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(54) **AIR CONDITIONING APPARATUS**

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EP 2 090 843 B1

Description

TECHNICAL FIELD

[0001] The present invention relates to air conditioning apparatuses.

BACKGROUND ART

[0002] In EP 1 014 011 A1 there is described an air conditioning apparatus according to the preamble of claim 1 and also a method and apparatus for controlling airflow in an indoor machine of an air conditioner. In more detail, there is provided an airflow control method and airflow controller for an air conditioner indoor unit capable of executing air conditioning so that indoor temperature distribution becomes uniform without any sense of airflow during heating operation. There are provided a turbofan that has an axis extending in an antero-posterior direction and blows air taken in from a front surface side radially outwardly with respect to an axis inside a casing and a heat exchanger disposed on the front surface side of the turbofan inside the casing. The casing is provided with outlet ports for blowing air from the turbofan in the vertical direction and the horizontal direction. During the heating operation, a control signal is outputted by a flap control section to an upper flap stepping motor and a left-hand flap stepping motor so as to narrow the openings of the upper, right-hand and left-hand flaps and make the opening of the lower flap wider than the openings of the upper, right-hand and left-hand flaps.

[0003] There have conventionally also been air conditioning apparatuses each of which includes an upper air-blowing port for blowing air supplied from a fan in the upward direction, a lower air-blowing port for blowing the air supplied from the fan in the downward direction, an upper damper for opening and closing the upper air-blowing port, and a lower damper for opening and closing the lower air-blowing port (see JP 2000-208366 A, for example).

[0004] During cooling operation of this air conditioning apparatus, the upper damper is opened and the lower damper is closed so that cold air may not be blown directly toward legs of a human body. During heating operation, on the other hand, the upper damper is closed and the lower damper is opened so that warm air may be sent toward the human legs.

[0005] When the upper and lower dampers are respectively kept opened and closed after stopping the cooling operation, a foreign substance may unfortunately invade the air conditioning apparatus from the upper air-blowing port. Then, the foreign substance may be caught at the closed lower damper without coming out from the lower air-blowing port. In a state that the foreign substance is stuck, when opening/closing of the lower damper is attempted upon a next startup operation, the lower damper may fail to normally operate due to the foreign substance.

SUMMARY OF INVENTION

INVENTION TO RESOLVE PROBLEM

[0006] An object of the present invention is accordingly to provide an air conditioning apparatus which enables a foreign substance to be easily taken out from a lower air-blowing port even if the foreign substance invades the apparatus from an upper air-blowing port, so that it is possible to prevent an operational failure in opening/closing of the shutter caused by the foreign substance.

SOLUTION TO PROBLEM

[0007] To achieve the above object, the present invention provides an air conditioning apparatus according to claim 1, comprising:

a main body casing;
an air-blowing fan placed inside the main body casing;
an upper air-blowing port provided in an upper part of the main body casing, for blowing air for air conditioning supplied from the fan;
a lower air-blowing port provided in a lower part of the main body casing for blowing air for air conditioning supplied from the fan;
a shutter for opening and closing the lower air-blowing port; and
a shutter driving section for driving the shutter, wherein
after or immediately before operation of the fan is stopped, the shutter is driven by the shutter driving section to put the lower air-blowing port into a fully opened state.

[0008] According to the above-configured air conditioning apparatus, the shutter is driven by the shutter driving section so that the lower air-blowing port is put into the fully opened state after or immediately before operation of the fan is stopped. As a result, even if a foreign substance invades the apparatus from the upper air-blowing port, the foreign substance can be easily taken out from the lower air-blowing port without being disturbed by the shutter. Also, it is possible to prevent operational failure of opening/closing of the shutter caused by invasion of the foreign substance into an air path to the lower air-blowing port.

[0009] In the air conditioning apparatus according to one embodiment of the invention, a lower air-blowing path for leading the air for air conditioning supplied from the fan to the lower air-blowing port is provided inside the main body casing,
the shutter is rotated around a shaft provided in a lower part of the lower air-blowing path, and
in the fully opened state of the shutter, a part of a lower wall surface among wall surfaces of the lower air-blowing

path is formed by a side surface of the shutter.

[0010] According to the embodiment, when the lower air-blowing port is put into the fully opened state by rotation of the shutter around the shaft provided in the lower part of the lower air-blowing path, a part of the lower wall surface among wall surfaces of the lower air-blowing path is formed by the side surface of the shutter, so that the lower surface of the lower air-blowing path has no level difference in level. This makes it possible for the invaded foreign substance to come out from the lower air-blowing port without being caught in the lower air-blowing path. Thereby, the foreign substance can easily be removed.

ADVANTAGEOUS EFFECTS OF INVENTION

[0011] As is cleared from the above, according to the air conditioning apparatus of the invention, even if a foreign substance invades from the upper air-blowing port, it is possible to easily take out the foreign substance from the lower air-blowing port. This makes it possible to realize an air conditioning apparatus which can prevent operational failure in opening/closing of the shutter caused by the foreign substance.

