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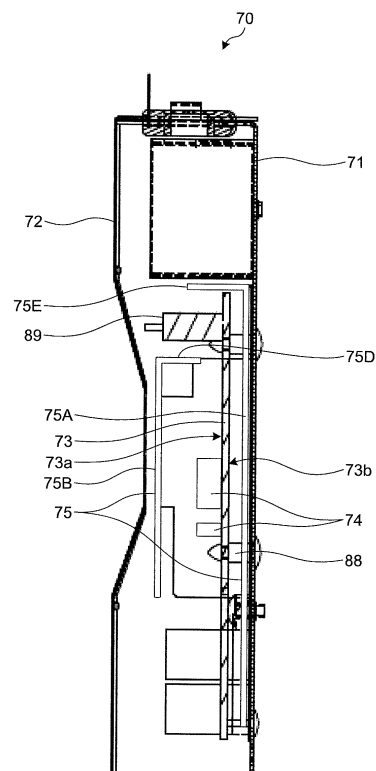
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(54) **VENTILATION DEVICE**

(57) The present invention includes a main body, a blower provided inside the main body, an electrical box (70) provided inside the main body, a control board (73) fixed inside the electrical box (70), an electronic component (74) mounted to a first face (73a) of the control board (73), and an insulation sheet (75) provided inside the electrical box (70). The insulation sheet (75) includes a first area (75A) between the electrical box (70) and a second face (73b) that is a rear face of the control board (73) with respect to the first face (73a), and a second area (75B) covering the first face (73a).

FIG.5



Description

Field

[0001] The present invention relates to a ventilator including an electrical box.

Background

[0002] A ventilator including blowers inside its main body is provided with a control board. The control board is mounted with electronic components that drive the blowers. The control board is housed in an electrical box that is made of metal and is provided inside the main body. Structure disclosed in Patent Literature 1 is such that an insulation sheet is provided between an electrical box and a control board for the purpose of ensuring insulation between the box and the control board.

Citation List

Patent Literature

[0003] Patent Literature 1: Japanese Patent No. 5143079

Summary

Technical Problem

[0004] The electrical box of the ventilator is composed of a case and a cover with a gap between the case and the cover. Inside the main body of the ventilator, air convection and a pressure change are caused when the blowers are driven, so that dust can enter the electrical box from the gap between the case and the cover. The dust easily enters the electrical box particularly when the ventilator is used in a harsh environment that is dusty.

[0005] If the dust entering the electrical box accumulates on the control board and the electronic components mounted on the control board, the dust deposit may cause a short circuit between the electronic components and thus may cause the ventilator to malfunction. The control board is covered by the insulation sheet disclosed in Patent Literature 1 at its face that is not mounted with the electronic components, so that the insulation sheet cannot prevent dust from accumulating on the electronic components.

[0006] The present invention has been made in view of the above, and an object of the present invention is to obtain a ventilator that does not cause dust to easily accumulate on a control board provided inside a main body as well as on electronic components mounted on the control board.

Solution to Problem

[0007] To solve the above-stated problem and to

achieve the object, the present invention includes: a main body; a blower provided inside the main body; an electrical box provided inside the main body; a control board fixed inside the electrical box; an electronic component mounted to a first face of the control board; and an insulation sheet provided inside the electrical box. The insulation sheet includes a first area between the electrical box and a second face that is a rear face of the control board with respect to the first face, and a second area covering the first face.

Advantageous Effect of Invention

[0008] The ventilator according to the present invention does not cause dust to easily accumulate on the control board provided inside the main body as well as on the electronic component mounted on the control board.

Brief Description of Drawings

[0009]

FIG. 1 is a front view of a ventilator according to a first embodiment of the present invention.

FIG. 2 is an exploded perspective view of the ventilator according to the first embodiment.

FIG. 3 is a perspective view of an electrical box according to the first embodiment.

FIG. 4 is a perspective view illustrating the electrical box according to the first embodiment, with a cover removed.

FIG. 5 is a sectional view of the electrical box according to the first embodiment.

FIG. 6 is a perspective view of an insulation sheet according to the first embodiment.

FIG. 7 is a front view of the insulation sheet according to the first embodiment.

FIG. 8 is a left side view of the insulation sheet according to the first embodiment.

FIG. 9 is a right side view of the insulation sheet according to the first embodiment.

FIG. 10 is a top view of the insulation sheet according to the first embodiment.

FIG. 11 is a bottom view of the insulation sheet according to the first embodiment.

FIG. 12 is a rear view of the insulation sheet according to the first embodiment.

FIG. 13 is a sectional view of the electrical box when the ventilator according to the first embodiment is installed vertically.

Description of Embodiment

[0010] With reference to the drawings, a detailed description is hereinafter provided of a ventilator according to an embodiment of the present invention. It is to be noted that this embodiment is not restrictive of the inven-

tion.

First Embodiment.

[0011] FIG. 1 is a front view of the ventilator according to the first embodiment of the present invention. FIG. 2 is an exploded perspective view of the ventilator according to the first embodiment. The ventilator 1 is of a wall-mounted type that is mounted, for example, in a room wall. The ventilator 1 includes a front panel 10, a front casing 20, a back casing 30, an inner casing 40, blowers 50A and 50B, a heat exchanger 60, an electrical box 70, and a terminal block box 80.

[0012] The front panel 10, the front casing 20, and the back casing 30 compose a main body of the ventilator 1. The front panel 10 is detachably mounted to a front of the front casing 20. The front panel 10 includes, at its front, a room interior outlet 11 through which outside air is expelled from the main body. The front panel 10 includes, at its top and bottom, room interior inlets 12 through which room air is drawn into the main body.

