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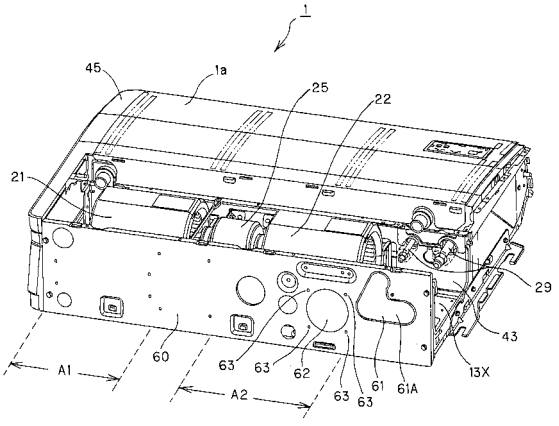
(54) CEILING SUSPENSION TYPE AIR CONDITIONER

(57) When an air conditioner is operated, outdoor air can be easily introduced, dew condensation, etc. caused by the introduction of outdoor air can be prevented from occurring in the air conditioner, and the air conditioner can be operated over a long term.

A ceiling type air conditioner 11 has a heat exchanger 15 an air blower 13 disposed in this order from the front surface provided with an air blow-out port 41, and also has a suction grille 37 provided to the bottom surface of a chamber 13X in which the air blower 13 is accommodated. The ceiling type air conditioner 1 is suspended from the ceiling of a room, and has an air conditioner main body 1a having a rear surface panel 60 in which electrical parts (motor 25, electrical part box 11) are accommodated. The rear surface panel 60 is provided with an outdoor air introducing port 62 disposed at such a position that introduced outdoor air does not directly impinge against the electrical parts.

FIG. 4



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Description

Technical Field

[0001] The present invention relates to a ceiling-suspended type air conditioner that is set up while suspended from the ceiling of a room.

Background Art

[0002] An air conditioner is equipped with a suction grille for taking in indoor air of a target object to be air conditioned and an air blow-out port for blowing out air-conditioned air.
For example, in a ceiling-suspended type air conditioner that is set up while suspended from the ceiling of a room by using suspending bolts (see Patent Document 1, for example), as suction grille is provided to the bottom surface of the main body of the air conditioner (the surface confronting the floor surface of a building), and an air blow-out port is provided to the front surface of the main body of the air conditioner. Patent Document 1: JP-A-9-275251

Disclosure of the Invention

Problem to be solved by the Invention

[0003] A conventional air conditioner merely circulates indoor air, and normally it has no ventilation function.
Recently, sick house syndrome has become a big social problem. For example, according to the Building Standard Law in Japan, it has been required that ventilation equipment which can be driven at all times over 24 hours and also has a ventilation frequency of 0.5 time/h or more (the capability of replacing the air volume (volume) of a house by 2 hours) must be set up in a living room of the house.
[0004] However, it causes rise-up of the equipment cost that the ventilation equipment is provided in addition to the air conditioner in a room, and this further needs the set-up area of the overall air conditioner device system. Furthermore, a duct, etc. required to connect the air conditioner and the ventilation equipment cause disfigurement of the room.
Therefore, an object of the present invention is to provide an air conditioner in which outdoor air can be easily introduced when the air conditioner is operated, dew condensation, etc. caused by the introduction of the outdoor air in the air conditioner can be prevented and also the long-term operation can be performed

Means of solving the Problem

[0005] In order to solve the above problem, a ceiling-suspended type air conditioner having a heat exchanger and an air blower disposed in this order from the front surface thereof provided with an air blow-out port, and a suction grille provided to the bottom surface of a chamber in which the air blower is accommodated, the air conditioner being set up while suspended from the ceiling of a room, is characterized by further comprising an air conditioner main body having electrical parts accommodated therein, wherein the air conditioner main body has a rear surface panel and the rearpanel is provided with anoutdoor air introducing port at such a position that the outdoor air thus introduced does not directly impinge against the electrical parts.
According to the above-described construction, by connecting an air supply duct to the outdoor air introducing port or the like, the outdoor air can be easily introduced when the air conditioner is operated. In addition, the outdoor air introducing port is disposed at the position where the introduced outdoor air does not directly impinge against the electrical parts, so that occurrence of dew condensation due to the introduction of the outdoor air can be prevented in the air conditioner.
[0006] In this case, the outdoor air introducing port may be constructed as a freely-detachable knock-out panel.
Furthermore, the electrical parts may contain at least one of an air blower motor constituting the air blower, an electrical part box and an electrical connector.
Still furthermore, the outdoor air introducing port may be disposed at such a position that the outdoor air is directly led to a fan constituting the air blower.
[0007] Furthermore, the outdoor air introducing port may be designed to have such an opening area that the mixing ratio between the indoor air circulated through the suction grille and the introduced outdoor air is equal to a predetermined ratio in accordance with the air blowing capability of the fan constituting the air blower.
Still furthermore, the predetermined ratio may be set in accordance with the ventilation capability per unit time to be required.

