(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 416 230 A1

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 158(3) EPC

(43) Date of publication:
06.05.2004 Bulletin 2004/19

(21) Application number: **02758786.4**

(22) Date of filing: **02.08.2002**

(51) Int Cl.[7]: **F24F 5/00**

(86) International application number:
PCT/JP2002/007920

(87) International publication number:
WO 2003/016788 (27.02.2003 Gazette 2003/09)

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR IE IT LI LU MC NL PT SE SK TR
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **09.08.2001 JP 2001242288**

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(54) **OUTDOOR UNIT OF AIR CONDITIONER**

(57) An outdoor unit of an air conditioner includes a heat sink cover 11 provided so as to cover the top surface of a heat sink 10 in a state of being apart from the top end 10t of the heat sink heat-conductively fitted with a heat-generating electrical component 9a so that a cooling air flows from the top side to the bottom side of the heat sink 10 and so that an opening 12 for the cooling air to flow in is formed, the heat sink cover 11 including a ventilation bulged portion 13 provided on the opposite side of the opening 12 in order to change the flowing direction of the air flow; and a waterproof plate 15 for preventing the entry of rainwater or the like into the heat sink 10, the waterproof plate 15 being provided apart from the top end 10t of the heat sink so that a ventilation path 16a is formed between the heat sink cover 11 and the top end 10t of the heat sink and so that a ventilation gap 16b is formed oppositely to the ventilation bulged portion.

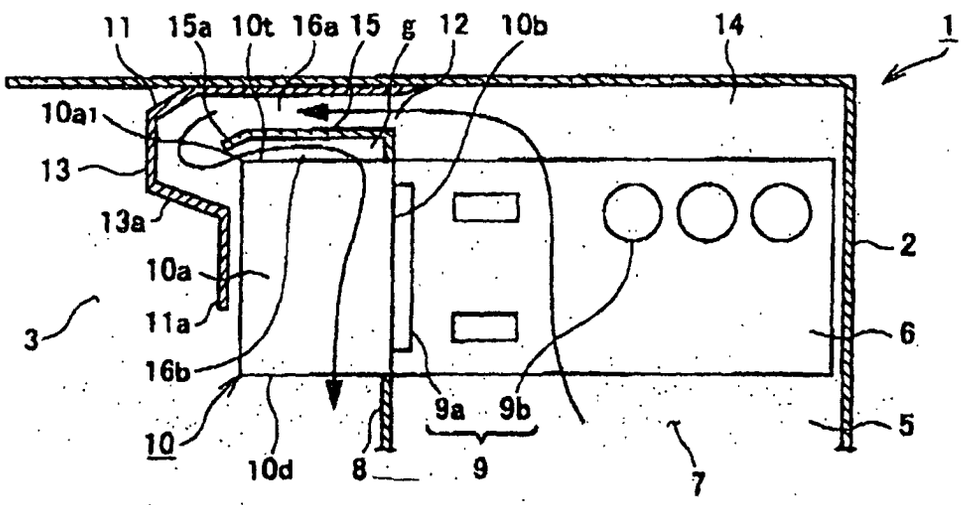


FIG. 3

EP 1 416 230 A1

Description

Technical Field

[0001] The present invention relates to an outdoor unit of an air conditioner. More specifically, the present invention relates to an outdoor unit of an air conditioner having improved cooling air flows to a heat sink and an enhanced cooling effect on electrical components, with the structures of a heat sink cover and a waterproof plate devised.

Background Art

[0002] Conventionally, the outdoor unit of an air conditioner has typically a structure as shown in Figs. 15 and 16. This type of outdoor unit of an air conditioner is partitioned by a partition plate 36 into an a machine chamber 35, and a blower chamber 34 accommodating a heat exchanger 32 and blower 33 in the outdoor unit 31. An electrical equipment box 37 is provided in an upper portion in the machine chamber 35, and a heat sink 39 for cooling an electrical components 38, such as a GTR (giant (high power) transistor) or rectifier, generating heat during the operation of the air conditioner, is provided in the blower chamber 34 so that fins 39a thereof are arranged along the longitudinal direction of the heat sink 39 across the partition plate 36 from the electrical component 38. The heat sink 39 has a heat sink cover 40 serving as an air duct for cooling, and is configured to take in air that has flowed from the machine chamber 35 through an upper portion of the heat sink 39 so that the air flows into the heat sink 39 downward from above. A waterproof plate 42 is attached to the top surface of the heat sink 39 leaving no space therebetween, in order to prevent the entry of rainwater or the like from a lower portion of the heat sink 39 due to backflow of air and prevent the entry thereof from an upper portion of an enclosure (casing) 41.

[0003] However, in the conventional outdoor unit 31 of an air conditioner, a cooling air taken in through the upper portion of the heat sink 39 becomes bent by an angle of 180°, and therefore, it is sucked in due to a differential pressure of the blower 33, so that it is difficult for the cooling air to reach the base side (electrical component side) of the heat sink 39. In particular, since the waterproof plate 42 is attached to the top surface of the heat sink 39 leaving no space therebetween, it is difficult for the cooling air to enter an air gap g0 in the vicinity of the upper side of the heat sink 39. This disadvantageously allows heat to easily accumulate. Furthermore, because the temperature of the electrical component 38 attached to the heat sink 39 rises to 90 to 100°C, heat is liable to be accumulated in air vortexes generated in an upper portion of the heat sink 39, so that the upper portion of the fin 39a is not put to effective use.

[0004] The present invention has been made for solving the above-described problems.

[0005] It is therefore an object of the present invention to provide an outdoor unit of an air conditioner that is capable of optimizing the cooling air flow to the heat sink, improving the cooling efficiency of the heat sink, achieving the size reduction of the heat sink, and enhancing the cooling effect on electrical components mounted on the electrical equipment board.

Disclosure of Invention

[0006] To achieve the above-described object, the present invention, in an aspect, provides an outdoor unit of an air conditioner that comprises: a unit body accommodating an outdoor heat exchanger and an outdoor blower and others; a blower chamber accommodating the outdoor heat exchanger and the outdoor blower; a machine chamber in which an electrical equipment board having thereon electrical components are arranged, wherein the blower chamber and the machine chamber are formed by partitioning off the unit body; a heat sink having a plurality of heat radiating fins formed in the longitudinal direction thereof and accommodated in the blower chamber, the heat sink being heat-conductively fitted with an electrical component generating heat and connected to the above-described electrical components; a heat sink cover provided so as to cover the top surface of the heat sink in a state of being apart from the top end of the heat sink so that a cooling air flows from the top side to the bottom side of the heat sink and so that an opening for the cooling air to flow in is formed, the heat sink cover including a ventilation bulged portion provided on the opposite side of the opening in order to change the flowing direction of the air flow, and a waterproof plate for preventing the entry of rainwater into the machine chamber, the waterproof plate being provided apart from the top end of the heat sink so that a ventilation path is formed between the heat sink cover and the top'end of the heat sink and so that a ventilation gap is formed oppositely to the ventilation bulged portion.

[0007] By virtue of these features, the cooling air flow to the heat sink is optimized. This makes it possible to improve the cooling efficiency of the heat sink, achieve the size reduction of the heat sink, and enhance the cooling effect on the electrical components mounted on the electrical equipment board.

[0008] In a preferred example, regarding the heat sink cover, the lower end portion thereof reaches the bottom end of the heat sink. With this arrangement, the cooling air flow can be reliably and accurately guided to the bottom end of the heat sink, thereby enhancing the cooling efficiency of the heat sink.