[0013] The front casing 20 includes a supply air opening 21 communicating with the room interior outlet 11, and an exhaust air opening 22 communicating with the room interior inlets 12.

[0014] The back casing 30 is mounted to a rear of the front casing 20. The back casing 30 includes an outside inlet 31 through which the outside air is drawn into the main body, and an outside outlet 32 through which the room air is expelled from the main body.

[0015] The inner casing 40 is mounted between the front casing 20 and the back casing 30. The inner casing 40 includes: a supply air passage 41 that lets the outside air flow from the outside inlet 31 toward the supply air opening 21; and an exhaust air passage 42 that lets the room air flow from the exhaust air opening 22 toward the outside outlet 32.

[0016] The inner casing 40 is mounted with the blowers 50A and 50B. The blower 50A is positioned to face the outside inlet 31 and creates the supply air flow through the supply air passage 41. The blower 50B is positioned to face the exhaust air opening 22 and creates the exhaust air flow through the exhaust air passage 42. The blower 50A includes a motor 51A and an impeller 52A. The blower 50B includes a motor 51B and an impeller 52B. The motors 51A and 51B are mounted to a motor mounting plate 53. The motor mounting plate 53 is mounted to the back casing 30 and the inner casing 40 so as to separate the exhaust air flow and the supply air flow.

[0017] The heat exchanger 60 causes heat exchange between the supply air flow and the exhaust air flow that flow through the supply air passage 41 and the exhaust air passage 42, respectively. The heat exchanger 60 is, for example, of rectangular-parallelepiped shape and has structure that only lets the air flow in a direction toward its opposite side. The heat exchanger 60 is held in the inner casing 40, and one of its two sides positioned respectively near the blowers 50A and 50B is where the

supply air flow enters, while the other side is where the exhaust air flow enters. The heat exchanger 60 touches the inner casing 40 at its top and bottom, so that the supply air flow and the exhaust air flow are prevented from mixing.

[0018] The electrical box 70 is housed between the front casing 20 and the back casing 30. This means that the electrical box 70 is provided inside the main body.

[0019] FIG. 3 is a perspective view of the electrical box 70 according to the first embodiment. FIG. 4 is a perspective view illustrating the electrical box 70 according to the first embodiment, with a cover removed. FIG. 5 is a sectional view of the electrical box 70 according to the first embodiment.

[0020] The electrical box 70 includes a case 71 having one side as an opening 71b, and the cover 72 covering the opening 71b of the case 71. A control board 73 is provided inside the electrical box 70. The control board 73 is fixed to the case 71 via spacers 88. A first face 73a of the control board 73 is mounted with a plurality of electronic components 74. The cover 72 covers the first face 73a of the control board 73 and the plurality of electronic components 74. The control board 73 is provided with a connector 89 connectable to lead wires (not illustrated). The control board 73 is connected to the motors 51A and 51B via the lead wires.

[0021] An insulation sheet 75 as an insulator is provided inside the electrical box 70. FIG. 6 is a perspective view of the insulation sheet 75 according to the first embodiment. FIG. 7 is a front view of the insulation sheet 75 according to the first embodiment. FIG. 8 is a left side view of the insulation sheet 75 according to the first embodiment. FIG. 9 is a right side view of the insulation sheet 75 according to the first embodiment. FIG. 10 is a top view of the insulation sheet 75 according to the first embodiment. FIG. 11 is a bottom view of the insulation sheet 75 according to the first embodiment. FIG. 12 is a rear view of the insulation sheet 75 according to the first embodiment.

[0022] Conductive parts of the electronic components 74 need to be covered with a strong structure in order to be protected from contact with a person. For this reason, the electrical box 70 housing the control board 73 has its case 71 and cover 72 that are made of metal fixed to each other by a screw 65, thus protecting the conductive parts of the electronic components 74 from external contact.

[0023] Moreover, insulation needs to be ensured between the metal case 71 and the control board 73 fixed to the case 71. Increasing a distance between the case 71 and the control board 73 or placing an insulator is a means of ensuring the insulation between the case 71 and the control board 73. In order for the electrical box 70 to be prevented from getting large as a result of the increased distance between the case 71 and the control board 73, placing the insulator is what is often chosen between these means.

[0024] In the first embodiment, as illustrated in FIGS.

5 and 6, the insulation sheet 75 includes a first area 75A between the case 71 and a second face 73b that is a rear face of the control board 73 with respect to the first face 73a. The first area 75A covers the second face 73b of the control board 73.

[0025] The insulation sheet 75 also includes a second area 75B covering the first face 73a of the control board 73. It is to be noted that the second area 75B covers a region, avoiding the connector 89. The insulation sheet 75 also includes third areas 75E, 75F, 75G, and 75H that are formed by bending ends of the first area 75A toward the second area 75B, and a third area 75D that is formed by bending an end of the second area 75B toward the first area 75A. The third area 75D is positioned inwardly of the connector 89. The third area 75E is positioned outwardly of the control board 73.

[0026] The insulation sheet 75 also includes a fourth area 75C connecting the first area 75A and the second area 75B. A sheet projection 76 is formed where the second area 75B and the fourth area 75C join, projecting toward an inner wall of the case 71. As illustrated in FIG. 4, the sheet projection 76 abuts a case projection 71a formed on the inner wall of the case 71. When the sheet projection 76 abuts the case projection 71a, the insulation sheet 75 is positioned inside the electrical box 70. In this way, a clearance is ensured, for example, between the inner wall of the case 71 and the fourth area 75C to facilitate passage of the lead wire 95. In other words, ease of work can be improved when the wires are routed inside the electrical box 70.

