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(11) **EP 1 008 814 A1**

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

(43) Date of publication:
14.06.2000 Bulletin 2000/24

(51) Int. Cl.⁷: **F24F 1/00**

(21) Application number: **98931046.1**

(86) International application number:
PCT/JP98/03103

(22) Date of filing: **10.07.1998**

(87) International publication number:
WO 99/08050 (18.02.1999 Gazette 1999/07)

(84) Designated Contracting States:
ES FR IT

(30) Priority: **08.08.1997 JP 21505897**

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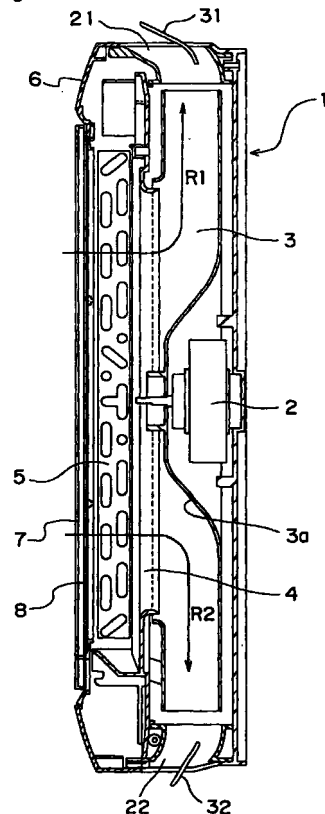
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(54) **AIR OUTLET STRUCTURE OF AIR CONDITIONERS**

(57) The invention provides an air outlet structure for air conditioners which enables air conditioning to be performed so that the room temperature distribution becomes uniform while any draft feeling is eliminated, without involving the swing function of flaps. In a casing, are provided a turbofan (3) whose axis is positioned along a back-and-forth direction and which blows off air, which has been sucked from the front side, radially outwardly with respect to the axis, and a heat exchanger (5) disposed in the casing on the front side of the turbofan (3). The casing has outlets (21, 22, 23, 24) for blowing off air, which has been blown off from the turbofan (3), in upper and lower, right and left directions. The ranging distance of air blown off from the upper outlet (21) is larger than ranging distances of air blown off from the lower, right and left outlets (22, 23, 24).

Fig. 3



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Description

TECHNICAL FIELD

[0001] The present invention relates to an air outlet structure for air conditioners which perform room air conditioning.

BACKGROUND ART

[0002] Conventionally, there has been provided an air conditioner in which a cross fin heat exchanger and a cross flow fan are disposed in a generally rectangular casing mounted on a wall surface, so that conditioning air is blown off from an air outlet provided on the under-side of the casing.

[0003] However, in this air conditioner, as shown in Fig. 8A, since the air flow direction of the conditioning air of an indoor unit 80 mounted on a wall surface is generally restricted to a forward direction, people tend to feel a draft in a living space S1 particularly during heating operation. Also, unless flaps for controlling the air flow direction are swung, it could be impossible to obtain a uniform temperature distribution, which causes a problem in comfortableness.

DISCLOSURE OF THE INVENTION

[0004] Therefore, an object of the present invention is to provide an air outlet structure for air conditioners which enables air conditioning to be performed so that the room temperature distribution becomes uniform while any draft feeling is eliminated, without involving the swing function of flaps.

[0005] In order to achieve the above-mentioned object, the present invention provides an air outlet structure for air conditioners, which comprises: a casing; a turbofan whose axis is positioned in the casing along a back-and-forth direction and which blows off air, which has been sucked from a front side, radially outwardly with respect to the axis; and a heat exchanger disposed in the casing on the front side of the turbofan, the casing having outlets for blowing off the air, which has been blown off from the turbofan, in upper and lower, right and left directions, as well as flaps for controlling flow directions of the air blown off from the outlets, respectively, wherein a ranging distance of the air blown off from the upper outlet is larger than any ranging distance of the air blown off from the lower, right and left outlets.

[0006] According to this invention, by the four-direction blowoff, blown-off air flows and circulates so as to engulf the indoor living space along the wall surface, the ceiling surface and the floor surface. Further, the ranging distance of air blown off from the upper outlet is larger than the ranging distances of air blown off from the lower-side, right-side and left-side outlets. As a result, for example, when the air blown off from the upper outlet is directed toward the front and set at a

higher velocity than the other outlets, air in the vicinity of the ceiling is pushed toward the opposite wall surface side, and further flows from the opposite wall surface side to the lower floor surface, thus the air being efficiently stirred so as to engulf the living space in the room. Therefore, warm air in upper part of the room is circulated particularly in the heating operation, by which floatage of warm air or residence of warm air in the upper part of the room is prevented. Thus, an air conditioning in which the indoor temperature distribution is uniform and which is free from any draft feeling can be attained without swinging function of flaps.

[0007] In an embodiment of the air outlet structure for air conditioners according to Claim 1, an angle of inclination of a direction of the air blown off from the upper outlet with respect to a plane vertical to the axis of the turbofan is larger than any angle of inclination of directions of air blown off from the lower, right and left outlets with respect to the plane vertical to the axis of the turbofan.

