

DESCRIPTION

Title of Invention: ELECTRIC APPARATUS

Technical Field:

5 [0001] This invention relates to an electric apparatus and, more particularly, to an electric apparatus which includes an air-blowing unit.

Background Art

[0002] Some types of electric apparatuses include an air-blowing unit. An example of said electric apparatuses is disclosed in Patent Literature 1. The electric apparatus shown in Patent Literature 1 has a casing having a rear wall with
10 a rectangular opening extending therethrough. An air-blowing unit is housed in the casing in such a manner as to extend into the housing through the rectangular opening. The air-blowing unit has a generally rectangular parallelepiped appearance. An air-blowing unit cover for the air-blowing unit is attached to the
15 casing to close the opening. The air-blowing unit cover is attached to the casing by engaging claws formed on the air-blowing unit cover with engagement parts formed in the casing.

Prior Art Literature

Patent Literatures

20 [0003] Patent Literature 1: JP2006-344661A

Disclosure of the Invention

Problems the Invention is to Solve

[0004] Although not specifically described, it is thought that, according to Patent Literature 1, the air-blowing unit housed in the casing is fixed to the casing
25 by means of screws. Accordingly, according to Patent Literature 1, it is necessary to house the air-blowing unit in the casing, then to screw the air-blowing unit to the casing, and, after that, to attach the cover of the air-blowing unit to the casing. Like this, the working for mounting the air-blowing unit is troublesome, and, in addition, checking and maintaining the air-blowing unit is also troublesome.

30 [0005] An object of this invention is to provide an electric apparatus having

an air-blowing unit with an air-blowing unit cover, which can be easily attached to the electric apparatus and can be easily checked and maintained.

Summary of Invention

[0006] According to an embodiment of the present invention, an electric
5 apparatus includes a casing with a duct unit disposed therein. An opening is
formed in one surface of the casing. The opening is in communication with the
duct unit. An air-blowing unit is disposed within the duct unit. A restraining
member is disposed within the duct unit. The restraining member abuts against
the air-blowing unit within the duct unit to restrain the air-blowing unit from moving.
10 An air-blowing unit cover having an inner surface facing to the air-blowing unit is
detachably secured to close the opening in the casing. A support member is
disposed on the inner surface of the air-blowing unit cover which, when the
air-blowing cover is attached to the opening, supports the air-blowing unit against
the restraining member. The support member attached to the inner surface of the
15 air-blowing unit cover and the restraining member disposed within the duct unit
sandwich to secure the air-blowing unit between them. In this manner, the
air-blowing unit is fixed. Like this, the air-blowing unit is secured by attaching the
air-blowing unit cover. This means that the working of attaching the air-blowing
unit can be facilitated. Also, by detaching the air-blowing unit cover, the
20 air-blowing unit is automatically released, and therefore checking and maintaining
the air-blowing and other units is facilitated.

[0007] The support member on the inner surface of the air-blowing unit cover
may be arranged to extend into the interior of the opening in the casing to thereby
support the air-blowing unit when the cover is attached to the opening. With this
25 arrangement, when the air-blowing unit cover is attached to the opening, the
support member supports and holds the air-blowing unit against the restraining
member within the opening. With this arrangement, the position of the
air-blowing unit can be arbitrarily chosen within the duct. For example, the
position of the air-blowing unit can be inner within the duct unit from the opening.
30 Thus, the degree of freedom in designing increases.

[0008] The opening of the duct unit may include an engagement hole formed in one wall of the duct unit and a shaft hole formed in the other wall facing the said one wall. In this arrangement, the air-blowing unit cover has a first flange overlying the outer surface of the one wall of the duct unit and a second flange overlying the outer surface of the said other wall of the duct unit. On the inner surface of the first flange of the air-blowing unit cover, there is provided an engaging member which can engage with the engagement hole. A rotation shaft which can be inserted into the shaft hole is formed on the inner surface of the second flange. With this arrangement, the air-blowing unit cover is made to engage with the opening, with the first and second flanges being mounted to sandwich the opening from the outside thereof. Then, no special arrangement for mounting the air-blowing unit cover to the opening is required to be formed on the inside of the opening. This, in turn, makes it possible for the opening to be of a size nearly equal to the size of the casing. This means that a larger air-blowing unit can be disposed within the opening. Like this, the degree of freedom in designing electric apparatuses increases. Also, it makes it possible for the air-blowing unit cover to be able to be mounted to and removed from the opening without resort to using tools or screws.