Effect of the Invention

[0008] According to the present invention, the outdoor air can be easily introduced when the air conditioner is operated, and also dew condensation, etc. which are caused by the introduction of the outdoor air can be prevented from occurring in the air conditioner, whereby the air conditioner can be operated over a long term.

Best mode for carrying out the Invention

[0009] Next, an embodiment of the present invention will be described with reference to the drawings.
Fig. 1 is a perspective view showing the outlook construction of a ceiling-suspended type air conditioner according to an embodiment. Fig. 2 is a cross-sectional view showing the internal construction of the main body of the air conditioner. Fig. 3 is a plan view showing the internal construction of the main body of the air conditioner.
[0010] As shown in Fig. 1, the ceiling-suspended type air conditioner 1 includes an air conditioner main body

1a, and a casing 12A. The casing 12A includes resin side covers 45 located at both the sides of the air conditioner main body 1a, and a bottom panel 14 and a suction grille 37 that are disposed at the lower portion (bottom portion) side of the air conditioner main body 1a.

[0011] Furthermore, the casing 12A is provided with a reception window 50 having a reception unit (not shown) for receiving an instruction signal from a remote controller (not shown) for controlling the air conditioner main body 1a. The caption unit is disposed on the back surface of the reception window 50.

[0012] As shown in Fig. 2, the air conditioner main body 1a is hooked to suspending bolts 3 suspended from the ceiling and set up to be fixed to the lower surface of the ceiling plate 5 of the room. The air conditioner main body 1a is provided with an air blow-out port 41 at the front surface side thereof. The air conditioner main body 1a has a heat exchanger 15 and an air blower 13 disposed in this order from the front surface side thereof. Furthermore, a louver 51 for adjusting the direction of blow-out air is disposed in the air blow-out port 41. Furthermore, various kinds of equipment such as an electrical part box 11, a refrigerant pipe 29, etc. is accommodated in the air conditioner main body 1a.

[0013] As shown in Fig. 3, the air blower 13 of this embodiment is equipped with two air blower units (fans) 21, 22 in an air blower chamber 13. These air blower units 21 and 22 are fixed/arranged on a rotational shaft 27 driven by one motor 25.

The heat exchanger 15 is a fin tube type heat exchanger as shown in Fig. 2. This heat exchanger 15 is mounted so as to be tilted in the air conditioner heat main body 1a. The refrigerant pipe 29 is connected to the heat exchanger 15. The refrigerant pipe 29 is led to the outside of the air conditioner main body 1a, and connected to a compressor, a pressure-reducing device, an outdoor heat exchanger, etc. of an outdoor unit (not shown).

[0014] As shown in Fig. 2, a drain pan 31 of foamed polystyrene is disposed below the heat exchanger 15. A panel 33 of a metal plate is disposed on the lower surface of the drain pan 31. As shown in Fig. 3, a drain pump unit 35 is connected through a flexible tube 32 to a drain pool 31a of the drain pan 31. The drain pump accommodated in the drain pump unit 35 sucks drain collected in the drain pool 31a and discharges it to the outside of the air conditioner main body 1a.

[0015] As shown in Fig. 2, the suction grille 37 of resin is disposed below the air blower 13. The suction grille 37 is provided with an air cleaning filter 39. When the air blower 13 is driven, indoor air is sucked into the air conditioner main body 1a through the suction grille 37 and the filter 39. After the air sucked into the air conditioner main body 1a is heat-exchanged in the heat exchanger 15, the air flow direction thereof is adjusted by the louver 51, and then the air is blown out through the air blow-out port 41 into the room.

