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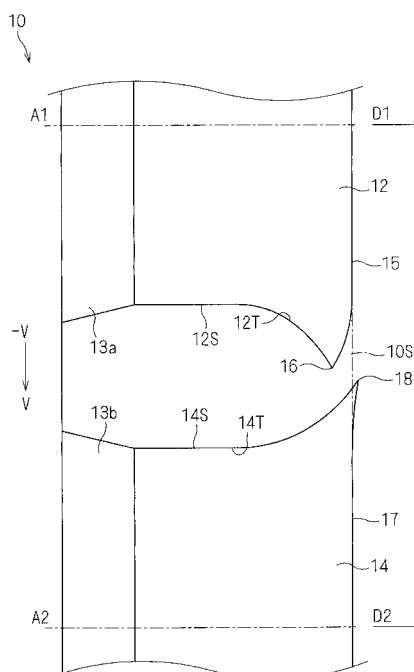
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(54) **OUTDOOR UNIT AND BELL MOUTH OF AIR CONDITIONER**

(57) In the present invention, an outer peripheral surface (14S) of a second bell mouth (14) is located in a lower side (V) in a vertical direction of a lower end (16) of a first bell mouth (12). That is, the lower end (16) of the first bell mouth (12) is located opposite to a direction (D2) in which the second bell mouth (14) is opened, compared to an upper end (18) of the second bell mouth (14) in the lower side (V) in the vertical direction of the lower end. In other words, the upper end (18) of the second bell mouth (14) in the lower side (V) in the vertical direction of the lower end (16) of the first bell mouth (12) is located closer to the direction (D2) in which the second bell mouth (14) is opened, than the lower end (16).

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Description

Technical Field

[0001] The present invention relates to a bell mouth, and an outdoor unit of an air conditioner using the same.

Background Art

[0002] An outdoor unit of an air conditioner (hereinafter, simply referred to as "outdoor unit") is provided with a fan and a bell mouth, and is disclosed in below-listed Patent Document 1 and the like. Further, an outdoor unit having an aspect in which a plurality of fans and bell mouths are respectively arranged in a vertical direction is disclosed in below-listed Patent Document 2 and the like.

[0003] For example, if the outdoor unit carries out a heating operation in a cold district for a long period of time, parts in each of the portions are cooled by outside air. Accordingly, moisture in the air is condensed and frozen onto the surface of the parts and a frost is formed (frosting). Frosting in the outdoor unit results in lowering of operation efficiency since heat exchange between the outside air and a heating medium is obstructed by the frost. Thus, in below-listed Patent Documents 3 and 4, there has been proposed a technique which attempts to remove the frosted moisture and suppress the frost generation.

[0004] In the outdoor unit, in addition to the frost generation, a water droplet may enter into an inner portion of a casing due to rainfall or snowfall. If the water droplet that entered into the casing is attached to a surface in an air duct side of the bell mouth, water droplet may be frozen on the surface and grow, and the ice may come into contact with a fan to generate an abnormal noise, or stop the fan. Accordingly, in below-listed Patent Documents 5 to 8, a technique has been proposed which prevents or suppresses the entering of the water droplet from an outer surface of the casing to a surface in the air duct side of the bell mouth (hereinafter, also referred to as "inner peripheral surface").

Prior Art Document

Patent Document

[0005]

Patent Document 1: Japanese Patent Application Laid-Open No. 2009-203980
 Patent Document 2: Japanese Patent Application Laid-Open No. 2008-128563
 Patent Document 3: Japanese Patent Application Laid-Open No. 2009-085484
 Patent Document 4: Japanese Patent Application Laid-Open No. 2009-281719
 Patent Document 5: Japanese Patent Application

Laid-Open No. 6-331175 (1994)

Patent Document 6: Japanese Patent Application Laid-Open No. 8-178365 (1996)

Patent Document 7: Japanese Patent Application Laid-Open No. 2009-257603

Patent Document 8: Japanese Utility Model Application Laid-Open No. 4-132336 (1992)

Summary of the Invention

Problem to be Solved by the Invention

[0006] Fig. 9 is a perspective view of an outdoor unit 90 of an air conditioner, and shows an outdoor unit in which two fans and two bell mouths provided in the periphery of the fans are arranged in line in a vertical direction. The fans and the bell mouths are not illustrated, however, they are provided within the outdoor unit 90 at positions corresponding to positions of front grills 32 and 34. Fig. 10 is a plan view of a substantial part of the outdoor unit 90, and shows a plan view of the front grills 32 and 34. Fig. 11 is a cross-sectional view of a substantial part of the conventional outdoor unit 90, and is a cross-sectional view at a position A-A shown in Fig. 10. Further, Fig. 12 is an enlarged view of a substantial part of the conventional outdoor unit 90, and shows a region B shown by an oval broken line in an enlarged manner.

[0007] As shown in Fig. 12, in the two bell mouths 92 and 94 which are arranged side by side in a vertical direction, a lower end 92b of the upper bell mouth 92, and an upper end 94c of the lower bell mouth 94 are close to each other. Accordingly, in the case where a water droplet 9d enters inside a casing 11 or condensation occurs (the water droplet 9d is generated) inside the casing 11, the water droplet 9d falls down along a surface of the upper bell mouth 92. In this case, the surface along which the water droplet 9d falls down not only includes a surface (hereinafter, also referred to as "inner peripheral surface") 92T in an air duct side of the upper bell mouth 92, but also includes a surface (hereinafter, also referred to as "outer peripheral surface") 92S opposite to the surface in the air duct side of the bell mouth 92. The water droplet 9d falling down along the surfaces 92S and 92T may fall down to the upper end 94c of the lower bell mouth 94 which exists immediately below. The water droplet 9d falling down to the upper end 94c of the lower bell mouth 94 may fall down along the inner peripheral surface 94T of the lower bell mouth 94, and may be frozen.

[0008] As described above, with respect to the water droplet 9d that entered into the casing 11, or the water droplet 9d generated within the casing 11, it is impossible to prevent or suppress the growth of ice 9e on the inner peripheral surface 94T, by the techniques disclosed in above-listed Patent Documents 5 to 8.

[0009] In view of the above problems, an object of the present invention is to provide a technique which prevents or suppresses entering of a water droplet into an air duct of a lower bell mouth, in an outdoor unit of an air

conditioner having a plurality of bell mouths arranged side by side in a vertical direction.

Means for Solving the Problem

[0010] In order to solve the above problems, a first aspect of an outdoor unit of an air conditioner according to the present invention is an outdoor unit (10, 10A, 10B) of an air conditioner including a first bell mouth (12, 12A), and a second bell mouth (14, 14A, 14B) which is adjacent to a lower side (V) in a vertical direction than the first bell mouth, wherein a lower end (16, 16A) in the vertical direction of the first bell mouth, and an outer peripheral surface (14S) of the second bell mouth in the lower side in the vertical direction of the lower end together cooperate to show a water conducting path which conducts a liquid to the lower side in the vertical direction.

[0011] In accordance with a second aspect of the present invention, in the outdoor unit of the air conditioner according to the first aspect, the lower end (16, 16A) of the first bell mouth is located opposite to a direction in which the second bell mouth is opened, compared to an upper end (18, 18A, 18B) of the second bell mouth in the lower side (V) in the vertical direction of the lower end.

[0012] In accordance with a third aspect of the present invention, the outdoor unit of the air conditioner according to the first aspect further includes a water conducting member (22) which extends toward a side opposite to a direction in which the second bell mouth is opened, compared to an upper end (18A) of the second bell mouth (14A) in the lower side (V) in the vertical direction of the lower end, while setting the lower end (16A) of the first bell mouth (12A) to a base point.

[0013] In accordance with a fourth aspect of the present invention, the outdoor unit of the air conditioner according to the first aspect further includes a water conducting member (24) which extends toward a direction in which the first bell mouth is opened, compared to the lower end of the first bell mouth in an upper side (-V) in the vertical direction of the upper end, while setting an upper end (18A) of the second bell mouth in the lower side (V) in the vertical direction of the lower end (16A) of the first bell mouth (12A) to a base point.

[0014] A first aspect of the bell mouth according to the present invention is a bell mouth (30) which is open to one side in a direction parallel to an axis (Q) around the axis, wherein a first end portion (32) which is most apart from the axis in the one side is located on a first surface (S1) in which a direction parallel to the axis is set to a normal line, and a second end portion (34) which is most apart from the axis in the one side opposite to the first end portion around the axis is located on a second surface (S2) which is different from the first surface while setting the direction parallel to the axis to a normal line.

Effects of the Invention

[0015] In accordance with the first aspect of the out-

door unit of the air conditioner according to the present invention, it is possible to prevent or suppress entering of a water droplet from the upper bell mouth into the air duct of the lower bell mouth. Accordingly, it is possible to prevent or suppress ice formation within the air duct, and it is possible to prevent or suppress breakage of the fan and/or abnormal noise generation.