[0012] Also, according to the air conditioning apparatus in the one embodiment, in a state that the shutter is opened by rotation of the shutter around the shaft provided in the lower part of the lower air-blowing path, a part of the lower wall surface among wall surfaces of the lower air-blowing path is formed by a side surface of the shutter. This makes it possible for an invaded foreign substance to come out from the lower air-blowing port without being caught in the lower air-blowing path, and thereby, the foreign substance can easily be removed.

BRIEF DESCRIPTION OF DRAWINGS

[0013]

Fig. 1 shows a refrigerant circuit diagram of an air conditioning apparatus in one embodiment of the invention;

Fig. 2 shows a perspective view of a floor-mounted indoor unit of the air conditioning apparatus;

Fig. 3 shows a cross sectional view of the indoor unit of the air conditioning apparatus;

Fig. 4 shows a flow chart for explaining operation of a control device of the air conditioning apparatus;

Fig. 5A shows a schematic view of the indoor unit of the air conditioning apparatus, wherein an upper air-blowing port is opened by rotation of a flap while a lower air-blowing port is opened or closed by rotation of a shutter around a shaft;

Fig. 5B shows a schematic view of the indoor unit of the air conditioning apparatus, wherein the upper air-blowing port is in a state opened while the lower air-blowing port is in a state closed by the shutter;

Fig. 5C shows a schematic view of the indoor unit of the air conditioning apparatus, wherein the upper air-blowing port is in the opened state while the lower air-blowing port is in the opened state by the shutter which is reclined on and along a rear lower wall surface of a lower air-blowing path; and

Fig. 5D shows a schematic view of the indoor unit of the air conditioning apparatus, wherein the shutter has an operational failure due to a foreign substance.

DESCRIPTION OF EMBODIMENTS

[0014] Hereinbelow, embodiments of the present invention on an air conditioning apparatus will be described in detail with reference to drawings.

[0015] Fig. 1 shows a refrigerant circuit diagram of the air conditioning apparatus as one embodiment of the invention. As shown in Fig. 1, the air conditioning apparatus has a compressor 1, a four-way valve 2 one end of which is connected to a discharge side of the compressor 1, an outdoor heat exchanger 3 one end of which is connected to another end of the four-way valve 2, an electric expansion valve 4 one end of which is connected to the other end of the outdoor heat exchanger 3, an indoor heat exchanger 5 one end of which is connected to the other end of the electric expansion valve 4 via a closing valve 12, and an accumulator 6 one end of which is connected to the other end of the indoor heat exchanger 5 via a closing valve 13 and the four-way valve 2 while the other end of the accumulator 6 is connected to a suction side of the compressor 1. A refrigerant circuit is formed by the compressor 1, the four-way valve 2, the outdoor heat exchanger 3, the electric expansion valve 4, the indoor heat exchanger 5 and the accumulator 6.

[0016] The air conditioning apparatus has an outdoor fan 7 placed in the vicinity of the outdoor heat exchanger 3, an indoor fan 8 placed in the vicinity of the indoor heat exchanger 5, a flap driving section 32 for driving a flap 24, a shutter driving section 31 for driving the shutter 30 (shown in Fig. 3), and a control device 11 for controlling the compressor 1, the electric expansion valve 4, the outdoor fan 7, the indoor fan 8, the flap driving section 32, the shutter driving section 31 and so on.

[0017] The control device 11 is formed by a microcomputer, an input/output circuit and so on. The control device 11 has a flap control section 11a for controlling the flap driving section 32, and a shutter control section 11b for controlling the shutter driving section 31.

[0018] An outdoor unit 10 is formed by the compressor 1, the four-way valve 2, the outdoor heat exchanger 3, the electric expansion valve 4, the accumulator 6, the outdoor fan 7 and the control device 11. An indoor unit 20 is formed by the indoor heat exchanger 5, the indoor fan 8, the flap driving section 32 and the shutter driving section 31.

[0019] In heating operation of the air conditioning apparatus having the above configuration, when the compressor 1 is started after the four-way directional control valve 2 is switched to a switch position shown by a solid line, a high pressure refrigerant discharged from the com-

pressor 1 goes into the indoor heat exchanger 5 via the four-way directional control valve 2. Then, the refrigerant is condensed by the indoor heat exchanger 5, decompressed by the electric expansion valve 4, and goes into the outdoor heat exchanger 3. The refrigerant is evaporated in the outdoor heat exchanger 3 and returns to the suction side of the compressor 1 via the four-way directional control valve 2 and the accumulator 6. In this way, to implement a refrigerating cycle, the refrigerant circulates through the refrigerant circuit which is formed by the compressor 1, the indoor heat exchanger 5, the electric expansion valve 4, the outdoor heat exchanger 3 and the accumulator 6. Indoor air is circulated through the indoor heat exchanger 5 by the indoor fan 8, and thereby the indoor room is heated.

[0020] On the other hand, in cooling operation, the four-way directional control valve 2 is switched to a switch position shown by a dotted line. The refrigerating cycle is implemented by circulation of the refrigerant in order of the compressor 1, the outdoor heat exchanger 3, the electric expansion valve 4, the indoor heat exchanger 5, and the accumulator 6.