[0009] The air-blowing unit may be disposed at the location from which the restraining member in the duct unit restrains the air-blowing unit from moving. To obtain this result, the inner surface of the air-blowing unit cover is made to face toward the air-blowing unit, and, then the rotation shaft of the air-blowing cover is inserted slantwise into the shaft hole of the opening. After that, the air-blowing unit cover is rotated, using the rotation shaft as the central axis of rotation, to make the engaging member engage with the engagement hole from outside of the engagement hole. In this manner, the air-blowing unit cover is mounted to the opening of the duct unit. When the air-blowing unit cover is mounted to the opening, the support member on the air-blowing unit cover enters into the duct unit through the opening to support the air-blowing unit. With this arrangement, the air-blowing unit can be disposed at any desired location inward of the opening in

the duct unit. Thus, the air-blowing unit cover can be easily mounted with one hand without resort to using screws or tools.

[0010] The first flange with the engaging member may be provided on the lower portion of the air-blowing unit cover. In this case, the engagement hole is formed in the lower portion of the opening, and the second flange with the rotation shaft is provided on the upper portion of the air-blowing unit cover. The shaft hole is formed in the upper portion of the opening. With this arrangement, the air-blowing unit cover is mounted to the opening in the following manner. First, the air-blowing unit cover is placed to cover the opening slantwise from above the opening so as to insert the rotation shaft into the shaft hole. The air-blowing unit cover is then rotated with the rotation shaft acting as the central axis of rotation to thereby make the air-blowing unit cover engage with the lower portion of the opening. In this manner, the air-blowing unit cover can be mounted to the opening with fewer working steps.

[0011] A cut may be formed on each side of the engaging member of the first flange. By virtue of the cuts, the engaging member exhibits elasticity with respect to the first flange. Then, by disengaging the engaging member from the engagement hole by applying a force against the force of the engaging member engaging with the engagement hole, the fixation of the air-blowing unit cover to the opening can be removed.

[0012] A plurality of support members may be provided on the inner surface of the air-blowing unit cover at locations corresponding to at least four corners of the air-blowing unit. With this arrangement, the four corners of the air-blowing unit can be stably supported against the restraining member.

[0013] A support member may be provided also near the engaging member. Then, this support member and the first flange of the air-blowing unit cover sandwich the aforementioned one wall of the opening. In case that cuts are in the first flange on both sides of the engaging member, the strength of portions of the first flange near the cuts is somewhat reduced. However, since the one wall of the opening is sandwiched between the first flange and the support member, the

air-blowing unit cover never vibrates even during the operation of the air-blowing unit.

[0014] An elastic member may be provided within the duct unit. The elastic member urges the air-blowing unit against the wall surface on which the elastic member is disposed and against the opposing wall. With this arrangement, when the air-blowing unit is inserted through the opening to the location where the restraining member is disposed, the air-blowing unit is temporarily fixed in a predetermined position by the pressure given by the elastic member, and the air-blowing unit is prevented from falling easily from that position. This makes it possible for the air-blowing cover to be mounted without being barred by the air-blowing unit.

Brief Description of Drawings

[0015] Fig. 1 is a partially broken-away, longitudinal cross-sectional, front view of an electric apparatus according to a first embodiment of the invention.

Fig. 2a is a partially broken-away, longitudinal cross-sectional, side view of the electric apparatus of Fig. 1.

Fig. 2b is a partially broken-away, transverse cross-sectional, plan view of the electric apparatus of Fig. 1.

Fig. 3 is a perspective view of an air-blowing unit mounting unit for use in the electric apparatus of Fig. 1

Fig. 4a is a front view of an air-blowing unit cover used in the electric apparatus of Fig.1.

Fig. 4b is a longitudinal cross-sectional, side view of the air-blowing unit cover used in the electric apparatus of Fig.1.

Fig. 4c is a rear view of the air-blowing unit cover used in the electric apparatus of Fig.1.

Fig. 5 shows how to mount the air-blowing unit cover used in the electric apparatus of Fig. 1.