[0009] In another preferred example, regarding the heat sink cover, the bottom surface portion of the ventilation bulged portion thereof forms a right or acute angle with respect to the vertical line. With this feature, the cooling air flow can be directed to the direction of the top end of the heat sink, and therefore, the air flow can reach the gap portion formed between the waterproof

plate and the top end of the heat sink, and then reach the planer side corner of the gap portion. This allows the fins to sufficiently exert their cooling effect, thereby improving the cooling efficiency with respect to the heat-generating electrical components.

[0010] In still another preferred example, regarding the heat sink cover, the bottom surface portion of the ventilation bulged portion thereof extends up to the central position of the top end of the heat sink, and simultaneously the waterproof plate extends up to the central position of the top end of the heat sink, thereby forming a ventilation port between the aforementioned bottom surface portion and the waterproof plate. With this arrangement, while keeping function of preventing rainwater or the like from entering into the machine chamber containing electrical components due to adverse winds or the like, it becomes possible that a supply air flows from the ventilation port to the root side of the heat sink, and thereby to improve the cooling efficiency with respect to the heat-generating electrical component.

[0011] In a further preferred example, the waterproof plate comprises a first flat plate provided apart from the top end of the heat sink and so as to extend up to the central position of the top end of the heat sink, and a second flat plate covering the entire heat sink and having therein a ventilation opening. With this feature, while keeping function of preventing water from entering into the machine chamber containing electrical components due to adverse winds or the like, it becomes possible that a supply air flows from the ventilation port to the root side of the heat sink, and thereby to enhance the cooling effect on the heat-generating electrical component.

[0012] In a yet further preferred example, the electrical equipment board and the heat-generating electrical component are disposed at the substantially central position with respect to the width direction of the heat sink, and there is provided an opening partitioning plate for partitioning the opening provided above the electrical equipment board into the left and right portions. With this arrangement, the heat-generating electrical component is effectively cooled, and by adjusting the partitioning position of the opening partitioning plate along a back-and-forth direction, it is possible to adjust the division of air flows into an air flow flowing along the front surface of the electrical equipment board and an air flow flowing along the rear surface thereof, and thereby to adjust the amount of cooling air required for the electrical equipment board. This allows the electrical component to be cooled under an optimal condition.

[0013] In another preferred example, the electrical equipment board comprises a first electrical equipment board disposed adjacent to the partition wall of the machine chamber and so as to form a substantially L-shape with respect to the heat sink, and a second electrical equipment board disposed substantially parallel to the first electrical equipment board and so as to extending up to a position opposed to the opening. With this feature, the electrical components mounted on both electrical equipment boards can be cooled. In addition, the amounts of cooling air flowing along the respective electrical equipment boards can be adjusted by adjusting the spacing (gap) between the two electrical components. Therefore, the required amounts of cooling air determined based on the heating values (amount of heat generation) of electrical components can be optimally distributed merely by adjusting the position of the second electrical equipment board.

[0014] In another preferred example, the heat sink is incised at its bottom end, and simultaneously the bottom end of the heat sink cover opposed to the bottom end of the heat sink is also incised. With this feature, it is possible to move down the heat sink without contacting a bell mouse or the outdoor blower in the blower chamber. This allows the area of the opening or the ventilation gap provided above the heat sink to become larger, resulting in improved cooling performance.

Brief Description of the Drawings

[0015]

Fig. 1 is a plan view of an outdoor unit of an air conditioner according to the present invention wherein the casing top plate thereof is removed.

Fig. 2 is a front view of the outdoor unit of an air conditioner according to the present invention wherein a portion of the casing front plate thereof is removed.

Fig. 3 is a sectional side view showing the vicinity of the heat sink of the outdoor unit of an air conditioner according to the present invention.

Fig. 4 is a perspective view showing the vicinity of the heat sink of the outdoor unit of an air conditioner according to the present invention.

Fig. 5 is a sectional side view of a first modification of a heat sink cover provided in the outdoor unit of an air conditioner according to the present invention.

Fig. 6 is a sectional side view of a second modification of a heat sink cover provided in the outdoor unit of an air conditioner according to the present invention.

Fig. 7 is a sectional side view of a third modification of a heat sink cover provided in the outdoor unit of an air conditioner according to the present invention.

Fig. 8 is a sectional side view of a modification of a waterproof plate provided in the outdoor unit of an air conditioner according to the present invention.

Fig. 9 is a perspective view of a first modification of an electrical equipment board provided in the outdoor unit of an air conditioner according to the present invention.

Fig. 10 is a sectional side view of the first modification of the electrical equipment board provided in

the outdoor unit of an air conditioner according to the present invention.

Fig. 11 is a perspective view of a second modification of the electrical equipment board provided in the outdoor unit of an air conditioner according to the present invention.

Fig. 12 is a sectional side view of the second modification of the electrical equipment board provided in the outdoor unit of an air conditioner according to the present invention.

Fig. 13 is a plan view of the second modification of the electrical equipment board provided in the outdoor unit of an air conditioner according to the present invention.

Fig. 14 is a sectional side view of modifications of a heat sink and a heat sink cover provided in the outdoor unit of an air conditioner according to the present invention.

Fig. 15 is a sectional view showing the vicinity of the heat sink in a conventional outdoor unit of an air conditioner.

Fig. 16 is a perspective view showing the vicinity of the heat sink in the conventional outdoor unit of an air conditioner.

Best Mode for Carrying Out the Invention

[0016] Hereinafter, an outdoor unit of an air conditioner according to an embodiment of the present invention will be described with reference to the accompanying drawings.

[0017] Fig. 1 is a plan view of an outdoor unit of an air conditioner according to the present invention wherein the casing top plate thereof is removed. Fig. 2 is a front view of the outdoor unit of an air conditioner according to the present invention wherein a part of the casing front plate thereof is removed.

[0018] As shown in Figs. 1 and 2, the outdoor unit 1 of an air conditioner according to the present invention has an unit body 4 accommodating an outdoor heat exchanger 2, outdoor blower 3, and others. The unit body 4 includes a blower chamber 5 accommodating the outdoor heat exchanger 2 and outdoor blower 3, and a machine chamber 7 partitioned off on one side of the unit body 4 and accommodating an electrical equipment board 6. The blower chamber 5 and the machine chamber 7 are partitioned off by a partition plate 8.

[0019] Furthermore, the machine chamber 7 accommodates electrical components 9 for use in controlling an inverter. The electrical components 9 comprises an electrical component, such a giant (high power) transistor (GTR) 9a, used for controlling an inverter and generating relatively high heat, and various operation control elements 9b, such as capacitors or the like, connected to the aforementioned GTR 9a.

[0020] Since the GTR 9a generates a relatively high heat during usage, it is desirable for the GTR 9a to dissipate the generated heat. Therefore, GTR 9a is attached to the heat sink 10 so as to make surface contact with the heat sink 10 so that heat generated by the GTR 9a can be dissipated.

[0021] For the heat sink 10, a material with a high thermal conductivity, such as an aluminum material, is used. As shown in Fig. 4, the heat sink 10 has a rectangular shape in section. On one surface side of the heat sink 10, a plurality of fins 10a extending from the top end 10t of the heat sink to the bottom end 10d thereof, is arranged each in an upright position, and the other surface side of the heat sink 10 forms a plane 10b. The heat sink 10 is attached to the partitioning plate 8. The fins 10a are situated on the blower chamber 5 side, whereas the plane 10b is exposed to the machine chamber 7 side from a mounting opening portion 8a formed in the partition plate 8. As describe above, the GTR 9a situated in the machine chamber 7 is mounted on the plane 10b exposed to the machine chamber 7 side.