[0021] Fig. 2 shows a perspective view of the indoor unit 20 of the air conditioning apparatus. The indoor unit 20 has a base frame 21, a front grill 22 and a front panel 23, as shown in Fig. 2, wherein the base frame 21 has a generally rectangular shape whose rear-face side is mounted on an indoor wall surface, wherein the front grill 22 is mounted on the front side of the base frame 21 and has a generally rectangular-shaped opening 22c, and wherein the front panel 23 is mounted so as to cover the opening 22c of the front grill 22.

[0022] An upper side outlet 22a is provided in the upper part of the front grill 22. A lower side outlet 22b is provided in the lower part of the front grill 22. The upper side outlet 22a of the front grill 22 is equipped with a flap 24. The flap 24 rotates during cooling and heating operations to respectively blow cool and warm air from the upper side outlet 22a in the obliquely upward forward direction. At the time of stoppage, the flap 24 covers the upper side outlet 22a, as shown in Fig. 2.

[0023] An upper side inlet 23a is provided on the upper side of the front panel 23. A lower side inlet 23b is provided on the lower side of the front panel 23. Further, lateral inlets 23c are provided on the right and left sides of the front panel 23 (Fig. 2 shows only a right-side inlet).

[0024] Fig. 3 shows a cross sectional view of the indoor unit 20 of the air conditioning apparatus. As shown in Fig. 3, a motor 26 is fixed onto a generally central portion of the base frame 21. The indoor fan 8, as an example of an air-blowing fan, placed on the base frame 21 so as to be connected to a shaft of the motor 26 which is oriented in an anteroposterior direction. The indoor fan 8 is a turbo fan for blowing air, which is sucked from the front side, in the outward radial direction with respect to the shaft. A bell mouth 27 is provided in the base frame 21 on the front side of the indoor fan 8. The indoor heat exchanger 5 is placed on the front side of the bell mouth 27. The front grill 22 is mounted on the front side of the indoor heat exchanger 5. The front panel 23 is mounted on the front side of the front grill 22. The opening 22c of the front grill 22 is equipped with a filter 25. A drain pan 28 is placed in the lower part of the bell mouth 27 and on the lower side of the indoor heat exchanger 5.

[0025] A flap 24, which vertically controls the blowing air, is placed in the upper air-blowing port 22a of an upper air-blowing path P1 in the front grill 22. The flap 24 is rotated by using the flap driving section 32 (shown in Fig. 1) around a shaft (not shown) provided on the side of the base frame 21. In the figure, an open state A1 of the flap 24 is shown by an alternate long and short dash line, whereas a closed state B1 is shown by a solid line.

[0026] The shutter 30 is placed in a lower air-blowing path P2 of the front grill 22, so that the lower air-blowing port 22b can be opened and closed by the shutter 30. The shutter 30 is rotated by using the shutter driving section 31 (shown in Fig. 1) around a shaft 30a which is provided on the side of the base frame 21 and on the lower side of the lower air-blowing path P2. In the figure, a fully opened state A2 and a fully closed state B2 are shown by an alternate long and short dash line. When the shutter 30 is in the fully opened state, a part of a lower curved inclined wall surface among wall surfaces of the lower air-blowing path P2 is formed by a side surface of the shutter 30, so that the lower surface of the lower air-blowing path P2 has no difference in level.

[0027] The air is sucked through the opening 22c of the front grill 22 by using the indoor fan 8, so that the air is blown in the outward radial direction with respect to the shaft of the indoor fan 8. Then, the air is blown out forward and obliquely upward from the upper air-blowing port 22a via the upper air-blowing path P1, while the air is blown out forward from the lower air-blowing port 22b via the lower air-blowing path P2.

[0028] Description is given on stop processing of the control device 11 in the air conditioning apparatus with reference to a flow chart shown in Fig. 4. It should be noted that the stop processing is repeatedly performed during air conditioning operation.

[0029] Upon start of the stop processing, it is determined in a step S1 whether or not the operation is stopped. If it is determined that the operation is stopped, then go to a step S2. If it is determined that the operation is not stopped, then the processing is ended.

[0030] In the step S2, the flap 24 is rotated to be closed by the flap driving section 32. As the result, the upper air-blowing port 22a is closed. Then, next is to proceed to a step S3.

[0031] In the step S3, it is determined whether or not the shutter 30 is in a closed state. If it is determined that the shutter 30 is in the closed state, then proceed to a step S4. If it is determined that the shutter 30 is not in the closed state, then end the processing.

[0032] In the step S4, the shutter 30 is opened to put the lower air-blowing port 22b into the fully opened state by the shutter driving section 31. Next, the processing is

ended. The lower air-blowing port 22b is put into the fully opened state either after or immediately before the air conditioning operation is stopped. At least, either after or immediately before the operation of the indoor fan 8 is stopped, the lower air-blowing port 22b is put into the fully opened state.

[0033] Figs. 5A to 5D show schematic views of operating states of the flap 24 and the shutter 30 in the indoor unit 20 of the air conditioning apparatus, wherein a reference numeral 8 denotes the indoor fan.

