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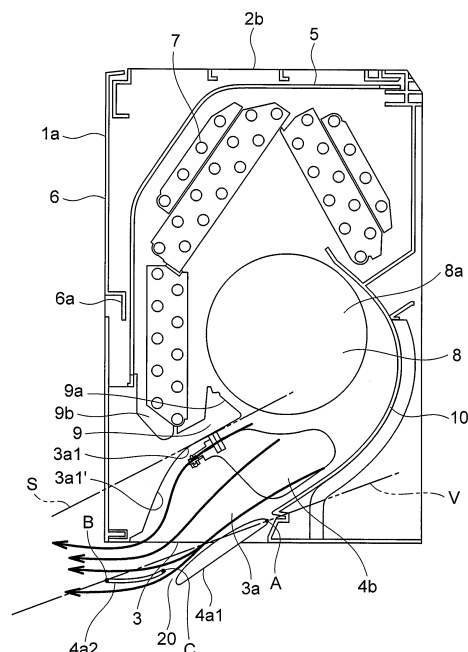
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(54) **AIR CONDITIONER**

(57) An air conditioner (100) includes a main body (1) having an air inlet (2a, 2b) and an air outlet (3) formed therein. The main body includes a front surface (1a), a rear surface (1c), an upper surface (1b), a lower surface (1d), and a pair of side surfaces (1e). The air inlet is formed in any one of the front surface, the upper surface, and the side surfaces. The air outlet is formed in the lower surface without extending to the front surface. An outlet air duct is defined upstream of the air outlet. A diffuser defines the front surface side of the outlet air duct. In side view, as the diffuser extends, downstream of the diffuser is away from an imaginary line that is a line extended from upstream of the diffuser.

FIG. 3



Description

Technical Field

[0001] The present invention relates to an air conditioner.

Background Art

[0002] In Patent Literature 1, there is disclosed an air conditioner including an air sending fan arranged in a main body of the air conditioner, and a blowout air duct defined by wall surfaces at downstream of the air sending fan. The blowout air duct is defined by a blowout air duct upper wall formed on a front portion side in the main body, and a blowout air duct lower wall formed on a rear portion side in the main body. An air outlet is formed at downstream of the blowout air duct. The air outlet is formed in each of a lower surface and a front surface of the main body of the air conditioner.

Citation List

Patent Literature

[0003] [PTL 1] JP 2009-79846 A

Summary of Invention

Technical Problem

[0004] During operation of the air conditioner, a user sometimes may feel uncomfortable with noises generated by functional components arranged inside the main body.

[0005] The present invention has been made in view of the above, and has an object to provide an air conditioner capable of solving a problem of noises.

Solution to Problem

[0006] In order to achieve the above-mentioned object, according to one embodiment of the present invention, there is provided an air conditioner, including: a main body having an air inlet and an air outlet formed therein; an air sending unit arranged in the main body; a heat exchange unit arranged in the main body; the main body including a front surface, a rear surface, an upper surface, a lower surface, and a pair of side surfaces, the air inlet being formed in any one of the front surface, the upper surface, and the side surfaces, the air outlet being formed in the lower surface without extending to the front surface, an outlet air duct defined on upstream of the air outlet; and a diffuser defining the front surface side of the outlet air duct, in which in side view, as the diffuser extends, downstream of the diffuser is away from an imaginary line that is a line extended from upstream of the diffuser.

Advantageous Effects of Invention

[0007] According to the air conditioner of the present invention, it is possible to solve the problem of noises.

Brief Description of Drawings

[0008]

FIG. 1 is a view for illustrating an installing state of an air conditioner according to a first embodiment of the present invention when viewed from the interior of a room.

FIG. 2 is a side view of the internal structure of the air conditioner of FIG. 1.

FIG. 3 is a side view of the internal structure of the air conditioner of FIG. 1.

FIG. 4 is a side view of the internal structure of the air conditioner of FIG. 1.