The partition plate 43 is apartitionplate for transversely partitioning substantially the center of the air conditioner main body 1a. The air blower 13 is disposed in a chamber partitioned by the partition plate 43.

[0016] Fig. 4 is a partially exploded perspective view from the rear surface side of the air conditioner main body. Fig. 5 is a partially enlarged perspective view from the rear surface side of the air conditioner main body.

The rear surface panel 60 is provided to the rear surface side of the air conditioner main body 1a. The rear surface panel 60 is provided with various kinds of holes such as a hole 61 for pipe connection in which a resin lid 61A is fitted before the setup, an outdoor air introducing port 62 constructed as a knock-out panel which is partially punched out freely detachably, holes for wiring, etc.

Screw holes 63 for securing a duct is provided around the outdoor air introducing port 62. A duct pipe 64 is connected to the duct securing screw holes 63 as occasion demands.

The chamber partitioned by the rear surface panel 60 and the partition plate 43 constitutes the air blower chamber 13X described above. The electrical part box 11 and the air blower are disposed in the air blower chamber 13X as described above.

[0017] In this case, the outdoor air introducing port 62 is disposed at such a position that the introduced outdoor air does not directly impinge against electrical parts containing at least the electrical part box 11, the motor 25 constituting the air blower 13 and the electrical connectors used for the above parts and also it does not obstruct the setup of the pipes.

Here, the outdoor air introducing port 62 is disposed at such a position that the introduced outdoor air does not directly impinge against electrical parts containing at least the electrical part box 11, the motor 25 constituting the air blower 13 and the electrical connectors used for the above parts for the following reason. That is, when the outdoor air comes into contact with these parts, dew condensation occurs in these parts. However, the above arrangement prevents deterioration of the parts which is caused by dew condensation. In this case, the parts such as the electrical part box 11, the motor 25, the electrical connectors, etc. are subjected to a shielding treatment except for parts required to be opened, such as exhaust vents, etc.

[0018] Areas indicated by a width direction range A1 and a width direction range A2 shown in Figs. 3 and 4 are considered as the positions on the rear surface panel 60 satisfying the above condition. Therefore, in this embodiment, the outdoor air introducing port 62 is provided within the area indicated by the width-direction range A2.

In addition to this arrangement, according to this embodiment, the outdoor air introducing port 62 is provided at a position to which the outdoor air is directly led to the air blower units (fans) 21, 22 constituting the air blower 13. As a result, the outdoor air can be surely introduced, mixed with circulated air and then blown out.

[0019] Furthermore, the outdoor air introducing port 62 is set to have such an open area that the mixing ratio between the indoor air circulated through the suction

grille 37 and the introduced outdoor air is equal to a predetermined ratio in accordance with the air blowing capability of the air blower units (fans) 21, 22 constituting the air blower 13. The mixing rate of the outdoor air to the circulating air is set to about 10 to 20% (normally about 15%) as the predetermined ratio. The mixing ratio is preset in accordance with the ventilation performance per unit time required (for example, 0.5/lhr).

According to this embodiment, the outdoor air can be easily introduced and the ventilation can be surely performed when the air conditioner is operated. Furthermore, dew condensation, etc. in the air conditioner which are caused by the introduction of the outdoor air can be prevented, so that it is possible to operate the air conditioner over a long term.

[0020] In the foregoing description, only one outdoor air introducing port is provided. However, plural outdoor air introducing ports may be provided in accordance with the size of the air conditioner main body. More specifically, the outdoor air introducing port may be provided to each of the area indicated by the width-direction range A1 and the area indicated by the width-direction range A2 shown in Figs. 3 and 4.

[0021] Furthermore, in the foregoing description, the outdoor air introducing port is constructed as the knock-out panel. However, it may be constructed so that the outdoor air introducing port is formed in the rear surface panel 60 in advance, and a blind plate is secured to the outdoor air introducing port by using the duct securing screw holes 63.

Furthermore, in the foregoing description, the outdoor introducing port is designed in a circular shape, however, it may be designed in any shape such as an elliptical shape, a polygonal shape or the like.

[0022] Still furthermore, in the foregoing description, the suction grille is designed as a fixed type. However, the present invention may be applied to an air conditioner having a suction grille elevating device. The suction grille elevating device supports the suction grille through four suspending cords to the air conditioner main body, and upwardly and downwardly moves the suction grille by playing out or rewinding the suspending cords. The filter mounted on the suction grille can be detached while the suction grille is downwardly moved to a lower position.