[0008] According to this embodiment, the angle of inclination of the direction of air blown off from the upper outlet with respect to a plane vertical to the axis of the turbofan is set larger than the angle of inclination of the directions of air blown off from the lower, right and left outlets with respect to a plane vertical to the axis of the turbofan, by which the air from the upper outlet is blown off forward and toward a wall surface opposite to the wall surface on which this indoor unit is mounted. Therefore, the ranging distance of the air blown off from the upper outlet can be made longer than the ranging distances of the air blown off from the lower, right and left outlets.

[0009] In an embodiment of the air outlet structure for air conditioners according to Claim 1 or 2, a length from front edge to rear edge of the upper flap is longer than any length from front edge to rear edge of the lower, right and left flaps.

[0010] According to this embodiment, the length from front edge to rear edge of the upper flap is set longer than the lengths from front edge to rear edge of the other flaps. As a result, a more effective air flow control can be attained so that the blowoff of air from the upper outlet to the front can be easily achieved.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011]

Fig. 1 is an exploded perspective view of main part of an indoor unit using an air outlet structure for air conditioners according to an embodiment of the present invention;

Fig. 2 is a front view of the indoor unit;

Fig. 3 is a sectional view as viewed from the line III-III of Fig. 2;

Fig. 4 is a schematic structural view of the indoor unit;

Fig. 5 is a main-part sectional view showing the air outlet structure on the upper side of the indoor unit;

Fig. 6 is a main-part sectional view showing the air outlet structure on the lower, left and right side of the indoor unit;

Fig. 7 is a view showing a state in which the indoor unit is mounted on an indoor wall surface; and

Fig. 8A is a view showing an air flow state of an indoor unit of an air conditioner according to the prior art, and Fig. 8B is a view showing an air flow state of the indoor unit of an air conditioner according to the embodiment of the invention.

BEST MODE FOR CARRYING OUT THE INVENTION

[0012] The air outlet structure for air conditioners according to the present invention is described in detail by way of embodiments thereof.

[0013] Fig. 1 is an exploded perspective view of main part of an indoor unit using the air outlet structure for air conditioners according to an embodiment of the present invention, where reference numeral 1 denotes a generally square-shaped bottom frame whose rear side is mounted on a room wall surface; 2 denotes a motor fixed via a motor fixing plate 12 to a mounting portion 11 provided at a generally center of the bottom frame 1; 3 denotes a turbofan whose axis is positioned in the bottom frame 1 along the back-and-forth direction and which is driven by the motor 2 so that the turbofan blows off air, which has been sucked from the front side, radially outwardly with respect to the axis; 4 denotes a bell mouth mounted on the bottom frame 1 on the front side of the turbofan 3; 5 denotes a heat exchanger mounted on the front side of the bell mouth 4; 6 denotes a front panel which is mounted on the bottom frame 1 on the front side of the heat exchanger 5 and which has a generally square-shaped suction port 6a; and 7 denotes a suction grille which is mounted on the suction port 6a of the front panel 6 and equipped with an air filter 8 on the rear side. A circular hole 14 is provided at a generally center of the bell mouth 4, and a drain pan 13 is disposed at a lower portion of the bell mouth 4. In addition, the bottom frame 1 and the front panel 6 constitute a casing.

[0014] Fig. 2 shows a front view of the indoor unit in which the suction grille 7 and the front panel 6 shown in Fig. 1 have been removed. As shown in Fig. 2, the bottom frame 1 has an outlet 21 on the upper side, an outlet 22 on the lower side, an outlet 23 on the right side, an outlet 24 on the left side. Also, an upper flap 31, a lower flap 32, a right flap 33 and a left flap 34 are attached at the outlets 21, 22, 23, 24, respectively. The upper flap 31, the lower flap 32, the right flap 33 and the left flap 34 are driven by an upper-flap stepping motor 41, a lower-flap stepping motor 42, a right-flap stepping motor 43 and a left-flap stepping motor 44, respectively, to control the flow directions of air blown off from the outlets 21, 22, 23, 24.