[0027] It is to be noted that the sheet projection 76 is not positionally limited to where the second area 75B and the fourth area 75C join. The sheet projection 76 has only to project from any part of the insulation sheet 75 to abut the inner wall of the electrical box 70. In the first embodiment, a U-shaped cut is made in the fourth area 75C, and a part surrounded by this cut is raised to become the sheet projection 76.

[0028] With the insulation sheet 75 including the first area 75A, the second area 75B, the third areas 75D, 75E, 75F, 75G, and 75H, and the fourth area 75C, accumulation of dust on the control board 73 and the electronic components 74 is suppressed.

[0029] In the example illustrated in FIG. 1, for example, a posture of the ventilator 1 is such that a longitudinal direction of the main body is aligned with a horizontal direction. This posture is simply referred to as horizontal installation. When the ventilator 1 is disposed horizontally, the electrical box 70 is disposed in a posture illustrated in FIG. 5. Dust mostly comes down from above when accumulating on the control board 73 and the electronic components 74. With the ventilator 1 being installed horizontally, an upper side of the control board 73 and an upper side of the electronic components 74 are covered by the third areas 75D and 75E. Therefore, the dust coming down from above inside the electrical box 70 is prevented by the third areas 75D and 75E from reaching the control board 73 and the electronic components 74. With

the ventilator 1 being installed horizontally, accumulation of the dust on the control board 73 and the electronic components 74 is thus suppressed by the third areas 75D and 75E.

[0030] A description is provided next of a case where a posture of the ventilator 1 disposed is such that the longitudinal direction of the main body is aligned with a vertical direction. This posture is simply referred to as vertical installation. FIG. 13 is a sectional view of the electrical box 70 when the ventilator 1 according to the first embodiment is installed vertically. In this case, an upper side of the first face 73a of the control board 73 and the electronic components 74 is covered by the second area 75B. Therefore, dust coming down from above inside the electrical box 70 is prevented by the second area 75B from reaching the first face 73a of the control board 73 and the electronic components 74. With the ventilator 1 being installed vertically, accumulation of the dust on the control board 73 and the electronic components 74 is thus suppressed by the second area 75B.

[0031] As described above, the ventilator 1 according to the first embodiment can suppress accumulation of dust on the control board 73 and the electronic components 74 even when its installation posture is changed. It is to be noted that not only when the ventilator 1 is installed horizontally or vertically, but also when the ventilator 1 is installed in other various postures, the insulation sheet 75 is partly positioned above the control board 73 and the electronic components 74, thus being capable of suppressing accumulation of dust on the control board 73 and the electronic components 74.

[0032] Because the plurality of installation postures are possible with the ventilator 1, when mounted, for example, in a wall with a smaller width than a longitudinal dimension of the main body, the ventilator 1 can be installed vertically. Because the posture of the ventilator 1 is thus selectable according to an installation place for the ventilator 1 and a position of a window or a beam that is provided in the installation place for the ventilator 1, architectural design flexibility improves. The wider range of posture options facilitates improvement of design of an environment in which the ventilator 1 is installed.

[0033] The above structures illustrated in the embodiment are illustrative of contents of the present invention, can be combined with other techniques that are publicly known and can be partly omitted or changed without departing from the gist of the present invention.

Reference Signs List

[0034] 1 ventilator; 10 front panel; 11 room interior outlet; 12 room interior inlet; 20 front casing; 21 supply air opening; 22 exhaust air opening; 30 back casing; 31 outside inlet; 32 outside outlet; 40 inner casing; 41 supply air passage; 42 exhaust air passage; 50A, 50B blower; 51A, 51B motor; 52A, 52B impeller; 53 motor mounting plate; 60 heat exchanger; 70 electrical box; 71 case; 71a case projection; 71b opening; 72 cover; 73 control board;

73a first face; 73b second face; 74 electronic component; 75 insulation sheet; 75A first area; 75B second area; 75C fourth area; 75D, 75E, 75F, 75G, 75H third area; 76 sheet projection; 80 terminal block box; 88 spacer; 89 connector.

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Claims

1. A ventilator comprising: 10
 - a main body;
 - a blower provided inside the main body;
 - an electrical box provided inside the main body;
 - a control board fixed inside the electrical box; 15
 - an electronic component mounted to a first face of the control board; and
 - an insulation sheet provided inside the electrical box,
 - wherein the insulation sheet includes a first area 20 between the electrical box and a second face that is a rear face of the control board with respect to the first face, and a second area covering the first face.
2. The ventilator according to claim 1, wherein the insulation sheet further includes a third area formed of at least one of an end of the first area and an end of the second area that is bent toward the area on an opposite side. 25 30
3. The ventilator according to claim 1 or 2, wherein the insulation sheet further includes a projection projecting toward an inner wall of the electrical box and abutting the inner wall. 35
4. The ventilator according to claim 3, wherein:
 - the insulation sheet further includes a fourth area connecting an end of the first area and an end of the second area; and 40
 - the projection is provided where the fourth area and at least one of the first area and the second area join. 45