In this case, the suction grille elevating device is accommodated in the side cover, the rear surface panel is preferable as the space in which the outdoor introducing port is provided , and thus this embodiment is preferably applied.

[0023] In the foregoing description, the outdoor introducing port is provided to the rear surface panel, however, it may be provided to the side cover side.

Brief Description of the Drawings

[0024]

[Fig. 1] is a perspective view showing the outlook construction of a ceiling-suspended air conditioner according to an embodiment.

[Fig. 2] is a cross-sectional view showing the internal construction of the air conditioner main body.

[Fig. 3] is a plan view showing the internal construction of the air conditioner main body.

[Fig. 4] is a partially exploded perspective view from the rear surface side of the air conditioner main body.

[Fig. 5] is a partially enlarged perspective view from the rear surface side of the air conditioner main body.

Description of Reference Numerals

[0025]

1	ceiling-suspended type air conditioner
1a	air conditioner main body
11	electrical part box (electrical part)
14	bottom panel
25	motor (electrical part)
37	suction grille
39	filter
41	air blow-out port
45	side cover
60	rear surface panel
61	pipe connecting hole
61A	lid
62	outdoor air introducing port

Claims

1. A ceiling-suspended type air conditioner having a heat exchanger and an air blower disposed in this order from the front surface thereof provided with an air blow-out port, and a suction grille provided to the bottom surface of a chamber in which the air blower is accommodated, the air conditioner being set up while suspended from the ceiling of a room, **characterized by** further comprising an air conditioner main body having electrical parts accommodated therein, wherein the air conditioner main body has a rear surface panel and the rear panel is provided with an outdoor air introducing port at such a position that the outdoor air thus introduced does not directly impinge against the electrical parts.

2. The ceiling-suspended type air conditioner according to claim 1, wherein the outdoor air introducing port is constructed as a freely-detachable knock-out panel.

3. The ceiling-suspended type air conditioner according claim 1, wherein the electrical parts contain at least one of an air blower motor constituting the air blower, an electrical part box and an electrical connector.

4. The ceiling-suspended type air conditioner according to claim 1, wherein the outdoor air introducing port is disposed at such a position that the outdoor air is directly led to a fan constituting the air blower.

5. The ceiling-suspended type air conditioner according to claim 1, wherein the outdoor air introducing port is designed to have such an opening area that the mixing ratio between the indoor air circulated through the suction grille and the introduced outdoor air is equal to a predetermined ratio in accordance with the air blowing capability of the fan constituting the air blower.

6. The ceiling-suspended type air conditioner according to claim 5, wherein the predetermined ratio is set in accordance with the ventilation capability per unit time to be required.