Fig. 6 is a perspective, exploded view of the electric apparatus of Fig.

1.

Fig. 7 is a perspective, exploded view of the electric apparatus of Fig. 1 viewed from the rear thereof.

Fig. 8a is a front view of a leaf spring used in the electric apparatus of Fig. 1.

Fig. 8b is a side view of the leaf spring used in the electric apparatus of Fig. 1.

Fig. 9 is a perspective, exploded view of an electric apparatus according to a second embodiment of the present invention.

Fig. 10 is a front view of a leaf spring used in an electric apparatus according to a third embodiment of the present invention.

Description of Embodiments

[0016] An electric apparatus according to a first embodiment of the present invention is a power supply apparatus for use with electroplating equipment, for example. As shown in Figs. 1, 2a and 2b, the electric apparatus includes a casing 1 of, for example, plastic or metallic material. The casing 1 has a generally rectangular parallelepiped shape. The casing 1 is formed of a bottom wall 4, two side walls 10, 10 arranged in parallel with each other (only one of them being shown), a rear wall (not shown) and a front wall 6, all of which are generally rectangular in shape. The casing 1 further includes a lid member 3 shown in Figs. 1 and 2a. The rear wall and the front wall 6 are in parallel with each other and disposed along the longer edges of the bottom wall 4. The side walls 10, 10 are disposed on opposite sides of the bottom wall 4, being orthogonal to the rear wall and the front wall 6. The interior of the casing 1 is partitioned into two sections, namely, a main section 2 and a duct unit 8, by a partition plate 5 disposed between side walls 10, 10. In the embodiment being described, the lid member 3 covers the entire top portion of the casing 1 including both sections, namely, the duct unit 8 and the main section 2, from the front wall 6 to the rear wall. The duct unit 8 has an inlet opening in the front wall 6 and an outlet opening in the rear wall. The side walls 10, the partition plate 5 and the lid member 3 placed on the casing 1 form a cylindrical body. As shown in Fig. 2a, an engagement hole 46 with which

a later-described air-blowing unit cover 30 is to be engaged is formed through the bottom wall 4 in the mid portion of the edge, on the inlet opening side, of the bottom wall 4 between the left and right sides thereof. A hem 4a is formed by hemming the bottom wall 4 in the portion where the inlet opening is formed. The hem 4a is located on top of the engagement hole 46 so that, when seen from the inside of the duct unit 8, the engagement hole 46 is hidden behind the hem 4a. When the casing 1 is seen from beneath, the engagement hole 46 can be seen. The hem 4a increases the strength of the bottom wall, and also prevents a hand of a worker from being injured by the edge of the inlet opening when he mounts a later-mentioned air-blowing unit 14.

[0017] As shown in Figs. 2a and 2b, an air-blowing unit mounting unit 12 is mounted in the duct unit 8. As shown in Fig. 3, the air-blowing unit mounting unit 12 includes a top plate 9 and side plates 18, 18, and is generally frame-shaped. The side plates 18, 18 are disposed in parallel with the side walls 10, 10 and the partition plate 5, which form the duct unit 8, and are fixed at a location within the duct unit 8 opposite to the hem 4a of the bottom wall 4 and in line with the inlet opening. In the deepest portion from the front of the air-blowing unit mounting unit 12, the side plates 18 are bent perpendicularly so that the surfaces of the bent portions face each other with a spacing disposed therebetween. The bent portions form restraining members 20. The top plate 9 is in parallel with the bottom wall 4, and includes an extension 9a extending somewhat outward of the front wall 6. Thus, the extension 9a extends forward of the front edge of the lid member 3. Further, in the right and left side portions of the extension 9a, shaft holes 44 for use in mounting a later-mentioned air-blowing unit cover 30 are formed therethrough. The bottom wall 4, and the top plate 9 and the side plates 18, 18 of the air-blowing unit mounting unit 12 provide an opening 7. The air-blowing unit mounting unit 12 or the top plate 9 is slightly higher than the air-blowing unit 14 as shown in Fig. 2a. The depth of the air-blowing unit mounting unit 12 is larger than the depth of the air-blowing unit 14. Windows 25, 25 are formed in the top plate 9 of the air-blowing unit mounting unit 12 at locations spaced in the

front-to-rear direction. The windows 25, 25 are used to attach elastic means, e.g. a leaf spring 22, to the top plate 9. The leaf spring 22 to be attached to the top plate 9 is generally rectangular in shape and convex as shown in Figs. 8a and 8b. The leaf spring 22 has a rectangular mounting piece 23 in the middle of each of the shorter sides thereof. Each of the mounting pieces 23, 23 has a width smaller than the leaf spring 22. The mounting pieces 23 are inserted into the associated windows 25, 25 in the air-blowing unit mounting unit 12 to thereby secure the leaf spring 22 to the inner side of the top plate 9.

