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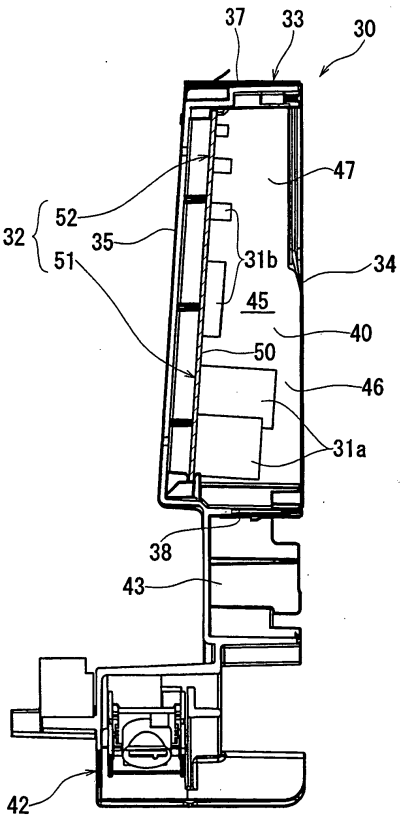
(54) INDOOR UNIT FOR AIR CONDITIONER

(57) .An indoor unit of an air conditioner accommodates an electrical component box 30 in an exterior case 10. The electrical component box 30 has an electrical component board 32 having various electrical components 31a, 31b ... mounted thereon and a box body 33 accommodating the electrical component board 32. The box body 33 includes an openable lid 34 placed along an inner surface of the exterior case 10 and a tilted surface part 35 that is placed so as to be opposed to the openable lid 34 and that is tilted relative to a vertical plane so as to narrow an extra space of an accommodation space 45 in the box body 33. The electrical component board 32 is placed with a tilt along the tilted surface part 35 so that the electrical components 31a, 31b, ... project toward the openable lid 34.

Fig.5



EP 2 072 926 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to an indoor unit of an air conditioner in which an electrical component box is installed.

BACKGROUND ART

[0002] In general, an indoor unit of an air conditioner, having a heat exchanger and a blower fan in an exterior case, cools or heats air taken in by the blower fan through air inlets by passing the air through the heat exchanger and then blows out the air through air outlets into a room.

[0003] In indoor units of this type, in a majority of cases, an electrical component box having a narrow width and a certain height is accommodated in a space that is narrow in width and that is on lateral side of the heat exchanger and the blower fan, for instance, in the exterior case, and an electrical component board having various electrical components mounted thereon is vertically installed in the electrical component box.

[0004] Among electrical component boxes are those provided with an openable lid on a side face thereof, which lid is exposed to outside by removal of the exterior case. Opening of the openable lid allows performance of maintenance such as repair and replacement of the electrical component board.

[0005] The electrical components mounted on the electrical component board, however, have different heights and thus a width of the electrical component box in which the electrical component board is longitudinally installed is set on the basis of an electrical component having the largest height, that is, the largest quantity of projection in a sideward direction (direction of width) from a mount surface of the board. This causes a problem in that a useless space is prone to be produced in the electrical component box and the width of the electrical component box might increase, thus obstructing reduction in size of the indoor unit.

[0006] There has been proposed an indoor unit, e.g., as shown in Fig. 10, having a configuration in which an electrical component box 4 accommodated in a space narrow in width on lateral side of a heat exchanger 2 and a blower fan 3 in an exterior case 1 is provided with an openable lid 5 on a side face thereof facing side parts of the heat exchanger 2 and the blower fan 3, in which an electrical component board 7 is vertically placed along a side part 6 opposed to the openable lid 5, in which the openable lid 5 is unevenly formed according to quantities of projection of electrical components 8 ... from a mount surface of the electrical component board 7 so as to eliminate useless spaces in the electrical component box 4, and in which reduction in width and, therefore, size of the indoor unit is achieved by effective arrangement of a fan motor of the blower fan 3 with use of a recess on the openable lid 5 (see JP 3154923 B2).

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0007] The configuration shown in Fig. 10, however, contributes to the reduction in size of the indoor unit but causes a problem in that work efficiency is deteriorated in maintenance such as repair and replacement of the electrical component board 7 in the electrical component box 4. In the configuration shown in Fig. 10, namely, opening of the openable lid 5 and maintenance of the electrical component board 7 in the electrical component box 4 cannot be carried out without removal of the exterior case 1 and further removal of the electrical component box 4, and thus bothersome works have to be done.

[0008] Though widths of a fan rotor and a fan motor of a blower fan have conventionally been the largest drag on reduction in width of an indoor unit, width of a heat exchanger has been becoming the largest drag in recent years because size reduction of the fan motor has been progressed. The configuration shown in Fig. 10, however, having the fan motor of the blower fan placed in the recess of the openable lid 5 cannot cope with such a situation in recent years as described above and there is room for improvement in the reduction in the width of the indoor unit.

[0009] The invention was made in order to solve conventional problems described above, and an object thereof is to improve a structure of an electrical component box in an indoor unit of an air conditioner, to thereby achieve size reduction of the indoor unit, and to improve maintenance environment of an electrical component board in the electrical component box.

SOLUTION TO PROBLEM

[0010] In order to achieve the object, there is provided an indoor unit of an air conditioner in which an electrical component box is accommodated in an exterior case,

[0011] the electrical component box comprising:

an electrical component board having electrical components mounted thereon, and

a box body accommodating the electrical component board,

the box body comprising:

an openable lid placed along an inner surface of the exterior case, and

a tilted surface part that is placed so as to be opposed to the openable lid and that is tilted relative to a vertical plane so as to narrow an extra space of an accommodation space in the box body, wherein

the electrical component board is placed with a tilt along the tilted surface part so that the electrical components project toward the openable lid.

[0012] According to the indoor unit of the air conditioner of this invention, the openable lid of the box body of the electrical component box is exposed to outside by removal of the exterior case. Therefore, only opening of the openable lid exposed to the outside without removal of the whole electrical component box makes it possible to easily carry out repair and replacement of the electrical component board that is placed so that the electrical components project toward the openable lid in the accommodation space in the box body, and thus maintenance environment can be improved.