FIG. 1

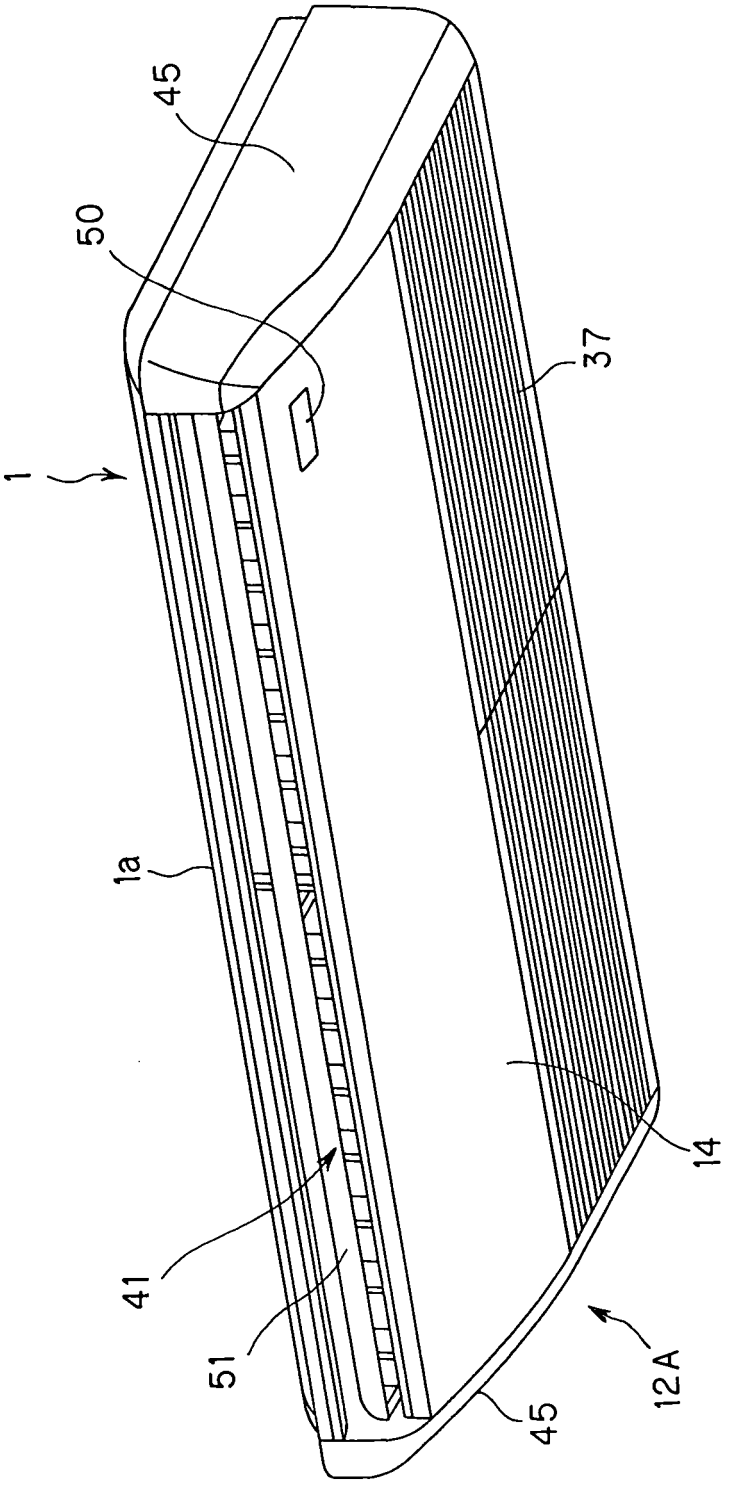


FIG. 2

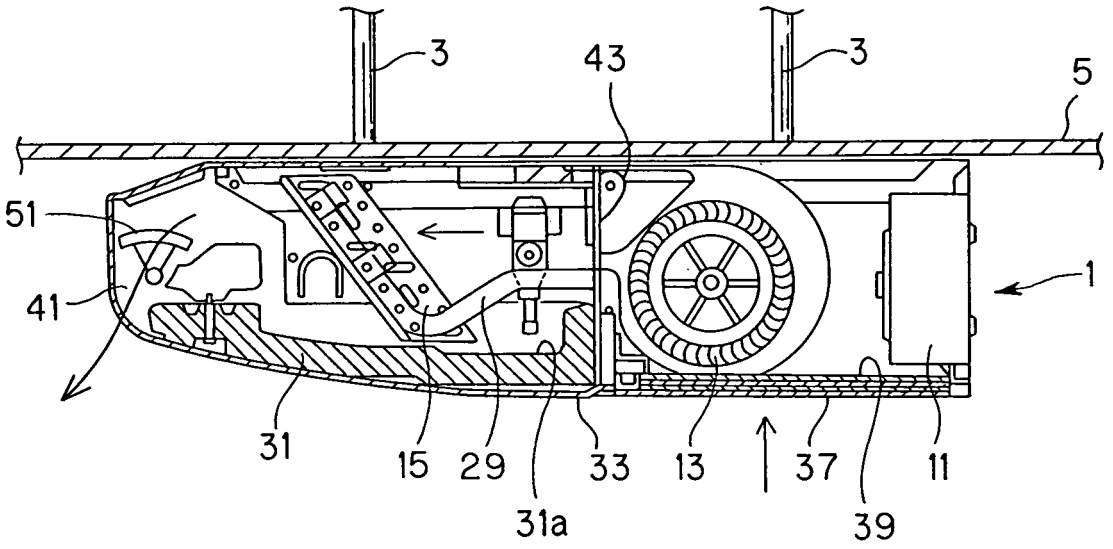