[0022] As shown in Figs. 3 and 4, a heat sink cover 11 is provided above the heat sink 10. The heat sink cover 11 has an inverted J-shape cross section in a manner such that there are provided an opening 12 and a ventilation bulged portion 13 formed on the opposite side of the opening 12 in order to change the flowing direction of an air flow. This heat sink cover 11 is provided so as to cover the top surface of the heat sink in a state of being apart from the top end 10t of the heat sink (fins) so that the opening 12 is formed. The bottom surface portion 13a of the ventilation bulged portion 13 forms an obtuse angle with respect to the vertical line. The bottom end 11a of the heat sink cover reaches the vicinity of the bottom end 10d of the heat sink (fins). The opening 12 is exposed to the ventilation path portion 14 formed above the machine chamber 7 in order to allow cooling air to flow from the machine chamber 7 thereinto.

[0023] Furthermore, above the heat sink 10, a waterproof plate 15 inserted into the opening 12 is provided in a state of being apart from the top end 10t of the fins. As shown in Fig. 3, the front end portion 15a of the waterproof plate 15, inclined downward with a small gradient, is positioned further toward the downstream side of air flow than a top end corner 10a1 of the fins 10a. A ventilation path 16a is formed between the waterproof plate 15 and the heat sink cover 11, and also a ventilation gap 16b is formed between the waterproof plate 15 and the top end 10t of the fins. As a result, a cooling air flow that has flowed in from the opening 12 passes through the ventilation path 16a, ventilation bulged portion 13, and ventilation gap 16b, and flows from the top side to the bottom side of the heat sink 10 along the fins 10a.

[0024] The waterproof plate 15 prevents rainwater or the like from entering into the machine chamber 7 through the heat sink cover 11 and wetting the electrical components 9 such as the GTR 9a and various operation control elements 9b in pouring water or in adverse wind conditions. The height of the opening 12 and the

distance between the heat sink 10 and the waterproof plate 15 can be freely determined based on the positional relationship between the heat sink cover 11 and the outdoor blower 3 or that between the heat sink cover 11 and a bell mouse 17 provided in the outdoor blower 3.

[0025] It is desirable for the various operation control elements 9b to suppress or inhibit a temperature rise. Therefore, the various operation control elements 9b are arranged in air flows in a state of being disposed adjacently to a partition wall of the machine chamber 7, for example, to the rear wall 4a of the unit body 4 and mounted on the electrical equipment board 6 disposed so as to form a substantially L-shape with respect to the heat sink 10.

[0026] Here, in Figs. 1 and 2, a reference numeral 18 denotes an air intake port, 19 denotes an air discharge port, and 20 denotes an machine chamber air intake port. In this embodiment, the machine chamber air intake port 20 is provided on a side surface of the unit body 4 but it may also be disposed on the front surface or rear surface of the unit body 4.

[0027] Next, descriptions will be made of the cooling and condensation of a coolant when the outdoor unit of an air conditioner is used as a condenser.

[0028] The coolant highly increased in temperature under compression by a compressor 22 accommodated in the machine chamber 7 flows into the outdoor heat exchanger 2 as shown in Fig. 1, and under the rotation of the outdoor blower 3, air is taken in through the air intake port 18. Then, the coolant is cooled and condensed by air blown off through the air discharge port 19. Because an inverter control circuit operates during the rotation of the outdoor blower 3, the electrical components 9 generate heat. In particular, the GTR 9a, having a high heating value, requires radiation of the generated heat.

[0029] On the other hand, when the outdoor blower 3 is rotated, the pressure inside the blower chamber 5 becomes negative, so that air is taken in through the machine chamber air intake port 20 as shown in Fig. 1. Furthermore, as shown in Fig. 3, the air taken into the machine chamber 7 flows through the machine chamber 7 as a cooling air flow, and cools the various operation control elements 9b mounted on the electrical equipment board 6 accommodated in the machine chamber 7, as well as the GTR 9a is also cooled. Moreover, the air that has cooled the electrical components 9 passes through the ventilation path portion 14 formed above the machine chamber 7, and arrives at the opening 12. The air flow that has arrived at the opening 12 passes through the ventilation path 16a formed between the waterproof plate 15 and the heat sink cover 11, and arrives at the ventilation bulged portion 13. At the ventilation bulged portion 13, the air flow is caused to change its direction, and arrives at the ventilation gap 16b. Then, the air flow flows from the top side to the bottom side of the heat sink 10 along the fins 10a. In this flowing-down process of air flow, by virtue of the function of the waterproof plate 15, the air flow that has been caused to change its direction at the ventilation bulged portion 13 reaches the ventilation gap 16b formed between the waterproof plate 15 and the top end 10t of the fins, and then its planar side corner "g" of the ventilation gap 16b, as shown in Figs. 3 and 4. This allows the fins 10a to sufficiently exert their effect, thereby improving the cooling effect on the GTR 9a. In addition, the front end portion 15a of the waterproof plate 15, inclined downward with a gradient, improves the ventilation efficiency. Furthermore, since the front end portion 15a is positioned further toward the downstream side of air flow than the top end corner 10a1 of the fins 10a, it is possible to reliably prevent the entry of rainwater or the like into the machine chamber 7.

[0030] In the process where the cooling air flow flows from the top side to the bottom side of the heat sink 10 along the fins 10a, the cooling air flow effectively cools the GTR 9a heat-conductively attached to the plane 10b of the heat sink 10, via the heat sink 10 with fins 10a.

[0031] Therefore, even though the GTR 9a generates heat, it is sufficiently radiated and cooled, and hence, the GTR 9a causes neither reduction in performance nor inconvenience. Moreover, since the radiation at the heat sink 10 in the up-and-down direction can be made uniform, the heat sink 10 can be reduced in size.

[0032] Next, descriptions will be made of a first modification of a heat sink cover provided in the outdoor unit of an air conditioner according to the first embodiment of the present invention.

[0033] In the above-described embodiment, the bottom end of the heat sink cover is positioned in the vicinity of the bottom end of the heat sink, whereas, in this first modification, the bottom end of the heat sink cover is extended up to the bottom end of the heat sink.

[0034] For example, as shown in Fig. 5, in the heat sink cover 11A according to the first modification, the bottom end 11Aa of the heat sink cover 11A, is extended up to the position of the bottom end 10Ad of the heat sink 10A (the bottom end of the fins). Because other components are the same as those in the outdoor unit of an air conditioner shown in Fig. 3, they are denoted by the same reference numerals as in the outdoor unit of an air conditioner shown in Fig. 3, and they are omitted from description.

[0035] For the reason described above, the cooling air flow can be reliably guided up to the bottom end 10Ad of the heat sink 10A, thereby enhancing the cooling efficiency with respect to the heat sink 10A.

[0036] A second modification of a heat sink cover will now be described.

[0037] In the above-described first embodiment, the bottom surface portion of the ventilation bulged portion of the heat sink cover forms an obtuse angle with respect to the vertical line, whereas, in this second modification, the bottom surface portion of the ventilation bulged portion of the heat sink cover forms a right or acute angle with respect to the vertical line.