[0016] In accordance with the second aspect of the outdoor unit of the air conditioner according to the present invention, it is possible to prevent or suppress entering of a water droplet from the upper bell mouth into the air duct of the lower bell mouth. Accordingly, it is possible to prevent or suppress ice formation within the air duct, and it is possible to prevent or suppress breakage of the fan and/or abnormal noise generation.

[0017] In accordance with the third aspect of the outdoor unit of the air conditioner according to the present invention, since the water conducting member is provided to the outdoor unit of the existing air conditioner in which a plurality of bell mouths are arranged in the direction having a component in the vertical direction, it is possible to prevent or suppress entering of a water droplet from the upper bell mouth into the air duct of the lower bell mouth. Accordingly, it is possible to prevent or suppress ice formation within the air duct, and it is possible to prevent or suppress breakage of the fan and/or abnormal noise generation.

[0018] In accordance with the fourth aspect of the outdoor unit of the air conditioner according to the present invention, since the water conducting member is provided to the outdoor unit of the existing air conditioner in which a plurality of bell mouths are arranged in the direction having a component in the vertical direction, it is possible to prevent or suppress entering of a water droplet from the upper bell mouth into the air duct of the lower bell mouth. Accordingly, it is possible to prevent or suppress ice formation within the air duct, and it is possible to prevent or suppress breakage of the fan and/or abnormal noise generation.

[0019] In accordance with the first aspect of the bell mouth according to the present invention, for example, if the first surface is located closer to one side of the axis than the second surface, by attaching a plurality of bell mouths in the vertical direction such that the first end portion is located above and the second end portion is located at a lower side, it is possible to prevent or suppress entering of a water droplet from the upper bell mouth into the air duct of the lower bell mouth.

[0020] These and other objects, features, aspects and advantages of the present invention will become more apparent from the following detailed description of the present invention when taken in conjunction with the accompanying drawings.

Brief Description of Drawings

[0021]

[Fig. 1] An enlarged view of a substantial part of an outdoor unit according to a first embodiment of the present invention.

[Fig. 2] A side view of a bell mouth according to an embodiment of the present invention.

[Fig. 3] An enlarged view of a substantial part of an outdoor unit according to a second embodiment of the present invention.

[Fig. 4] An enlarged view of a substantial part of an outdoor unit according to a third embodiment of the present invention.

[Fig. 5] An enlarged view of a substantial part of an outdoor unit according to a first modification of the present invention.

[Fig. 6] An enlarged view of a substantial part of an outdoor unit according to a second modification of the present invention.

[Fig. 7] An enlarged view of a substantial part of an outdoor unit according to a third modification of the present invention.

[Fig. 8] An enlarged view of a substantial part of Fig. 7.

[Fig. 9] A perspective view of an outdoor unit of an air conditioner.

[Fig. 10] A plan view of a substantial part of the outdoor unit.

[Fig. 11] A cross-sectional view of a substantial part of a conventional outdoor unit.

[Fig. 12] An enlarged view of a substantial part of the conventional outdoor unit.

Embodiments for Carrying Out the Invention

[0022] Hereinafter, a preferable embodiment of the present invention will be described with reference to the drawings. Note that only elements which are relevant to the present invention will be shown in the following drawings starting with Fig. 1.

<First embodiment>

[0023] Fig. 1 is an enlarged view of a substantial part of an outdoor unit 10 according to a first embodiment of the present invention, and shows a region which corresponds to a region B in Fig. 11 in an enlarged manner. Here, as to an outer shape, the outdoor unit 10 has an outer shape formed in the same shape as the outdoor unit 90 shown in Fig. 9, and is denoted with reference numeral 10 in Fig. 9. The outdoor unit 10 according to the first embodiment of the present invention is provided with two bell mouths 12 and 14 which are adjacent along a vertical direction, as shown in Fig. 1.

[0024] Specifically, the outdoor unit 10 is provided with the first bell mouth 12 which is opened toward a first direction D1 perpendicular to the vertical direction, and the second bell mouth 14 which is adjacent to a lower side V in the vertical direction than the first bell mouth 12, and is opened toward a second direction D2 perpendicular

to the vertical direction. In the first embodiment, there is shown an aspect in which the first direction D1 and the second direction D2 are parallel to each other, however, the first direction D1 and the second direction D2 may be non-parallel to each other.

[0025] In this case, taking the first bell mouth 12 as an example, the direction in which the bell mouth is opened is a direction in which an area (hereinafter, referred to as "cross-sectional area") that an inner peripheral surface 12T of the first bell mouth 12 cuts out a surface having an axis (hereinafter, also referred to as "axis of the bell mouth") A1 of a fan (not shown) attached to the first bell mouth 12 as a normal line becomes gradually larger up to an end portion in a direction which is along the axis A1, that is, a direction which is directed from one side to the other side of an end portion (corresponding to "connection portion 13a" mentioned later in the first embodiment) fixed to the other member. Further, the axis A1 of the first bell mouth 12 is equivalent to an axis of rotation of the fan (not shown) which is attached to the first bell mouth 12. In the second bell mouth 14, an opening direction D2 and an axis A2 are defined in the same manner. In the first embodiment, the first direction D1 and the axis A1 are formed in parallel, and the second direction D2 and the axis A2 are formed in parallel.

[0026] A lower end 16 in the vertical direction close to the first direction D1 side of the first bell mouth 12, and an outer peripheral surface 14S of the second bell mouth 14 in the lower side V in the vertical direction thereof together cooperate to show a water conducting path which conducts a liquid to the lower side V in the vertical direction. Giving a specific example, the outer peripheral surface 14S of the second bell mouth 14 is located in the lower side V in the vertical direction of the lower end 16 of the first bell mouth 12. That is, the lower end 16 of the first bell mouth 12 is located opposite to the direction D2 in which the second bell mouth 14 is opened, compared to an upper end 18 of the second bell mouth 14 in the lower side V in the vertical direction thereof. In other words, the upper end 18 of the second bell mouth 14 in the lower side V in the vertical direction of the lower end 16 of the first bell mouth 12 is located closer to the direction D2 side in which the second bell mouth 14 is opened, than the lower end 16.

[0027] More specifically, for example, as shown in Fig. 1, an opening end 15 which corresponds to an end portion in a side of the first direction D1 of the first bell mouth 12 is formed approximately as a surface 10S having a direction parallel to the axis A1 (A2) as a normal line, in cross-sectional view. Further, the vicinity thereof including the lower end 16 of the first bell mouth 12 is curved toward the side opposite to the first direction D1 than the surface 10S. In the vicinity thereof, a height of the lower end 16 along the vertical direction becomes minimum.

[0028] In this case, the first bell mouth 12 has, for example, a connection portion 13a in an end portion in the side opposite to the first direction D1. The connection portion 13a is connected to a front grill 32 (refer to Fig.

9) provided to the outdoor unit 10. The connection portion 13a is located at a portion where the cross-sectional area becoming gradually smaller from the opening end 15 becomes minimum, or in a side opposite to the opening end 15 with respect to the portion. The lower end 16 of the first bell mouth 12 in the first embodiment is structured such that a height along the vertical direction is formed minimum between the portion and the opening end 15. In this case, the second bell mouth 14 has a connection portion 13b. The second connection portion 13b is connected to a front grill 34 (refer to Fig. 9) in an end portion in a side opposite to the second direction D2 of the second bell mouth 14. The connection portion 13b is located at the same height as a portion in which the height along the vertical direction of the outer peripheral surface 14S and an inner peripheral surface 14T which continue from an upper end 18 corresponding to an end portion close to the second direction D2 side of the second bell mouth 14 becomes minimum, or in a side opposite to an opening end 17 with respect to the portion.

[0029] At this time, it is desirable that the second bell mouth 14 is formed to have the following aspect. That is, the opening end 17 of the second bell mouth 14 is formed approximately as the surface 10S. Further, the vicinity thereof including the upper end 18 of the second bell mouth 14 in the lower side V in the vertical direction of the lower end 16 of the first bell mouth 12 is curved closer to the second direction D2 side than the surface 10S. Since the second bell mouth 14 is formed to have such an aspect, a water droplet that falls down from the lower end 16 of the first bell mouth 12 tends to fall down to the outer peripheral surface 14S of the second bell mouth 14.

[0030] As described above, the outer peripheral surface 14S of the second bell mouth 14 is located in the lower side V in the vertical direction of the lower end 16 of the first bell mouth 12. Therefore, the water droplet falling down along an outer peripheral surface 12S and the inner peripheral surface 12T of the first bell mouth 12 falls down from the lower end 16 of the first bell mouth 12 to the outer peripheral surface 14S of the second bell mouth 14. The water droplet that fell down onto the outer peripheral surface 14S falls down along the outer peripheral surface 14S. Accordingly, it is possible to prevent or suppress the water droplet from entering into the inner peripheral surface 14T (into an air duct) of the second bell mouth 14 from the lower end 16 of the first bell mouth 12. Therefore, it is possible to prevent or suppress ice formation (formation of ice pillar) on the air duct of the second bell mouth 14. Further, it contributes to prevention or suppression of breakage of the fan attached to the inner peripheral side of the second bell mouth 14 and/or abnormal noise generation.