FIG. 3

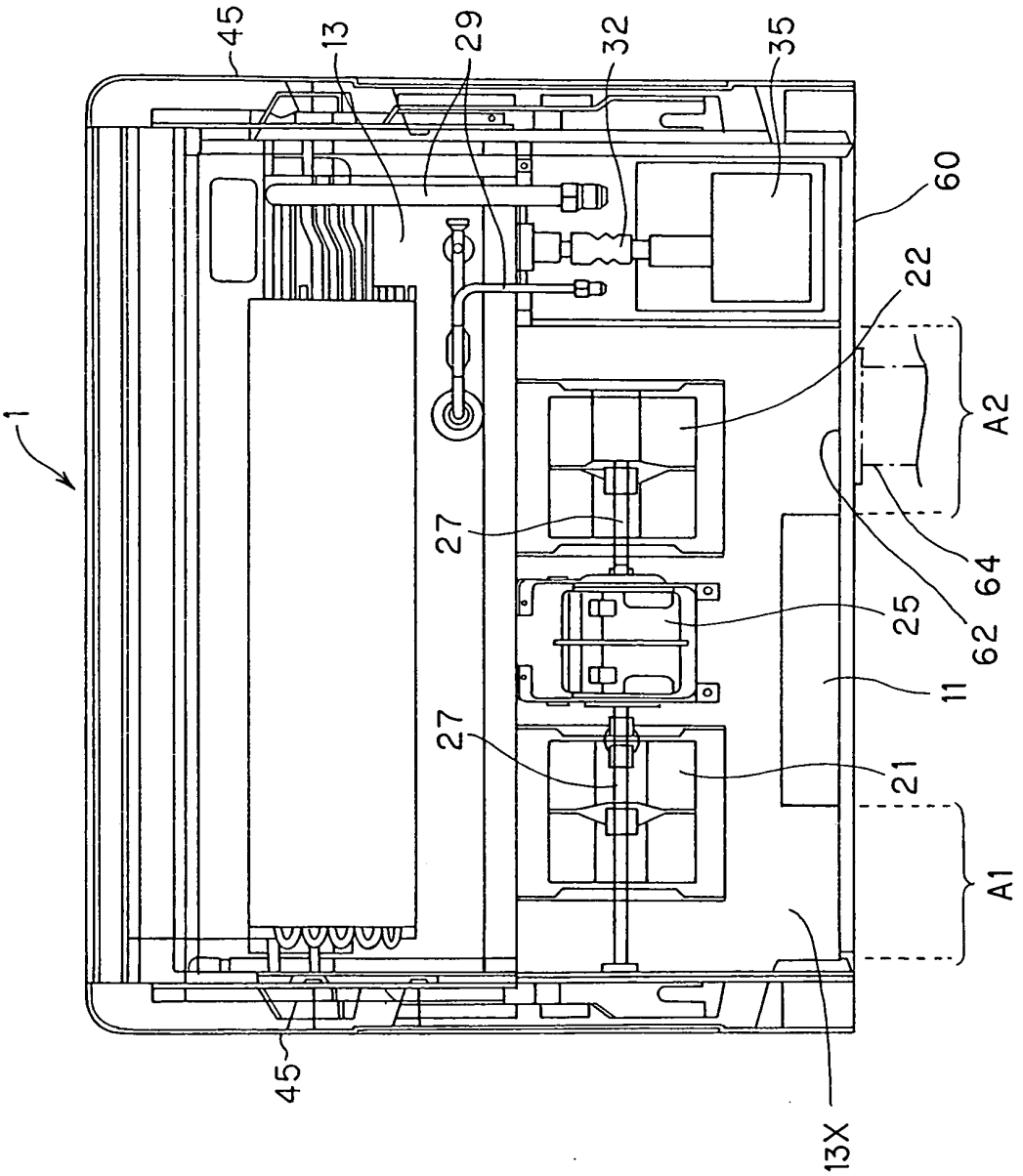


FIG. 4