[0038] For example, as shown in Fig. 6, in the heat sink cover 11 B according to the second modification, the bottom surface portion 13Ba of its ventilation bulged portion 13B forms a right or acute angle with respect to the vertical line.

[0039] As a result, the cooling air flow can be directed to the direction of the top end 10Bt of the heat sink, and therefore, the air flow can reach the ventilation gap 16b formed between the waterproof plate 15 and the top end 10Bt of the heat sink (the top end of the fins), and then the planer side (fin root side) corner "g" of the ventilation gap 16b. This allows the fins 10a to sufficiently exert their effect, thereby improving the cooling effect on the GTR 9a.

[0040] Next, a heat sink cover according to a third modification will be described below.

[0041] In the above-described first embodiment, the bottom surface portion of the ventilation bulged portion of the heat sink cover forms an obtuse angle with respect to the vertical line, whereas, in this third modification, the bottom surface portion of the ventilation bulged portion of a heat sink cover bends at a right angle and is extended to the central position of the top end of the fins.

[0042] For example, as shown in Fig. 7, in the heat sink cover 11 C according to the third modification, the bottom surface portion 13Ca of its ventilation bulged portion 13C forms a right angle with respect to the vertical line, and is extended up to the central position of the top end 10Ct of the fins (heat sink). The waterproof plate 15C is also extended up to the central position of the top end 10Ct of the fins. Thus, in the vicinity of the central position of the top end 10Ct of the fins, a ventilation port 16C formed of the bottom surface portion 13Ca and the waterproof plate 15C, is provided. Also, there is provided a fin cover portion 13Cb extending from the ventilation bulged portion 13C along the fins 10Ca.

[0043] As a result, while keeping function of preventing rainwater or the like from entering into the machine chamber containing electrical components 9 due to adverse winds or the like, it is possible to supply air flows from the ventilation port 16C to the root side of the heat sink 10C, and thereby to improve the cooling effect on the GTR 9a.

[0044] Next, a modification of a waterproof plate used in the first embodiment according to the present invention will be described.

[0045] The waterproof plate used in the above-described embodiment is formed of a single flat plate, and its front end reaches the top end corner of the fins, whereas the waterproof plate according to this modification includes a first flat plate extending up to the central position of the top end of the fins, and a second flat plate covering the entire fins and having therein a ventilation opening.

[0046] For example, as shown in Fig. 8, the waterproof plate 15D according to this modification includes a first flat plate 15D1 provided apart from the top end 10Dt of the fins and extending up to the central position of the top end 10Dt of the fins, and a second flat plate 15D2 covering the entire of the top end 10Dt of the fins and having therein a ventilation opening portion 16D.

[0047] As a consequence, it is possible to prevent rainwater or the like from entering into the machine chamber through the heat sink cover 11 D when there are adverse winds or the like. Air flows supplied from the opening 12D above the heat sink is divided into an-air flow flowing along the ventilation bulged portion 13 of the heat sink cover 11 D and an air flow passing through the ventilation opening portion 16D of the second flat plate 15D2, and these divided air flows are supplied from the upstream side of the heat sink 10D to the root of thereof, thereby enhancing the cooling efficiency.

[0048] Next, a first modification of an electrical equipment board used in the embodiment according to the present invention will be described.

[0049] The electrical equipment board used in the above-described embodiment is disposed so as to form a substantially L-shape with respect to the heat sink, whereas the electrical equipment board according to this first modification is disposed so as to form a substantially T-shape with respect to the heat sink.

[0050] For example, as shown in Figs. 9 and 10, the electrical equipment board 6E according to the first modification is positioned in the center with respect to the width direction (lateral direction) of the heat sink 10E, and the GTR 9a is also positioned in the center of the heat sink 10E. Moreover, above the electrical equipment board 6E, there is provided an opening partitioning plate 21 for partitioning the opening 12E into the left and right portions, the opening partitioning plate 21 being bent at the central portion.

[0051] Thus, the GTR 9a, positioned in the substantially central position of the heat sink 10E, is effectively cooled. In addition, by adjusting the partitioning position of the opening partitioning plate 21 along a back-and-forth direction, it is possible to adjust the division of air flows into an air flow flowing along the front surface of the electrical equipment board 6E and an air flow flowing along the rear surface thereof, thereby adjust the amount of cooling air required for the electrical equipment board 6E. This allows the GTR 9a and various operation control elements 9b to be cooled under an optimal condition.

[0052] A second modification of an electrical equipment board used in the embodiment according to the present invention will now be described.

[0053] While the electrical equipment board used in the above-described embodiment is disposed so as to form a substantially L-shape with respect to the heat sink, the electrical equipment board according to this second modification is arranged so that a second electrical equipment board is additionally provided parallel to and apart from the first electrical equipment board.

[0054] For example, as shown in Figs. 11 to 13, the

electrical equipment board 6F according to the second modification includes the first electrical equipment board 6F1 disposed adjacently to the rear wall 4Fa of the unit body, serving as a partition wall of the machine chamber 7F and so as to form a substantially L-shape with respect to the heat sink 10F, and the second electrical equipment board 6F2 disposed parallel to the first electrical equipment 6F1 and so as to extend up to a position opposed to the opening 12F.

[0055] As a result, as shown in Fig. 11, an air flow taken in through the machine chamber air intake port of the machine chamber 7F flows along the first electrical equipment board 6F1 and the second electrical equipment board 6F2. This allows the cooing of various operation control elements 9Fb mounted on the first and second electrical equipment boards 6F1 and 6F2. Furthermore, the amounts of cooling air flowing on the respective electrical components boards 6F1 and 6F2 can be adjusted by adjusting the spacing between the first and second electrical equipment boards 6F1 and 6F2. Therefore, the required amounts of cooling air determined based on the heating values of the various operation control elements 9Fb can be optimally distributed merely by adjusting the position of the second electrical equipment board 6F2.

[0056] Next, reference will be made to a modification in which the heat sink and heat sink cover according to the embodiment of the present invention are simultaneously modified.

[0057] In the above-described embodiment, the fins of the heat sink each has a rectangular shape in section, and the bottom end of the heat sink cover extends up to the bottom end of the fins, whereas, in this modification of heat sink and heat sink cover, the bottom end of the fins and that of the heat sink cover are incised.

[0058] For example, as shown in Fig. 14, the heat sink 10G in this modification is incised at its bottom end 10Gd, and further, the bottom end 11Ga of the heat sink cover opposed to the bottom end 10Gd of the fins is also incised.

[0059] By virtue of this feature, when it is necessary to increase the area of the opening 12 or the ventilation gap 16Gb provided above the heat sink 10G in order to increase the amount of air flow for the purpose of improving the cooling performance, it is possible to move down the heat sink 10G without contacting the bell mouse or the outdoor blower in the blower chamber 5G.

Industrial Applicability

[0060] According to the present invention, an outdoor unit of an air conditioner can be provided that is capable of optimizing the cooling air flow to the heat sink, thereby improving the cooling efficiency of the heat sink, achieving the size reduction of the heat sink, and enhancing the cooling effect on electrical components mounted on the electrical equipment board.