[0034] Fig. 5A shows that the upper air-blowing port 22a is opened by rotation of the flap 24 while the lower air-blowing port 22b is opened or closed by rotation of the shutter 30 around the shaft 30a. Fig. 5B shows that the upper air-blowing port 22a is in the closed state while the lower air-blowing port 22b is closed by the shutter 30. Fig. 5C shows that the upper air-blowing port 22a is in the closed state while the lower air-blowing port 22b is opened by the shutter 30 which is reclined on and along a rear lower wall surface of a lower air-blowing path.

[0035] If a foreign substance invades from the upper air-blowing port 22a under the state shown in Fig. 5B (b) and thereafter the shutter 30 is rotated as shown in Fig. 5C, then the shutter 30 has an operational failure due to the foreign substance 50 as shown in Fig. 5D.

[0036] Contrary to this, according to the air conditioning apparatus in the embodiment of the present invention, upon stop of the operation, the shutter 30 is driven by the shutter driving section 31 to put the lower air-blowing port 22b into the fully opened state. Therefore, even if a foreign substance invades from the upper air-blowing port 22a, it is possible to easily take out a foreign substance from the lower air-blowing port 22b. This makes it possible to realize an air conditioning apparatus which can prevent the operational failure in opening/closing of the shutter 30 caused by the foreign substance.

[0037] Also, when the lower air-blowing port 22b is put into the fully opened sate by rotation of the shutter 30 around the shaft 30a provided in the lower part of the lower air-blowing path P2, a part of the lower curved inclined wall surface among wall surfaces of the lower air-blowing path P2 is formed by the side surface of the shutter 30, so that the lower surface of the lower air-blowing path P2 has no level difference in level. This makes it possible for an invaded foreign substance to come out from the lower air-blowing port 22b without being caught in the lower air-blowing path P2. Thereby, the foreign substance can easily be removed.

[0038] In the above-stated embodiments, description has been given on the air conditioning apparatus using the indoor fan 8 which is a turbo fan blowing the air sucked from the front side toward the outward radial direction with respect to the shaft. However, the fan for blowing air is not limited to the above. The present invention is applicable to air conditioning apparatus using other types of centrifugal fans or the like.

[0039] In the embodiments, the separate-type air conditioning apparatus having exterior and indoor units has been employed. However, the present invention may also be applied to air conditioning apparatus having other configurations.

Claims

1. An air-conditioning apparatus, comprising:

a main body casing (21, 22);
an air-blowing fan (8) placed inside the main body casing (21, 22);
an upper air-blowing port (22a) provided in an upper part of the main body casing (21, 22) and configured to blow air for air conditioning supplied from the fan (8);
a lower air-blowing port (22b) provided in a lower part of the main body casing (21, 22) and configured to blow air for air conditioning supplied from the fan (8);
a shutter (30) configured to open and close the lower air-blowing port (22b); and
a shutter driving section (31) configured to drive the shutter (30), **characterized in that** after or immediately before operation of the fan (8) is stopped, the shutter driving section (31) is configured to drive the shutter (30) to put the lower air-blowing port (22b) into a fully opened state.

2. The air conditioning apparatus according to claim 1, wherein
a lower air-blowing path (P2) for leading the air for air conditioning supplied from the fan (8) to the lower air-blowing port (22b) is provided inside the main body casing (21, 22),
the shutter (30) is rotatable around a shaft provided in a lower part of the lower air-blowing path (P2), and in the fully opened state of the shutter (30), a part of a lower wall surface among wall surfaces of the lower air-blowing path (P2) is formed by a side surface of the shutter (30).

Patentansprüche

1. Klimaanlagenvorrichtung umfassend:

ein Hauptkörpergehäuse (21, 22);
einen Gebläselüfter (8), der innerhalb des Hauptkörpergehäuses (21, 22) platziert ist;
eine obere Gebläseöffnung (22a), die in einem oberen Teil des Hauptkörpergehäuses (21, 22) bereitgestellt ist und so konfiguriert ist, dass sie Luft zur Klimatisierung ausbläst, die von dem Lüfter (8) geliefert wird;
eine untere Gebläseöffnung (22b), die in einem unteren Teil des Hauptkörpergehäuses (21, 22) bereitgestellt ist und so konfiguriert ist, dass sie

Luft zur Klimatisierung ausbläst, die von dem Lüfter (8) geliefert wird;
einen Verschluss (30), der so konfiguriert ist, dass er die untere Gebläseöffnung (22b) öffnet und zu schließt; und
einen Verschlussantriebsabschnitt (31), der so konfiguriert ist, dass er den Verschluss (30) antreibt,
dadurch gekennzeichnet, dass nachdem oder unmittelbar bevor der Betrieb des Lüfters (8) gestoppt ist, der Verschlussantriebsabschnitt (31) so konfiguriert ist, dass er den Verschluss (30) antreibt, um die untere Gebläseöffnung (22b) in einen vollständig geöffneten Zustand zu bringen.