<Bell mouth>

[0031] Each of the first bell mouth 12 and the second bell mouth 14 according to the first embodiment can be obtained by employing one bell mouth 30. For example,

as shown in Fig. 2, the axis A1 of the first bell mouth 12 and the axis A2 of the second bell mouth 14 are set to be the same, and this is set as an axis Q of the bell mouth 30. Further, the first direction D1 and the second direction D2 are set to be the same, and this is set as a direction R in which the bell mouth 30 is opened. In the present embodiment, the axis Q and the direction R are parallel.

[0032] In one side in the direction R of the bell mouth 30, a first end portion 32 which is most apart from the axis Q is located on the first surface S1 having the direction R as a normal line. Further, in one side in the direction R of the bell mouth 30, a second end portion 34 which is most apart from the axis Q in a side opposite to the first end portion 32 around the axis Q is located on the second surface S2 having the direction R as a normal line. That is, the first end portion 32 and the second end portion 34 are located in one side in the direction R, and in plan view along the direction R, the first end portion 32, the axis Q, and the second end portion 34 are arranged approximately in the same linear shape. However, the first surface S1 and the second surface S2 are non-identical surfaces. Specifically, for example, the first surface S1 is located closer to the direction R side than the second surface S2.

[0033] In short, the bell mouth 30 can be obtained by joining a portion being closer to the lower side V side in the vertical direction than the axis A1 and including the axis A1 of the first bell mouth 12 shown in Fig. 1, and a portion closer to an upper side -V side in the vertical direction than the axis A2 of the second bell mouth 14 while aligning end portions in the direction R with each other.

[0034] When a plurality of bell mouths 30 each having the shape as described above are attached in the vertical direction while satisfying the following condition, it is possible to prevent or suppress the water droplet from entering into the air duct. That is, the bell mouth 30 is attached such that the first end portion 32 of the bell mouth 30 is located in the upper side -V in the vertical direction, and the second end portion 34 is located in the lower side V in the vertical direction, respectively. Further, the first end portion 32 of one bell mouth 30 is attached so as to be located closer to the direction R side than the second end portion 34 of the other bell mouth 30 which is provided in the upper side -V in the vertical direction of the one bell mouth 30. Particularly, in the case where a surface S3 formed by an end portion in a direction -R side of the one bell mouth 30 is perpendicular the direction R, an end portion in the direction -R side of the one bell mouth 30 and the end portion in the direction -R side of the other bell mouth 30 which is adjacent thereto in the vertical direction are attached so as to be located on the same surface S3.

[0035] If a plurality of bell mouths 30 are attached while satisfying the condition described above, it is possible to prevent or suppress entering of the water droplet from the bell mouth 30 provided in an upper stage into the air duct of the bell mouth 30 provided in a lower stage.

<Second embodiment>

[0036] Now, as a second embodiment according to the present invention, a description will be given mainly of an aspect which includes a water conducting member conducting the water droplet from the lower end 16 of the first bell mouth 12 to the outer peripheral surface 14S of the second bell mouth 14 in the first embodiment, with reference to the drawings. In the following embodiment, the structures having the same functions as those of the above embodiment are denoted by the same reference numerals, and descriptions thereof will be omitted.

[0037] Fig. 3 is an enlarged view of a substantial part of an outdoor unit 10A according to the second embodiment of the present invention, and shows a region which corresponds to the region B in Fig. 11 in an enlarged manner. The outdoor unit 10A of the second embodiment also has an outer shape formed in the same shape as the outdoor unit 90 shown in Fig. 9, and is denoted with reference numeral 10A in Fig. 9. As shown in Fig. 3, the outdoor unit 10A according to the second embodiment is provided with two bell mouths 12A and 14A which are adjacent along the vertical direction, and a water conducting member 22.

[0038] The first bell mouth 12A is opened toward the first direction D1, and the second bell mouth 14A is opened toward the second direction D2. An opening end 15A which is an end portion in the first direction D1 side of the first bell mouth 12A shows a surface 10S in cross-sectional view. In the second embodiment, an opening end 17A which is an end portion in the second direction D2 side of the second bell mouth 14A is also shows the surface 10S in cross-sectional view. In the case where the water conducting member 22 is provided, the opening end 17A does not necessarily show the surface 10S, but may be located closer to the direction -R side than the surface 10S.

[0039] The water conducting member 22 extends toward a side opposite to the second direction D2 in which the second bell mouth 14A is opened, by setting a lower end 16A in the vertical direction of the first bell mouth 12A to a base point. Specifically, the water conducting member 22 extends from the lower end 16A of the first bell mouth 12A toward the outer peripheral surface 14S of the second bell mouth 14A.

[0040] In the second embodiment, there is shown an aspect in which an end portion 21 in one side of the water conducting member 22 is attached to the lower end 16A of the first bell mouth 12A, and an end portion 23 in the other side of the water conducting member 22 comes into contact with the outer peripheral surface 14S of the second bell mouth 14A. However, as long as the outer peripheral surface 14S of the second bell mouth 14A is located in the lower side V in the vertical direction of the end portion 23, the end portion 23 does not necessarily come into contact with the outer peripheral surface 14S.

[0041] As described above, the water conducting member 22 extends from the lower end 16A of the first

bell mouth 12A toward the outer peripheral surface of the second bell mouth 14A. Accordingly, the water droplet falling down along the outer peripheral surface 12S and the inner peripheral surface 12T of the first bell mouth 12A falls down from the lower end of the first bell mouth 12A to the outer peripheral surface 14S of the second bell mouth 14A via the water conducting member 22. Therefore, it is possible to prevent or suppress entering of the water droplet from the lower end 16A of the first bell mouth 12A to the inner peripheral surface 14T of the second bell mouth 14.

<Third embodiment>

[0042] Now, as a third embodiment according to the present invention, a description will be given mainly of an aspect which includes the water conducting member other than the water conducting member 22 shown in the second embodiment, with reference to the drawings.

[0043] Fig. 4 is an enlarged view of a substantial part of an outdoor unit 10B according to the third embodiment of the present invention, and shows a region which corresponds to the region B in Fig. 11. The outdoor unit 10B of the third embodiment also has, as to an outer shape, the same shape as the outdoor unit 90 shown in Fig. 9, and is denoted with reference numeral 10B in Fig. 9. As shown in Fig. 4, the outdoor unit 10B according to the third embodiment is provided with two bell mouths 12A and 14A, and a water conducting member 24.

[0044] The water conducting member 24 extends toward the first direction D1 in which the first bell mouth 12A is opened in the upper side -V in the vertical direction of an upper end 18A, by setting the upper end 18A of the second bell mouth 14A in the lower side V in the vertical direction of the lower end 16A in the vertical direction of the first bell mouth 12A to a base point. Specifically, the water conducting member 24 has one end 25 attached to the upper end 18A of the second bell mouth 14A, and extends therefrom toward a direction having a component in the first direction D1, and a component in the upper side -V in the vertical direction. The other end 27 opposite to the one end 25 of the water conducting member 24 is located closer to the first direction D1 side than the lower side V in the vertical direction of the lower end 16A of the first bell mouth 12A. That is, in the third embodiment, the opening end 17A does not necessarily show the surface 10S, but the opening end 17A may be located closer to the direction -R side than the surface 10S as long as the other end 27 protrudes to the first direction D1 side than the lower end 16A.

[0045] Accordingly, the water conducting member 24 is located in the lower side V in the vertical direction of the lower end 16A of the first bell mouth 12A. Therefore, the water droplet falling down along the outer peripheral surface 12S and the inner peripheral surface 12T of the first bell mouth 12A falls down onto the water conducting member 24. The water droplet that fell down onto the water conducting member 24 falls down to the outer pe-

ripheral surface 14S of the second bell mouth 14A via the water conducting member 24.

[0046] Except for the one end 25 attached to the upper end 18A of the second bell mouth 14A, the water conducting member 24 is located closer to the first direction D1 (or the second direction D2) side than the respective opening ends 15A and 17A of the two bell mouths 12A and 14A. Therefore, even if an air gap along the vertical direction between the plurality of bell mouths in the existing outdoor unit is small, it is possible to easily attach the water conducting member 24, and it is possible to prevent or suppress entering of the water droplet into the air duct of the bell mouth attached to the lower stage.

<Modification>

[0047] The description has been given above of the preferable embodiments of the present invention, however, the present invention is not limited thereto. The first to third embodiments may be appropriately combined or may be further combined with a first modification or the like described below.