Claims

1. An outdoor unit of an air conditioner, comprising:

a unit body accommodating an outdoor heat exchanger and an outdoor blower and others;
a blower chamber accommodating the outdoor heat exchanger and the outdoor blower;
a machine chamber in which an electrical equipment board having thereon electrical components are arranged in the longitudinal direction of the unit body,

wherein the blower chamber and the machine chamber are formed by partitioning off the unit body;

a heat sink having a plurality of heat radiating fins formed in the longitudinal direction thereof and accommodated in the blower chamber, the heat sink being heat-conductively fitted with an electrical component generating heat and connected to said electrical components;

a heat sink cover provided so as to cover the top surface of the heat sink in a state of being apart from the top end of the heat sink so that a cooling air flows from the top side to the bottom side of the heat sink and so that an opening for the cooling air to flow in is formed, the heat sink cover including a ventilation bulged portion provided on the opposite side of the opening in order to change the flowing direction of the air flow; and

a waterproof plate for preventing the entry of water into the machine chamber, the waterproof plate being provided apart from the top end of the heat sink so that a ventilation path is formed between the heat sink cover and the top end of the heat sink and so that a ventilation gap is formed oppositely to the ventilation bulged portion.

2. The outdoor unit of an air conditioner according to Claim 1, wherein a bottom end of the heat sink cover reaches the bottom end of the heat sink.

3. The outdoor unit of an air conditioner according to Claim 1 or 2, wherein a part of the heat sink cover is bent at a right or an acute angle.

4. The outdoor unit of an air conditioner according to Claim 1, wherein the bottom surface portion of the ventilation bulged portion of the heat sink cover extends up to a central position on the top end of the heat sink, wherein the waterproof plate also extends up to the central position of the top end of the heat sink, so that a ventilation port is formed between the bottom surface portion of the ventilation bulged portion and the waterproof plate.

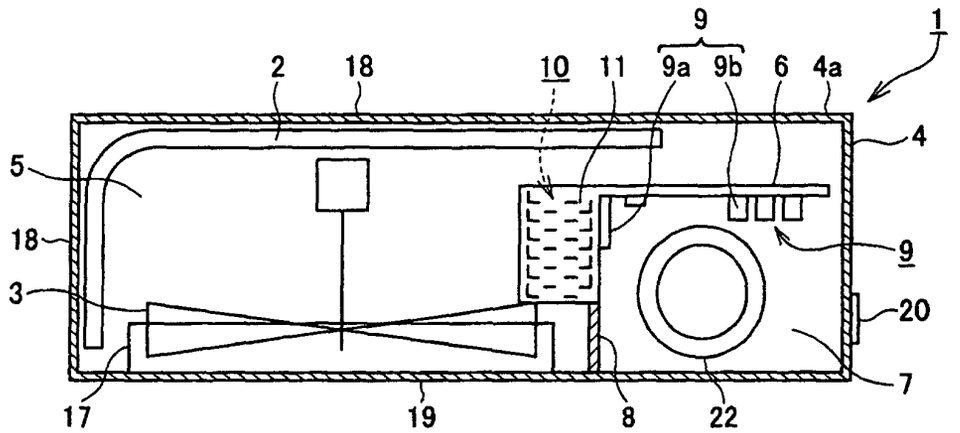
5. The outdoor unit of an air conditioner according to Claim 1, wherein the waterproof plate comprises a

first flat plate provided apart from the top end of the heat sink and extending up to a central position of the top end of the heat sink, and a second flat plate provided so as to cover the entire heat sink and having therein a ventilation opening.

6. The outdoor unit of an air conditioner according to Claim 1, wherein the electrical equipment board and the heat-generating electrical component are disposed in the substantially central position with respect to the width direction of the heat sink, and wherein an opening partitioning plate is provided for partitioning the opening provided above the electrical equipment board into the left and right portions.

7. The outdoor unit of an air conditioner according to Claim 1, wherein the electrical equipment board comprises a first electrical equipment board disposed adjacent to a partitioning wall of the machine chamber and so as to form a substantially L-shape with respect to the heat sink, and a second electrical equipment board disposed substantially parallel to the first electrical equipment board and so as to extend up to a position opposed to the opening.

8. The outdoor unit of an air conditioner according to Claim 1, wherein the heat sink is incised at the bottom end thereof, and wherein the bottom end of the heat sink cover opposed to the bottom end of the heat sink is also incised.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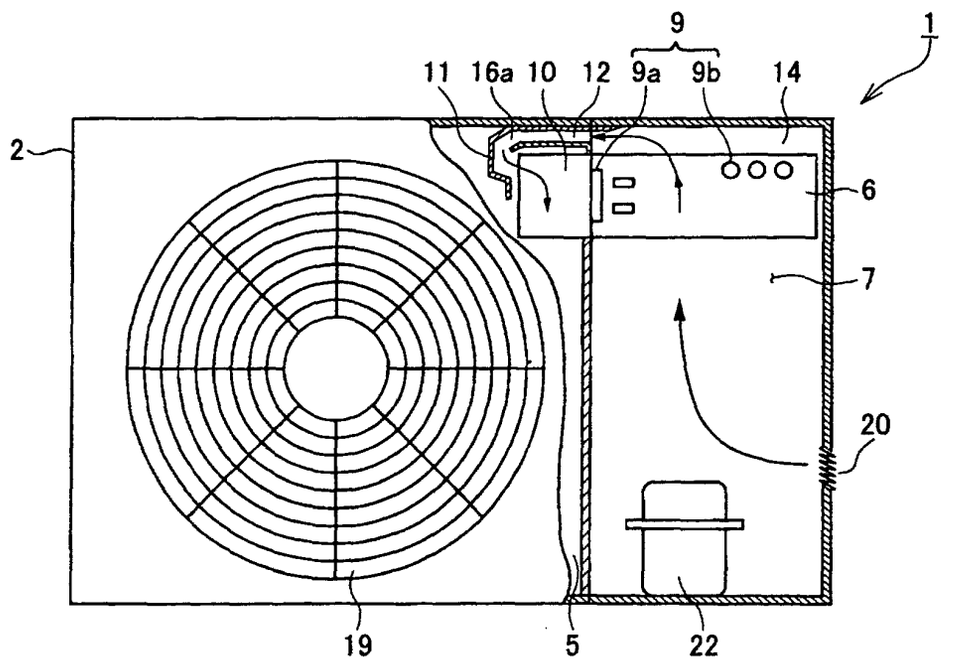
1
2
18
10
11
9a
9b
6
4a
4
5
18
3
9
20
7
17
19
8
22

FIG. 1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9a
9b
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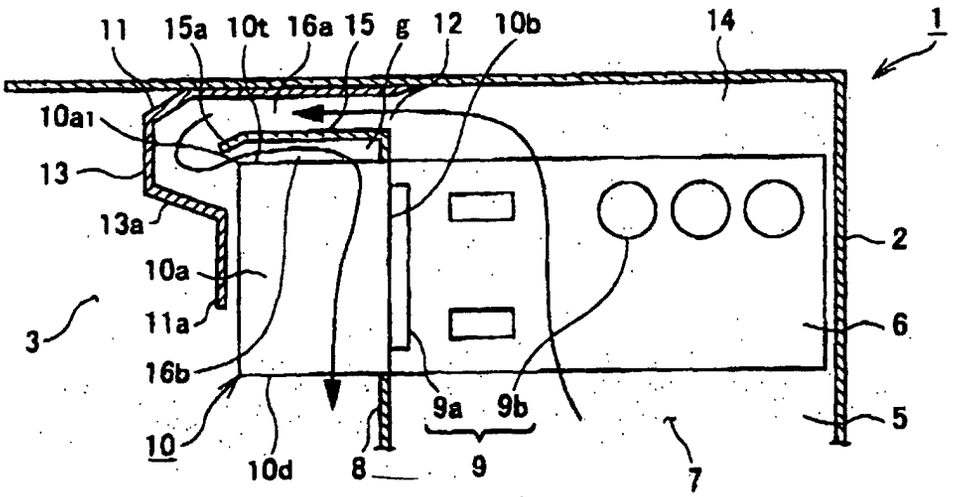
22