[0018] The air-blowing unit 14 is disposed within the air-blowing unit mounting unit 12 in the duct unit 8. The air-blowing unit 14 is disposed such that the front surface thereof is located deeper than the location of the hem 4a and the rear surface thereof abuts the restraining members 20, 20 of the air-blowing unit mounting unit 12. As shown in Figs. 2a and 2b, since the rear surface of the air-blowing unit 14 abuts the restraining members 20, the air-blowing unit 14 is restrained from moving deeper into the duct unit 8. The air-blowing unit 14 used in the embodiment being described includes, as shown in Figs. 6 and 7, a cylindrical member 14a in which a fan 15 is disposed, and which includes flat portions 14b formed to be in parallel with the associated ones of the bottom wall 4, the side wall 10, the partition plate 5 and the top plate 9.

[0019] With the rear surface of the air-blowing unit 14 abutting against the restraining members 20, 20, the flat portion 14b of the air-blowing unit 14 is pressed by the leaf spring 22 secured to the inner side of the top plate of the air-blowing unit mounting unit 12, and therefore the air-blowing unit 14 is urged toward the bottom wall 4.

[0020] The area of the convex portion of the leaf spring 22 is large, and, when the air-blowing unit 14 is inserted from the opening 7 to a position near the restraining members 20, 22, the convex portion of the leaf spring 22 comes into contact with the flat portion 14b. As the air-blowing unit 14 is inserted into the air-blowing unit mounting unit 12, while pressing the air-blowing unit 14 toward the bottom wall 4, a force to pull the air-blowing unit 14 inward of the air-blowing unit

mounting unit 12 acts on the air-blowing unit 14 to move it to its proper mounting position. If the air-blowing unit 14 is urged further into the air-blowing unit mounting unit 12, it cannot go deeper than the restraining members 20 since the rear surface of the air-blowing unit 14 abuts against the restraining members 20.

5 Once the air-blowing unit 14 is disposed at its proper position, the pressing force of the leaf spring 22 acts in the direction toward the bottom wall 4 to thereby temporarily keep the air-blowing unit 14 at that position. The hem 4a of the bottom wall 4 faces the front bottom portion of the air-blowing unit 14 and serves as a slipping-off preventing member to prevent the air-blowing unit 14 from simply
10 dropping off through the opening 7. Thus, it never happens that the air-blowing unit 14 moves and disturbs the mounting of the air-blowing unit cover 30 described later.

[0021] Although not shown, parts to be cooled by cool air from the air-blowing unit 14, such as semiconductor devices, coils, capacitors, and
15 transformers, which are used in an electroplating power supply apparatus, for example, are mounted in the duct unit 8.

[0022] The air-blowing unit cover 30 is mounted to the opening 7. The air-blowing unit cover 30 is frame-shaped and has first and second flanges 32 and 31, which extend backward from an outer surface 35b, as shown in Figs. 4a
20 through 4c. The air-blowing unit cover 30 is provided with a plurality of laterally extending crosspieces 36, and the wind flows through the spaces between adjacent ones of the crosspieces 36. The crosspieces 36 are spaced vertically, and three columns of vertically arranged crosspieces 36 are laterally arranged. There are provided on the inner surface 35a of the air-blowing unit cover 30, where no
25 crosspieces are provided, a top area 33 and a bottom area 34. Support members 48 extend backward from the inner surface of the top area 33, and support members 52 and 54 extend backward from the inner surface of the bottom area 34. The end of each of the support members 48, 52 and 54 are shaped to be in parallel with the front surface of the air-blowing unit 14. The air-blowing unit cover 30
30 may be made of plastic, for example.

