

TITLE OF THE INVENTION

OUTDOOR UNIT FOR AIR-CONDITIONING APPARATUS

FIELD OF INVENTION

The present invention relates to an outdoor unit for an air-conditioning apparatus.

BACKGROUND OF THE INVENTION

An inside of an outdoor unit for an air-conditioning apparatus is partitioned in a rightward-and-leftward direction into two spaces by a partition plate which stands upright on a bottom plate. One of the two spaces is a fan chamber in which a heat exchanger and an air-sending fan are arranged, and the other of the two spaces is a machine chamber in which a compressor is installed.

The air-sending fan is a propeller fan including a plurality of blades. The air-sending fan is positioned downstream of the heat exchanger along an air flow generated by the air-sending fan. A rotary shaft of a fan motor is connected to the air-sending fan, and the air-sending fan is rotated by a rotational drive force of the fan motor transmitted through the rotary shaft, thereby generating the air flow.

The fan motor is positioned between the air-sending fan and the heat exchanger, and is mounted to a fan motor support having a lower portion fixed to the bottom plate.

It is known that the outdoor unit for an air-conditioning apparatus has the fan motor support which is positioned between the air-sending fan and the heat exchanger and also supports the air-sending fan through intermediation of the fan motor, as disclosed in International publication No. WO2018/087873A1 (PTL1).

When an engineer mounts the fan motor to a predetermined position, the engineer needs to press the fan motor to the fan motor support by one hand and screw the fan motor on the fan motor support to fix the fan motor by the other hand. As such, before the fan motor is fixed on the fan motor support by the screws, the fan motor needs to be temporary fixed at a predetermined position of the fan motor support.

Therefore, the development of the outdoor unit for an air-conditioning apparatus capable to temporary fix the fan motor at the predetermined position of the fan motor support surely and easily, is required.

CITATION LIST

Patent Literature

PTL 1: International publication No. WO2018/087873A1

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SUMMARY OF THE INVENTION

The objective of the present invention is to provide an outdoor unit for an air-conditioning apparatus which is capable to temporary fix the fan motor at the predetermined position of the fan motor support surely and easily by a simple constitution.

In order to achieve the above objective, an embodiment of the present invention provides
10 an outdoor unit for an air-conditioning apparatus, comprising: a fan motor configured to drive to rotate an air-sending fan; and a fan motor support positioned between a heat exchanger and the air-sending fan and configured to fix the fan motor, the fan motor support including plural fan motor holding members formed to stand up from the fan motor support on the side of the fan motor, wherein the fan motor is held by the plural fan motor holding members in an area enclosed
15 by the plural fan motor holding members, wherein the fan motor holding member includes a standing wall connecting the fan motor support, a guide wall which contacts with the fan motor, a folding portion between the standing wall and guide wall, and is configured such that the fan motor holding member is folded at the folding portion, and wherein the fan motor holding member is configured to be bent and bowed when the fan motor is held by the plural fan motor
20 holding members.

According to the embodiment of the present invention, since the fan motor holding member is configured to be bent and bowed when the fan motor is held by the plural fan motor holding members, the elastic force is generated in the direction from the standing wall toward the guide wall.

25 Therefore, in the area enclosed by the plural fan motor holding members, the fan motor is held by plural fan motor holding members since the guide wall is pressed toward the fan motor by their elastic force. As a result, the outdoor unit for an air-conditioning apparatus is capable to temporary fix the fan motor at the predetermined position of the fan motor support surely and easily by the simple constitution.

30 Furthermore, even if the type of the fan motor differs (for example, the fan motor having slightly different diameter, the fan motor formed in a slightly different shape, ...), the outdoor unit for an air-conditioning apparatus is capable to temporary fix the fan motor at the

predetermined position of the fan motor support surely and easily since the fan motor holding member is deformable.