[0015] Fig. 3 is a sectional view as viewed from the line III - III of Fig. 2, where the turbofan 3 and the heat exchanger 5 are provided as thin type ones while the motor 2 mounted on the bottom frame 1 is accommodated in a recessed portion forming a curved surface 3a of the turbofan 3. Air sucked in from the front by the turbofan 3 is blown off from the upper-and-lower, right-and-left outlets 21, 22 (only two outlets shown in Fig. 3) as indicated by arrows R1, R2 via the suction grille 7, the air filter 8 and the heat exchanger 5. At the upper outlet 21, air from the turbofan 3 is blown off obliquely upward in the front when the upper flap 31 is at a specified degree of openness, where the air flow direction becomes about 60 degrees with respect to a plane vertical to the axis of the turbofan 3. Meanwhile, at the lower-side outlet 22, air from the turbofan 3 is blown off obliquely downward in the front when the lower flap 32 is at a specified degree of openness, where the air flow direction becomes about 30 degrees with respect to a plane vertical to the axis of the turbofan 3. Also, at the right outlet 23 and the left outlet 24 (shown in Fig. 2), which are similar in construction to the lower outlet 22, air from the turbofan 3 is blown off obliquely sideways in the front when the right flap 33 and the left flap 34 (shown in Fig. 2) are at a specified degree of openness, where the air flow direction becomes about 30 degrees with respect to a plane vertical to the axis of the turbofan 3. At the upper outlet 21, which is substantially larger in blowoff resistance than the other outlets 22, 23, 24, the velocity of blown-off air becomes faster. Like this, the direction of air blown off from the upper outlet 21 is set to the forward direction and the velocity of air blown off from the outlet 21 is made faster, so that the ranging distance of air blown off from the upper outlet 21 is made larger than that of the outlets 22, 23, 24.

[0016] Fig. 4 is a schematic structural view of the indoor unit. This indoor unit comprises the upper-flap stepping motor 41, the lower-flap stepping motor 42, the right-flap stepping motor 43 and the left-flap stepping motor 44 as a driving section, and a control unit 10 for controlling the stepping motors 41, 42, 43, 44, the turbofan 3 and the like. The control unit 10 comprises a microcomputer, input/output circuits and the like, and has a flap control section 10a which outputs a control signal to the stepping motors 41, 42, 43, 44 responsive to the state of operation thereby to control the degree of openness of the upper flap 31, the lower flap 32, the right flap 33 and the left flap 34. The stepping motors 41, 42, 43, 44 and the flap control section 10a of the control unit 10 constitute an air flow control unit.

[0017] Fig. 5 is a main-part sectional view of the upper-side outlet of the indoor unit for air conditioners, and Fig. 6 is a main-part sectional view of the lower-side, right-side and left-side of the indoor unit. It is noted that Figs. 5 and 6 are purposed to explain in detail the air outlet structure of the indoor unit for air conditioners, which is different from the air outlet structure of the indoor unit shown in Fig. 3.

[0018] As shown in Fig. 5, a guide portion 51 having a curved surface 51a gradually curved obliquely forward from the turbofan 3 side is placed on the rear side of an upper outlet 53 of a casing 50, while a guide portion 52 having a curved surface 52a gradually curved obliquely forward from the turbofan 3 side is placed on the front side of the outlet 53. These guide portions 51, 52 define a blowoff passage for blowing off the conditioning air obliquely upward in the front. Also, at the outlet 53, is mounted an upper flap 54 rotatably supported by a rotating shaft 55. This upper flap 54, while opened at a specified degree of openness, has its front edge side gradually curved toward the turbofan 3 side so that air smoothly flows along the blowoff passage. Further, a plurality of vertical plates 56 (only one shown in Fig. 5) extending generally vertically at specified intervals are provided on the front side of the vane surface of the upper flap 54. When the upper flap 54 is brought to a specified degree of openness, air flow is controlled by the guide portions 51, 52 and the upper flap 54 so that the direction of air blown off from the turbofan 3 comes to form an angle of about 60 degrees with a plane vertical to the axis of the turbofan 3. To narrow the degree of openness of the upper flap 54, the upper flap 54 is rotated along a direction of arrow R3.

[0019] Also, as shown in Fig. 6, a guide portion 61 having a curved surface 61a gradually curved obliquely forward from the turbofan 3 side is placed on the rear side of lower, right and left outlets 63 of the casing 50, and a guide portion 62 having a curved surface 62a gradually curved obliquely forward from the turbofan 3 side is placed on the front side of the casing 50. At the lower outlet 63, these guide portions 61, 62 define a blowoff passage for blowing off the conditioning air from the outlet 63 obliquely downward in the front. At the right and left outlets 63, the guide portions 61, 62 define a blowoff passage for blowing off the conditioning air from the outlets 63 obliquely sideways and forward. Also, at the outlets 63, are mounted lower, right and left flaps 64 rotatably supported by a rotating shaft 65. A plurality of vertical plates 66 (only one shown in Fig. 6) extending generally vertically at specified intervals are provided on the front side of the vane surface of the upper flap 64. At the lower outlet 63, when the lower flap 64 is brought to a specified angle, air flow is controlled by the guide portions 61, 62 and the flap 64 so that the direction of air blown off from the turbofan 3 is made obliquely downward and forward so as to form an angle of about 30 degrees with a plane vertical to the axis of the turbofan 3. Also, at the right and left outlets 63, when the right flap 64 and the left flap 64 are brought to a specified angle, air flow is controlled by the guide portions 61, 62 and the flaps 64 so that the direction of air blown off from the turbofan 3 is made obliquely forward so as to form an angle of about 30 degrees with a vertical plane including the axis of the turbofan 3. To narrow the degree of openness of the flaps 64, the flaps 64 are rotated along a direction of arrow R4.

