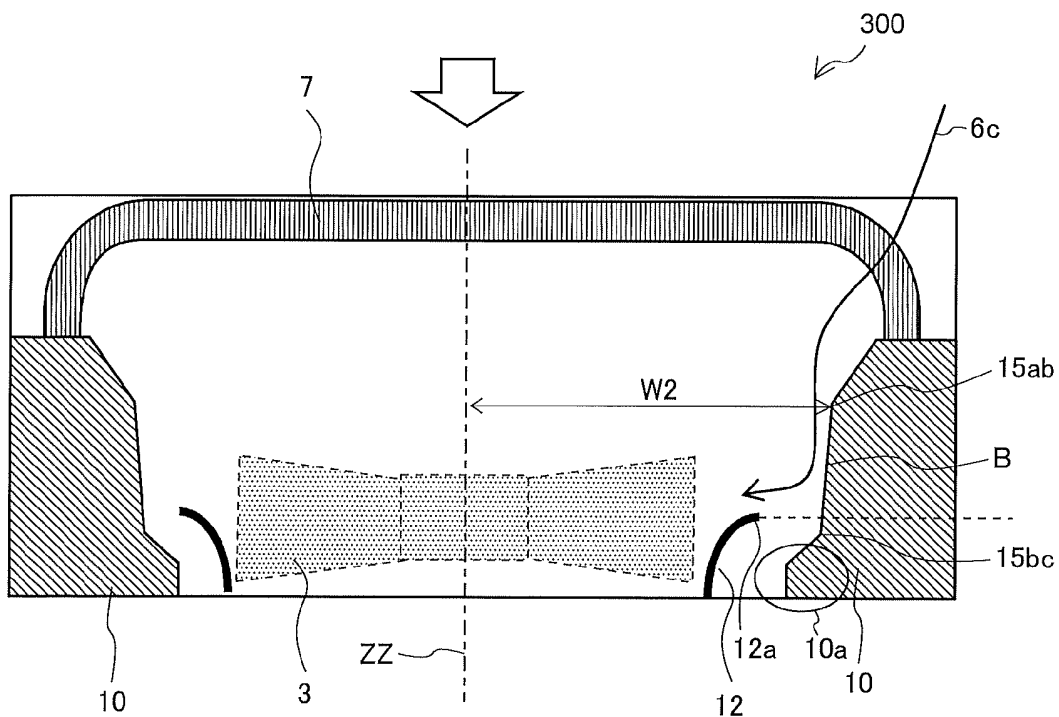


FIG. 15

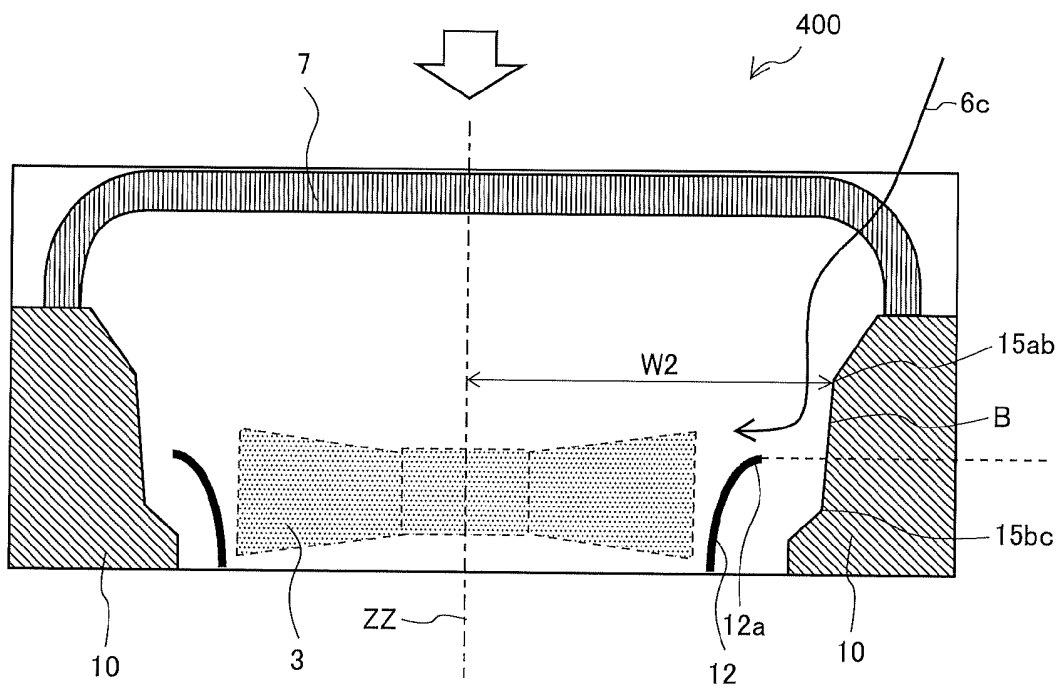


FIG. 16

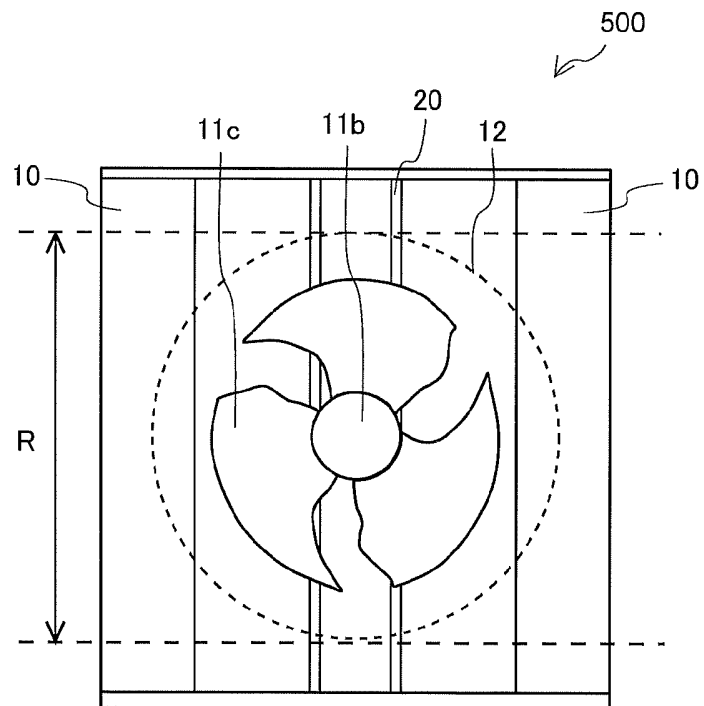


FIG. 17

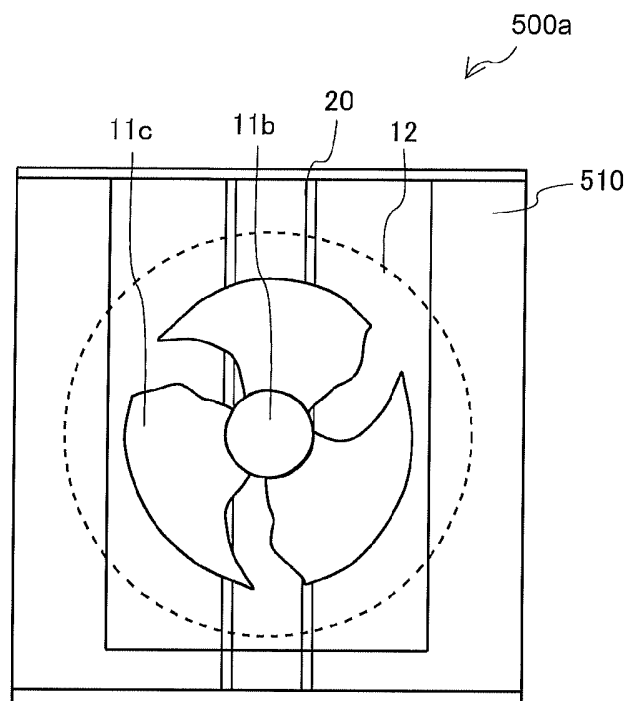


FIG. 18

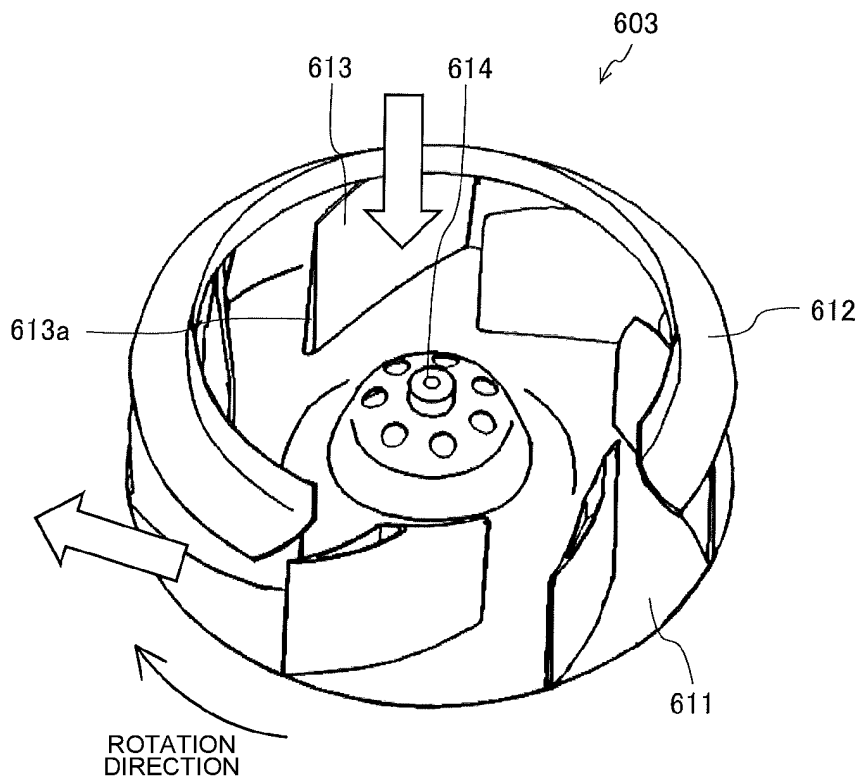


FIG. 19

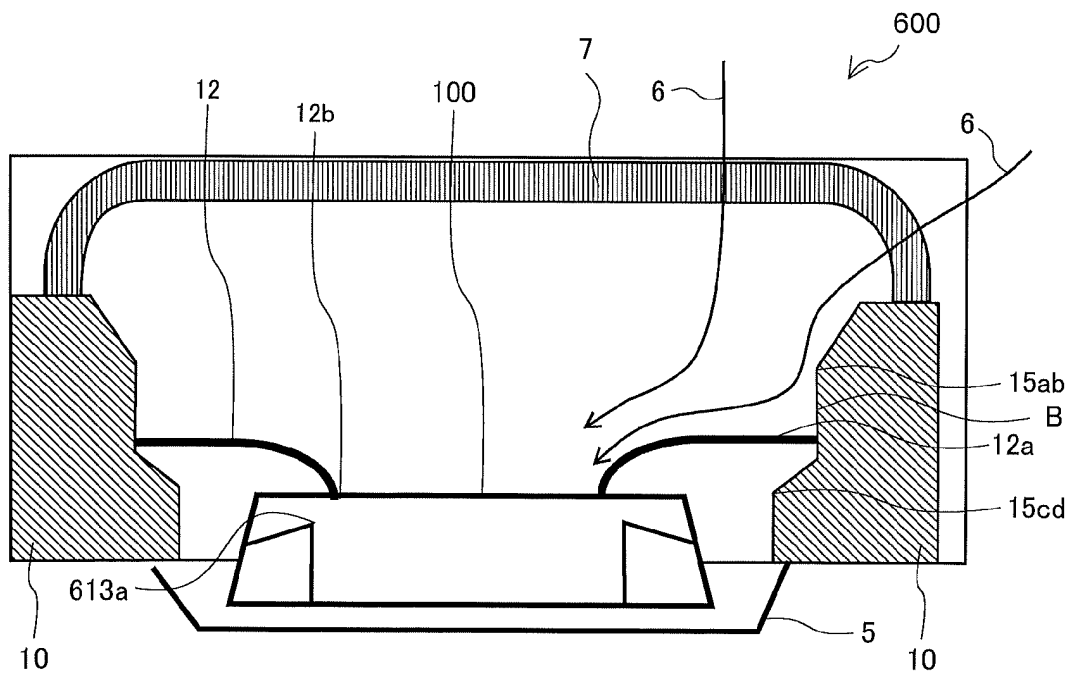


FIG. 20

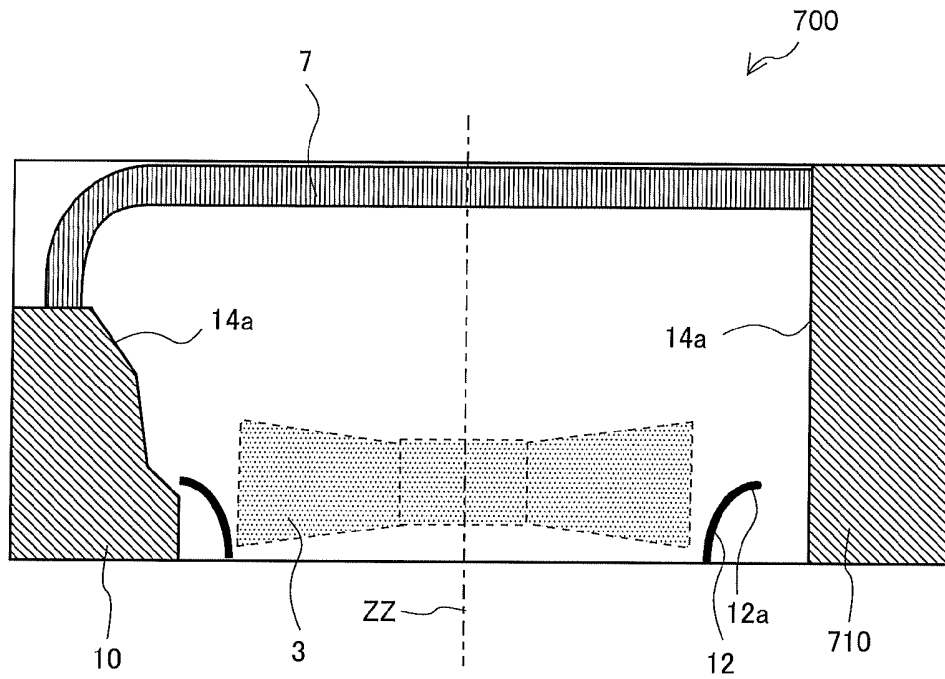


FIG. 21

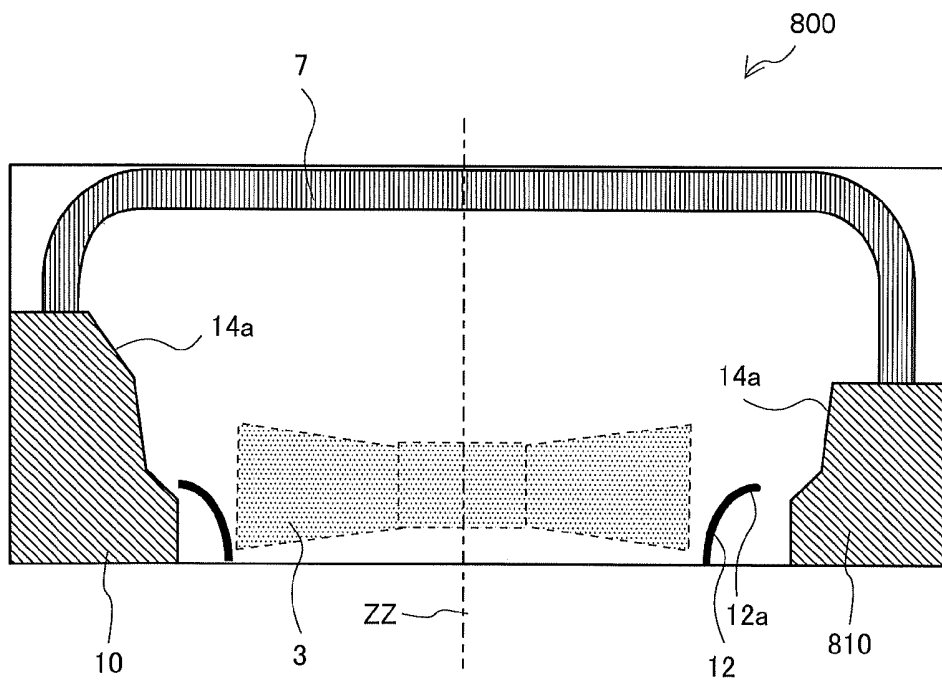