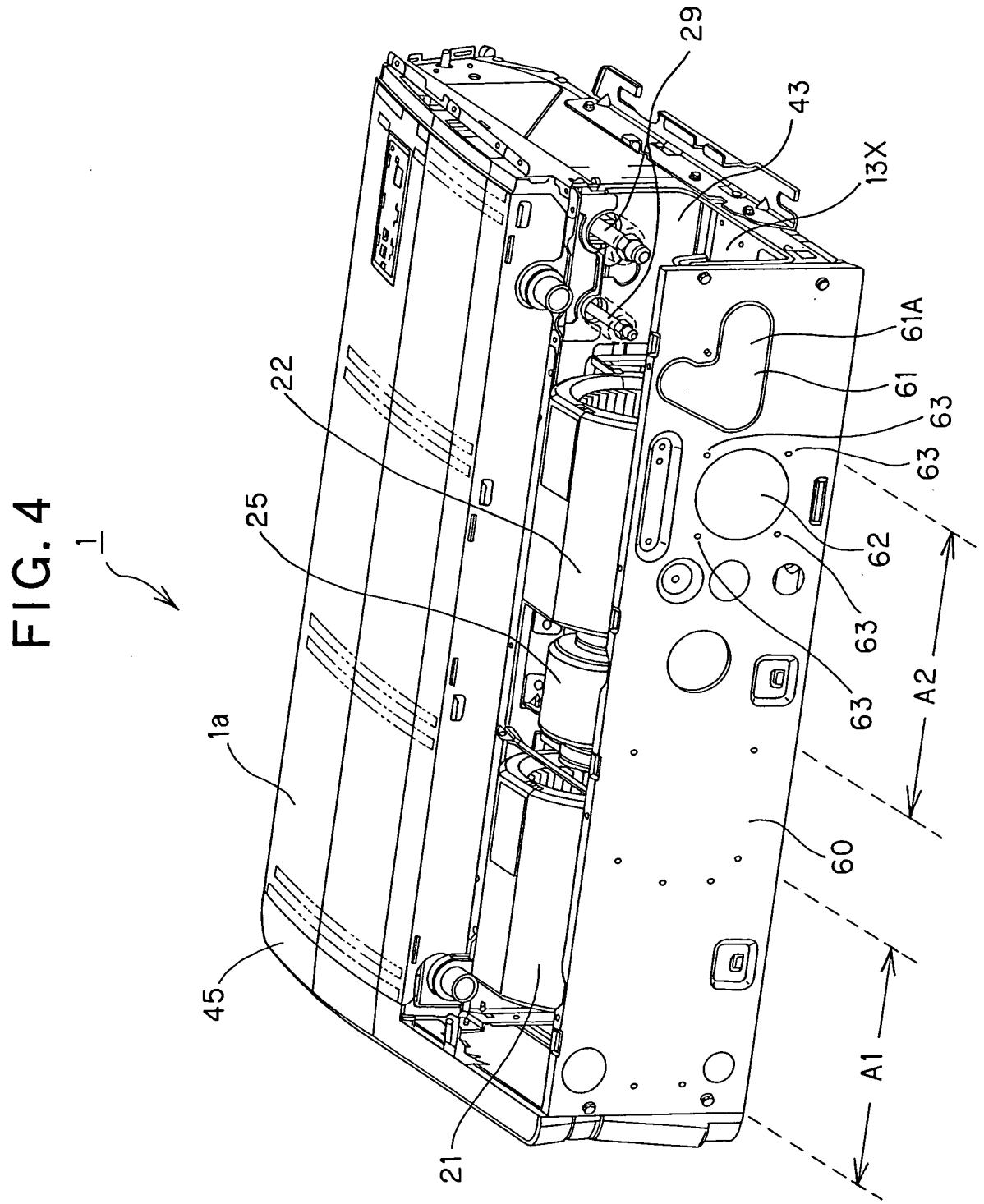
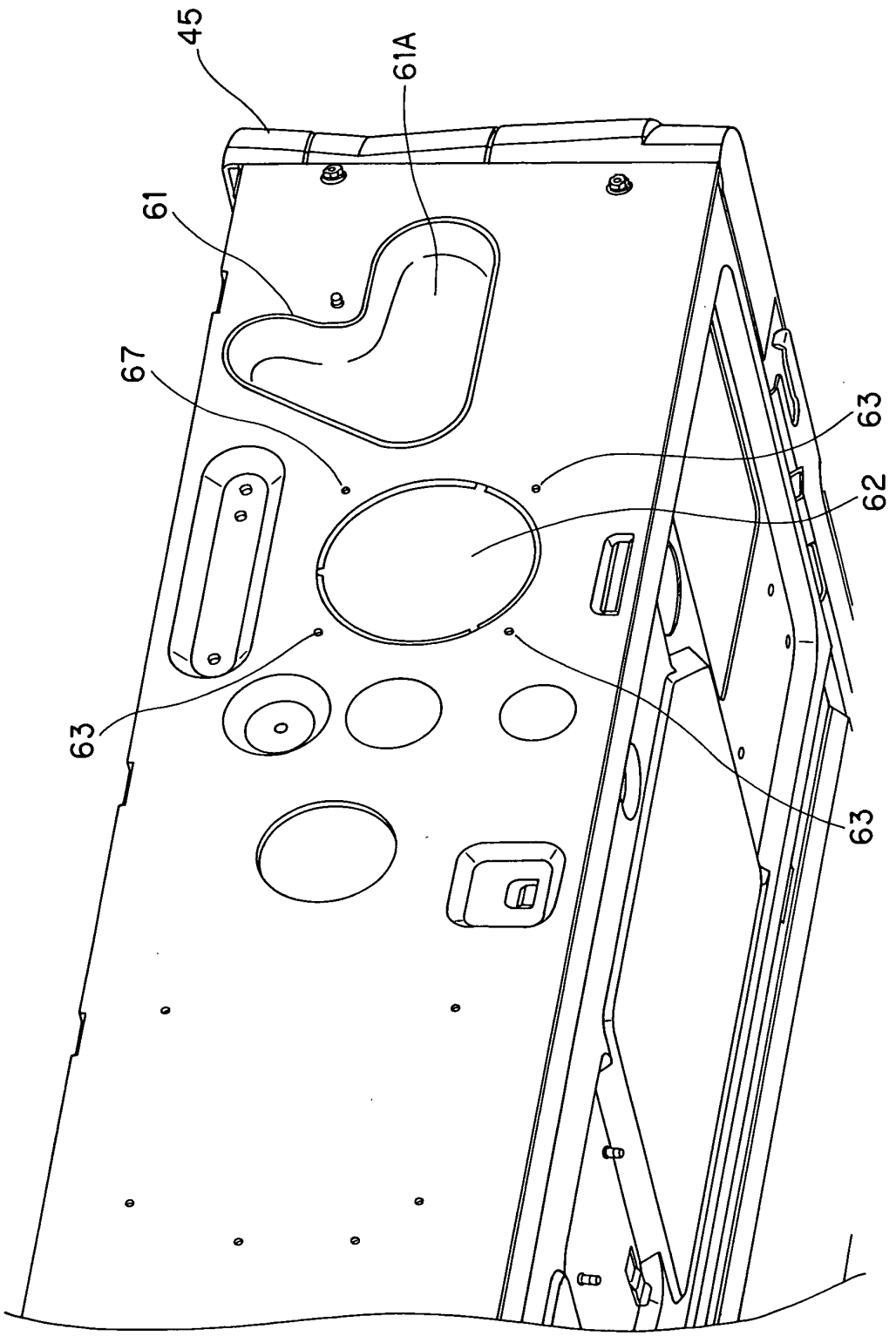