[0020] In the air conditioner having this constitution, as shown in Fig. 3, when the motor 2 is rotated, the turbofan 3 is rotated so that air is sucked in via the heat exchanger 5 from the axial front of the turbofan 3, flowing along the curved surface of a curved portion 3a of the turbofan 3, and conditioning air heat-exchanged by the heat exchanger 5 is blown off from the upper-and-lower, right-and-left outlets 21, 22, 23, 24 (shown in Fig. 2) radially outwardly. When this occurs, the stepping motors 41, 42, 43, 44 are controlled by the flap control section 10a of the control unit 10 shown in Fig. 4 so that the degree of openness of the upper flap 31, the lower flap 32, the right flap 33 and the left flap 34 shown in Fig. 2 is controlled, so that the directions of air flows blown off from the outlets 21, 22, 23, 24 are controlled, respectively. For example, as shown in Fig. 7, when the indoor unit 70 of this invention is mounted on an indoor wall surface so that air is blown off in the four directions of upper and lower, right and left, air blown off in the four directions flows and circulates so as to engulf the indoor living space along the wall surface, the ceiling surface and the floor surface, thereby preventing people from feeling a draft in the living space S2 and thus improving the comfortableness in cooling and heating operation as shown in Fig. 8B.

[0021] As shown above, in the outlet structure of the air outlet structure, since the upper-side air outlet structure (shown in Fig. 5) is longer in the ranging distance of blown-off air than the lower-side, right-side and left-side air outlet structures (shown in Fig. 6), the air blown off from the upper outlet 53 efficiently stirs air so as to engulf the living space in the room together with the flow of air blown off from the lower, right and left outlets 63, thereby circulating the warm air in upper part of the room particularly in the heating operation. Therefore, an air conditioning in which the indoor temperature distribution is uniform and which is free from any draft feeling can be attained without swinging the flaps, and the comfortableness can be improved.

[0022] Also, since the angle of inclination of the blowoff direction from the upper outlet 21 with respect to a plane vertical to the axis of the turbofan 3 has been set to about 60 degrees, which is larger than the about 30-degree angle of inclination of the blowoff direction from the lower, right and left outlets 22, 23, 24, the air from the upper outlet 21 is blown off toward a wall surface opposite to the wall surface on which the indoor unit is mounted. As a result, the ranging distance of air blown off from the upper outlet 21 can be made longer than the ranging distance of the air blown off from the lower, right and left outlets 22, 23, 24.

[0023] Also, as shown in Fig. 5, since the length from front edge to rear edge of the upper flap 54 is made longer than the lengths from front edge to rear edge of the lower, right and left flaps 64, a more effective air flow control can be achieved so that air can be easily blown off from the upper outlet 21 to the front. Besides, the upper flap 54 is curved at its upstream side

so that air blown off from the turbofan 3 is smoothly guided, thus making it easy particularly to blow off air to the front.

[0024] In the above embodiment, the direction of air blown off from the upper outlet 21 is set to about 60 degrees with respect to a plane vertical to the axis of the turbofan 3, the direction of air blown off from the lower outlet 22 is set to about 30 degrees with respect to a plane vertical to the axis of the turbofan 3, and the direction of air blown off from the right and left outlets 23, 24 is set to about 30 degrees with respect to a plane vertical to the axis of the turbofan 3. However, it is only required that the ranging distance of air blown off from the upper outlet be larger than the ranging distance of air blown off from the lower, right and left outlets, and the angle of air flow blown off from the individual outlets may be set to any appropriate values.

Industrial Applicability

[0025] The air outlet structure for air conditioners of the present invention is used for air conditioners that blow off conditioning air in upper and lower, right and left directions.

Claims

1. An air outlet structure for air conditioners, which comprises: a casing (1, 6); a turbofan (3) whose axis is positioned in the casing (1, 6) along a back-and-forth direction and which blows off air, which has been sucked from a front side, radially outwardly with respect to the axis; and a heat exchanger (5) disposed in the casing (1, 6) on the front side of the turbofan (3), the casing (1, 6) having outlets (21, 22, 23, 24) for blowing off the air, which has been blown off from the turbofan (3), in upper and lower, right and left directions, as well as flaps (31, 32, 33, 34) for controlling flow directions of the air blown off from the outlets (21, 22, 23, 24), respectively, wherein

a ranging distance of the air blown off from the upper outlet (21) is larger than any ranging distance of the air blown off from the lower, right and left outlets (22, 23, 24).

2. The air outlet structure for air conditioners according to Claim 1, wherein

an angle of inclination of a direction of the air blown off from the upper outlet (21) with respect to a plane vertical to the axis of the turbofan (3) is larger than any angle of inclination of directions of air blown off from the lower, right and left outlets (22, 23, 24) with respect to the plane vertical to the axis of the turbofan (3).

3. The air outlet structure for air conditioners according to Claim 1 or 2, wherein

a length from front edge to rear edge of the upper flap (31) is longer than any length from front edge to rear edge of the lower, right and left flaps (32, 33, 34).