<First modification>

[0048] For example, as shown in Fig. 5, a second bell mouth 14B adjacent to the lower side V in the vertical direction of the first bell mouth 12A may show the following shape. That is, in the lower side -V in the vertical direction of the lower end 16A in the vertical direction of the first bell mouth 12A, an opening end 17B which is an end portion in the second direction D2 side of the second bell mouth 14B shows approximately the surface 10S in cross-sectional view. Further, an upper end 18B of the second bell mouth 14B in the lower side V in the vertical direction of the lower end 16A of the first bell mouth 12A protrudes closer to the second direction D2 side than the surface 10S, and extends toward the upper side -V in the vertical direction. That is, the second bell mouth 14B may show a shape obtained by integrating the water conducting member 24 with the second bell mouth 14B shown in Fig. 4 of the third embodiment.

<Second modification>

[0049] Further, for example, as shown in Fig. 6, the first bell mouth 12 shown in Fig. 1 of the first embodiment may be combined with the second bell mouth 14A shown in Fig. 3 of the second embodiment.

<Third modification>

[0050] Further, a water conducting member 22A described below may be employed in place of the water conducting member 22 (refer to Fig. 3) shown in the second embodiment. Fig. 7 is a plan view of a substantial part of an outdoor unit 10C according to a third modification of the present invention, and is a plan view at the

time of viewing the first bell mouth 12A and the second bell mouth 14A from the side of the opening ends 15A and 17A along the first direction D1 (and the second direction D2) toward the connection portions 13a and 13b.

Note that fans which are respectively attached to the first bell mouth 12A and the second bell mouth 14A are not illustrated. Further, Fig. 8 is an enlarged view of a rectangular region C shown by a broken line in Fig. 7.

[0051] As shown in Fig. 8, it is possible to employ an aspect in which the water conducting member 22A extends in a direction (a direction parallel to the paper surface of the drawing) W having a component of a direction perpendicular to both the component in the lower side V in the vertical direction and the component in the first direction D1 (or the second direction D2), in addition to both the components. As shown in Fig. 12, in the case where the upper bell mouth 92 and the lower bell mouth 94 are adjacently provided in the vertical direction, attaching the water conducting member 22 between the two bell mouths 12A and 14A as in the second embodiment may be difficult. Accordingly, the water conducting member 22A may be structured to extend toward the outer peripheral surface 14S at positions other than the position which corresponds in plan view to the position of the upper end 18A of the second bell mouth 14A, while setting the lower end 16A of the first bell mouth 12A provided in the upper stage to a base point. With the water conducting member 22A described above, it is possible to prevent or suppress the breakage and/or the abnormal noise generation of the fan which is attached to the inner peripheral side of the second bell mouth 14A provided in the lower stage, by retrofitting the water conducting member 22A to the existing outdoor unit.

[0052] In the first to third embodiments and the first to third modifications, the description is given of the aspect in which the first bell mouth 12 or 12A and the second bell mouth 14, 14A, or 14B are both opened toward the direction (the first direction D1 or the second direction D2) perpendicular to the vertical direction. However, the direction in which the bell mouths 12, 12A, 14, 14A, and 14B are opened is not necessarily perpendicular to the vertical direction.

[0053] That is, there may be provided a first bell mouth which is opened toward the first direction D1 perpendicular to the vertical direction, or a third direction having the component in the first direction D1 and the component of the lower side V in the vertical direction, and a second bell mouth which is adjacent to the lower side V in the vertical direction than the first bell mouth and is opened toward the second direction D2 perpendicular to the vertical direction, or a fourth direction having the component in the second direction D2 and the component of the lower side V in the vertical direction, and a lower end in the vertical direction of the first bell mouth, and an outer peripheral surface of the second bell mouth in the lower side V in the vertical direction of the lower end may together cooperate to show a water conducting path conducting the liquid to the vertically lower side.

[0054] Further, in the first to third embodiments and the first to third modifications, the description has been given of the aspect in which the upper end 18, 18A, or 18B of the second bell mouth 14, 14A, or 14B in the lower side V in the vertical direction of the lower end 16 or 16A in the vertical direction of the first bell mouth 12 or 12A is equal to the upper end in the vertical direction of the second bell mouth 14, 14A, or 14B itself. However, the upper end 18, 18A, or 18B is not necessarily the upper end in the vertical direction of the second bell mouth 14, 14A, or 14B itself. In other words, the lower end 16 or 16A in the vertical direction of the first bell mouth 12 or 12A is not necessarily located in the upper side -V in the vertical direction of the upper end in the vertical direction of the second bell mouth 14, 14A, or 14B itself.

[0055] Further, in the first to third embodiments and the first to third modifications, the drawings show the aspect in which the magnitude in plan view along the first direction D1 of the first bell mouth 12 or 12A and the magnitude in plan view along the second direction D2 of the second bell mouth 14, 14A, or 14B are approximately equal with each other. However, the first bell mouth and the second bell mouth do not necessarily have the approximately equal magnitude with each other.

[0056] While the invention has been shown and described in detail, the foregoing description is in all aspects illustrative and not restrictive. It is therefore understood that numerous modifications not illustrated herein can be devised without departing from the scope of the invention.

Description of Reference Numerals

[0057]

10, 10A, 10B	outdoor unit
12, 12A	first bell mouth
14, 14A, 14B	second bell mouth
14S	outer peripheral surface
16, 16A	lower end of first bell mouth
18, 18A, 18B	upper end of second bell mouth
22, 24	water conducting member
30	bell mouth
32	first end portion
34	second end portion
S1	first surface
S2	second surface