2. Klimaanlagenvorrichtung nach Anspruch 1, wobei ein unterer Gebläsepfad (P2) zum Führen der Luft zur Klimatisierung, die von dem Lüfter (8) zu der unteren Gebläseöffnung (22b) geliefert wird, innerhalb des Hauptkörpergehäuses (21, 22) bereitgestellt ist, der Verschluss (30) um einen Schaft drehbar ist, der in einem unteren Teil des unteren Gebläsepfads (P2) bereitgestellt ist, und
im vollständig geöffneten Zustand des Verschlusses (30) ein Teil von einer untere Wandfläche zwischen Wandflächen des unteren Gebläsepfads (P2) durch eine Seitenfläche des Verschlusses (30) gebildet ist.

Revendications

1. Appareil de climatisation comprenant :

un boîtier de corps principal (21, 22) ;
un ventilateur de soufflage d'air (8) placé à l'intérieur du boîtier de corps principal (21, 22) ;
un orifice de soufflage d'air supérieur (22a) prévu dans une partie supérieure du boîtier de corps principal (21, 22) et configuré pour souffler l'air pour la climatisation fourni à partir du ventilateur (8) ;
un orifice de soufflage d'air inférieur (22b) prévu dans une partie inférieure du boîtier de corps principal (21, 22) et configuré pour souffler l'air pour la climatisation fourni par le ventilateur (8) ;
un obturateur (30) configuré pour ouvrir et fermer l'orifice de soufflage d'air inférieur (22b) ; et
une section d'entraînement d'obturateur (31) configurée pour entraîner l'obturateur (30), **caractérisé en ce que** :

après ou immédiatement avant l'arrêt du fonctionnement du ventilateur (8), la section d'entraînement d'obturateur (31) est configurée pour entraîner l'obturateur (30) à mettre l'orifice de soufflage d'air inférieur (22b) dans un état complètement ouvert.

2. Appareil de climatisation selon la revendication 1, dans lequel :

une trajectoire de soufflage d'air inférieure (P2) pour amener l'air pour la climatisation fourni par le ventilateur (8) à l'orifice de soufflage d'air inférieur (22b), est prévue à l'intérieur du boîtier de corps principal (21, 22),
l'obturateur (30) peut tourner autour d'un arbre prévu dans une partie inférieure de la trajectoire de soufflage d'air inférieure (P2), et
à l'état complètement ouvert de l'obturateur (30), une partie d'une surface de paroi inférieure parmi les surfaces de paroi de la trajectoire de soufflage d'air inférieure (P2), est formée par une surface latérale de l'obturateur (30).