BRIEF DESCRIPTION OF DRAWINGS

5 The principle of the present invention and its advantages will become apparent in the following description taking in consideration with the accompanying drawings in which:

FIG.1 is an outer appearance perspective view of an outdoor unit for an air-conditioning apparatus according to the embodiment 1 of this invention;

FIG.2 is an exploded perspective view of the outdoor unit illustrated in FIG.1;

10 FIG.3 is an exploded perspective view for illustrating a fan motor and a fan motor support in the outdoor unit illustrated in FIG.1 as viewed from a front side of the fan motor support;

FIG.4 is a perspective view of the fan motor support in the outdoor unit illustrated in FIG.1 as viewed from a rear side of the fan motor support;

15 FIG.5 is a perspective view of the fan motor in a state of being mounted to the fan motor support illustrated in FIG.3;

FIG.6 is a front view of the fan motor in the state of being mounted to the fan motor support illustrated in FIG.3;

FIG.7 is an enlarged view of the fan motor holding members illustrated in FIG.3 when viewed from a left oblique direction;

20 FIG.8 is an enlarged view of the fan motor holding members illustrated in FIG.3 when viewed from a front direction;

FIG.9 is IX-IX line section view of FIG.8;

FIG.10 is an explanation view about the fan motor holding member;

FIG.11 is a first variation of the fan motor holding member;

25 FIG.12 is a second variation of the fan motor holding member;

FIG.13 is a third variation of the fan motor holding member; and

FIG.14 is an explanation view about the projection of the guide wall of the fan motor holding member.

30 DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

Hereinafter, the outdoor unit for an air-conditioning apparatus according to embodiments of the invention will be described with reference to the drawings and the like. Here, in the



FIG. 7

the air-sending fan 7 has an air outlet 2a opposed to the air-sending fan 7, and a fan guard 12 is mounted on a front side of the air outlet 2a.

The left side panel 3 has a plurality of ventilation holes, and an air flow, which is generated through the rotation of the air-sending fan 7 is caused to pass through the heat exchanger 8, and is caused to blow out through the air outlet 2a. The air-sending fan 7 is positioned downstream of the heat exchanger 8 along the air flow generated by the air-sending fan 7.

The air-sending fan 7 is a propeller fan including a plurality of blades, which are provided on an outer periphery of a center boss portion at equal intervals in a circumferential direction. The air-sending fan 7 is rotated by a rotational drive force of the fan motor 20 being a DC brushless motor of a mold type. The fan motor 20 includes a rotary shaft 21 projecting toward a front side, and the rotary shaft 21 is connected to a center of the boss portion of the air-sending fan 7. The rotational drive force of the fan motor 20 is transmitted to the air-sending fan 7 through the rotary shaft 21 so that the air-sending fan 7 is rotated.

The fan motor 20 configured to drive the air-sending fan 7 to rotate thereof is fixed to a fan motor support 30 positioned on a rear side of the air-sending fan 7 and on a front side of the long side portion of the heat exchanger 8. The fan motor 20 is positioned on the rear side of the air-sending fan 7. The fan motor support 30 has a bottom portion fixed to the bottom plate 1, and is positioned between the air-sending fan 7 and the heat exchanger 8 in the frontward-and-backward direction. The fan motor support 30 is configured to support not only the fan motor 20 but also the air-sending fan 7 connected to the rotary shaft 21 of the fan motor 20.

FIG.3 and FIG.4 are perspective views of the fan motor support 30. In FIG.3 and FIG.4, the fan motor support 30 is viewed from different directions. In FIG.3, the fan motor 20 is also illustrated. The fan motor support 30 is made of sheet metal, and is integrally molded. The fan motor support 30 includes a pair of support columns 31, which are apart from each other in the rightward-and-leftward direction at a predetermined interval and extend in the upward-and-downward direction. The upward-and-downward direction, in which the pair of support columns 31 extend, is substantially the vertical direction.

Further, the fan motor support 30 includes an upper transverse plate 32 and a lower transverse plate 33, which are formed so as to extend across the pair of support columns 31 in the rightward-and-leftward direction at an upper end portion and a lower end portion of the pair of support columns 31. Fixing plates 34 which project toward the front side of the outdoor unit 100 are connected to the lower transverse plate 33. For example, the fixing plates 34 are fixed

by screws to the bottom plate 1 so that the fan motor support 30 stands upright on the bottom plate 1.

Further, in the middle of the pair of support columns 31 in the upward-and-downward direction between the upper transverse plate 32 and the lower transverse plate 33, there are
5 formed two intermediate transverse plates 35a and 35b. The intermediate transverse plates 35a and 35b are arranged at a predetermined interval in the upward-and-downward direction and extend in the rightward-and-leftward direction across the pair of support columns 31.