FIG. 2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16a
15
g
12
10b
14
1
10a1
13
13a
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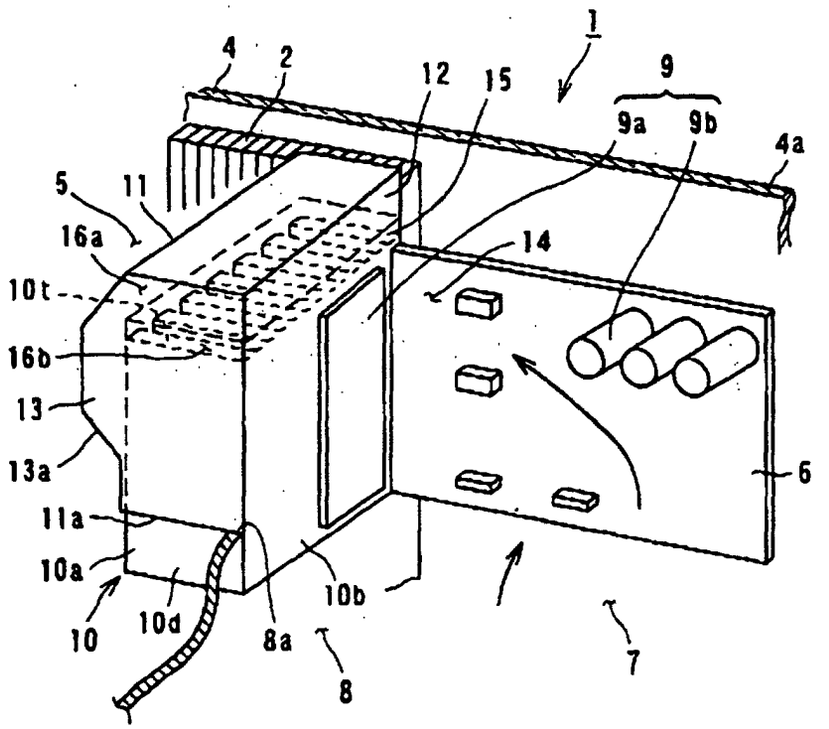
11a
3
16b
10
10d
8
9
9a
9b
7
2
6
5

FIG. 3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2
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15
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9a
9b
4a
5
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16a
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16b
13
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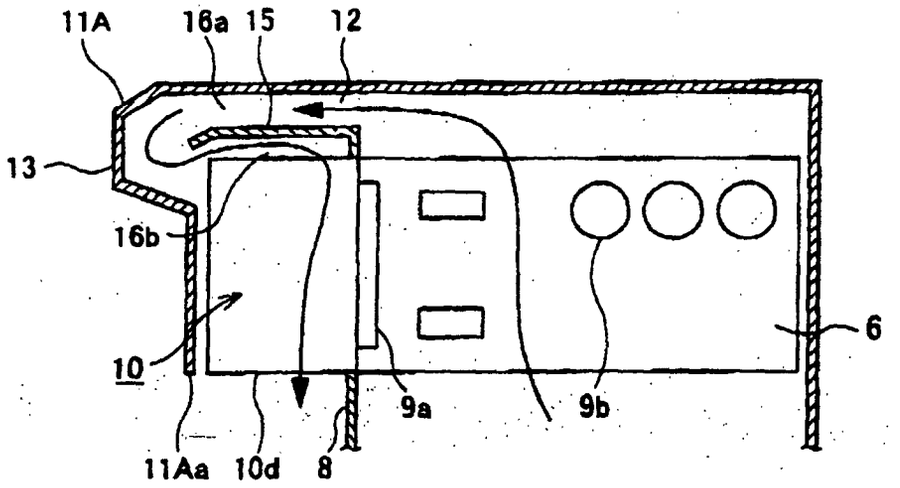
10a
10
10d
8a
8
10b
7
6

FIG. 4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9b
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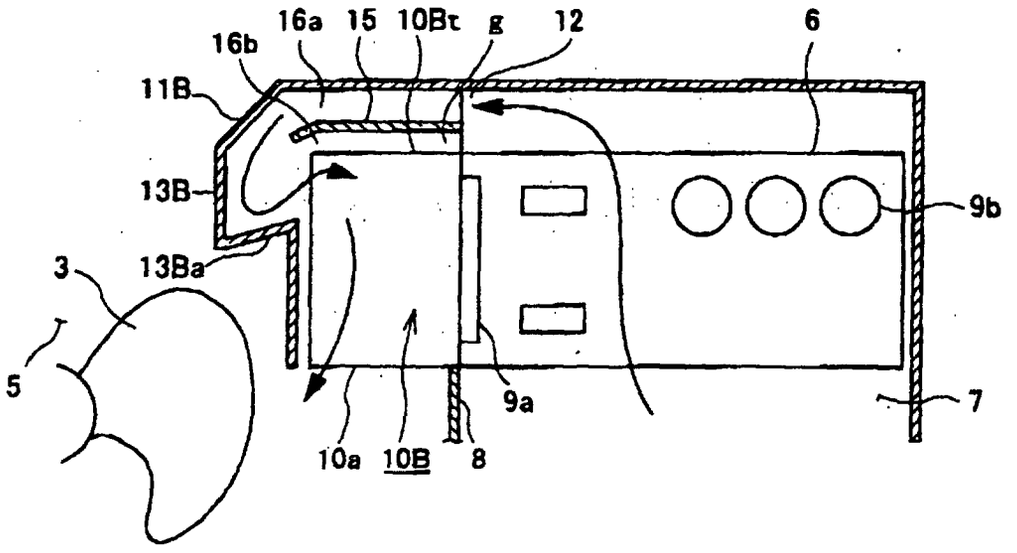
10d
8

FIG. 5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g
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16b
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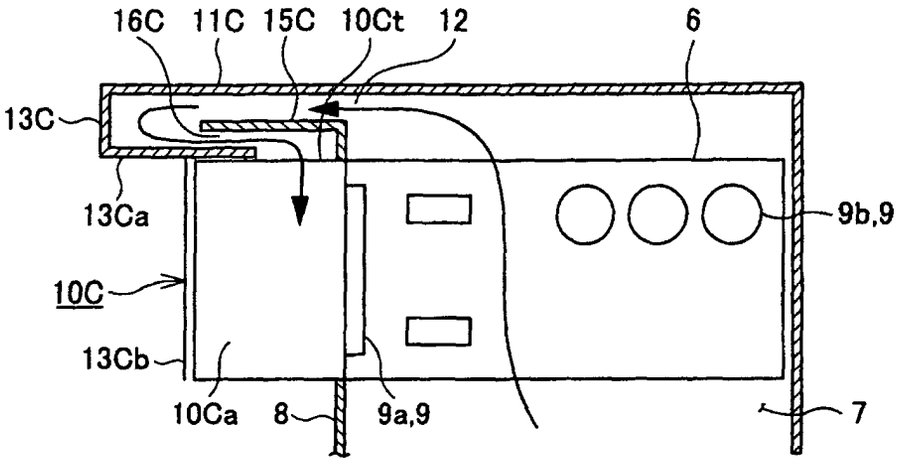
9b
3
13Ba
5
9a
7
10a
10B
8