Description of Embodiments

[0009] Now, an air conditioner (indoor unit) according to embodiments of the present invention is described with reference to the accompanying drawings. Note that, in the drawings, the same reference symbols represent the same or corresponding parts. Further, existing outdoor units may be used as an outdoor unit of the present invention.

First Embodiment

[0010] FIG. 1 is an installation schematic view of an air conditioner according to a first embodiment of the present invention when viewed from a room. FIG. 2 to FIG. 4 are side views of the internal structure of the air conditioner of FIG. 1. FIG. 2 is an illustration of a state of the air conditioner during shutdown. FIG. 3 is an illustration of a state of the air conditioner during horizontal blowing (lateral blowing) operation. FIG. 4 is an illustration of a state of the air conditioner during downward blowing (vertical blowing) operation.

[0011] As illustrated in FIG. 1, an air conditioner (indoor unit) 100 includes a main body 1 that forms a contour of the air conditioner 100. The air conditioner 100 is an example of a wall-mounting type, and is supported on a wall 11a of a room 11 that is a space to be air-conditioned. The air conditioner of the present invention is not limited to be installed in a room of a home, but may be installed in a room of a building for an institution or in a storehouse, for example.

[0012] Further, the air conditioner of the present invention is a type other than a so-called ceiling-concealed type, and is an air conditioner, in which a rear surface of the main body is held in abutment on or positioned close to a wall surface (wall excluding a ceiling and a floor) defining the space to be air-conditioned, and in which a front surface of the main body faces a side of the space

to be air-conditioned. In other words, in the air conditioner of the present invention, an air inlet and an air outlet are not formed in the same surface unlike the ceiling-concealed type, and it is only necessary that the air conditioner of the present invention be arranged not at a center portion of the space to be air-conditioned but close to the wall surface defining the space to be air-conditioned.

[0013] The main body 1 has substantially a rectangular parallelepiped shape. Specifically, the main body 1 includes a rear surface 1c facing the wall 11a of the room 11, a front surface 1a on the opposite side of the rear surface 1c, an upper surface 1b, a lower surface 1d, and a pair of right and left side surfaces 1e. In the air conditioner of the present invention, the air inlet is formed in any one of the front surface, the upper surface, and the side surfaces of the main body. The air outlet is formed in the lower surface without extending to the front surface. A specific example of this embodiment is further described.

[0014] In the upper surface 1b forming an upper portion of the main body 1, there is formed an air inlet 2b in a grille form, which is configured to suck air inside the room into the air conditioner 100. Further, a front grille 6 is mounted on the front surface 1a, and an air inlet 2a is formed in a center portion of the front grille 6 in a height direction of the main body. The air inlet 2a extends in a width direction of the front grille 6. An air guide wall 6a is arranged on downstream of the air inlet 2a. A front surface side of an air duct on the downstream of the air inlet 2a is formed by a back surface of the front grille 6, whereas a rear surface side of the air duct on the downstream of the air inlet 2a is formed by the air guide wall 6a. The air guide wall 6a extends to the rear surface side from a portion of the front grille 6 above the air inlet 2a, and then extends downward.

[0015] An air outlet 3 configured to supply the conditioned air into the room is formed in the lower surface 1d forming a lower portion of the main body 1. The air outlet 3 is formed only in the lower surface 1d, and is not formed in the front surface 1a and the right and left side surfaces 1e.

[0016] Inside the main body 1, a cross-flow fan (air sending unit) 8 including an impeller 8a, and a guide wall 10 are arranged. The cross-flow fan 8 is arranged between an inlet-side air duct E1 and an outlet-side air duct E2. The cross-flow fan 8 is configured to suck air through the air inlets 2a and 2b, and to blow out air through the air outlet 3. The guide wall 10 extends from a rear side of the cross-flow fan 8 to a lower side thereof, and is configured to guide, to the air outlet 3, air discharged from the cross-flow fan 8.

[0017] Further, in the main body 1, there are arranged a filter (ventilation resistor) 5 configured to remove dust and the like in the air sucked through the air inlets 2a and 2b, a heat exchanger (heat exchange unit, ventilation resistor) 7 configured to generate conditioned air by transferring hot or cold energy of refrigerant to air, and a stabilizer 9 configured to partition the inlet-side air duct

E1 and the outlet-side air duct E2.