The upper intermediate transverse plate 35a is arranged closer to the upper transverse plate 32, and the lower intermediate transverse plate 35b is arranged closer to the lower
10 transverse plate 33. Front surfaces of the upper transverse plate 32, the lower transverse plate 33, and the two intermediate transverse plates 35a and 35b are flush with front surfaces of the pair of support columns 31.

A pair of fan motor holding members 40, which project toward the front side of the outdoor unit 100 with respect to the pair of support columns 31, namely which are formed to
15 stand up from the fan motor support 30 on the side of the fan motor 20, are formed at a position in the middle of the fan motor support 30, in the upward-and-downward direction between the two intermediate transverse plates 35a and 35b. The pair of a fan motor holding members 40 are formed by bending parts of the fan motor support 30 which is the metal sheet.

In this embodiment, as shown in FIG.3 to FIG.8, the pair of a fan motor holding members
20 40 are formed to face each other in the left and right direction, but not limited to this. The pair of a fan motor holding members 40 are required to be arranged symmetrically with respect to the center of an area enclosed by the plural fan motor holding members 40, for example in the up and down direction. Additionally, the number of the fan motor holding members may be, for example, three or more without limited to two.

25 The pair of fan motor holding members 40 hold the fan motor 30 in the area enclosed by the plural fan motor holding members 40. The fan motor holding member 40 includes a motor mounting surface 42 which is formed by folding the end of the fan motor holding member 40, for the purpose of fixing the fan motor 20 on the motor mounting surface 32 by the screws 14.

The lower portion of the motor mounting surface 42 is provided with a fan motor placing
30 part 43 which is formed by punching and bending a part of the motor mounting surface 42 and projects to the front side, so that the fan motor 20 is paced on the fan motor placing part 43 and is temporary fixed to the fan motor holding member 40.

As shown in FIG.3 and FIG.4, the fan motor holding member 40 is folded at the middle position in the upward-and-downward direction of the fan motor holding member 40. The fan motor holding member 40 includes a standing wall 44 connecting the fan motor support 30, a guide wall 45 which contacts with the fan motor 20, a folding portion 46 between the standing wall 44 and guide wall 45, and is configured such that the fan motor holding member 40 is folded at the folding portion 46. The details will be described later.

The motor mounting surfaces 42 are flat surfaces opposed to the air outlet 2a of the front panel 2, and are formed in the middle of the pair of support columns 31 in the upward-and-downward direction and between the pair of support columns 31 in the rightward-and-leftward direction. Further, the motor mounting surfaces 42 each have a plurality of screw holes 42a.

The upper intermediate transverse plate 35a is positioned above the motor mounting surfaces 42 at a predetermined interval in the upward-and-downward direction. The lower intermediate transverse plate 35b is positioned below the motor mounting surfaces 42 at a predetermined interval in the upward-and-downward direction.

In the pair of support columns 31, the outer sides are bent toward the rear side at portions between the upper transverse plate 32 and the upper intermediate transverse plate 35a and between the lower intermediate transverse plate 35b and the lower transverse plate 33 so that a cross section thereof is formed into a L-shape being opened on the rear side, in order to improve the strength of the support column 31.

On an upper portion of the fan motor support 30, there is formed a heat exchanger fixing portion 38 which is continuous with a lower end of the upper transverse plate 33 and projects toward the rear side. The heat exchanger fixing portion 38 has a fitting portion having a U-shaped cross section being open downward, and an upper end portion of the long side portion of the heat exchanger 8 is fitted into the fitting portion. With this configuration, the heat exchanger 8 stands upright stably.

Further, the fan motor support 30 includes a top plate 39 which is continuous with the upper end of the upper transverse plate 33 and projects toward the front side. The top plate 39 has a contact surface which is bent downward at a distal end of the top plate 39, and a screw hole is formed in the contact surface. The contact surface is brought into contact with a rear surface of the front panel 2, and the top plate 39 is fixed by a screw to the front panel 2. With this configuration, the top panel 5 is reinforced by the top plate 39 provided on the lower side.