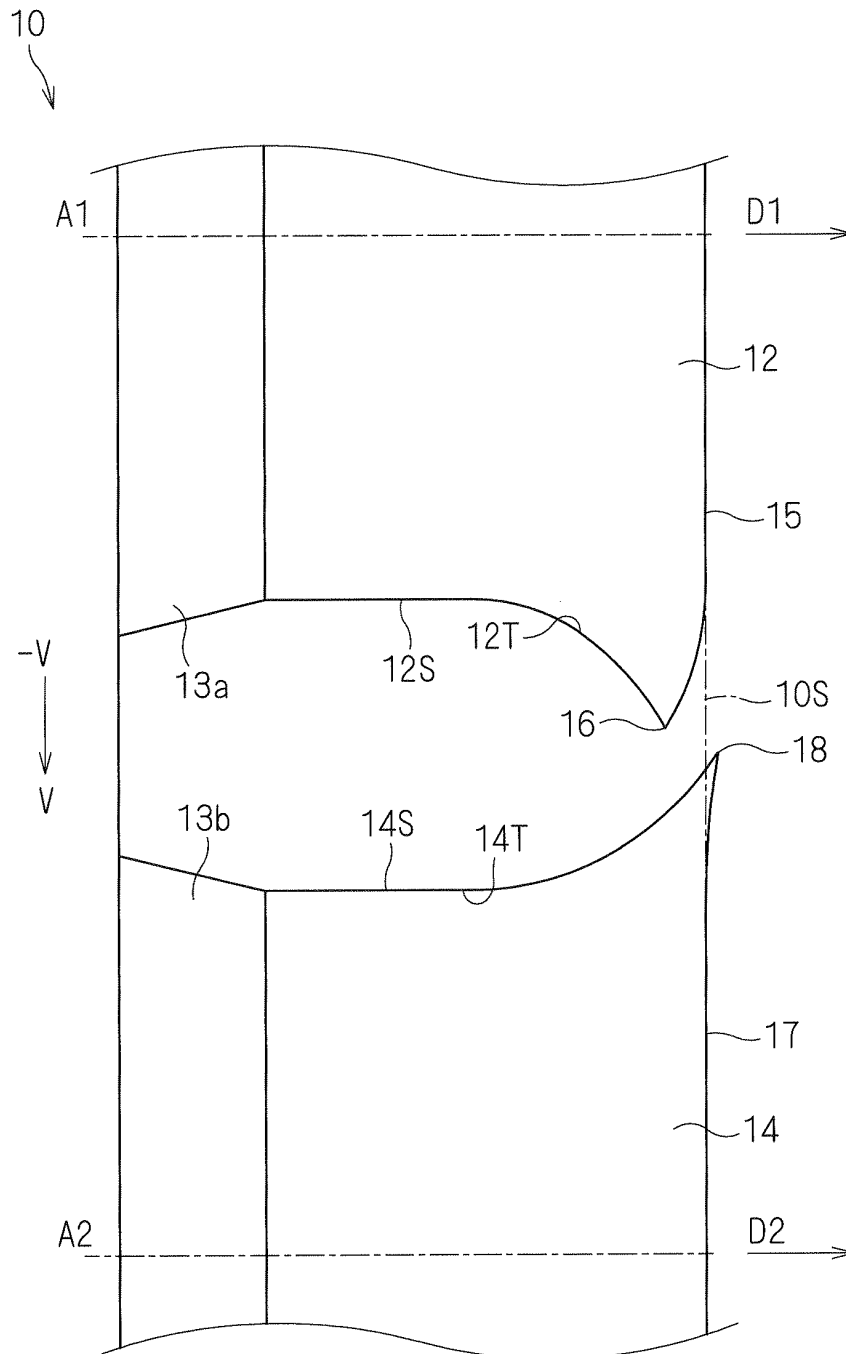
Claims

1. An outdoor unit (10, 10A, 10B) of an air conditioner comprising:
 - a first bell mouth (12, 12A); and
 - a second bell mouth (14, 14A, 14B) which is adjacent to a lower side (V) in a vertical direction than said first bell mouth, wherein
 - a lower end (16, 16A) in the vertical direction of said first bell mouth, and an outer peripheral surface (14S) of said second bell mouth in the lower side in said vertical direction of said lower end together cooperate to show a water conducting path which conducts a liquid to the lower side in said vertical direction.
2. The outdoor unit (10, 10A, 10B) of the air conditioner according to claim 1, wherein said lower end (16, 16A) of said first bell mouth is located opposite to a direction in which said second bell mouth is opened, compared to an upper end (18, 18A, 18B) of said second bell mouth in the lower side (V) in said vertical direction of said lower end.
3. The outdoor unit (10A) of the air conditioner according to claim 1, further comprising a water conducting member (22) which extends toward a side opposite to a direction in which said second bell mouth is opened, compared to an upper end (18A) of said second bell mouth (14A) in the lower side (V) in said vertical direction of said lower end, while setting said lower end (16A) of said first bell mouth (12A) to a base point.
4. The outdoor unit (10B) of the air conditioner according to claim 1, further comprising a water conducting member (24) which extends toward a direction in which said first bell mouth is opened, compared to said lower end of said first bell mouth in an upper side (-V) in the vertical direction of said upper end, while setting an upper end (18A) of said second bell mouth in the lower side (V) in said vertical direction of said lower end (16A) of said first bell mouth (12A) to a base point.
5. A bell mouth (30) which is open to one side in a direction parallel to an axis (Q) around said axis, wherein

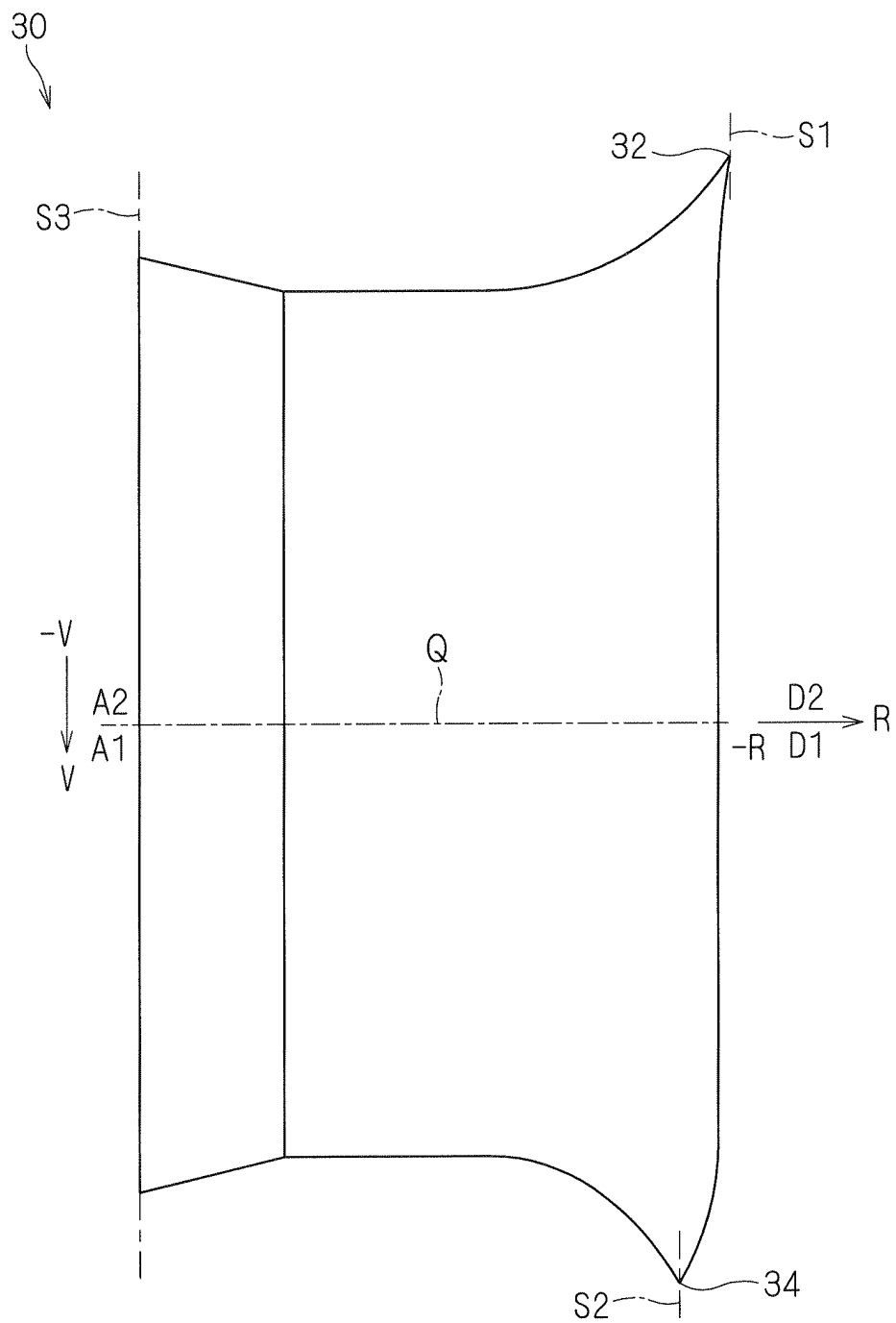
a first end portion (32) which is most apart from said axis in said one side is located on a first surface (S1) in which a direction parallel to said axis is set to a normal line, and

a second end portion (34) which is most apart from said axis in said one side opposite to said first end portion around said axis is located on a second surface (S2) which is different from said first surface while setting the direction parallel to said axis to a normal line.