[0023] In the center portion of the rear edge of the first flange 32 of the air-blowing unit cover 30, two notches 39 are formed, being spaced from each other, as shown in Fig. 4c. An arm-like engaging member 40 extends between the notches 39. The arm-like engaging member 40 extends from the inner surface of the air-blowing unit cover 30 slantwise downward toward the rear and, then, horizontally, and has a claw extending upward.

[0024] Further, as shown in Fig. 4c, rotation shaft members 42 are formed in portions near the opposite ends of the inner surface of the second flange 31 of the air-blowing unit cover 30. The rotation shaft members 42 each includes, as is seen in Fig. 4b, a stepped portion 42b extending rearward and downward from the inner surface of the second flange 31 and a rotation shaft 42a extending rearward and downward from the rear end of the stepped portion 42b.

[0025] As shown in Fig. 2a, by means of the engaging member 40 and the rotation shaft members 42, the air-blowing unit cover 30 is mounted to the opening 7. With the air-blowing unit cover 30 mounted to the opening 7, the second flange 31 is located above the top plate 9 of the air-blowing unit mounting unit 12, the first flange 32 is located beneath the bottom wall 4, and the support members 48, 52 and 54 extend into the duct unit 8 through the opening 7, causing the support members 48 and 50 to come into contact with the front surface of the air-blowing unit 14 and push the air-blowing unit 14 toward the restraining members 20, 20 to thereby support the air-blowing unit 14.

[0026] Fig.6 illustrates the electric apparatus according to the present embodiment viewed from the rear side, and Fig. 7 shows the electric apparatus viewed from its front side. The air-blowing unit 14, when inserted through the opening 7, is urged slantwise downward by the pressing force of the leaf spring 22 and led toward the deep portion of the duct unit 8, and the rear surface of the air-blowing unit 14 abuts against the restraining members 20. As a result, the air-blowing unit 14 is placed in the proper position predetermined by the restraining members 20. With the air-blowing unit 14 placed in position in the air-blowing unit mounting unit 12, the air-blowing unit 14 is urged directly downward in a

portion at a level beneath the top plate 9 as shown in Fig. 5, whereby the air-blowing unit 14 is prevented from moving upward or downward, or rightward or leftward. After the air-blowing unit 14 is mounted to the air-blowing unit mounting unit 12 of the duct unit 8, the air-blowing unit cover 30 is mounted to the front of the opening 7.

[0027] The air-blowing unit cover 30 is mounted to the opening 7 in the following manner. First, as shown in Fig. 5, the air-blowing unit cover 30 is positioned slantwise with the second flange 31 of the air-blowing unit cover 30 placed near the extension 9a of the top plate 9 of the air-blowing unit mounting unit 12 and with the first flange 32 of the air-blowing unit cover 30 placed in a position spaced from the bottom wall 4. Next, the rotation shafts 42a, 42a of the stepped rotation shaft members 42, 42 of the air-blowing unit cover 30 are inserted into the shaft holes 44 in the extension 9a of the top plate 9 from slantwise above. Next, the air-blowing unit cover 30 is rotated in such a direction that the first flange 32 moves toward the bottom wall 4 with the rotation shafts 42a, 42a acting as fulcrums. When the engaging member 40 comes to the lower portion of the bottom wall 4, the engaging member 40 is pressed by the bottom wall 4 and bends downward. As the air-blowing unit cover 30 is rotated further, the engaging member 40 comes into engagement with the engagement hole 46 formed in the bottom wall 4, whereby the air-blowing unit cover 30 is mounted to the opening 7. In this state, the rotation shafts 42a are inserted into the top plate 9, but, since the stepped portions 42b of the rotation shaft members 42 are above the top plate 9, the second flange 31 of the air-blowing unit cover 30 is kept away above the top plate 9. To remove the air-blowing unit cover 30 from the opening 7, the engaging member 40 is bent downward below the bottom wall 4 against its engagement force so that the engaging member 40 is disengaged from the engagement hole 46, whereby the fixing of the air-blowing unit cover 30 to the opening 7 is released. After that, the air-blowing unit cover 30 is rotated in the direction opposite to that for attaching the cover 30 with the rotation shafts 42a, 42a acting as the fulcrums. It is understood that no tools or screws are required for mounting and removing the air-blowing unit

cover 30 to and from the opening 7. In addition, a person can mount and remove the air-blowing unit cover 30 easily with one hand. When the air-blowing unit cover 30 is removed, the rotation of the rotation shafts 42a is not disturbed by the top plate 9 since the second flange 31 is kept spaced above the top plate 9 due to the stepped portions 42b of the rotation shaft portions 42. Thus, the air-blowing unit cover 30 can be rotated instantly about the rotation shafts 42a, so that the removal of the cover 30 can be done efficiently.