[0018] The guide wall 10 forms the outlet-side air duct E2 in cooperation with a lower surface side of the stabilizer 9. The guide wall 10 forms a helical surface from the cross-flow fan 8 toward the air outlet 3.

[0019] The filter 5 is formed into, for example, a mesh shape, and is configured to remove dust and the like in the air sucked through the air inlets 2a and 2b. The filter 5 is mounted on the downstream of the air inlets 2a and 2b and on upstream of the heat exchanger 7 in the air duct from the air inlets 2a and 2b to the air outlet 3. The filter 5 extends from an upper side of the heat exchanger 7 to a front side thereof.

[0020] The heat exchanger 7 (indoor heat exchanger) functions as an evaporator to cool the air during cooling operation, and functions as a condenser (radiator) to heat the air during heating operation. The heat exchanger 7 is mounted on downstream of the filter 5 and on upstream of the cross-flow fan 8 in the air duct from the air inlets 2a and 2b to the air outlet 3 (center portion inside the main body 1). In FIG. 2, the heat exchanger 7 is shaped so as to surround the front portion and the upper portion of the cross-flow fan 8. However, this shape is merely an example, and the present invention is not limited thereto.

[0021] The heat exchanger 7 is connected to an outdoor unit of a known mode including a compressor, an outdoor heat exchanger, an expansion device, and the like, to thereby construct a refrigeration cycle. Further, as the heat exchanger 7, for example, a cross-fin type fin-and-tube heat exchanger including a heat transfer tube and a large number of fins is used.

[0022] A vertical airflow-direction vane 4a and a lateral airflow-direction vane 4b are arranged in an outlet air duct 3a. The lateral airflow-direction vane 4b is arranged between the vertical airflow-direction vane 4a and the cross-flow fan 8 in a pivotable manner. The vertical airflow-direction vane 4a is configured to vertically adjust a direction of air blown out from the cross-flow fan 8, and the lateral airflow-direction vane 4b is configured to laterally adjust the direction of the air blown out from the cross-flow fan 8.

[0023] The vertical airflow-direction vane 4a includes a first vane 4a1 and a second vane 4a2. The first vane 4a1 and the second vane 4a2 have separate driving sources, respectively, and are pivoted individually.

[0024] During shutdown, the first vane 4a1 closes the air outlet 3, and forms an outer surface of an apparatus body. That is, the first vane 4a1 serves as both an airflow-direction control portion and a designed portion for the contour of the main body. An upper surface (surface on the air duct side) of the first vane 4a1 during shutdown has a convex shape. Further, the first vane 4a1 is arranged in a pivotable manner, and a pivot axis of the first vane 4a1 is positioned close to the guide wall in a lower portion of the outlet air duct 3a.

[0025] During shutdown, the second vane 4a2 is accommodated in the outlet air duct 3a, and is arranged between the first vane 4a1 and the cross-flow fan 8 and

between the third vane 4a3 and the cross-flow fan 8. During shutdown, the entire second vane 4a2 is accommodated in the main body 1. Meanwhile, during operation, the second vane 4a2 is moved to an outside of the air outlet 3. That is, the second vane 4a2 functions as the airflow-direction control portion, but does not function as the designed portion for the contour of the main body.

[0026] Further, although details are described below, in brief, the second vane 4a2 is directly aligned with the first vane 4a1 during horizontal blowing (lateral blowing) as illustrated in FIG. 3, whereas the second vane 4a2 is aligned in parallel to the first vane 4a1 during downward blowing (vertical blowing) as illustrated in FIG. 4.