Fig.1

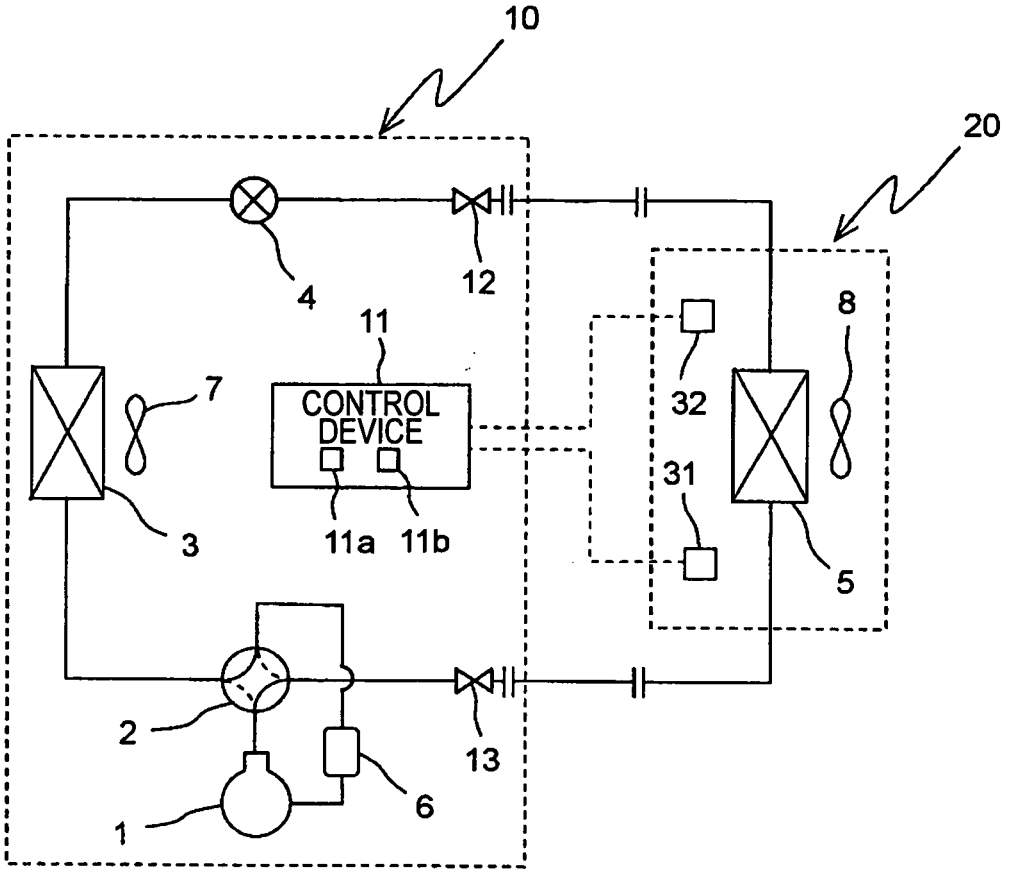


Fig.2

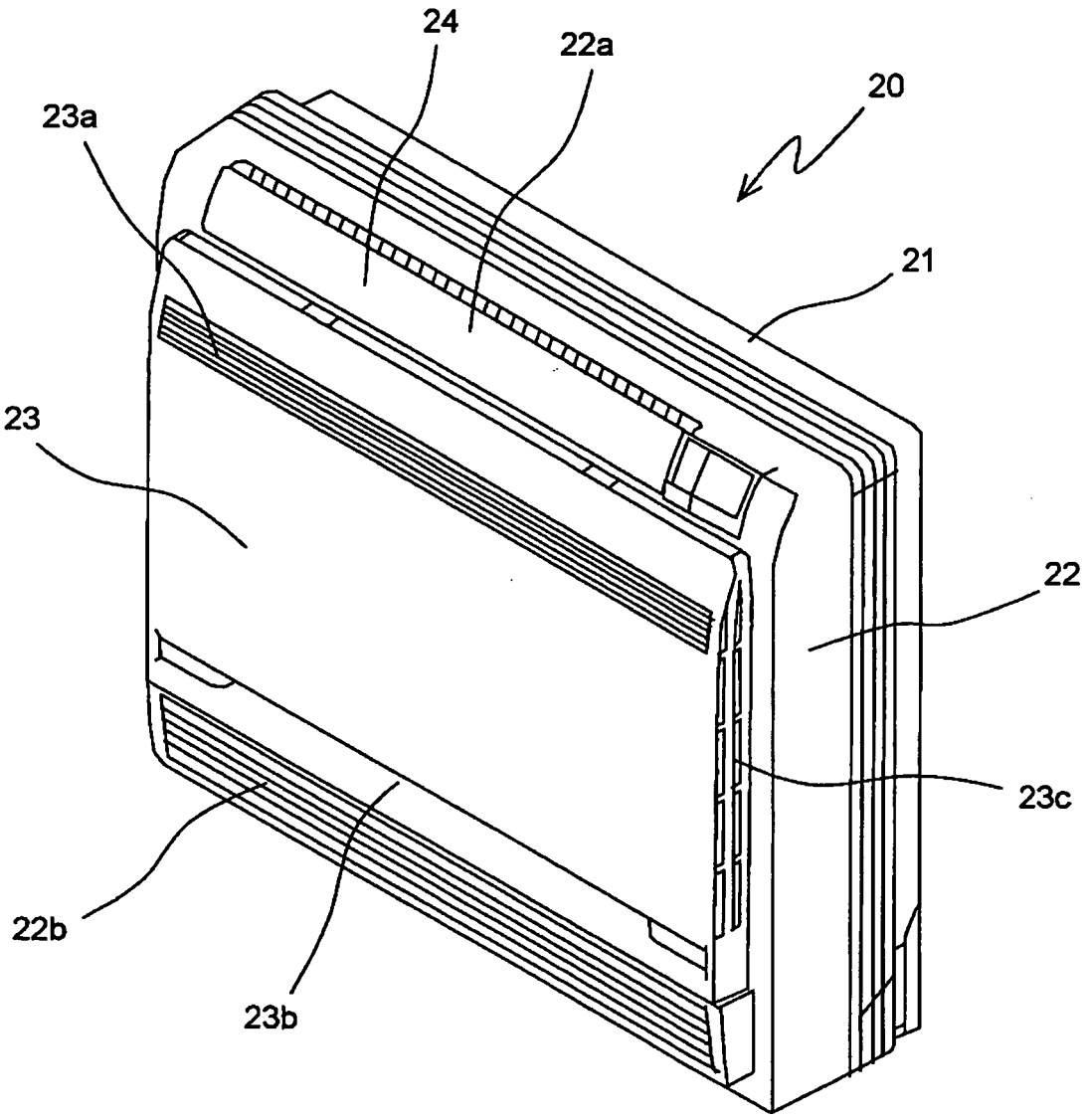


Fig.3

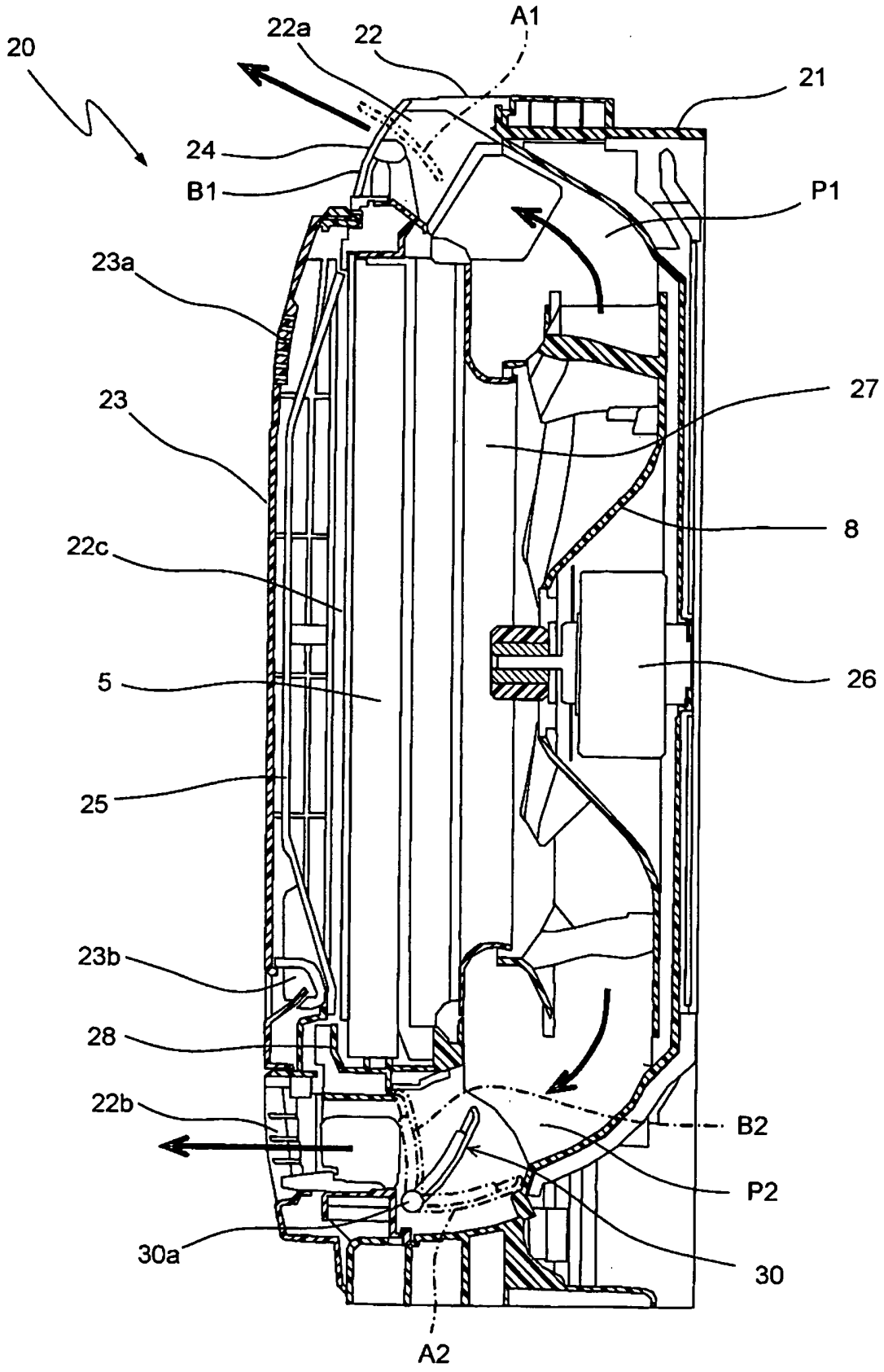

20
22a
22
A1
21
24
B1
P1
23a
23
27
8
22c
5
26
25
23b
28
22b
B2
P2
30a
30
A2

Fig.4