[0013] Besides, the extra space of the accommodation space in the box body is narrowed by the tilted surface part of the box body of the electrical component box, so that widths of the electrical component box can partially be reduced and so that size reduction of the indoor unit can be achieved.

[0014] In one embodiment,the electrical component board in the electrical component box comprises:

a first section on which the electrical components having large quantities of projection toward the openable lid are intensively mounted, and
a second section on which the electrical components having smaller quantities of projection toward the openable lid than the electrical components are intensively mounted, wherein
the first section of the electrical component board is placed corresponding to a large accommodation part having large distances between the openable lid and the tilted surface part in the accommodation space in the box body, and wherein the second section of the electrical component board is placed corresponding to a small accommodation part having smaller distances between the openable lid and the tilted surface part than the large accommodation part in the accommodation space in the box body.

[0015] For the accommodation of the electrical component board in the accommodation space in the box body of the electrical component box, according to this embodiment, the first section on which the electrical components having large quantities of projection are intensively mounted and the second section on which the electrical components having small quantities of projection are intensively mounted are placed corresponding to the large accommodation part and the small accommodation part, respectively, so that effective utilization of the accommodation space and considerable reduction of the extra space can be achieved.

[0016] In one embodiment, the openable lid of the box body of the electrical component box is placed along an inner surface of a side wall of the exterior case, wherein the tilted surface part of the box body of the electrical component box is placed so as to face a side part of a heat exchanger accommodated in the exterior case, and wherein refrigerant pipes of the heat exchanger are placed in a vacant space produced by a tilt of the tilted surface section.

[0017] According to this embodiment, the width of the heat exchanger that has been the largest drag in recent years on the reduction in the width of the indoor unit is absorbed by the arrangement of the refrigerant pipes of the heat exchanger with use of the vacant space produced by the tilt of the tilted surface part of the box body in the electrical component box, so that the width of the indoor unit can effectively be reduced and so that size reduction of the indoor unit can more reliably be achieved.

[0018] In one embodiment, the tilted surface part of the box body of the electrical component box is tilted so that upper part of the tilted surface part is closer to the openable lid than lower part of the tilted surface part.

[0019] According to this embodiment, in which the tilted surface part of the box body of the electrical component box is tilted so that the upper part of the tilted surface part is closer to the openable lid than the lower part of the tilted surface part, the electrical component board placed along the tilted surface part can more easily be seen from an operator who performs an operation from diagonally below on lateral side of the indoor unit, once the openable lid is removed in maintenance of the electrical component board, and thus the maintenance environment can further be improved.

BRIEF DESCRIPTION OF DRAWINGS

[0020]

Fig. 1 is a front view of an indoor unit of an air conditioner in accordance with an embodiment of the invention;
Fig. 2 is a vertical section of the indoor unit of the embodiment;
Fig. 3 is a schematic diagram of the indoor unit that illustrates arrangement of a heat exchanger, a blower fan, and an electrical component box in the indoor unit;
Fig. 4 is a front view of the electrical component box of the embodiment;
Fig. 5 is a vertical section of the electrical component box of the embodiment;
Fig. 6 is a side view of the electrical component box of the embodiment;
Fig. 7 is a front view showing an internal structure of the indoor unit from which an exterior case has been removed;
Fig. 8 is an enlarged view of main parts of the indoor unit;
Fig. 9 is a side view of the indoor unit; and
Fig. 10 is a schematic diagram of an indoor unit that illustrates conventional arrangement of a heat exchanger, a blower fan, and an electrical component box.

DESCRIPTION OF EMBODIMENTS

[0021] An embodiment of the invention will be described in detail with reference to the drawings. As shown in Figs. 1 and 2, an indoor unit of an air conditioner in accordance with the embodiment of the invention has an heat exchanger 11 and a blower fan 12 in an exterior case 10, cools or heats air taken in by the blower fan 12 through inlet ports 13 by passing the air through the heat exchanger 11, and then blows out the air through air outlets 14 formed on front face of lower part of the exterior case 10.

[0022] The exterior case 10 is detachably mounted on a bottom frame 20 having the heat exchanger 11 and the blower fan 12 fixed thereto. The heat exchanger 11 has a fin 21 which is shaped like an inverted letter "V" and which is pierced by refrigerant pipes 22, and the blower fan 12 is placed so that a portion thereof is surrounded by the fin 21.

[0023] In the exterior case 10, as shown in Fig. 3, an electrical component box 30 is accommodated on lateral side of the heat exchanger 11 and the blower fan 12. Specifically, the electrical component box 30 is placed in a space narrow in width between the heat exchanger 11, the blower fan 12 and one side wall 23 of the exterior case 10.

[0024] Figs. 4 through 6 show a structure of the electrical component box 30. The electrical component box 30 has an electrical component board 32 having various electrical components 31a, 31b ... mounted thereon and a box body 33 accommodating the electrical component board 32 in a vertical position.

[0025] The box body 33 is composed of a first side surface part 34 extending vertically along an inner surface of the side wall 23 of the exterior case 10, a second side surface part 35 that is provided so as to be opposed to the first side surface part 34 and so as to face a side part of the heat exchanger 11, a top surface part 37 stretched laterally between upper ends of the first side surface part 34 and the second side surface part 35, a bottom surface part 38 stretched laterally between lower ends of the first side surface part 34 and the second side surface part 35, a front surface part 39 stretched between front ends of the first side surface part 34 and the second side surface part 35 and extending vertically, and a rear surface part 40 stretched between rear ends of the first side surface part 34 and the second side surface part 35 and extending vertically. To the bottom surface part 38, a reception display part 42 corresponding to a display panel 41 provided on the exterior case 10 is connected through an arm 43.

[0026] The first side surface part 34 of the box body 33 is composed of an openable lid that opens or closes an accommodation space 45 in the box body 33, and the second side surface part 35 that is placed so as to be opposed to the openable lid 34 is formed as a tilted surface part tilted relative to a vertical plane. The tilted surface part 35 is tilted so that upper part of the tilted surface part 35 is closer to the openable lid 34 than lower part of the tilted surface part 35. In the accommodation space 45 in the box body 33, accordingly, distances between the openable lid 34 and the tilted surface part 35 decrease in an upward direction.