FIG. 6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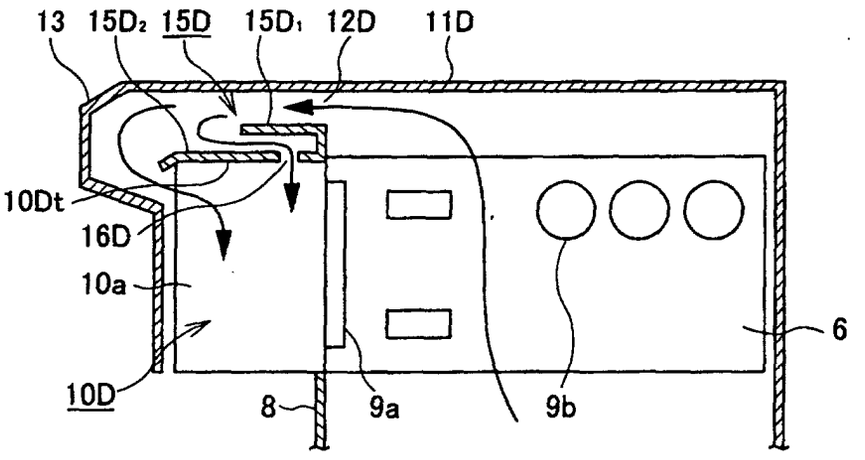
13Ca
9b,9
10C
13Cb
10Ca
8
9a,9
7

FIG. 7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15D1
12D
11D
10Dt
16D
10a
6
10D
8
9a
9b

FIG. 8

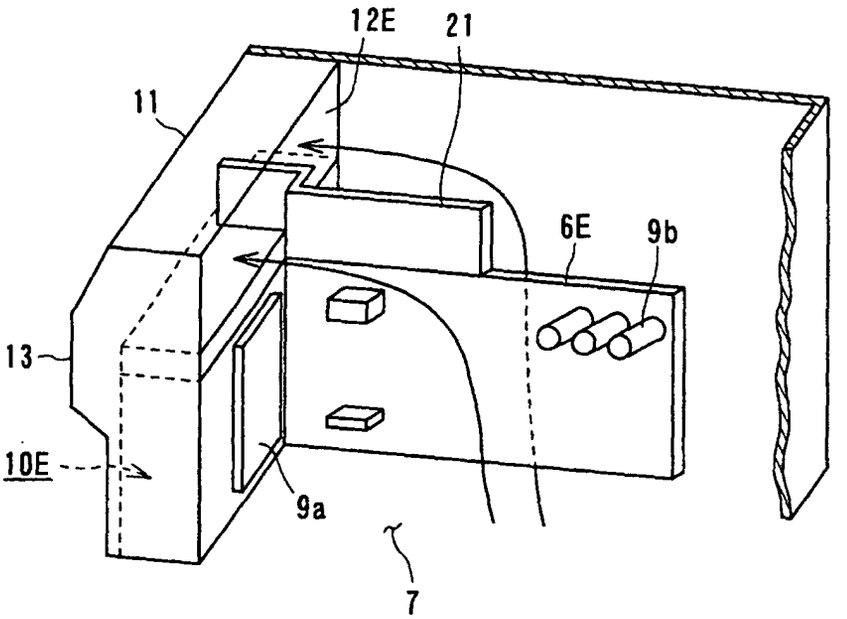


FIG. 9

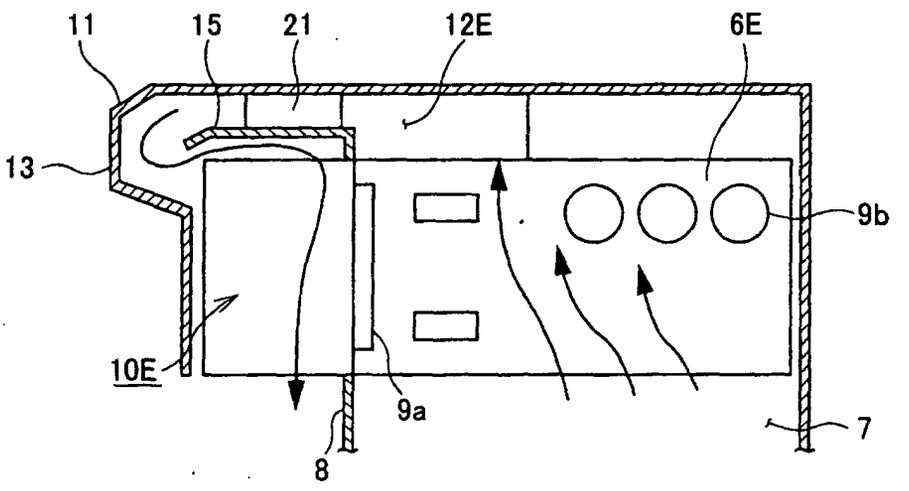
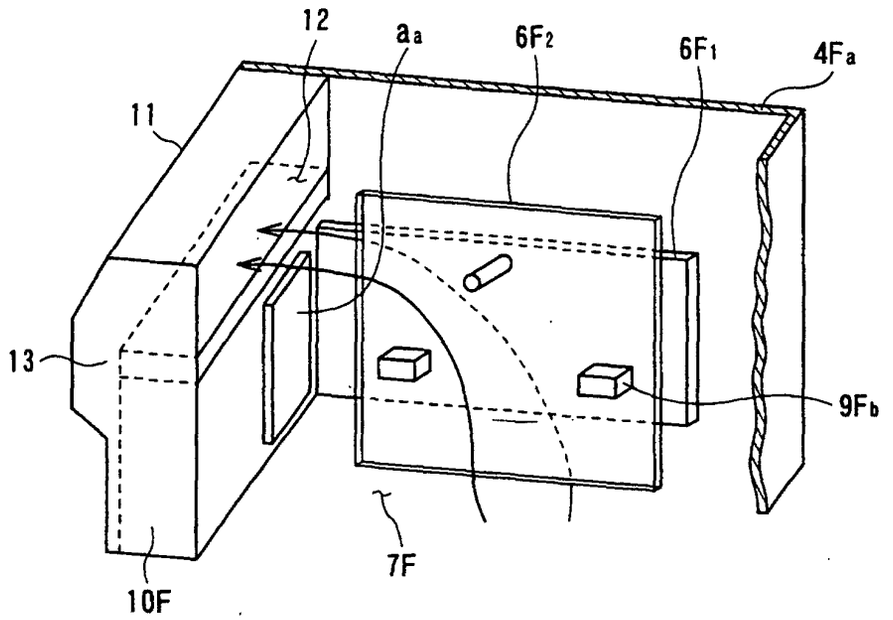