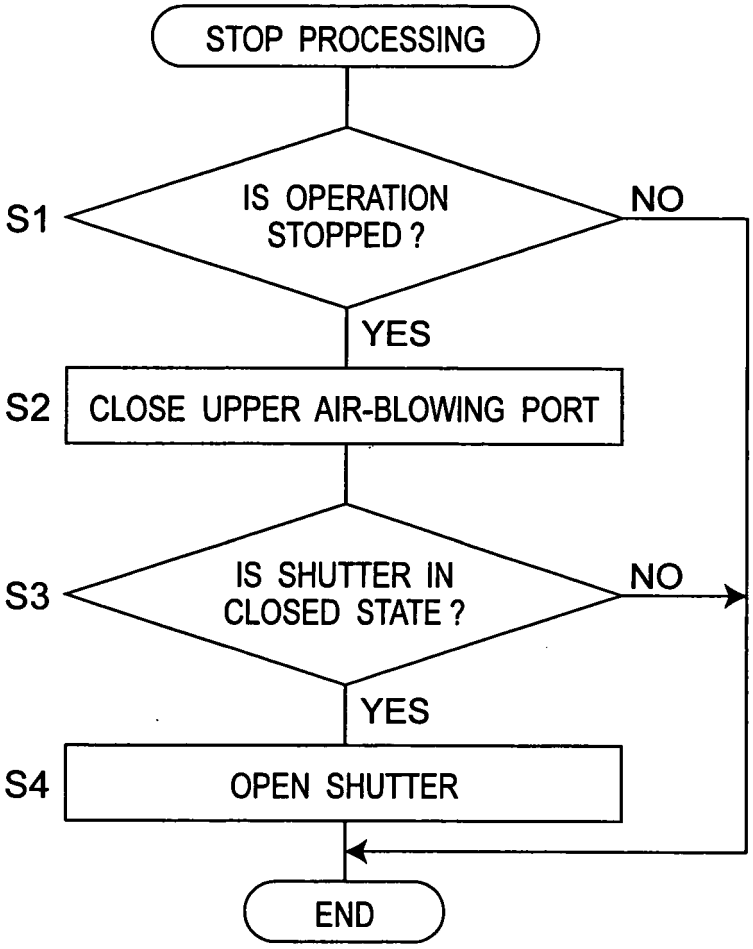

STOP PROCESSING
S1
IS OPERATION STOPPED ?
NO
YES
S2
CLOSE UPPER AIR-BLOWING PORT
S3
IS SHUTTER IN CLOSED STATE ?
NO
YES
S4
OPEN SHUTTER
END

Fig.5A

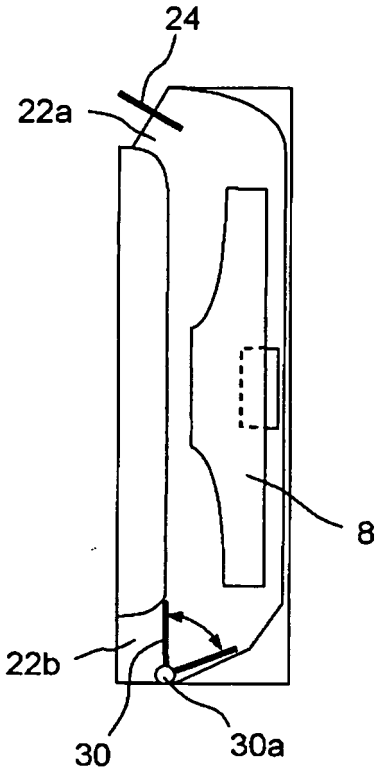


Fig.5B