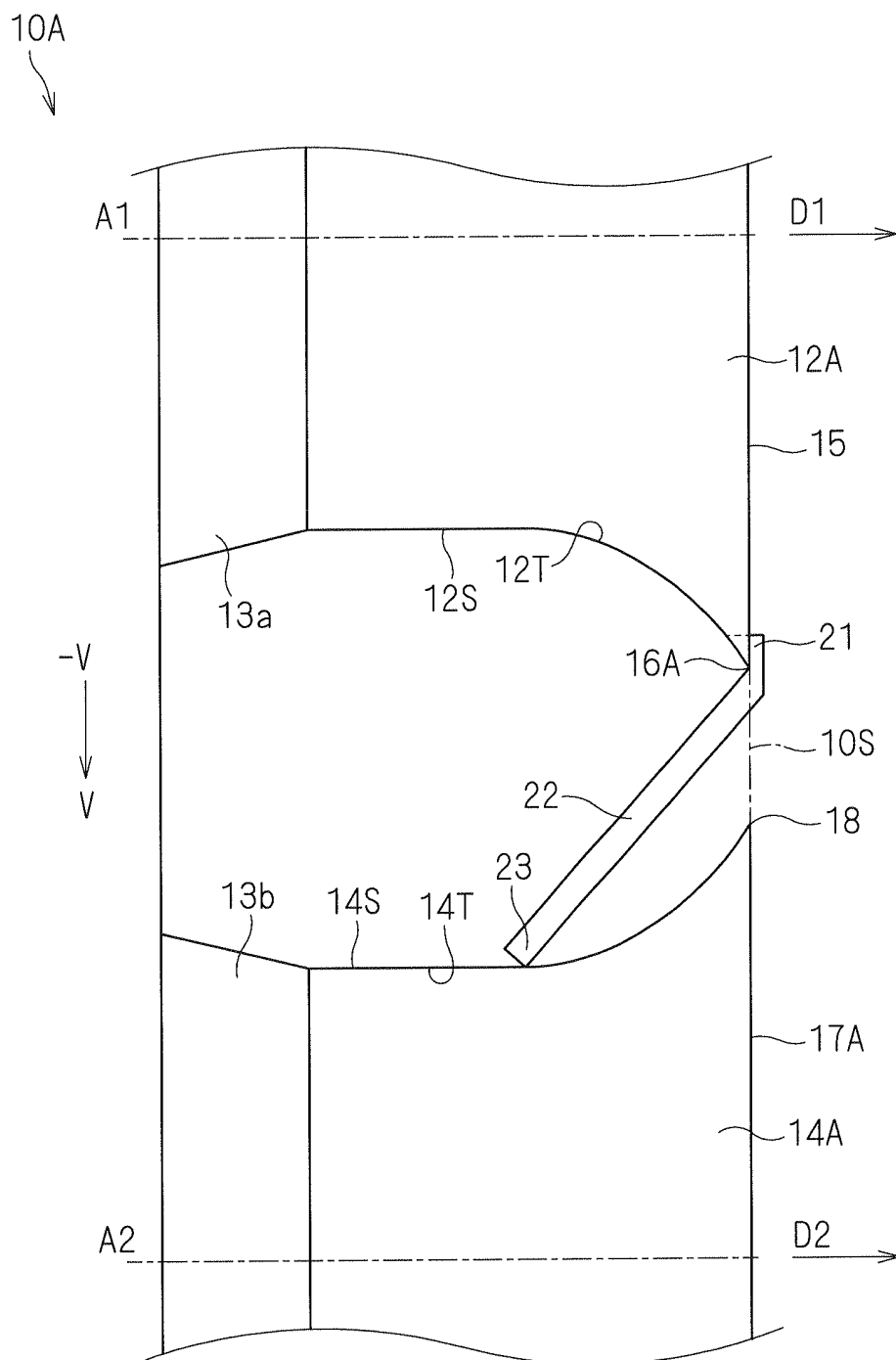
F I G . 1



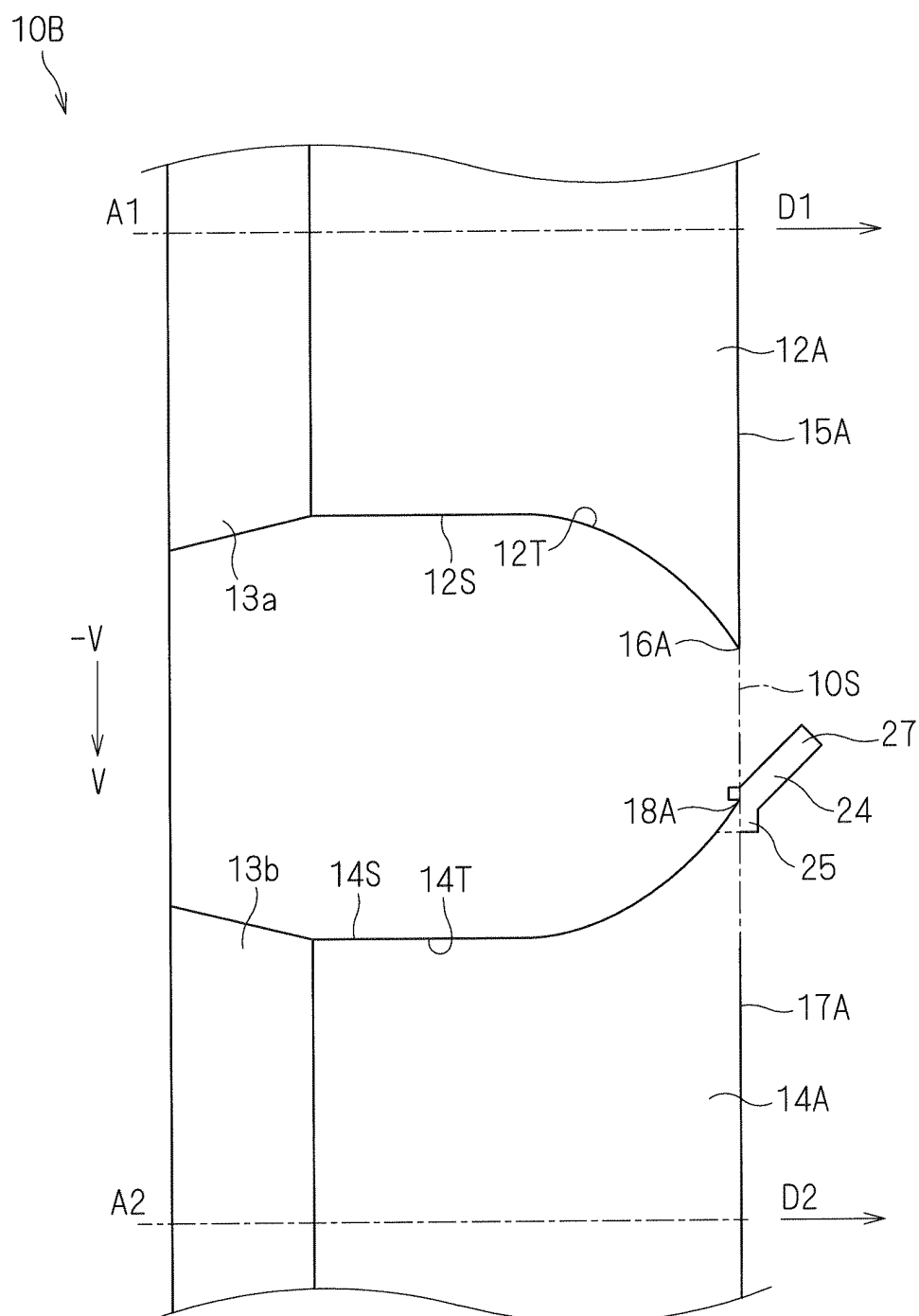
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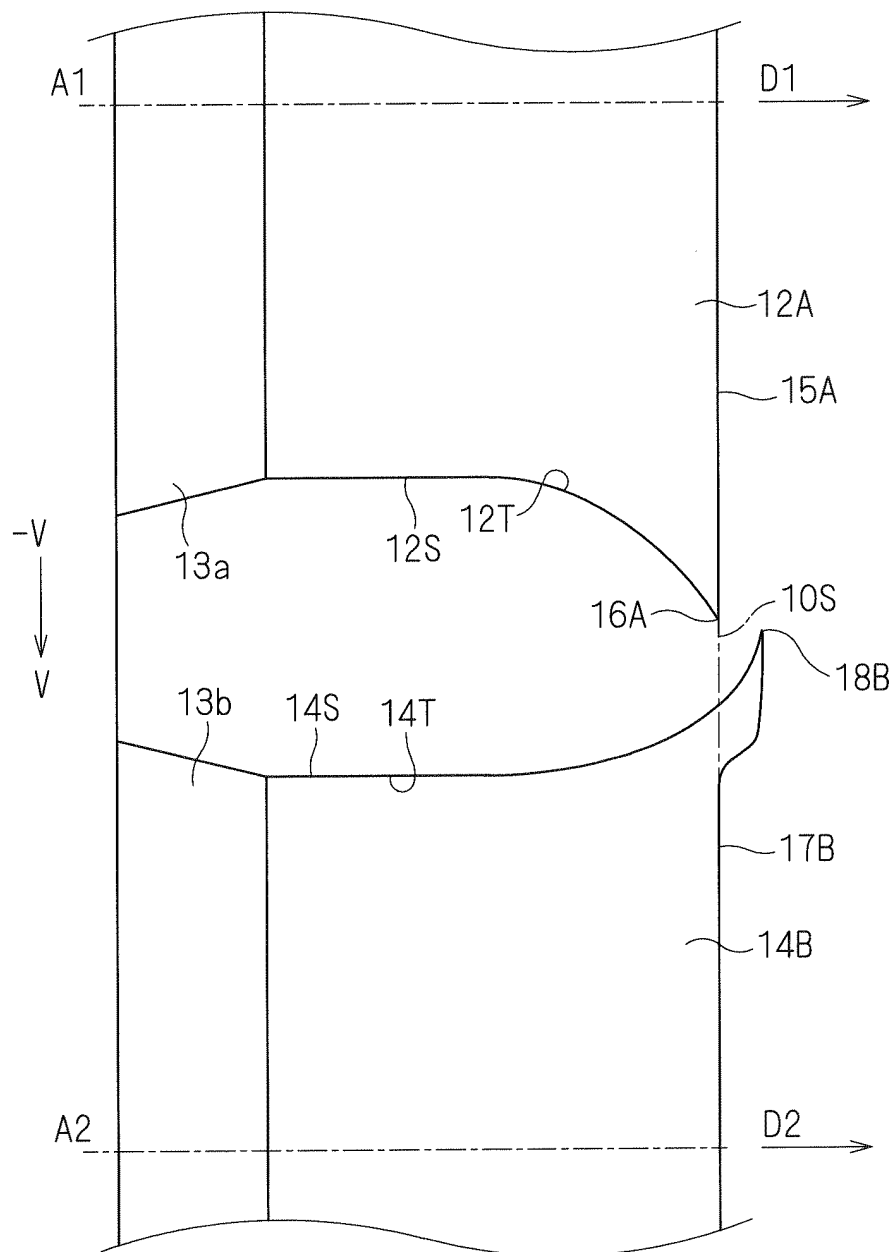
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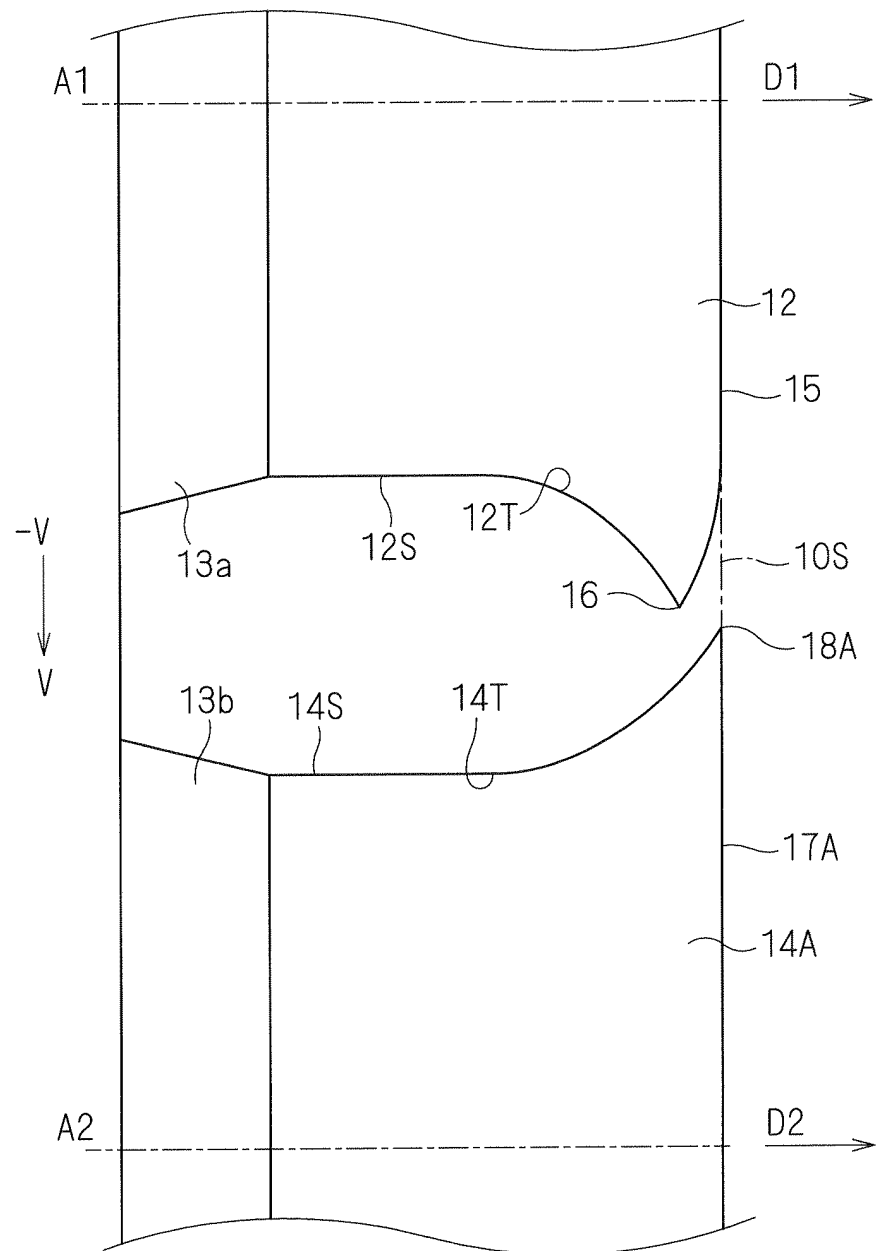
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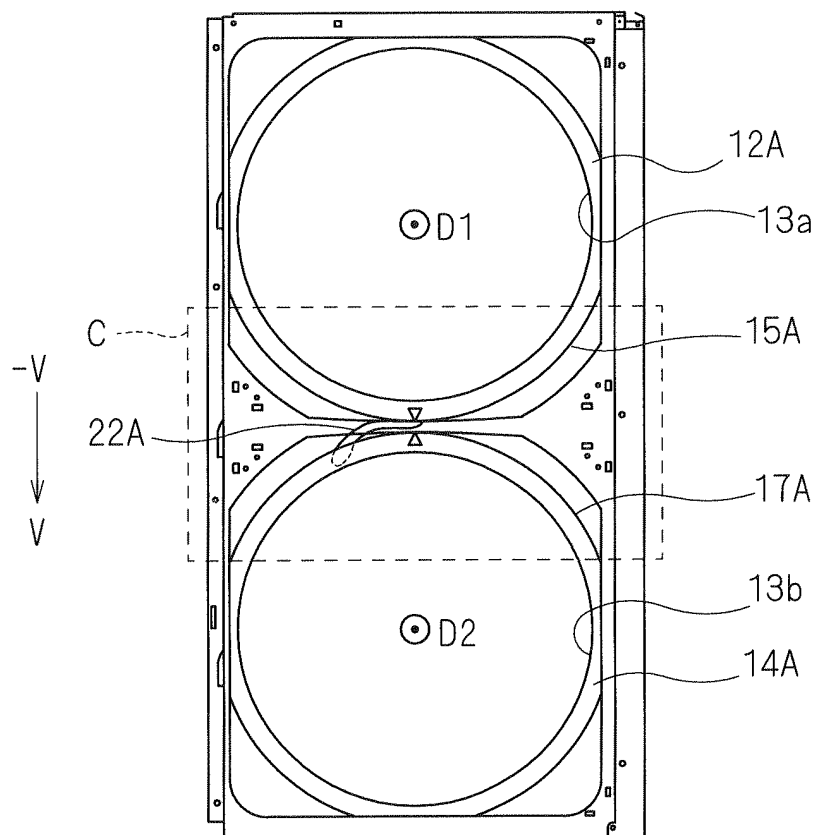