As such, even if a load is applied from above the top panel 5, for example, in a case of stacking, deformation of the top panel 5 may be prevented. Further, the top panel 39 is fixed by

a screw to the front panel 2. Accordingly, the fan motor support 30 stands upright stably. A cushioning material (not shown in the figure) configured to absorb an impact load is sandwiched between the top panel 5 and the top plate 39.

As illustrated in FIG.3, the fan motor 20 includes a cylindrical main body portion 22, an
5 rectangular mounting plate 23 extending from the outer periphery of the cylindrical main body portion 22, and the rotary shaft 21 which projects from the front side of the main body portion 22.

For example, the outer periphery of the main body portion 22 is formed of a mold resin which covers a motor stator and a circuit board (not shown in the figure). The main body portion
10 22 has a circular shape in front view, and a center of the main body portion 22 and a center of the rotary shaft 21 match with each other. The rotary shaft 21 has one end connected to the air-sending fan 7 and another end connected to a motor rotator positioned on an inner peripheral side of the motor stator.

FIG.5 is a perspective view of the fan motor 20 in a state of being mounted to the fan
15 motor support 30, and FIG.6 is a front view thereof. Each edge of the mounting plate 23 includes two notches 23b which match with the notches 42b of the motor mounting surface 42, so as to confirm if the fan motor 20 is temporary fixed at the predetermined position by visual inspection.

The mounting plate 23 includes bolt passing holes 23a in the four corners. The rear
20 surface of the mounting plate 23 are contact with the motor mounting surfaces 42 of the motor support 30 and are mounted and fixed to the motor mounting surfaces 42 of the motor support 30 by four screws 14 screwed through the screw passing holes 23a into the screw holes 42a.

In the outdoor unit 100, the heat exchanger 8 is installed on the bottom plate 1, and then,
the fan motor support 30 is fixed to the bottom plate 1, and an upper portion of the heat exchanger 8 is fitted to the heat exchanger fixing portion 38. After that, the fan motor 20 is mounted to the
25 motor mounting surfaces 42 from the front side, and the air-sending fan 7 is connected to the rotary shaft 21 of the fan motor 20.

As shown in FIG.7 to FIG.9, the fan motor holding member 40 is folded at the middle
position in the upward-and-downward direction of the fan motor holding member 40, and includes the standing wall 44, the guide wall 45, the folding portion 46 where the fan motor
30 holding member 40 is folded. The folding portion 46 forms part of the motor mounting surface 42.

In this embodiment, the folding portion 46 is bent at a right angle with respect to the standing wall 44 and the guide wall 45 is bent at a right angle with respect to the folding wall

46, but not limited to this. For example, the fan motor holding member 40 may be folded such that the folding portion 46 is convexly curved and the cross section of the folding portion 46 is U-shaped.

FIG.7 is an enlarged view of the fan motor holding members 40 when viewed from a left oblique direction, FIG.8 is an enlarged view of the fan motor holding members 40 when viewed from a front direction, and FIG.9 is IX-IX line section view of FIG.8.

As shown in FIG.9, the fan motor holding member 40 is formed so that the guide wall 45 is almost in parallel with the standing wall 44. Though it is sometimes difficult that the guide wall 45 is formed inclined at a prescribed angle relative to the standing wall 44, since it is enough that the fan motor holding member 40 is formed so that the guide wall 45 include a part to be parallel with the standing wall 44, it is possible to manufacture the fan motor holding member 40 easily.

The standing wall 44 connects with the support columns 31 and the motor mounting surfaces 42 including the folding portion 46. The standing wall 44 projects toward the front side, is substantially perpendicular to the front surfaces of the support columns 31.

In this embodiment, the guide wall 45 is the member which contact with the cylindrical main body portion 22 of the fan motor 20, and is formed so as to be almost in parallel with the standing wall 44. The guide wall 45 includes one projection 45a which projects toward the area enclosed by the fan motor holding members 40, but is not limited to this. The guide wall may be informed to include plural projections which project toward the area enclosed by the fan motor holding members 40.

Advantages of the projection 45a include that it is possible to prevent complication of an installation process of the fan motor 20 since it is easy to determine if the projection 45a is formed in the guide wall 45.