[0028] As shown in Fig. 4c, the support members 48, 48 in the top area 33 of the inner surface 35a of the air-blowing unit cover 30 are located near the stepped rotation shaft portions 42, 42 and nearer to the cover side walls than the stepped rotation shaft portions 42, 42 are. Further, the support members 48, 48 have their free ends projecting further backward than the rear edge of the second flange 31 as shown in Fig. 4b. The support members 50, 50 are formed in the bottom area 34 of the cover inner surface 35a at locations near the cover side walls. The free ends of the support members 50, 50, too, extend further backward than the rear edge of the first flange 32.

[0029] The support members 48, 48, 50, 50 are located at locations corresponding to at least four corners on the front side of the air-blowing unit 14 when the air-blowing unit cover 30 is mounted to the opening 7, as shown in Figs. 1 and 4c. In the position where the free ends of the support members 48, 48, 50, 50 extend into the duct unit 8, the support members 48, 48, 50, 50 are in contact with the front surface of the air-blowing unit 14 and push the air-blowing unit 14 in the direction from the front side of the opening 7 toward the restraining members 20, 20 to thereby support the air-blowing unit 14. With this arrangement, even when external force, such as vibrations, tending to move the air-blowing unit 14 in the direction toward the opening 7, is applied, the support members 48, 50 push back to and support the air-blowing unit 14 at the original position to which the air-blowing unit 14 is restrained by the restraining members 20. Furthermore, as stated previously, the air-blowing unit 14 is applied with an urging force from the leaf spring 22, and accordingly is not readily moved. Since the support members

48, 48, 50, 50 go into the duct unit 8 and support the air-blowing unit 14 in the duct unit 8 at the four corners, a large number of degree of freedom in determining the position of the air-blowing unit 14 along the depth of the duct unit 8 from the opening 7 is available so that the air-blowing unit 14 can be stably supported.

5 Since the air-blowing unit 14 is supported from both front and back sides thereof by means of the restraining members 20 and the support members 48, 48, 50, 50, the air-blowing unit 14 is automatically secured by mounting the air-blowing unit cover 30, without resort to screwing the air-blowing unit 14 to the opening 7. When the air-blowing unit cover 30 is detached, the securing of the air-blowing unit 14 is

10 automatically released. Thus, the detaching the air-blowing unit 14 is easy, which facilitates maintenance check. The air-blowing unit cover 30 is mounted to the opening 7 by sandwiching the opening 7 between the first flange 32 pressing the lower side of the bottom wall 4 and the second flange 31 pressing the upper side of the top plate 9, which eliminates need of providing, along the inner periphery of the

15 opening 7, of a structure for mounting the air-blowing unit cover 30. Accordingly, the opening 7 can be as large as the size of the casing 1 permits and, still, the air-blowing unit 14 can be safely secured. This means that the degree of freedom in designing can be increased, allowing the use of a large-sized air-blowing unit which can provide larger cooling effect.

20 [0030] With the air-blowing unit cover 30 mounted to the opening 7, the support members 48, 48 are in the positions within the duct unit 8 and inward of the opening 7, where their top surfaces and the second flange 31 sandwich the top plate 9 therebetween, as shown in Fig. 2a. Further, the support members 50, 50 are in the positions within the duct unit 8 and inward of the opening 7, where their

25 bottom surfaces and the first flange 32 sandwich the bottom wall 4 therebetween. Since the top plate 9 and the bottom wall 4, which form the opening 7, are held by the air-blowing unit cover 30, the movement of the air-blowing unit cover 30 in the vertical directions, which could be caused when forces in the vertical directions are applied to the air-blowing unit cover 30, can be suppressed.