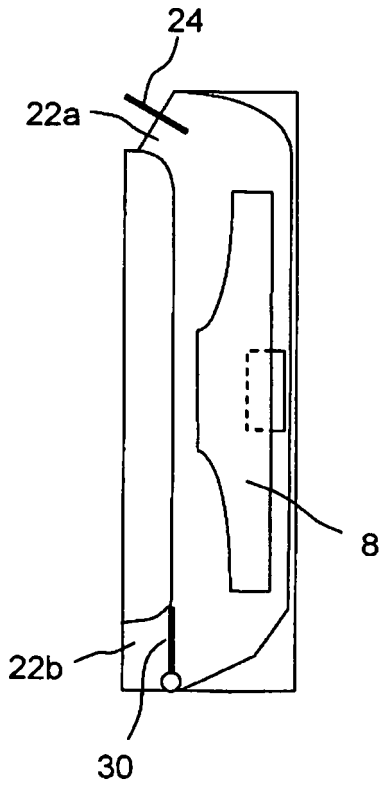


Fig.5C

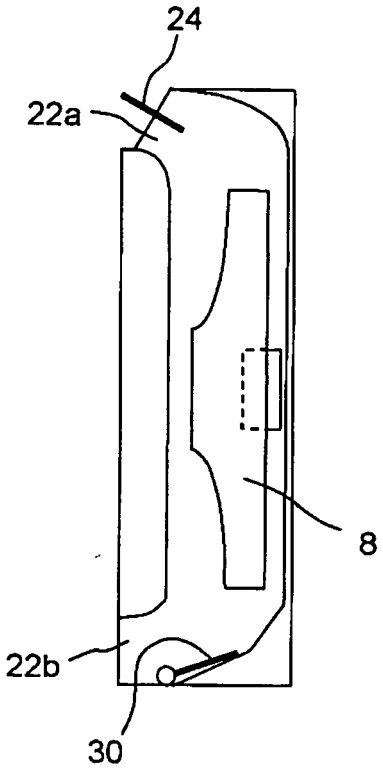
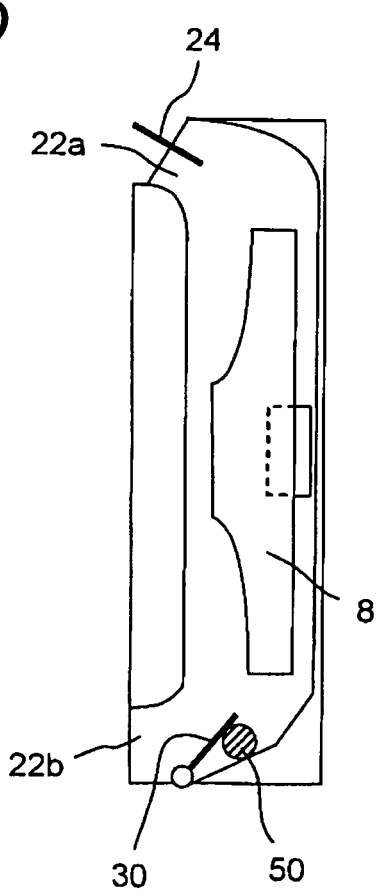


Fig.5D



REFERENCES CITED IN THE DESCRIPTION

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- JP 2000208366 A **[0003]**