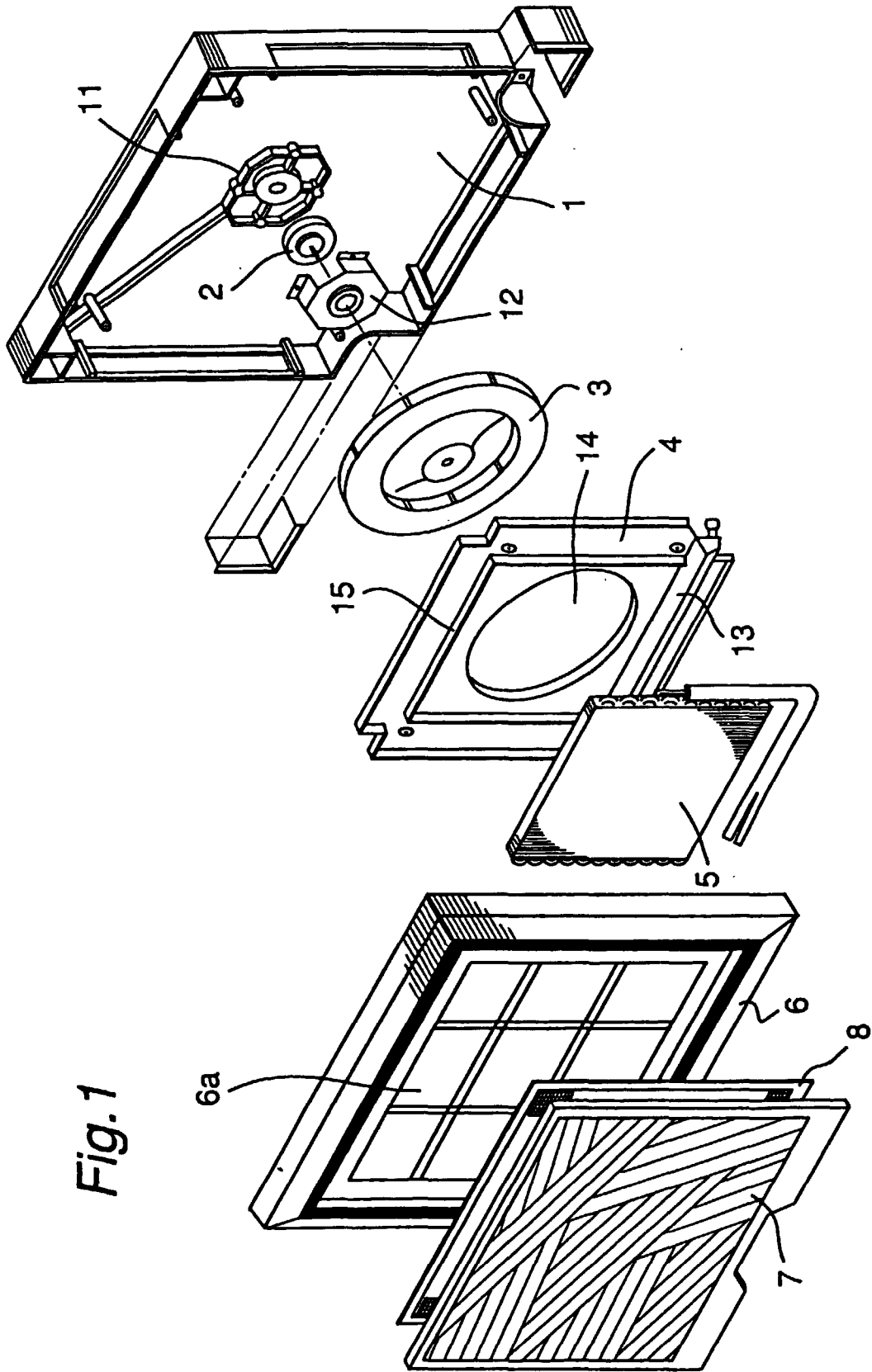


Fig. 1

Fig. 2

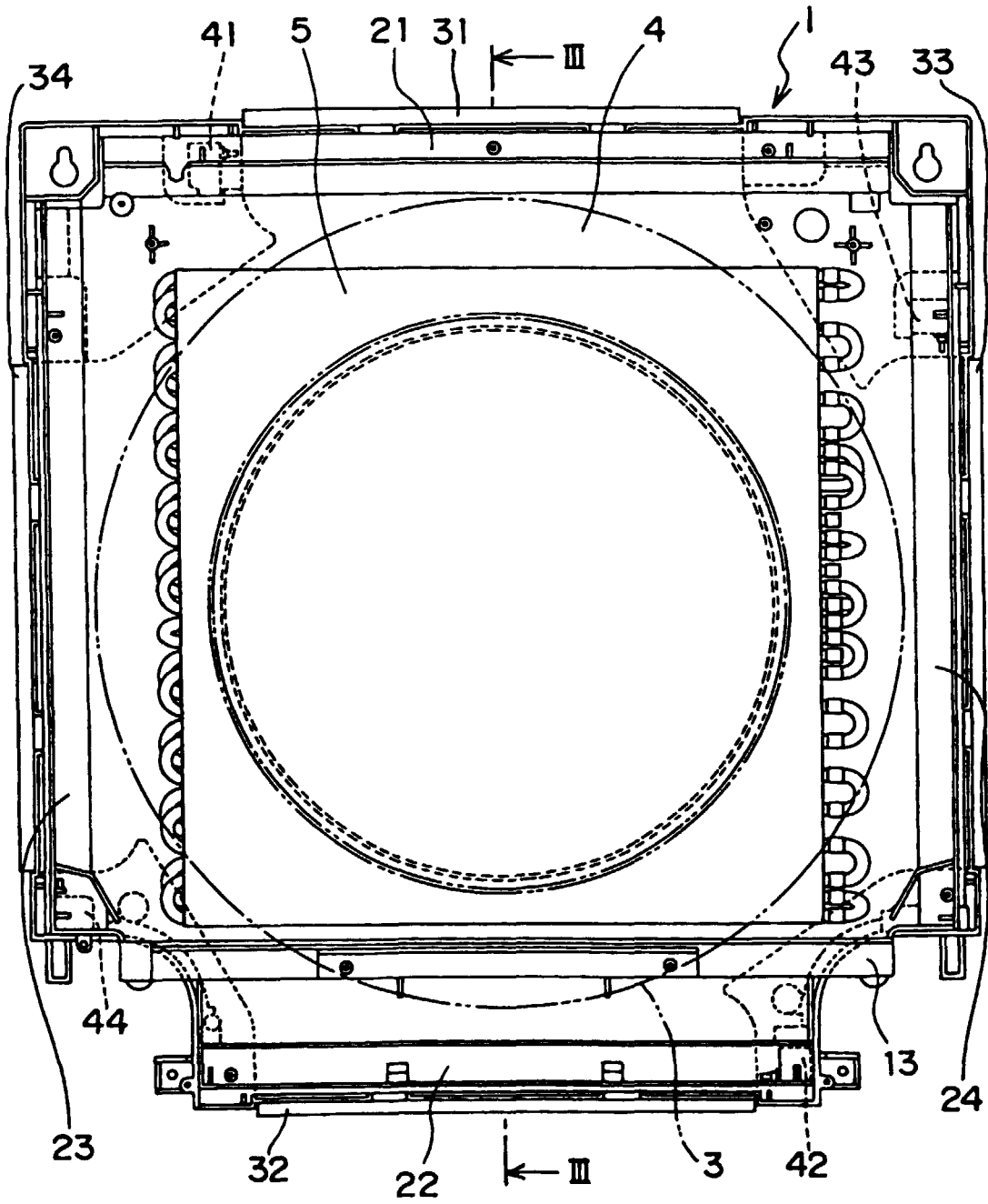


Fig. 3

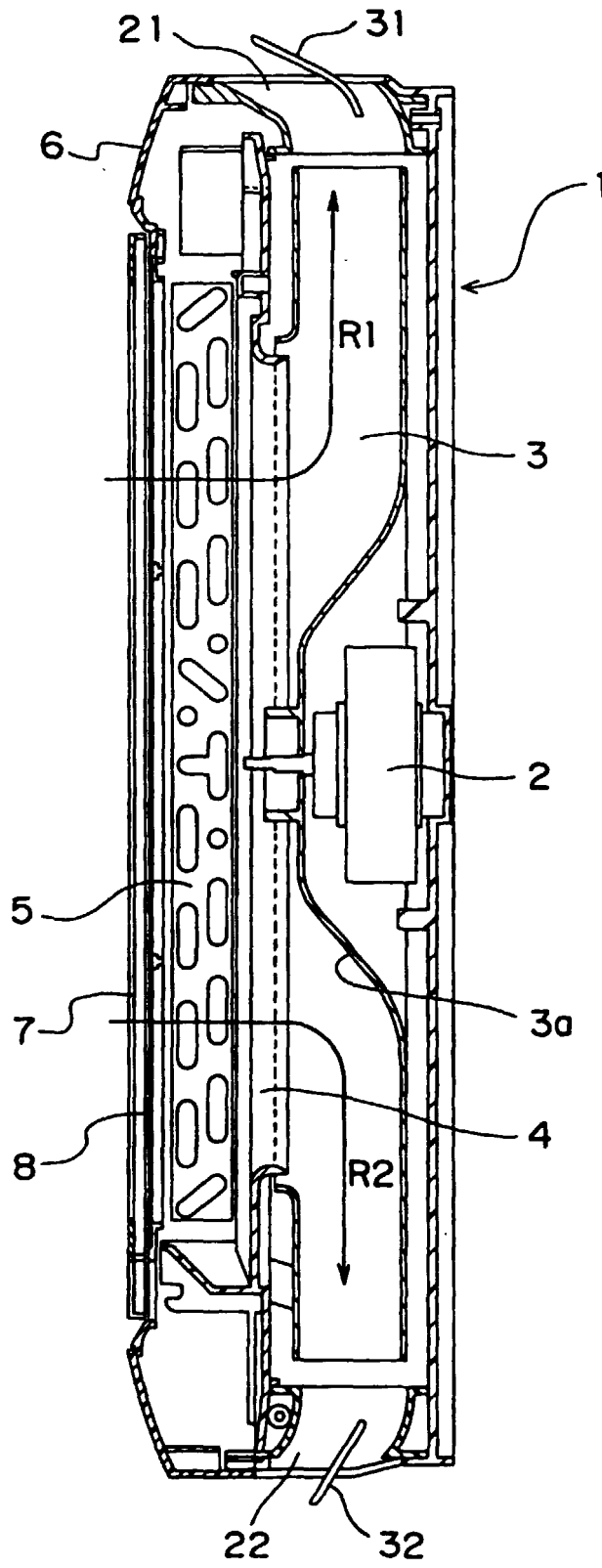


Fig.4

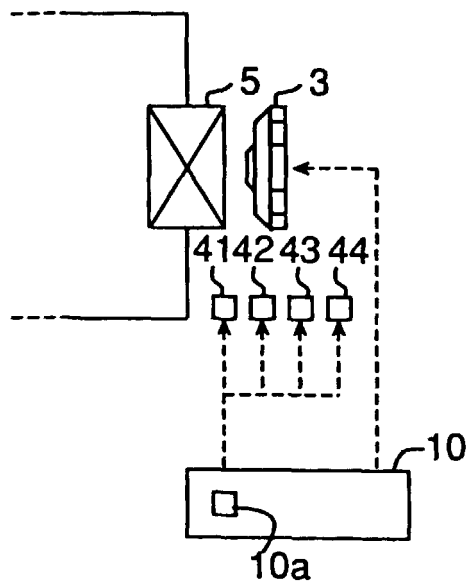


Fig. 5

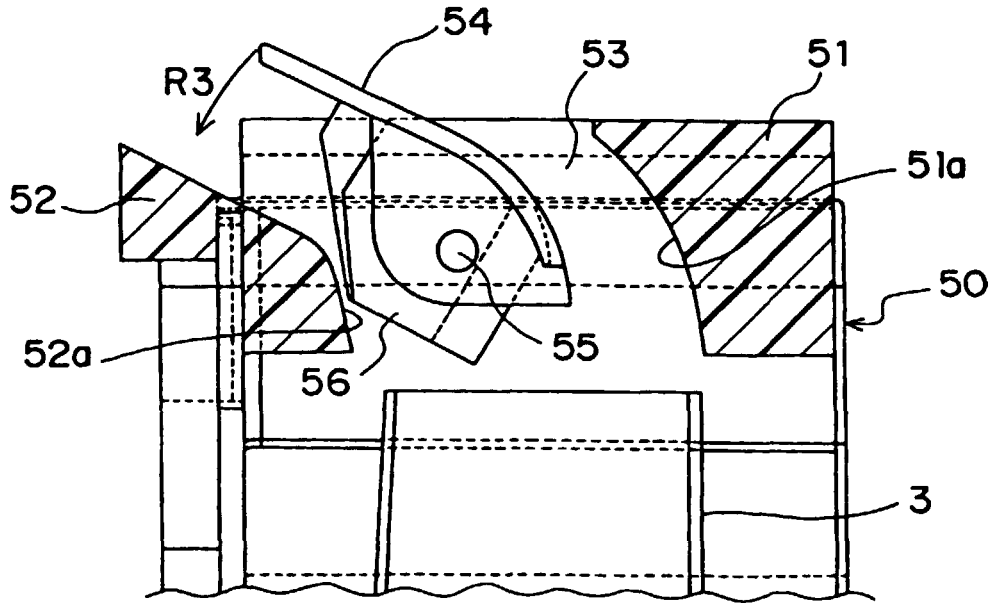


Fig. 6

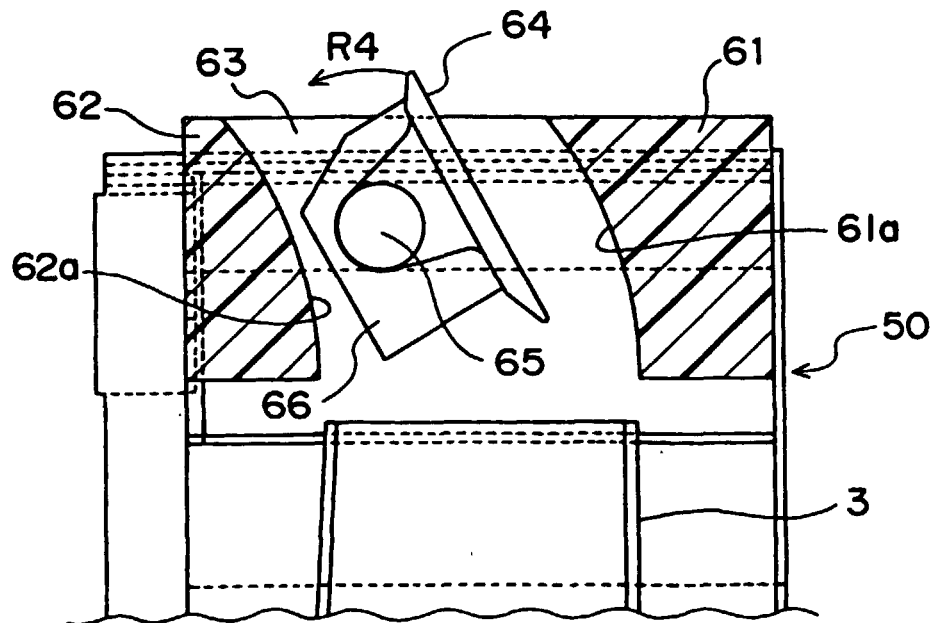


Fig. 7

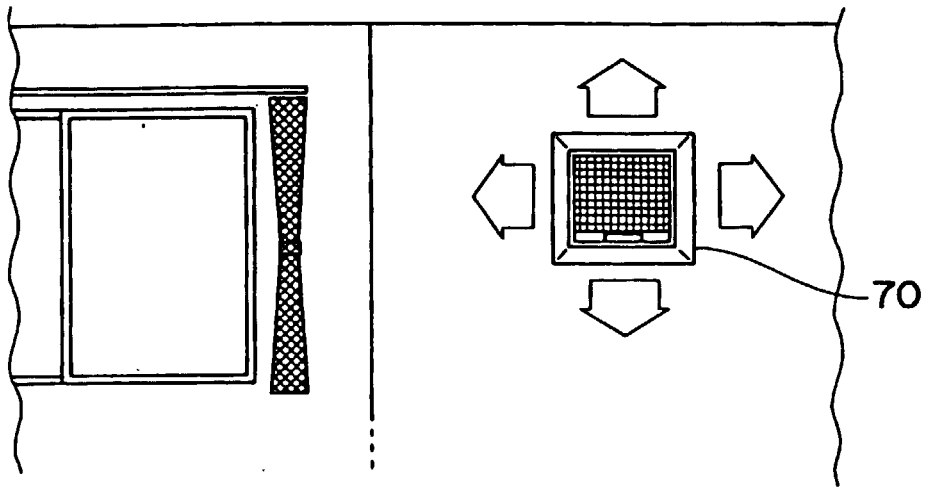
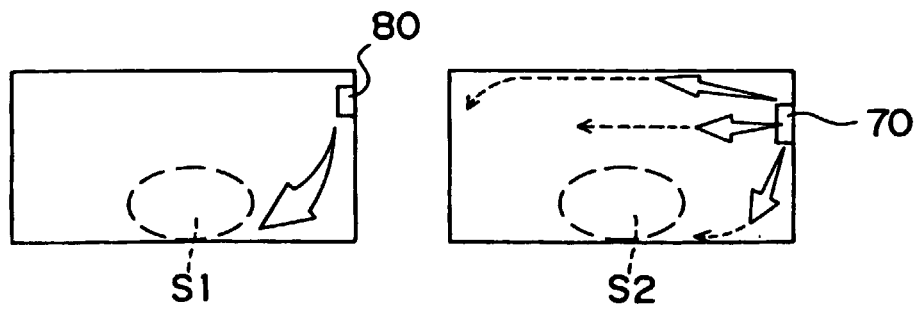


Fig. 8A

Fig. 8B



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP98/03103