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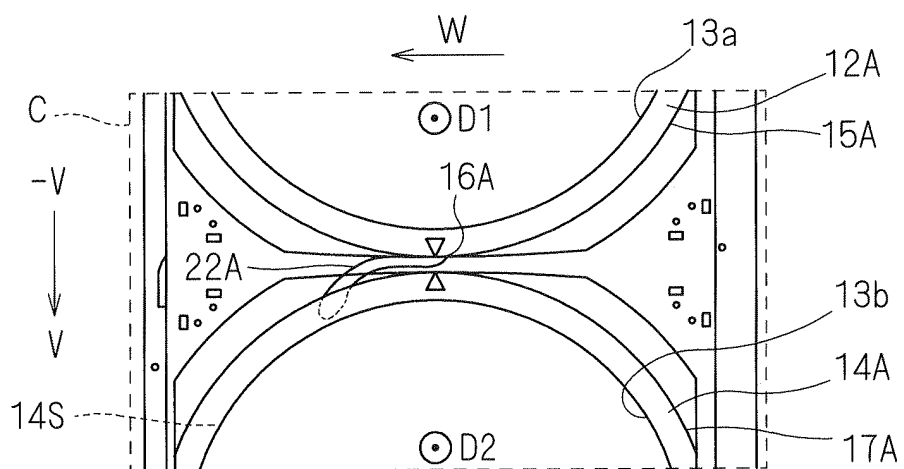
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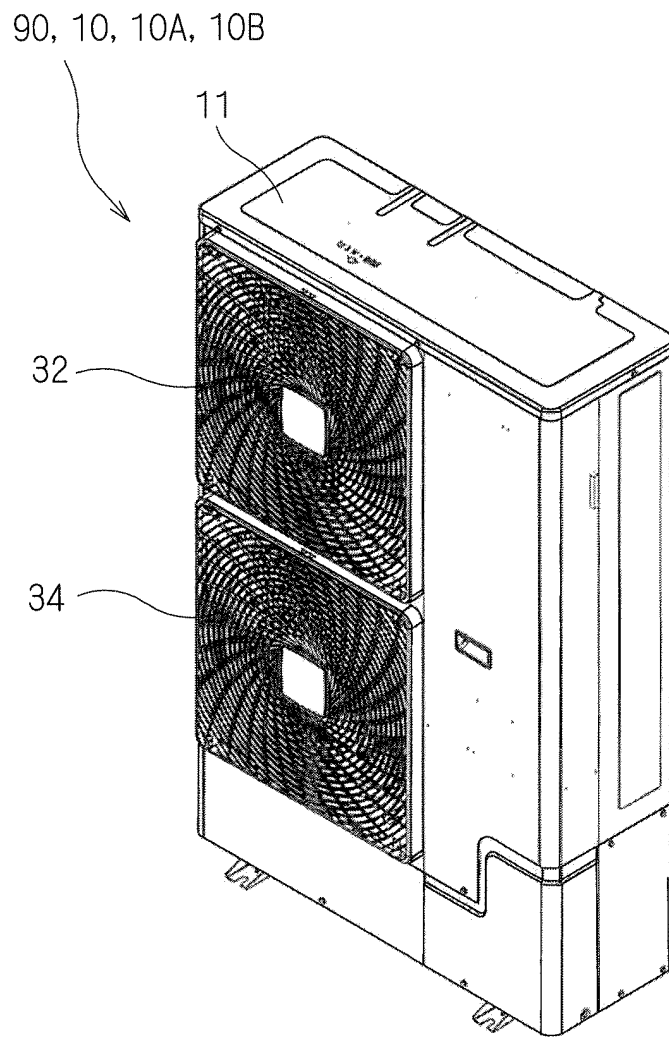
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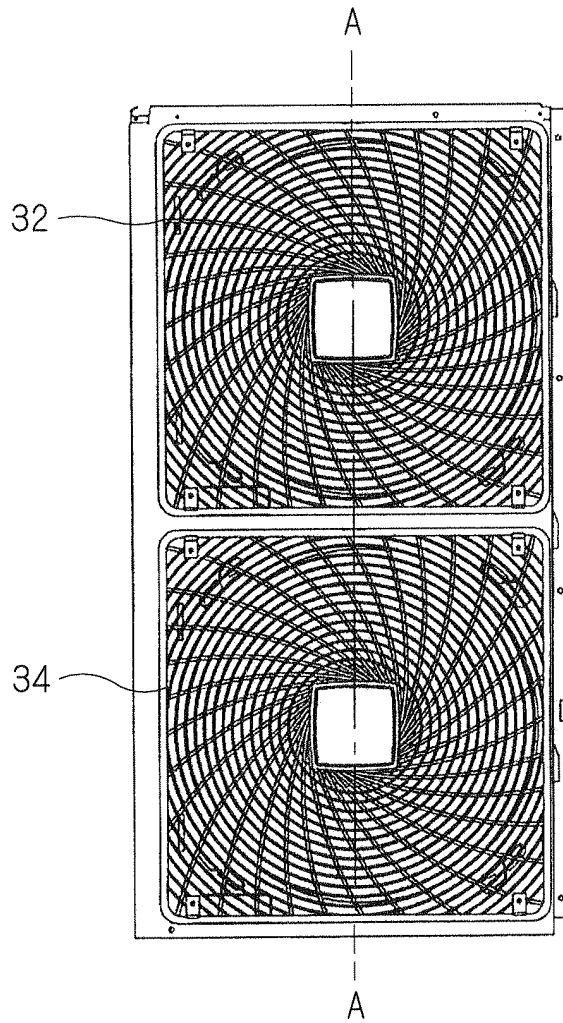
F I G . 8