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FIG.1

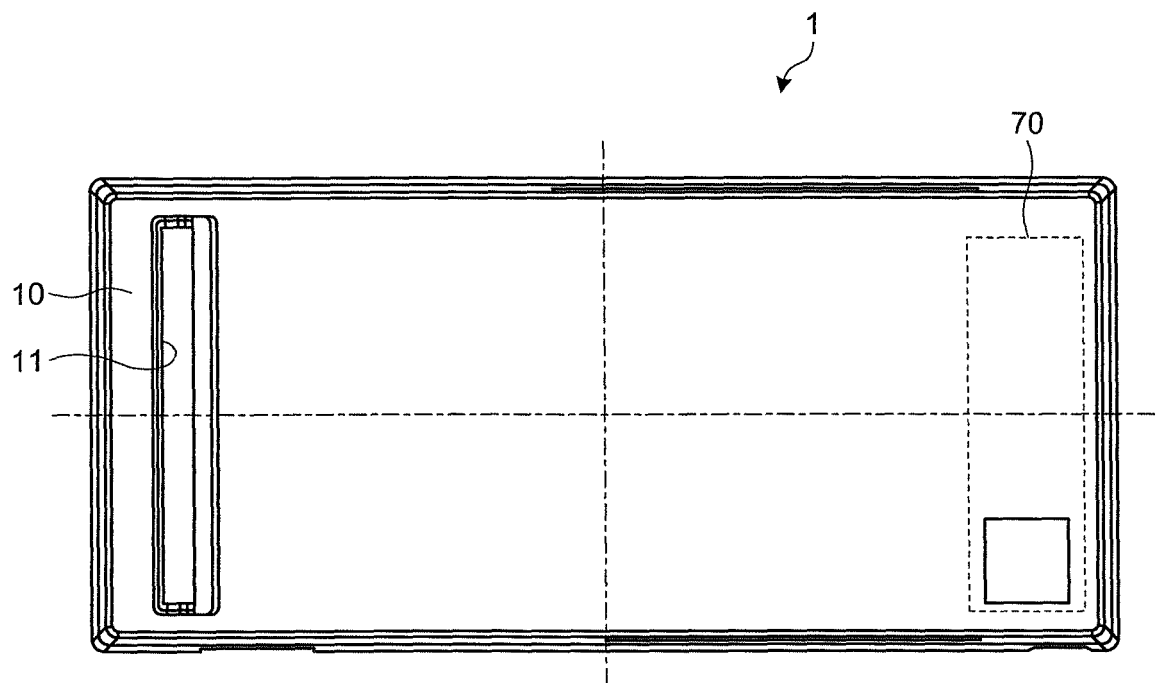


FIG.2

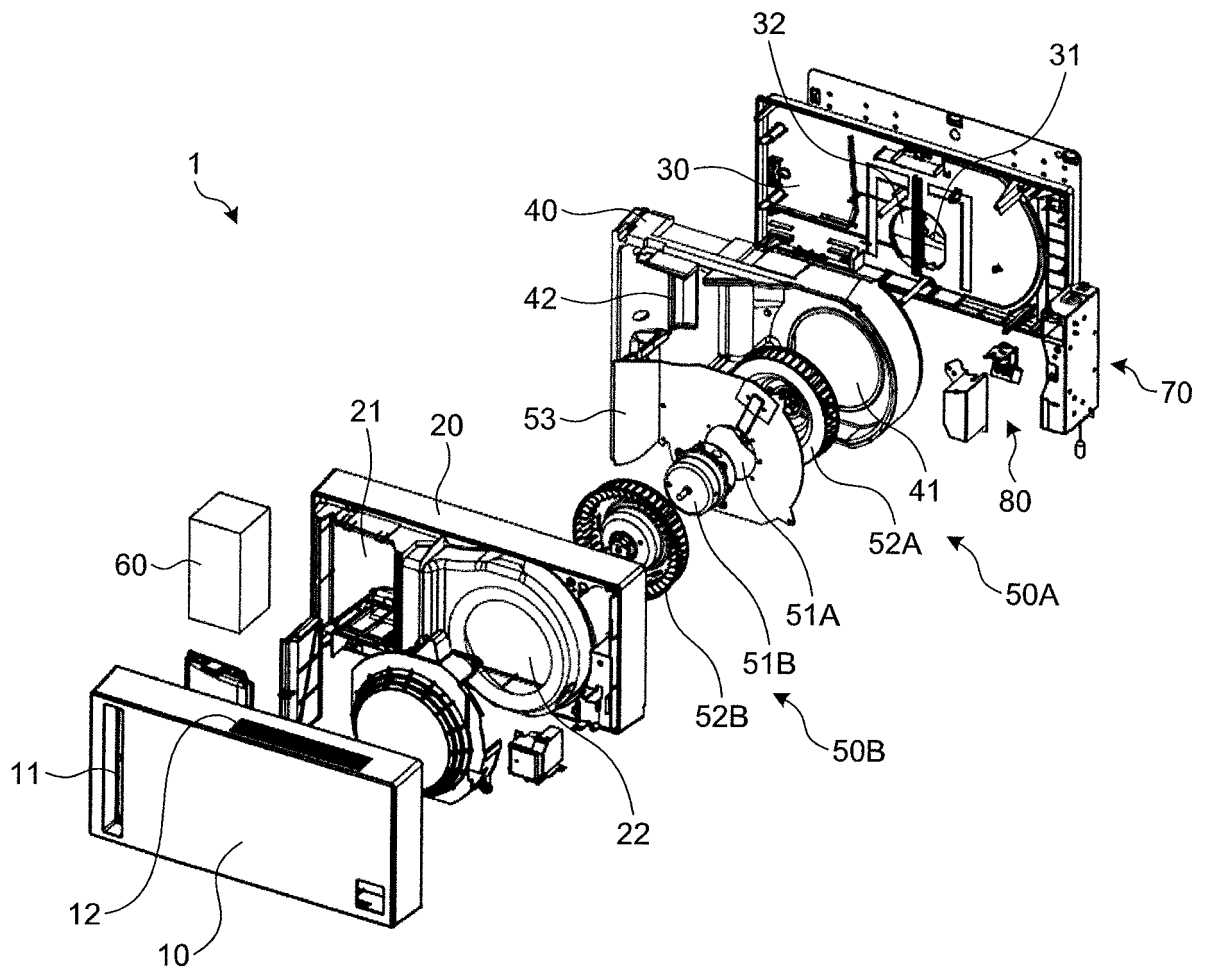


FIG.3

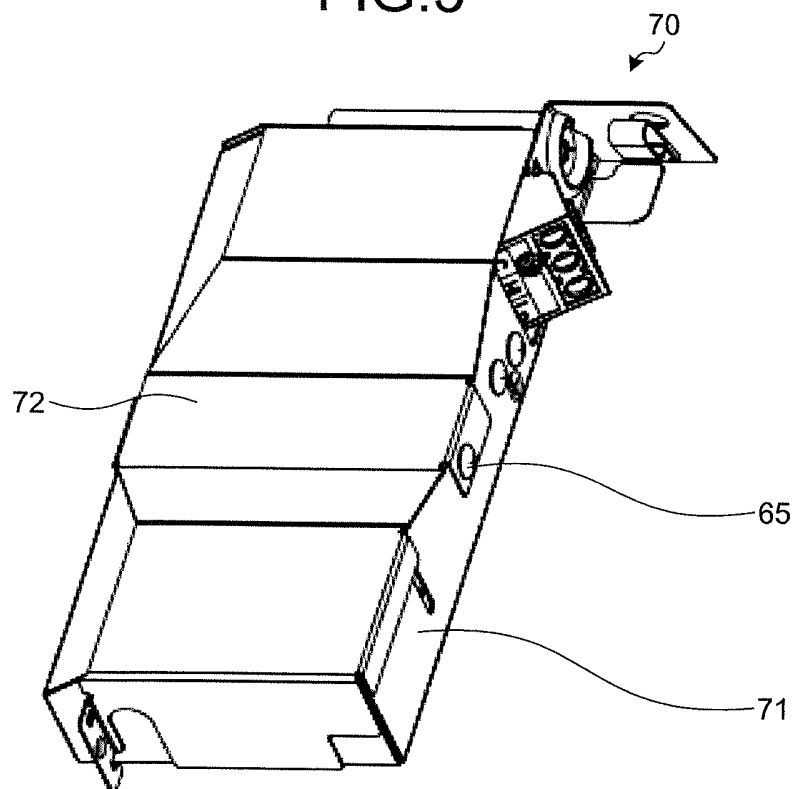


FIG.4

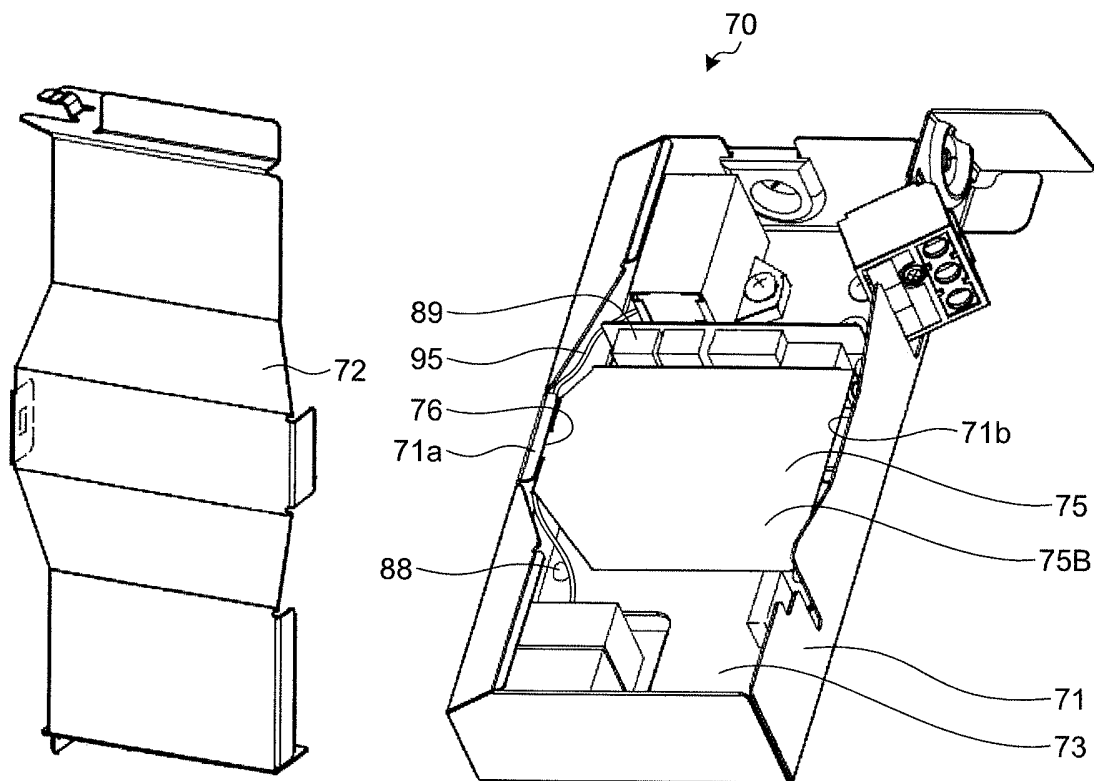


FIG.5

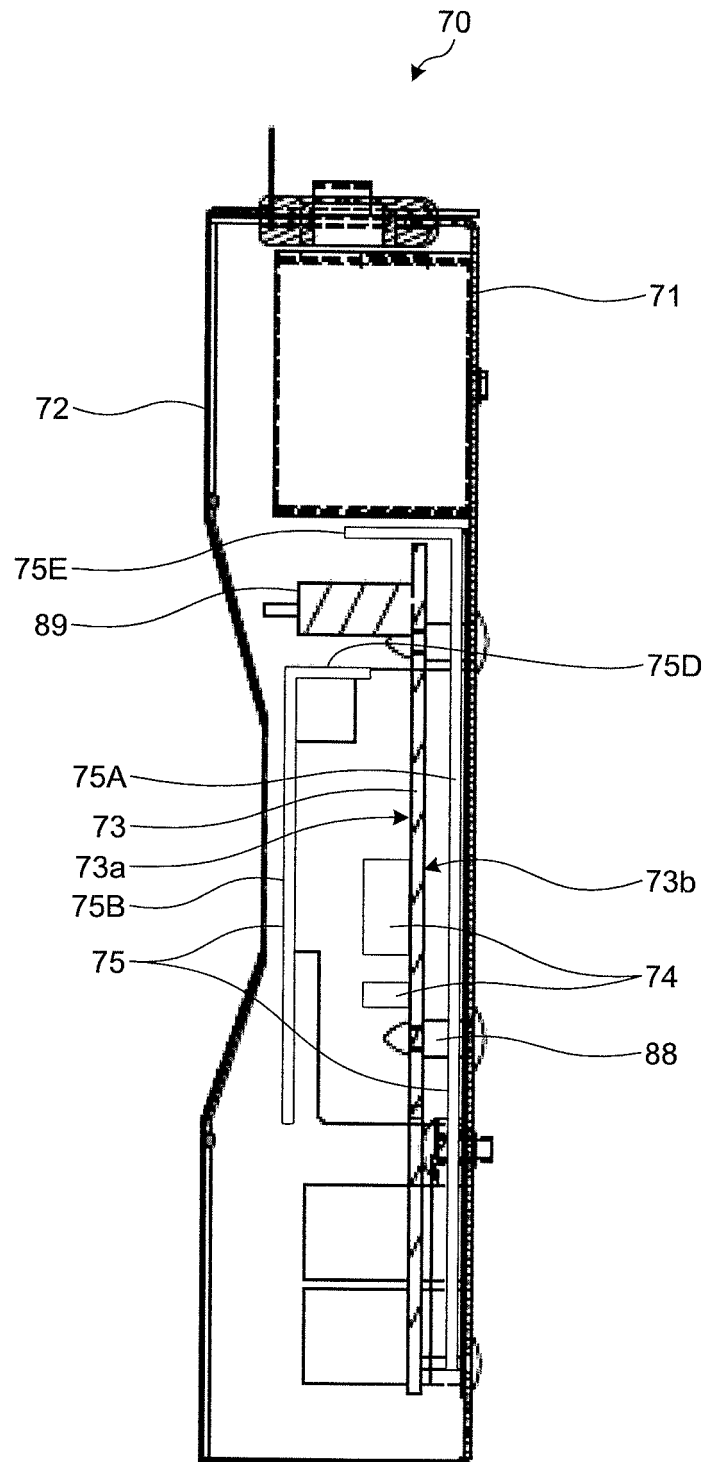


FIG.6

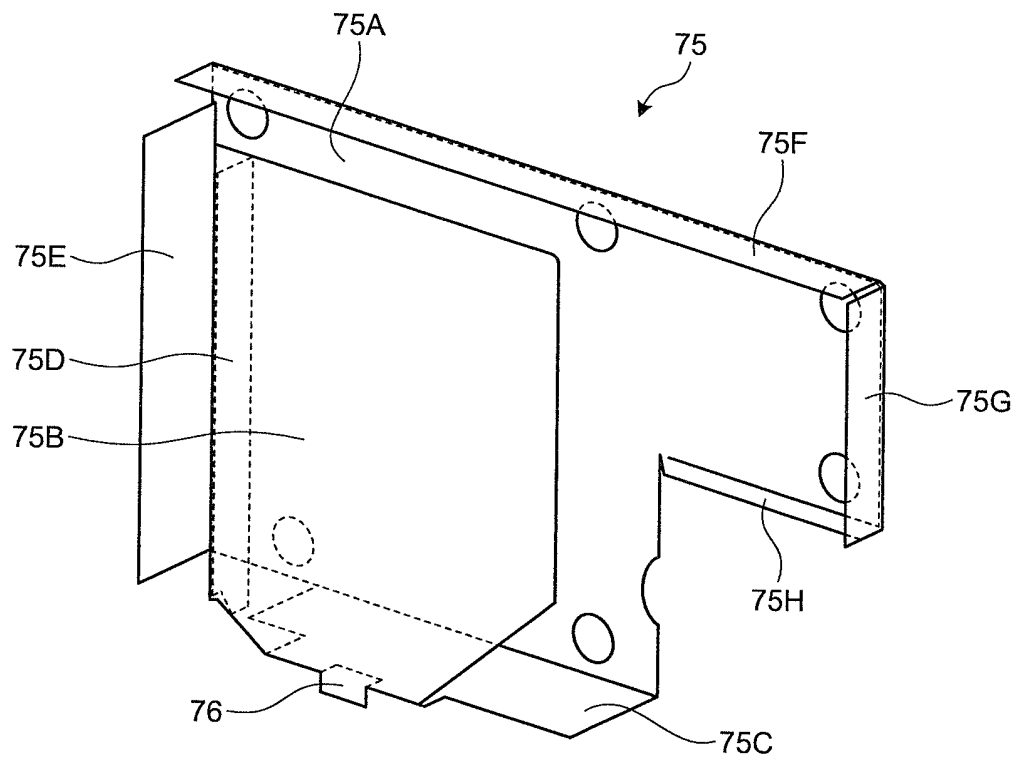


FIG.7

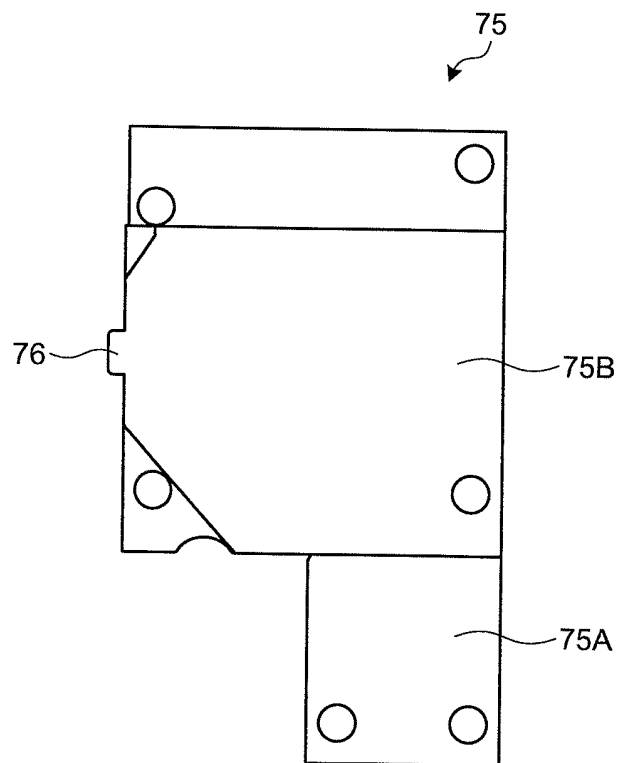


FIG.8

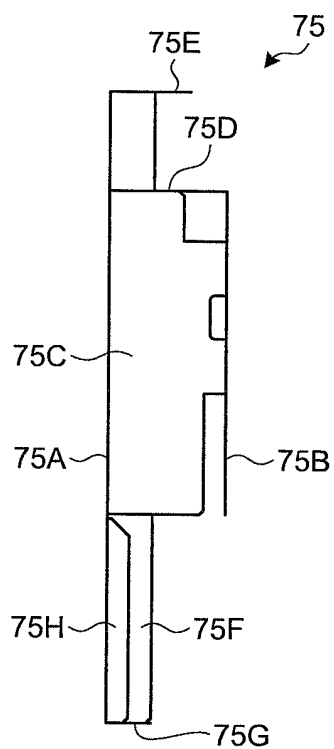