A. CLASSIFICATION OF SUBJECT MATTER Int.Cl. ⁶ F24F1/00		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols) Int.Cl. ⁶ F24F1/00		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Jitsuyo Shinan Koho 1926-1998 Toroku Jitsuyo Shinan Koho 1994-1998 Kokai Jitsuyo Shinan Koho 1971-1998		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP, 2-136628, A (Mitsubishi Electric Corp.), 25 May, 1990 (25. 05. 90) (Family: none)	1
Y	JP, 57-160032, U (Sharp Corp.), 7 October, 1982 (07. 10. 82) (Family: none)	1
A	JP, 2-169935, A (Hitachi, Ltd.), 29 June, 1990 (29. 06. 90) (Family: none)	1
A	JP, 59-113124, U (Takahiko Asano), 31 July, 1984 (31. 07. 84) (Family: none)	1
A	JP, 55-15553, U (Matsushita Electric Industrial Co., Ltd.), 31 January, 1980 (31. 01. 80) (Family: none)	1
A	JP, 4-158127, A (Matsushita Electric Industrial Co., Ltd.), 1 June, 1992 (01. 06. 92) (Family: none)	1
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.		
<p>* Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"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</p> <p>"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</p> <p>"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</p> <p>"&" document member of the same patent family</p>		
Date of the actual completion of the international search 9 September, 1998 (09. 09. 98)		Date of mailing of the international search report 22 September, 1998 (22. 09. 98)
Name and mailing address of the ISA/ Japanese Patent Office		Authorized officer
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