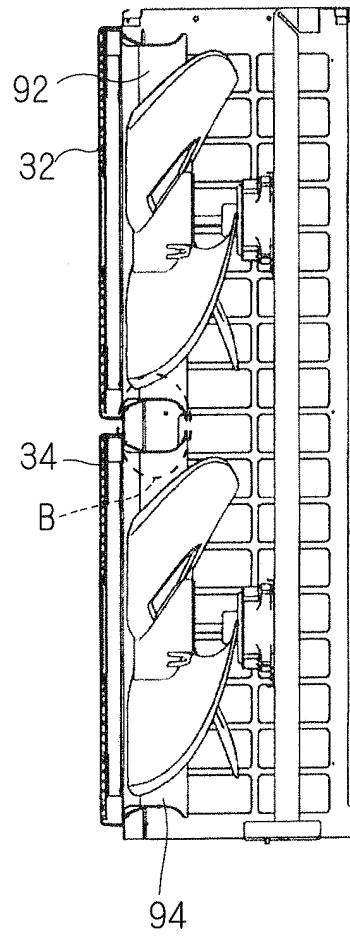
F I G . 9



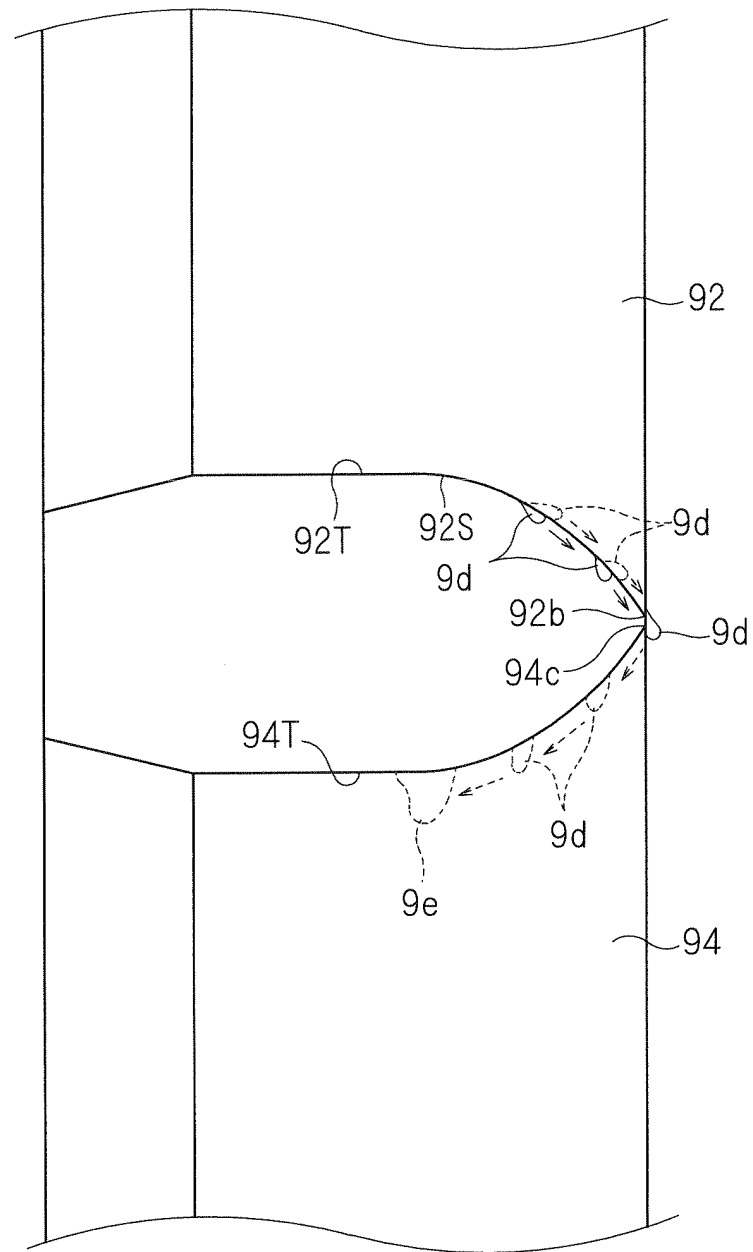
F I G . 1 0



F I G . 1 1



F I G . 1 2



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2011/054313

A. CLASSIFICATION OF SUBJECT MATTER F24F1/38 (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) F24F1/38		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2011 Kokai Jitsuyo Shinan Koho 1971-2011 Toroku Jitsuyo Shinan Koho 1994-2011		
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 A	JP 2002-357335 A (Daikin Industries, Ltd.), 13 December 2002 (13.12.2002), paragraphs [0056] to [0058]; fig. 5 & EP 1391661 A1 & WO 2002/097337 A1 & CN 1389672 A & CN 2577163 Y	1, 2 3, 4
X A	JP 2009-204291 A (Daikin Industries, Ltd.), 10 September 2009 (10.09.2009), paragraphs [0035], [0036]; fig. 2 to 5 (Family: none)	5 1-4
A	JP 2008-267727 A (Mitsubishi Electric Corp.), 06 November 2008 (06.11.2008), entire text; all drawings (Family: none)	1-5
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "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 25 April, 2011 (25.04.11)		Date of mailing of the international search report 17 May, 2011 (17.05.11)
Name and mailing address of the ISA/ Japanese Patent Office		Authorized officer
Facsimile No.		Telephone No.

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2011/054313

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2003-106564 A (Toshiba Carrier Corp.), 09 April 2003 (09.04.2003), entire text; all drawings (Family: none)	1-4
A	JP 2008-89271 A (Hitachi Appliances, Inc.), 17 April 2008 (17.04.2008), entire text; all drawings (Family: none)	1-5
A	JP 2006-77585 A (Mitsubishi Electric Corp.), 23 March 2006 (23.03.2006), entire text; all drawings (Family: none)	1-5

Form PCT/ISA/210 (continuation of second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2011/054313

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

The invention in claim 1 cannot be considered to be novel in the light of the invention described in the document 1: JP 2002-357335 A (Daikin Industries, Ltd.), 13 December 2002 (13.12.2003), paragraphs [0056] - [0058], fig. 5, & EP 1391661 A1 & WO 2002/097337 A1 & CN 1389672 A & CN 2577163 Y, and does not have a special technical feature.

(continued to extra sheet)

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☒ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

Form PCT/ISA/210 (continuation of first sheet (2)) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2011/054313

Continuation of Box No.III of continuation of first sheet(2)

Consequently, a group of inventions in claims (claims 1 - 5) have no technical relationship involving the same or corresponding special technical feature, and therefore cannot be considered to be so linked as to form a single general inventive concept.

Meanwhile, claims 1 and 2 are relevant to the portions of main invention (the invention firstly set forth in claims).

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2009203980 A [0005]
- JP 2008128563 A [0005]
- JP 2009085484 A [0005]
- JP 2009281719 A [0005]
- JP 6331175 A [0005]
- JP 8178365 A [0005]
- JP 2009257603 A [0005]
- JP 4132336 A [0005]