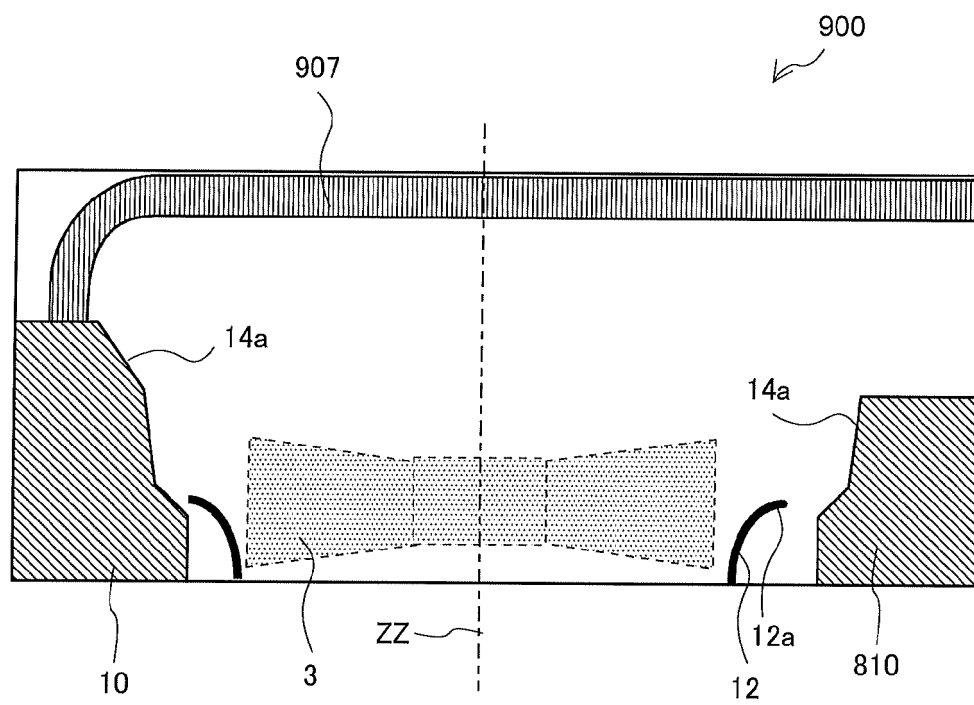


FIG. 22



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2018/032074

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl. F24F1/54 (2011.01) i, F24F1/40 (2011.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Int. Cl. F24F1/54, F24F1/40

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

Published examined utility model applications of Japan 1922-1996

Published unexamined utility model applications of Japan 1971-2018

Registered utility model specifications of Japan 1996-2018

Published registered utility model applications of Japan 1994-2018

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2015-127624 A (MITSUBISHI ELECTRIC CORP.) 09 July 2015, paragraphs [0001]-[0027], fig. 1-7 & CN 204388253 U	1-6
Y	JP 5-133564 A (MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD.) 28 May 1993, paragraphs [0006]-[0014], fig. 1-3 & CN 1072493 A	1-6
A	JP 2010-127590 A (MITSUBISHI ELECTRIC CORP.) 10 June 2010, entire text, all drawings (Family: none)	5



Further documents are listed in the continuation of Box C.



See patent family annex.

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"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

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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

07.11.2018

Date of mailing of the international search report

20.11.2018

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Japan Patent Office
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Telephone No.

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- JP 2002267207 A [0003]
- JP 6213198 A [0003]