FIG. 5



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2004/017382

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[7] F24F1/00

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl[7] F24F1/00

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 1996-2005
Kokai Jitsuyo Shinan Koho 1971-2005 Toroku Jitsuyo Shinan Koho 1994-2005

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 11-108386 A (Sanyo Electric Co., Ltd.), 23 April, 1999 (23.04.99), Full text; Figs. 1 to 2 (Family: none)	1-6
Y	CD-ROM of the specification and drawings annexed to the request of Japanese Utility Model Application No. 12268/1992(Laid-open No. 73422/1993) (Fujitsu General Ltd.), 08 October, 1993 (08.10.93), Full text; all drawings (Family: none)	1-6

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
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Date of the actual completion of the international search	Date of mailing of the international search report
28 January, 2005 (28.01.05)	15 February, 2005 (15.02.05)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2004/017382

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 54-42125 Y2 (Mitsubishi Electric Corp.), 07 December, 1979 (07.12.79), Full text; all drawings (Family: none)	1-6
Y	JP 4-22181 Y2 (Daikin Industries, Ltd.), 20 May, 1992 (20.05.92), Full text; all drawings (Family: none)	1-6
Y	JP 2001-165484 A (Mitsubishi Electric Corp.), 22 June, 2001 (22.06.01), Par. No. [0015]; Fig. 1 (Family: none)	2
Y	JP 2002-38586 A (Toto Ltd.), 06 February, 2002 (06.02.02), Par. No. [0037]; Fig. 3 (Family: none)	2

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