FIG.9

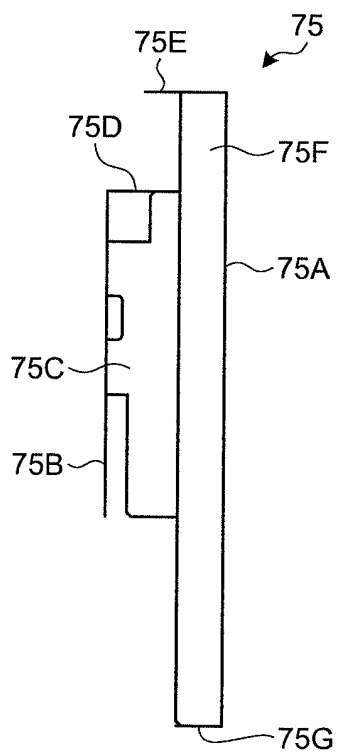


FIG.10

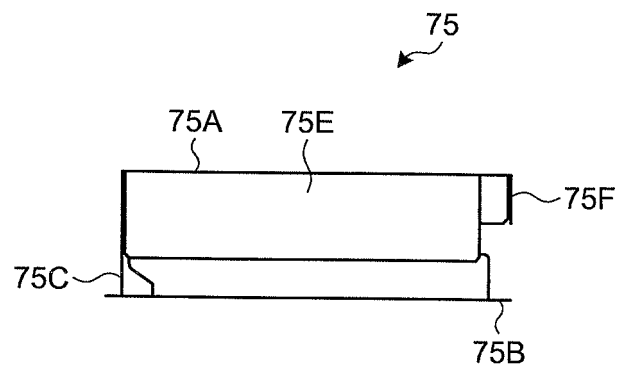


FIG.11

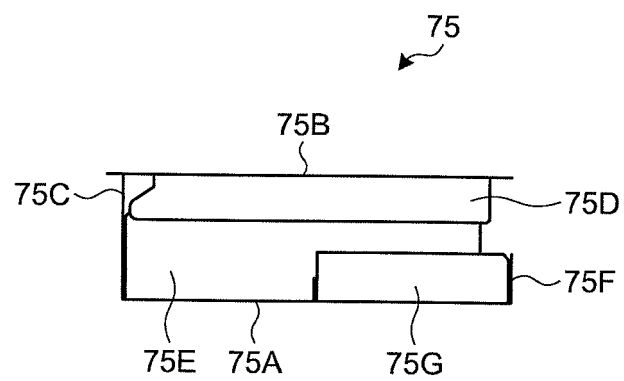


FIG.12

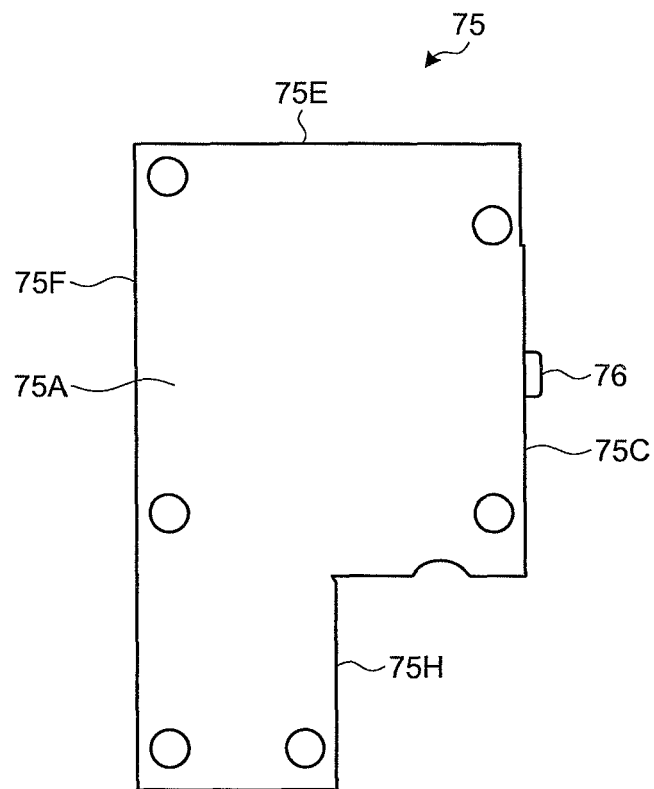
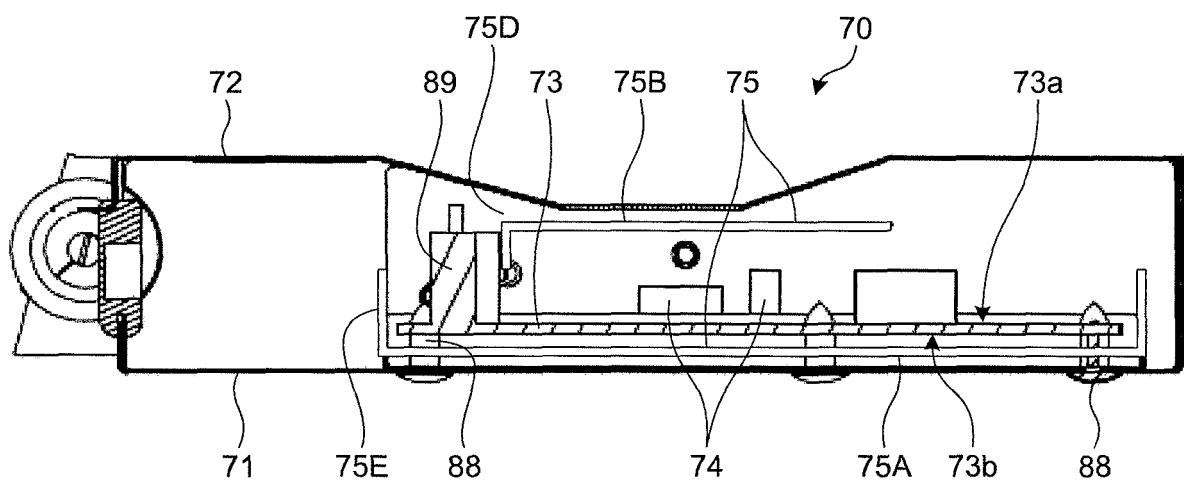


FIG.13



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2017/027090

A. CLASSIFICATION OF SUBJECT MATTER

H05K5/02(2006.01) 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)

H05K5/00-5/06, 7/14, F24F7/10

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 1996-2017

Kokai Jitsuyo Shinan Koho 1971-2017 Toroku Jitsuyo Shinan Koho 1994-2017

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.
A	JP 2014-149106 A (Mitsubishi Electric Corp.), 21 August 2014 (21.08.2014), entire text; all drawings (Family: none)	1-4
A	JP 2009-021315 A (Funai Electric Co., Ltd.), 29 January 2009 (29.01.2009), entire text; all drawings & US 2009/0017672 A1 entire text; all drawings & EP 2015625 A2	1-4
A	JP 2004-214303 A (Hitachi Kokusai Electric Inc.), 29 July 2004 (29.07.2004), entire text; all drawings (Family: none)	1-4

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

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Date of the actual completion of the international search
05 October 2017 (05.10.17)Date of mailing of the international search report
17 October 2017 (17.10.17)Name and mailing address of the ISA/
Japan Patent Office
3-4-3, Kasumigaseki, Chiyoda-ku,
Tokyo 100-8915, Japan

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2017/027090

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 7-262468 A (Nohmi Bosai Ltd.), 13 October 1995 (13.10.1995), entire text; all drawings (Family: none)	1-4

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 5143079 B [0003]