As such, since a distance between the standing wall 44 and a tip of the projection 45a is longer than that between the standing wall 44 and the guide wall 45 other than the tip of the projection 45a, the projection 45a is contacted with the fan motor 20 surely. As a result, the fan motor 20 is held by the guide walls 45 which is pressed toward the fan motor 20 by their elastic force A which is generated due to the deformation of the guide walls 45 (See FIG.10.).

In this embodiment, though the fan motor holding member 40 is formed so that the guide wall 45 is almost in parallel with the standing wall 44, the fan motor holding member 40' may be formed so that the guide wall 45' has a portion where a distance between the standing wall 44 and the guide wall 45' other than a part connecting with the folding portion 46 is longer than

that between the standing wall 44 and the part connecting with the folding portion 46 (FIG.11). The fan motor 20 is held by the guide walls 45' which are pressed toward the fan motor 20 by their elastic force which is generated due to the deformation of the guide walls 45'. In this case, it is not always necessary to form the projection 45a in the guide wall 45' if the guide wall 45' is formed inclined at a prescribed angle relative to the standing wall 44.

Moreover, as shown in FIG.12, the guide wall 45' which is formed inclined at a prescribed angle relative to the standing wall 44 may include the projection 45a, since the fan motor 20 is held by the guide walls 45 which are pressed toward the fan motor 20 by their elastic force which is generated due to the deformation of the guide walls 45'. In this case, since it is easy to determine if the projection 45a is formed in the guide wall 45', it is possible to prevent complication of an installation process of the fan motor 20.

Furthermore, as shown in FIG.13, if the guide wall 45'' is formed inclined at a prescribed angle relative to the standing wall 44, the end of the guide wall 45'' on the side of the fan motor support 30 may be formed to be bent to the side of the standing wall 44 since the fan motor 20 is held by the guide walls 45'' which are pressed toward the fan motor 20 by their elastic force which is generated due to the deformation of the guide walls 45''. In this case, it is possible to prevent the end of the guide wall from damaging the fan motor and improve the workability.

As shown in FIG 14, the projection 45a of the guide wall 45 is formed to be long sideways, for the purpose of improving in acceptability for the contact position between the fan motor 20 and the projection 45a of the guide wall 45. As such, the outdoor unit 100 is capable to temporary fix the fan motor 20 at the predetermined position of the fan motor support 30 more surely and more easily by the simple constitution.

In this embodiment, the projection 45a of the guide wall 45 is formed to be long sideways, but not limited to this. The projection of the guide wall 45 is required to be formed to be long sideways when viewed from the vertical direction of the area enclosed by the fan motor holding members 40. For example, the projection of the guide wall 45 may be a long sideways rectangle, long sideways rectangles, a long sideways ellipse, long sideways ellipses, a long sideways inclined rectangle, long sideways inclined rectangles, a long sideways inclined ellipse, long sideways inclined ellipses or the combination thereof.

Next, the operation of the outdoor unit 100 will be provided with reference to FIG.10.

As mentioned above, the guide wall 45 is the member which contact with the cylindrical main body portion 22 of the fan motor 20, and is formed so as to be almost in parallel with the

standing wall 44. The guide wall 45 includes one projection 45a which projects toward the area enclosed by the fan motor holding members 40.

Firstly, when the fan motor 20 is mounted to the fan motor support 30, the fan motor 20 is inserted into the area enclosed by the fan motor holding members 40 from the side of fan motor holding member 40 toward the fan motor support 30.

Since the guide wall 45 has the portion 45a where a distance between the standing wall 44 and the guide wall 45 other than a part connecting with the folding portion 46 is longer than that between the standing wall 44 and the part connecting with the folding portion 46, the fan motor 20 is contacted with the guide wall 45 of the fan motor holding member 40.

Next, when the fan motor 20 is continuously inserted into the area enclosed by the fan motor holding members 40, the guide wall 45 deforms so that the guide wall 45 comes closer to the standing wall 44 because the standing wall 44 connects with the fan motor support 30. Namely, the fan motor holding member 20 is configured to be bent and bowed when the fan motor 20 is held by the plural fan motor holding members 40. As such, the elastic force A is generated in the direction from the standing wall 44 toward the guide wall 45.