FIG. 10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a_a
$6F_2$
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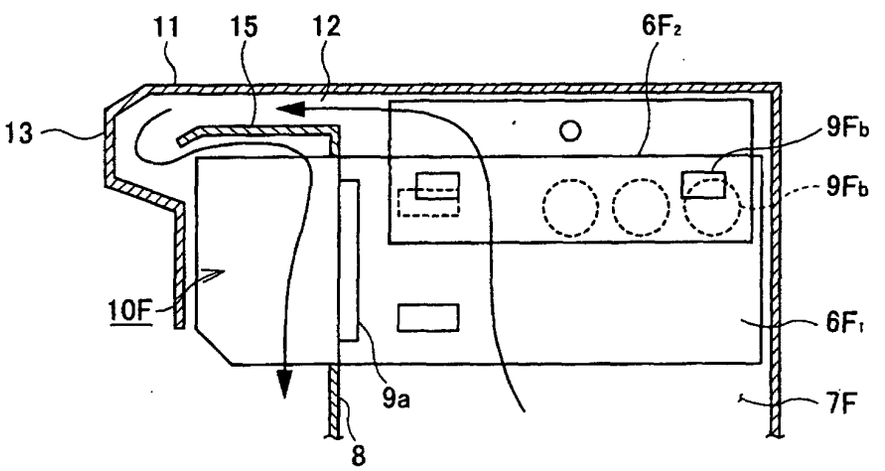
11
13
$9F_b$
7F
10F

FIG. 11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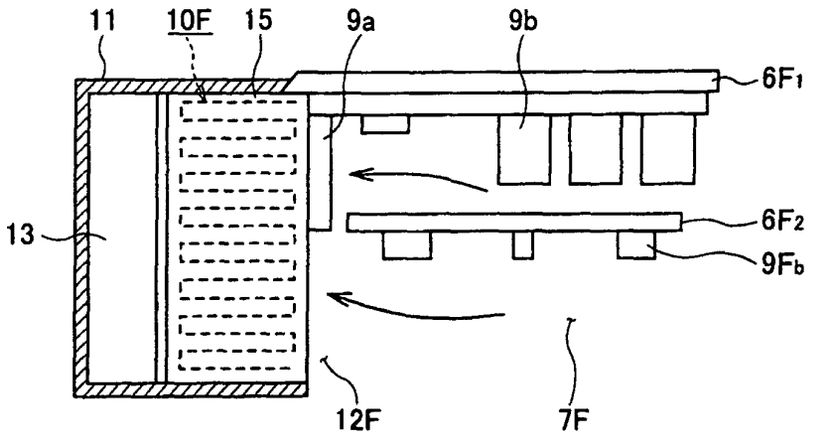
15
12
$6F_2$
13
$9F_b$
$9F_b$
10F
$6F_1$
9a
7F
8

FIG. 12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9a
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6F2
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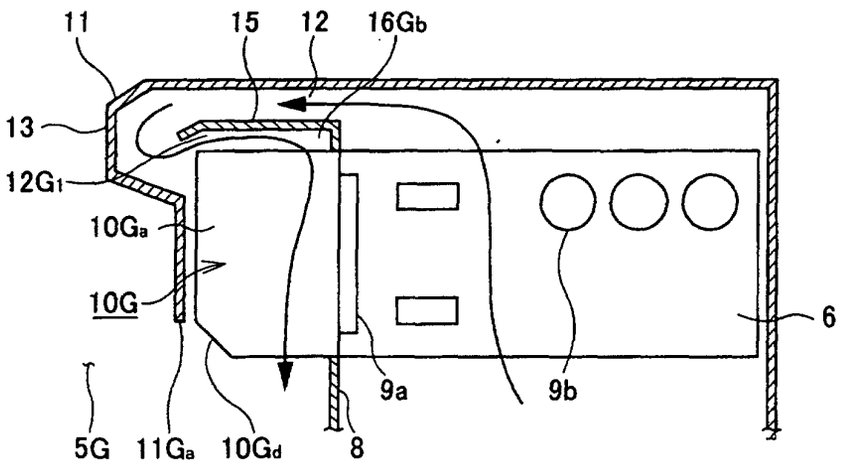
12F
7F

FIG. 13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9a
9b
5G
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10Gd
8

FIG. 14

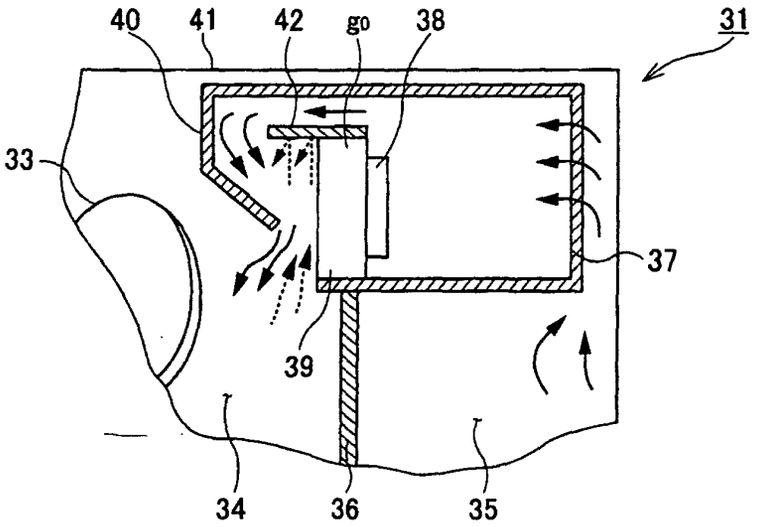

FIG. 15

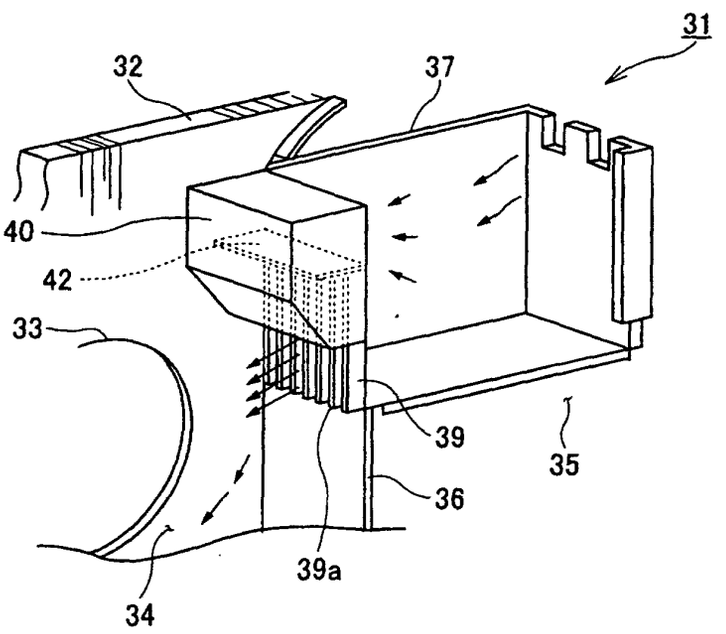

FIG. 16

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP02/07920

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[7] F24F5/00

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] F24F5/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho	1926-1996	Toroku Jitsuyo Shinan Koho	1994-2002
Kokai Jitsuyo Shinan Koho	1971-2002	Jitsuyo Shinan Toroku Koho	1996-2002

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.
X Y	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 62159/1990 (Laid-open No. 100729/1991) (Toshiba Corp.), 21 October, 1991 (21.10.91), Page 9, lines 9 to 12 (Family: none)	1-5,8 6,7
Y A	JP 11-118203 A (Mitsubishi Electric Corp.), 30 April, 1999 (30.04.99), Full text; all drawings (Family: none)	6,7 1-5,8
A	JP 2000-104951 A (Mitsubishi Electric Corp.), 11 April, 2000 (11.04.00), Full text; all drawings (Family: none)	1-8

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

* Special categories of cited documents:
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
23 August, 2002 (23.08.02)	10 September, 2002 (10.09.02)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (July 1998)