[0027] As shown in Fig. 5, the electrical component board 32 has a first section 51 on which tall electrical components 31a ... having large quantities of projection from a mount surface 50 of the board are intensively mounted and a second section 52 on which short electrical components 31b ... having smaller quantities of projection from the mount surface 50 of the board than the electrical components 31a ... are intensively mounted.

[0028] The electrical component board 32 is fixed with a tilt along the tilted surface part 35 so that the electrical components 31a, 31b, ... project in a sideward direction (direction of width) toward the openable lid 34 of the box body 33. In a state in which the electrical component board 32 is fixed, the first section 51 is placed corresponding to a lower large accommodation part 46 having large distances between the openable lid 34 and the tilted surface part 35 in the accommodation space 45 in the box body 33, and the second section 52 is placed corresponding to an upper small accommodation part 47 having small distances between the openable lid 34 and the tilted surface part 35 in the accommodation space 45 in the box body 33.

[0029] In the electrical component box 30, namely, the tilted surface part 35 of the box body 33 facing the side parts of the heat exchanger 11 and the electrical component board 32 is tilted toward the openable lid 34 so as to narrow an extra space of the accommodation space 45 in the box body 33 that is produced between heads of the electrical components 31a, 31b, ... and the openable lid 34, and widths of the electrical component box 30 are thereby reduced partially.

[0030] Figs. 7 through 9 show an internal structure of the indoor unit from which the exterior case 10 has been removed. As shown in Figs. 7 and 8, a portion of the refrigerant pipes 22 of the heat exchanger 11 is placed in a vacant space 60 produced by the tilt of the tilted surface part 35 of the box body 33 in the electrical component box 30. Thus the width of the heat exchanger 11 that has been the largest drag in recent years on the reduction in the width of the indoor unit is absorbed, so that the width of the indoor unit is effectively reduced and so that size reduction of the indoor unit is achieved.

[0031] When the electrical component board 32 in the electrical component box 30 is repaired or replaced in the indoor unit having the above configuration, the exterior case 10 is initially removed from the bottom frame 20. As shown in Figs. 8 and 9, the openable lid 34 of the electrical component box 30 is then exposed to the outside. Once the accommodation space 45 in the box body 33 is opened by removal of the openable lid 34, the electrical component board 32 is exposed to the outside so that maintenance such as repair and replacement thereof can be done. Therefore, the whole electrical component

box 30 does not have to be removed and maintenance environment can be improved. Besides, the electrical component board 32 placed with the tilt along the tilted surface part 35 of the box body 33 can easily be seen from an operator who performs an operation from diagonally below on lateral side of the indoor unit, and thus the maintenance is further facilitated. Once the repair or replacement of the electrical component board 32 is completed, the openable lid 34 may be attached and the exterior case 10 may be attached to the bottom frame 20.

[0032] Though the specific embodiment of the invention has been described above, the invention is not limited to the embodiment but may be embodied with various modifications within the scope of the invention.

Claims

1. An indoor unit of an air conditioner in which an electrical component box (30) is accommodated in an exterior case (10),
the electrical component box (30) comprising:

an electrical component board (32) having electrical components (31a, 31b) ... mounted thereon, and
a box body (33) accommodating the electrical component board (32),
the box body (33) comprising:

an openable lid (34) placed along an inner surface of the exterior case (10), and
a tilted surface part (35) that is placed so as to be opposed to the openable lid (34) and that is tilted relative to a vertical plane so as to narrow an extra space of an accommodation space (45) in the box body (33), wherein
the electrical component board (32) is placed with a tilt along the tilted surface part (35) so that the electrical components (31a), (31b), ... project toward the openable lid (34).

2. The indoor unit of the air conditioner as claimed in Claim 1, wherein
the electrical component board (32) in the electrical component box (30) comprises:

a first section (51) on which the electrical components (31a) ... having large quantities of projection toward the openable lid (34) are intensively mounted, and
a second section (52) on which the electrical components (31b) ... having smaller quantities of projection toward the openable lid (34) than the electrical components (31a) are intensively mounted, wherein
the first section (51) of the electrical component board (32) is placed corresponding to a large accommodation part (46) having large distances between the openable lid (34) and the tilted surface part (35) in the accommodation space (45) in the box body (33), and wherein the second section (52) of the electrical component board (32) is placed corresponding to a small accommodation part (47) having smaller distances between the openable lid (34) and the tilted surface part (35) than the large accommodation part (46) in the accommodation space (45) in the box body (33).

3. The indoor unit of the air conditioner as claimed in Claim 1 or 2, wherein
the openable lid (34) of the box body (33) of the electrical component box (30) is placed along an inner surface of a side wall (23) of the exterior case (10), wherein the tilted surface part (35) of the box body (33) of the electrical component box (30) is placed so as to face a side part of a heat exchanger (11) accommodated in the exterior case (10), and wherein refrigerant pipes (22) of the heat exchanger (11) are placed in a vacant space (60) produced by a tilt of the tilted surface section (35).

4. The indoor unit of the air conditioner as claimed in Claim 3, wherein
the tilted surface part (35) of the box body (33) of the electrical component box (30) is tilted so that upper part of the tilted surface part (35) is closer to the openable lid (34) than lower part of the tilted surface part (35).