Therefore, in the area enclosed by the fan motor holding members 40, the fan motor 20 is held by the fan motor holding members 40 which press the guide walls 45 toward the fan motor 20 by their elastic force A. As a result, the outdoor unit 100 is capable to temporary fix the fan motor 20 at the predetermined position of the fan motor support 30 surely and easily by the simple constitution.

Moreover, since the fan motor 20 is capable to be fixed at the predetermined position of the fan motor support 30 by the screws 14 and so on, it is possible for the engineer to improve workability including the installation of the fan motor 20 on the fan motor support 30.

Furthermore, even if the type of the fan motor 20' differs (for example, the fan motor having slightly different diameter, the fan motor formed in a slightly different shape, ...), the outdoor unit 100 for an air-conditioning apparatus is capable to temporary fix the fan motor 20' at the predetermined position of the fan motor support 30 surely and easily since the fan motor holding member 40 is deformable.

Although specific embodiments of the invention have been disclosed and described as well as illustrated in the accompanying drawings, it is simply for the purpose of better understanding of the principle of the present invention and it is not as a limitation of the scope and spirit of the teaching of the present invention. Adaption and modification to various structures such as design or material of the invention are possible and apparent to a skilled person

without departing from the scope of the present invention which is to be determined by the claims.

List of reference:

- 1 : Bottom plate
- 5 1a : Leg portion
- 2 : Front panel
- 2a : Air outlet
- 3 : Left side panel
- 4 : Right side panel
- 10 5 : Top panel
- 6 : partition plate
- 7 : Air-sending fan
- 8 : Heat exchanger
- 9 : Compressor
- 15 10 : Electrical component unit
- 12 : Fan guard
- 14 : Screw
- 15 : Casing
- 20, 20' : Fan motor
- 20 21 : Rotary shaft
- 22 : Cylindrical main body portion
- 23 : Mounting plate
- 23a : bolt passing hole
- 23b : Notch
- 25 30 : Fan motor support
- 31 : Support column
- 32 : Upper transverse plate
- 33 : Lower transverse plate
- 34 : Fixing plate
- 30 35a : Upper intermediate transverse plate
- 35b : Lower intermediate transverse plate
- 38 : Heat exchanger fixing portion
- 39 : Top plate

- 40 : Fan motor holding member
- 42 : Motor mounting surface
- 42a : Screw holes
- 42b : Notch
- 5 43 : Fan motor placing part
- 44 : Standing wall
- 45, 45', 45'' : Guide wall
- 45a : Projection
- 46 : Folding portion
- 10 100 : Outdoor unit
- F : Fan chamber
- M : Machine chamber

CLAIMS

1. A outdoor unit for an air-conditioning apparatus, comprising:
a fan motor configured to drive to rotate an air-sending fan; and
a fan motor support positioned between a heat exchanger and the air-sending fan and
5 configured to fix the fan motor, the fan motor support including plural fan motor holding
members formed to stand up from the fan motor support on the side of the fan motor,
wherein the fan motor is held by the plural fan motor holding members in an area
enclosed by the plural fan motor holding members,
wherein the fan motor holding member includes a standing wall connecting the fan
10 motor support, a guide wall which contacts with the fan motor, a folding portion between the
standing wall and guide wall, and is configured such that the fan motor holding member is folded
at the folding portion, and
wherein the fan motor holding member is configured to be bent and bowed when the
fan motor is held by the plural fan motor holding members.
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2. The outdoor unit for an air-conditioning apparatus of claim 1, wherein the guide wall
includes at least one projection which projects toward the area enclosed by the plural fan motor
holding members, and wherein the guide wall has a portion where a distance between the
standing wall and a tip of the at least one projection is longer than that between the standing
20 wall and the guide wall other than the tip of the at least one projection.
3. The outdoor unit for an air-conditioning apparatus of claim 2, wherein the fan motor
holding member is formed so that the guide wall include a part to be parallel with the standing
wall.
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4. The outdoor unit for an air-conditioning apparatus of claims 2 or 3, wherein the
projection of the guide wall is formed to be long sideways when viewed from the vertical
direction of the area enclosed by the plural fan motor holding members.
- 30 5. The outdoor unit for an air-conditioning apparatus of any one of preceding claims 1
to 4, wherein an end of the guide wall on the side of the fan motor support is formed to be bent
to the side of the standing wall.