30 [0031] As shown in Fig. 4c, in the embodiment being described, the

additional support members 52, 52, 54, 54 having the same shape as the support members 52, 52 described previously are provided between the support members 50, 50 formed in the bottom area 34 of the inner surface 35a of the air-blowing unit cover 30 and the associated ones of the notches 39, 39, respectively. The strength of the center portion of the first flange 32 is decreased because of the notches 39. However, since the support members 52, 52, 54, 54 can grasp the bottom wall 4 forming the opening 7, in cooperation with the first flange 32, the air-blowing unit cover 30 can be secured and fixed to the opening 7 firmly and stably.

[0032] Since part of the opening 7 is grasped by the air-blowing unit cover 30, once the air-blowing unit cover 30 is mounted to the opening 7, the air-blowing unit cover 30 never shifts horizontally or vertically. The air-blowing unit 14 is not mounted to the air-blowing unit mounting unit 12 with screws, but is sandwiched and secured by the support members 48, 50, 52 and 54 on the air-blowing unit cover 30 and the restraining members 20, 20. Further, the elastic leaf spring 22 on the top plate 9 urges the flat portion 14b so as to urge the air-blowing unit 14 against the bottom wall 4 and to thereby retain the air-blowing unit 14 in position. In this manner, the air-blowing unit 14 can be secured in position with no screws or nails, and therefore it can be detached from the air-blowing unit mounting unit 12 in the duct unit 8 simply by detaching the air-blowing unit cover 30 from the opening 7. Thus, checking and maintaining of the air-blowing unit 14 can be done easily.

[0033] Fig. 9 shows a second embodiment of the present invention. According to the second embodiment, plural leaf springs 22, e.g. two leaf springs 22, are disposed, being spaced along the length direction of the top plate 9 of the air-blowing unit mounting unit 12. With this arrangement, the air-blowing unit 14 can be fixed in the duct unit 8 more stably and more firmly than in the first embodiment. The remainder of the structure is same as that of the first embodiment, and the same reference numerals and symbols are attached to equivalent parts with giving no description about them.

[0034] A leaf spring 22a used in a third embodiment of the present invention

is shown in Fig. 10. According to the third embodiment, the leaf spring 22a used has a larger width than that of the leaf spring 22 of the first and second embodiments as shown in Fig. 10. Using the larger-width leaf spring 22a, the contacting area of the leaf spring 22a contacting the flat portion 1b formed in the air-blowing unit 14 is larger, so that the air-blowing unit 14 can be secured to the duct unit 8 more firmly. The remaining portions are the same as those of the first and second embodiments, and therefore no further explanations about them are given.

[0035] In the embodiments described above, the restraining members 20 are formed by bending the side plates of the air-blowing unit mounting unit 12, but the restraining members can be formed in different manners. For example, a wall which abuts against the rear surface of the air-blowing unit 14 and connects the side wall 10 and the partition plate 5 may be provided, with an airway, through which air from the air-blowing unit 14 can pass to the rear wall side, formed therein, leaving margins around the airway, the margins being used as the restraining members. In another example, projections may be formed to project inward from the side wall 10, the partition plate 5, the bottom wall 4 and the top plate 9 in such a manner that the projections abut against the rear surface of the air-blowing unit 14. These projections can be used as the restraining members. In still another example, a wall which connects the side wall 10 and the partition plate 5 may be provided, with an airway, through which air from the air-blowing unit 14 can pass to the rear wall side, formed therein, leaving margins around the airway. Projections like the ones described above are formed to extend from the edges of all or part of the side wall 10, the partition plate 5, the bottom plate 4 and the top plate 9. In the described embodiments, eight support members in total are used, but the number of the support members and the locations where they are disposed can be changes appropriately. However, for firm holding of the air-blowing unit 14, it is desirable to provide the support members for at least the four corners of the front surface of the air-blowing unit 14. The engaging member 40 and the rotation shaft members 42, 42 have been described to be disposed on the first and second

flanges 32 and 31 of the air-blowing unit cover 30, respectively, but the rotation shaft members 42, 42 may be provided on the first flange 32 and the engaging member 40 may be provided on the second flange 31. The air-blowing unit cover 30 may be mounted to the opening 7 in a manner as to be laterally openable.