Fig.1

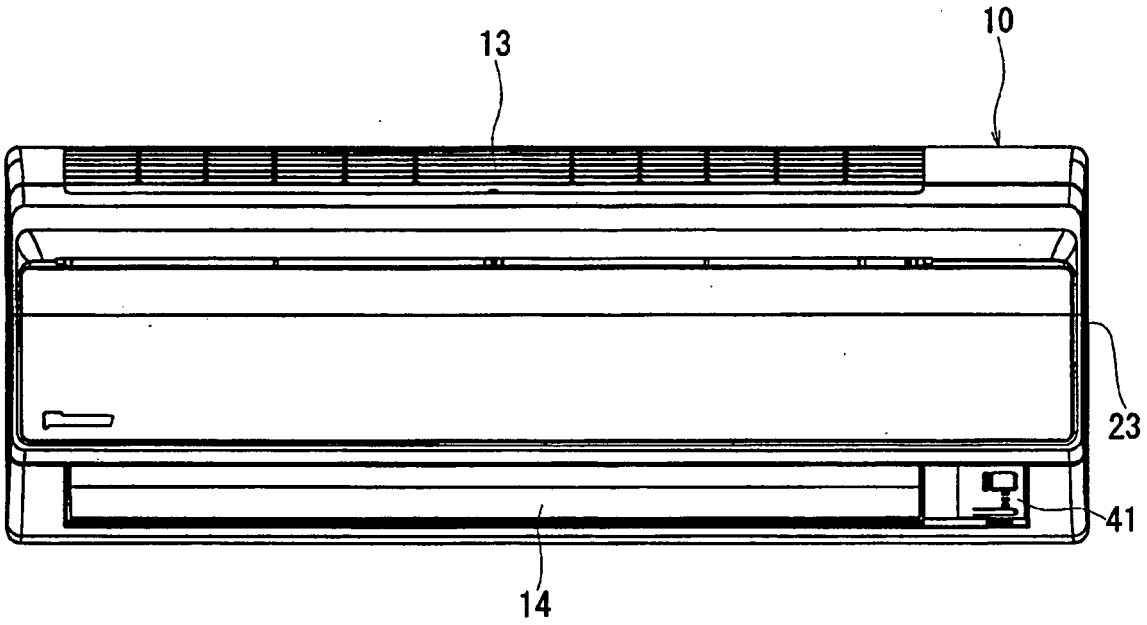


Fig.2

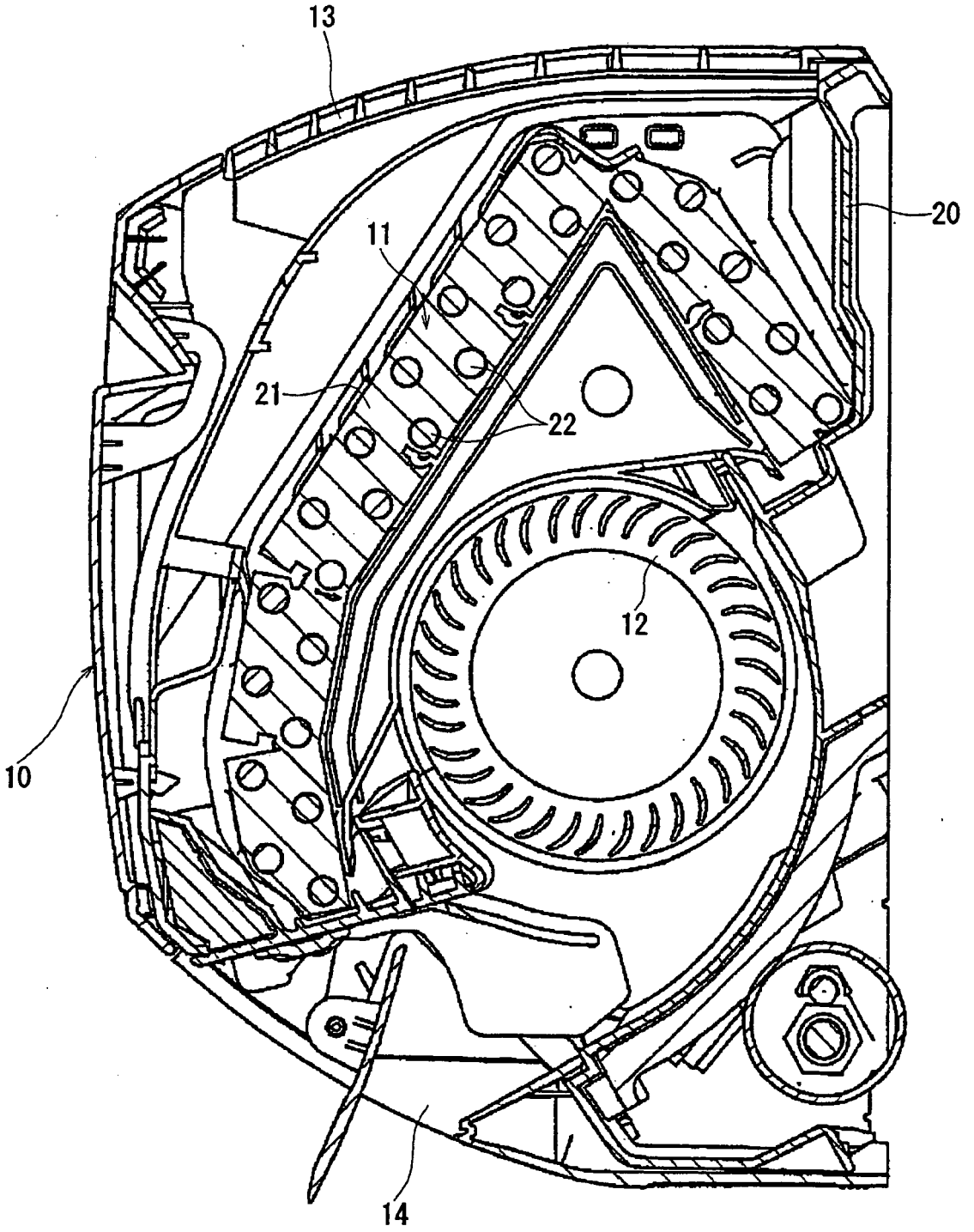


Fig.3

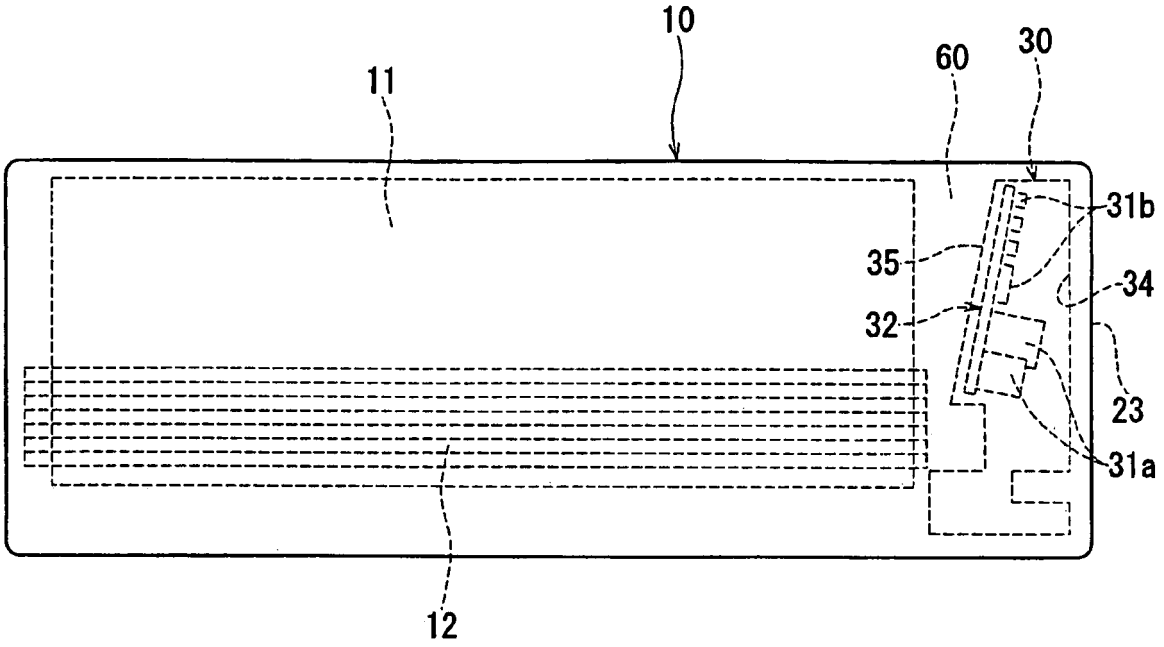


Fig.4

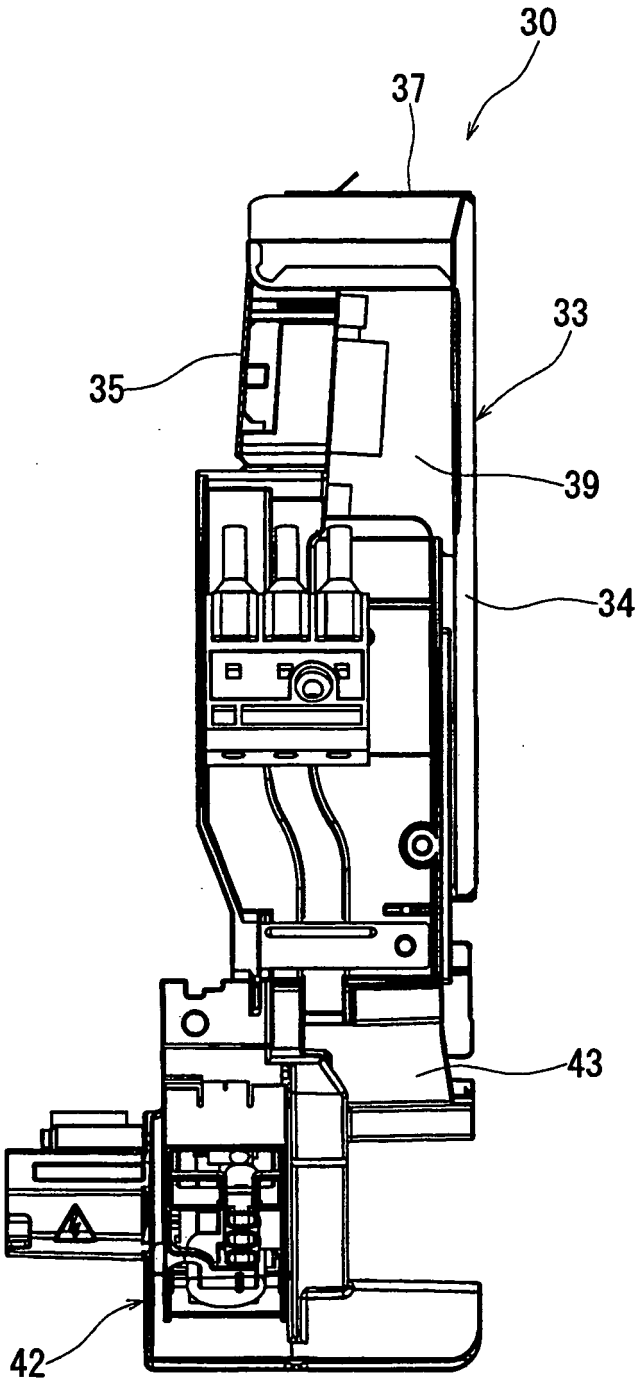


Fig.5

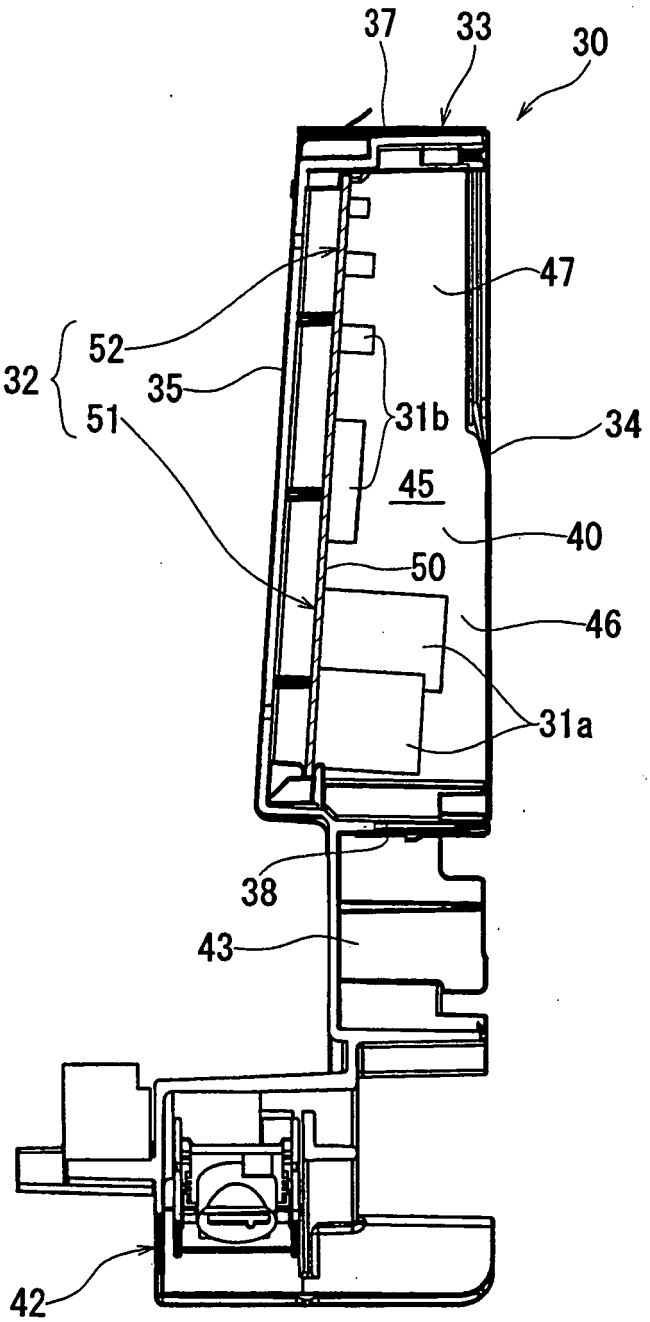


Fig.6

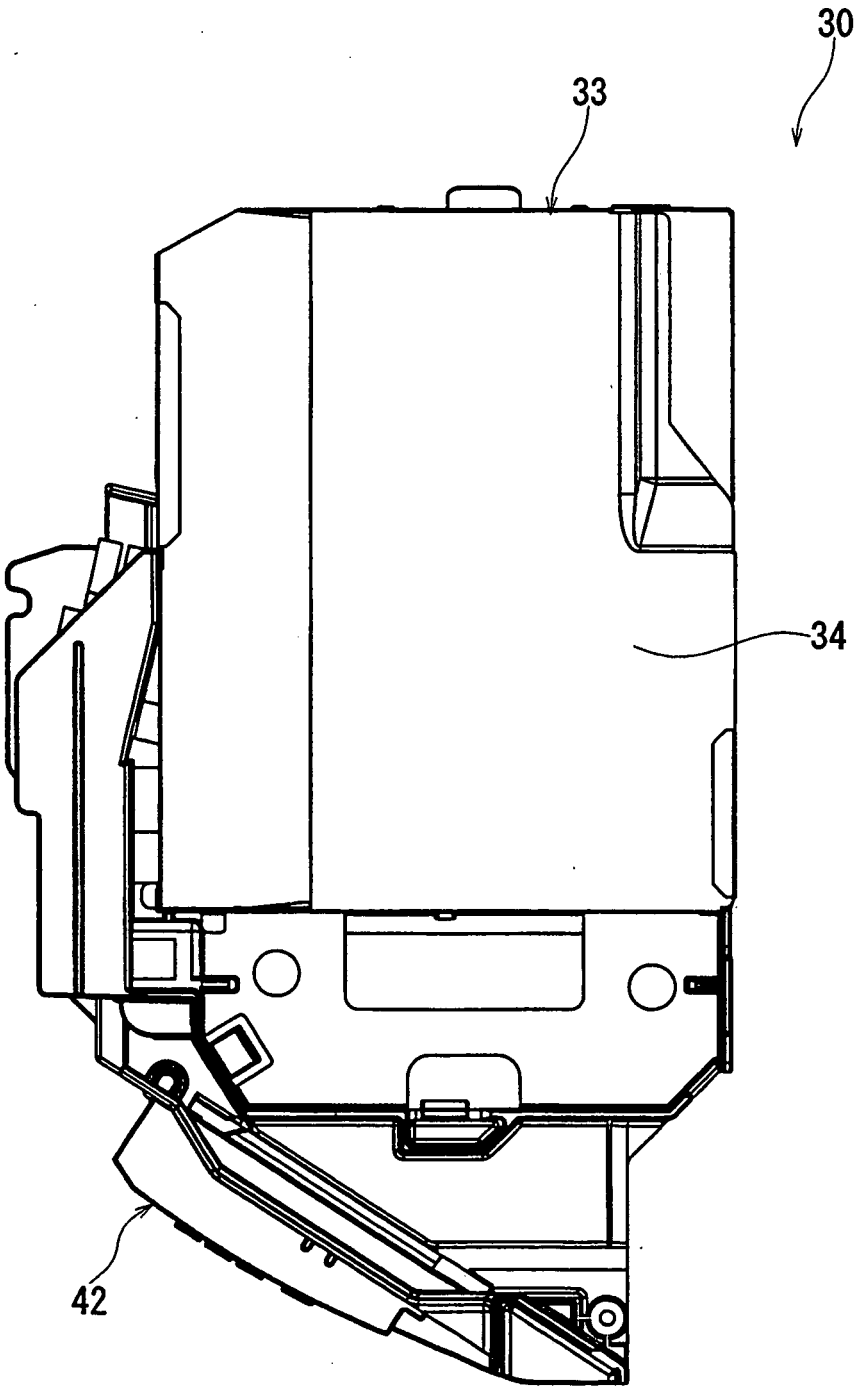


Fig.7

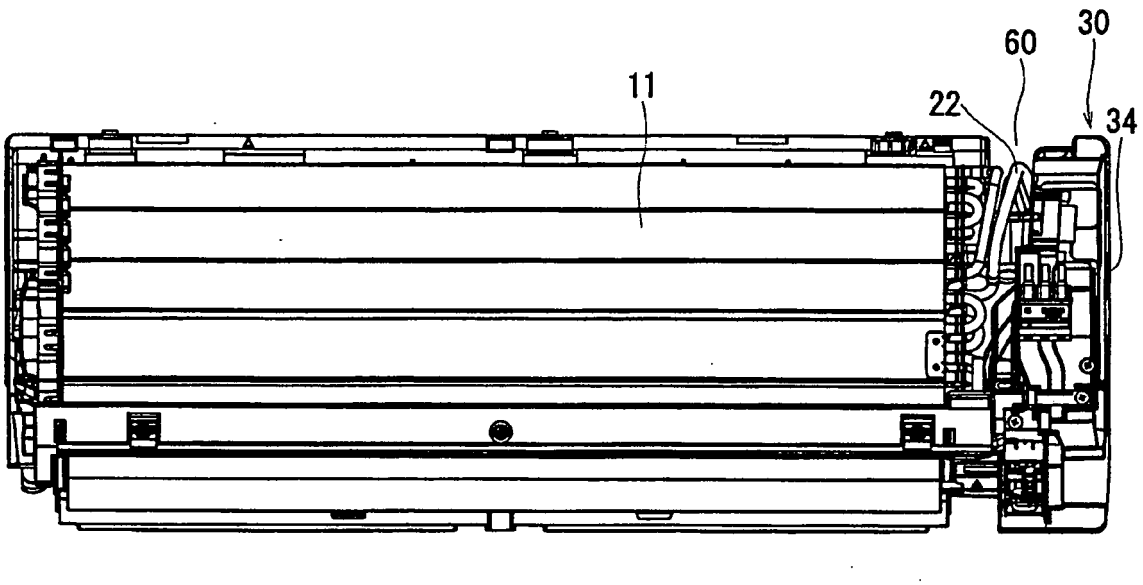


Fig.8

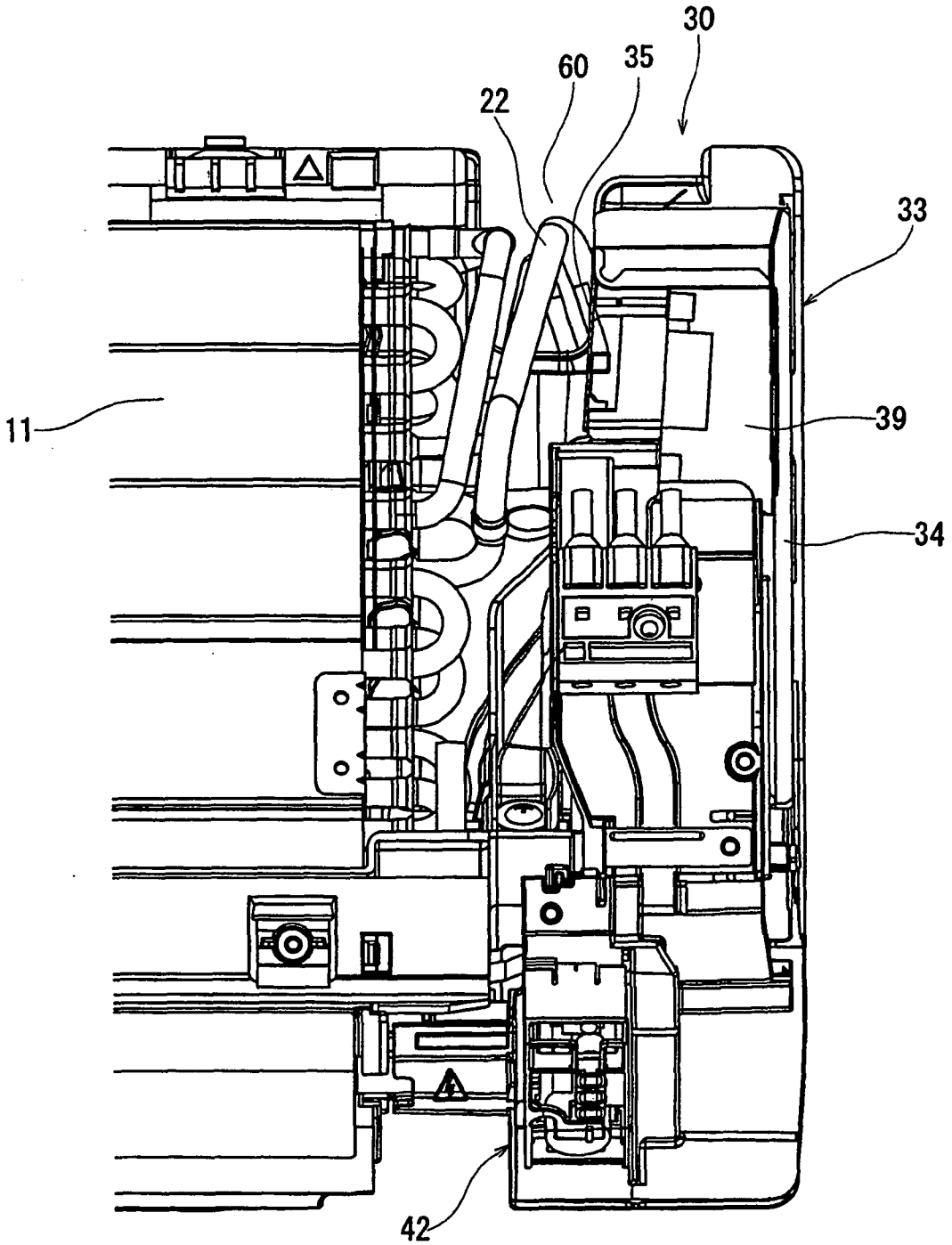


Fig.9

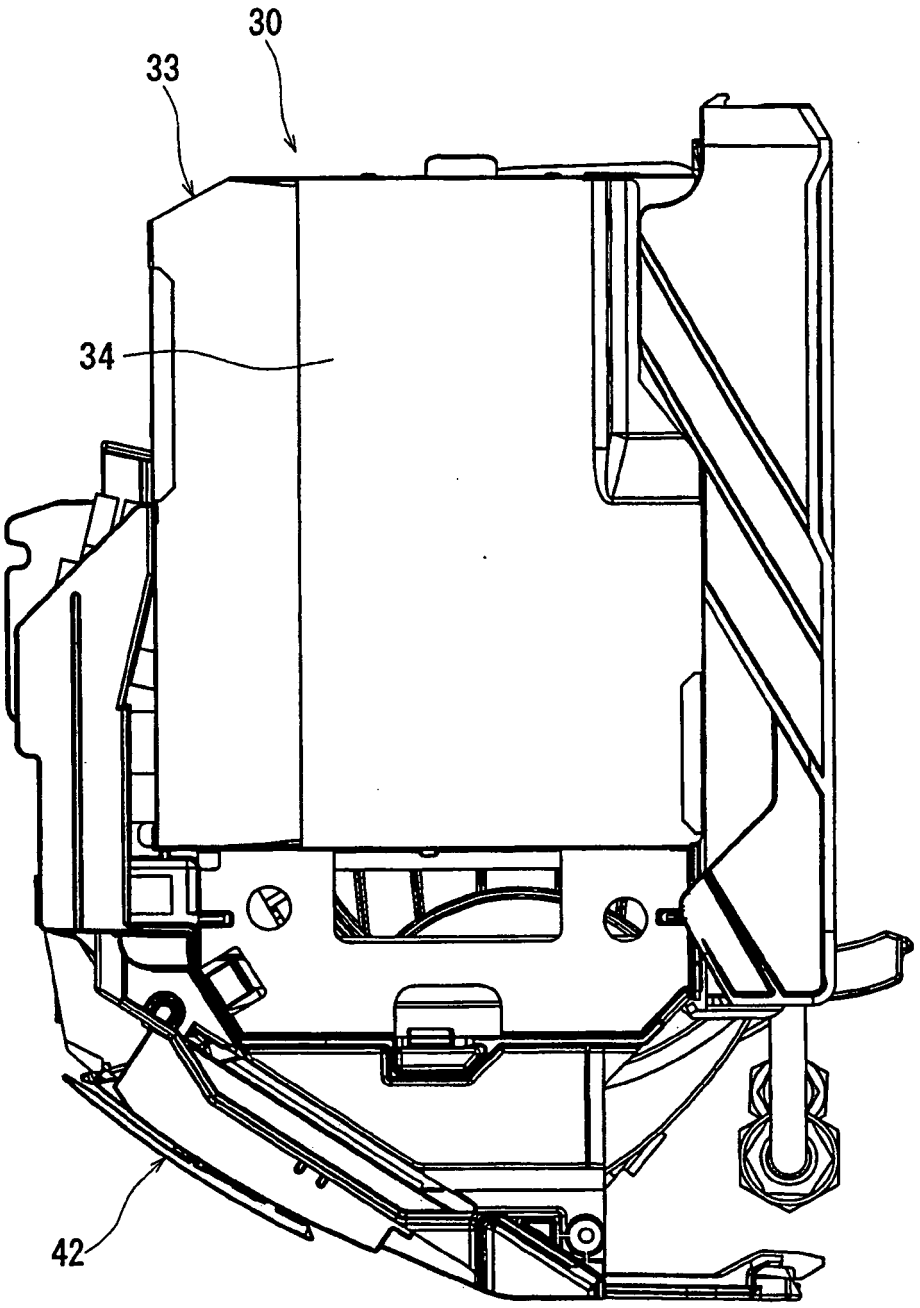
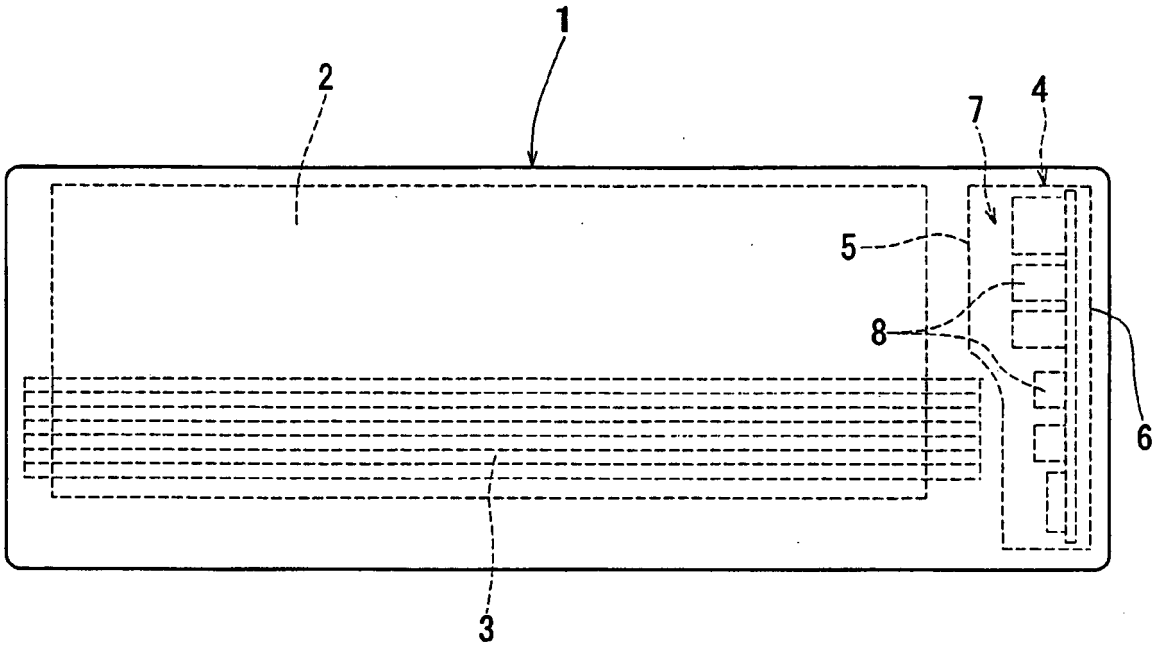


Fig.10



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2007/068938

A. CLASSIFICATION OF SUBJECT MATTER
F24F13/20(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)
F24F13/20

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 1996-2007
Kokai Jitsuyo Shinan Koho 1971-2007 Toroku Jitsuyo Shinan Koho 1994-2007

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 A	JP 2005-76995 A (Daikin Industries, Ltd.), 24 March, 2005 (24.03.05), Par. No. [0034]; Fig. 8 (Family: none)	1,3 2,4
Y A	JP 4-9532 A (Sanyo Electric Co., Ltd.), 14 January, 1992 (14.01.92), Page 2, upper right column, lines 3 to 14; page 2, lower left column, lines 7 to 9; page 2, lower left column, lines 15 to 20 (Family: none)	1,3 2,4

☐ 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	Date of mailing of the international search report
18 December, 2007 (18.12.07)	08 January, 2008 (08.01.08)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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