- 5 Although the opening 7 has been described to be formed from the bottom wall 4 and the top plate 9 and the side plates 18, 18 of the air-blowing unit mounting unit 12, the air-blowing unit mounting unit 12 may be eliminated. Instead, the cylindrical duct unit 8 may be used as the opening 7, with end shaft holes and engaging holes formed in the duct unit 8.

Claims:

1. An electric apparatus comprising:

a casing housing a duct unit therein;

5 an opening formed in one surface of said casing, said opening communicating with said duct unit;

an air-blowing unit disposed in a portion of said duct unit remote from said opening;

a restraining member disposed in said duct unit, said restraining member
10 abutting against and restraining said air-blowing unit from moving;

an air-blowing unit cover having an inner surface facing said air-blowing unit, said air-blowing unit cover being detachably mounted to said opening; and

a support member provided on the inner surface of said air-blowing unit cover, for supporting said air-blowing unit, when said air-blowing unit cover is
15 attached to said opening, said support member supporting said air-blowing unit in such a manner that, when said air-blowing unit tends to move toward said opening, said support member pushes back said air-blowing unit toward said restraining member;

said air-blowing unit having, in a front surface thereof, no holes for
20 engagement with said support member;

said support member having a free end extending toward a front portion of said air-blowing unit within said opening.

2. An electric apparatus comprising:

25 a casing housing a duct unit therein;

an opening formed in one surface of said casing, said opening communicating with said duct unit;

an air-blowing unit disposed in said duct unit;

a restraining member disposed in said duct unit, said restraining member
30 abutting against and restraining said air-blowing unit from moving;

an air-blowing unit cover having an inner surface facing said air-blowing unit, said air-blowing unit cover being detachably mounted to said opening; and

5 a support member provided on the inner surface of said air-blowing unit cover, for supporting said air-blowing unit, when said air-blowing unit cover is attached to said opening, said support member supporting said air-blowing unit in such a manner that, when said air-blowing unit tends to move toward said opening, said support member pushes back said air-blowing unit toward said retraining member;

10 said opening including an engagement hole formed in one wall and a shaft hole formed in other wall facing said one wall;

said air-blowing unit cover having a first flange overlying said one wall of said opening and a second flange overlying said other wall of said opening;

15 an engaging member which can engage with said engagement hole being formed on the inner surface of said first flange of said air-blowing unit cover, and a rotation shaft member which can be inserted into said shaft hole being formed on the inner surface of said second flange.

3. The electric apparatus according to Claim 2, wherein said rotation shaft member includes a stepped portion extending backward and downward from the inner surface of said second flange, and a rotation shaft contiguous to the rear portion of said stepped portion and extending further downward of said stepped portion.

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4. The electric apparatus according to Claim 2, wherein:

said air-blowing unit is placed in a position within said duct unit to which said air-blowing unit is restrained by said restraining member;

5 said rotation shaft of said air-blowing unit cover is placed in said shaft hole in said opening in such a manner that said air-blowing unit cover, with said inner surface of said air-blowing unit cover facing said air-blowing unit, can be rotated with said rotation shaft acting fulcrum of rotation; and

said support member on said air-blowing unit cover enters into the interior of said opening, with said engaging member of said air-blowing unit cover being
10 engaged with said engagement hole in said opening.

5. The electric apparatus according to Claim 2, wherein:

said first flange with said engaging member formed therein is provided in a lower portion of said air-blowing unit cover, said engagement hole being formed in
15 a lower portion of said opening; and

said second flange with said rotation shaft formed therein is provided in an upper portion of said air-blowing unit cover, said shaft hole being formed in an upper portion of said opening.

20 6. The electric apparatus according to Claim 2, wherein said first flange of said air-blowing unit cover has notches on opposite sides of said engaging member.

7. The electric apparatus according to Claim 6, wherein said support member
25 is also provided near said engaging member, said support member and said first flange of said air-blowing unit cover sandwich therebetween to hold said one wall of said opening.

8. The electric apparatus according to Claim 2, wherein a plurality of said
30 support members are provided on the inner surface of said air-blowing unit cover

for at least four corners of said air-blowing unit.

9. The electric apparatus according to Claim 2, wherein an elastic member is disposed within said duct unit, said elastic member urges said air-blowing unit
5 toward a wall facing a wall on which said elastic member is disposed.