[0027] Further, a pivot axis of the second vane 4a2 is positioned in an upper portion of the air outlet 3 and close to the stabilizer. During horizontal blowing, the second vane 4a2 is moved to a front side of the first vane 4a1 in a forward direction of the blown-out air, and then is aligned with the first vane 4a1 in series. It is necessary to arrange the first vane 4a1 and the second vane 4a2 in series under a state in which, in side view of FIG. 3, an upstream end C of the second vane 4a2 is positioned below an imaginary line V connecting an upstream end A of the first vane 4a1 and a downstream end B of the second vane 4a2 to each other (state in which the upstream end C is positioned on a side away from the main body 1 with respect to the imaginary line V). With this arrangement, during horizontal blowing, the first vane 4a1 and the second vane 4a2 form a single imaginary vane having an imaginary chord larger than a chord of each of the first vane 4a1 and the second vane 4a2. During downward blowing, the first vane 4a1 and the second vane 4a2 function as two separate vanes each having an individual chord. That is, it can be said that it is possible to obtain a mode in which vane chords are varied in accordance with airflow directions without exchanging the vanes themselves.

[0028] Further, during horizontal blowing, a clearance 20 is secured between the first vane 4a1 and the second vane 4a2 arranged in series. In particular, in the first embodiment, the first vane 4a1 and the second vane 4a2 are moved in a pivoting manner so that, when the first vane 4a1 and the second vane 4a2 are aligned in series, the upper surface (surface on the main body side) of the first vane 4a1 has an upward convex shape (shape convex toward the main body) and a lower surface (surface on a side opposite to the main body) of the second vane 4a2 has a downward convex shape (shape convex toward the side opposite to the main body).

[0029] Further, as illustrated in FIG. 4, during downward blowing, a part of the second vane 4a2 is out of the air outlet 3. As illustrated in FIG. 3, during horizontal blowing, the second vane 4a2 is completely out of the air outlet 3 (the entire second vane 4a2 is out of the air outlet 3).

[0030] Meanwhile, during downward blowing, the second vane 4a2 is moved to a position between the first vane 4a1 and downstream of a diffuser 3a1 to be described below, and is shifted to a posture substantially

parallel to the first vane 4a1 and the downstream of the diffuser 3a1. That is, during downward blowing, the second vane 4a2 is aligned in parallel to the first vane 4a1. Further, at this time, the first vane 4a1 and the second vane 4a2 are moved in a pivoting manner so that a surface of the second vane 4a2 opposed to the first vane 4a1 has a convex shape swelling toward the first vane 4a1 and a surface of the first vane 4a1 opposed to the second vane 4a2 has a convex shape swelling toward the second vane 4a2.

[0031] The stabilizer 9 is configured to partition the inlet-side air duct E1 and the outlet-side air duct E2, and as illustrated in FIG. 2 to FIG. 4, the stabilizer 9 is mounted on a lower side of the heat exchanger 7. The inlet-side air duct E1 is positioned on an upper side of the stabilizer 9, and the outlet-side air duct E2 is positioned on a lower side of the stabilizer 9.

[0032] The stabilizer 9 includes a tongue portion 9a configured to separate the inlet-side air duct E1 and the outlet-side air duct E2 from each other, a drain pan 9b configured to temporarily accumulate water droplets dripping from the heat exchanger 7, and the diffuser 3a1 being an upper wall surface (front-surface-side wall surface) of the outlet air duct 3a of the air outlet 3.

[0033] Upstream of the diffuser 3a1 extends in the same direction as an extending direction of downstream of the guide wall 10. In side view, the upstream of the diffuser 3a1 is aligned substantially in parallel to the downstream of the guide wall 10. Further, in side view, the upstream of the diffuser 3a1 includes a straight portion. Assuming that, in side view of FIG. 3, a line extended from the straight portion of the upstream of the diffuser 3a1 is represented as an imaginary line S, a front part of the imaginary line S extends so as to intersect the front surface 1a of the main body 1. Further, a downstream portion 3a1' of the diffuser 3a1 extends away from the imaginary line S and away from the front surface 1a. In side view, the downstream portion 3a1' of the diffuser 3a1 is curved or inclined. The downstream portion 3a1' of the diffuser 3a1 extends away from the imaginary line S as the diffuser 3a1 extends toward downstream thereof. That is, in side view, as the diffuser 3a1 extends, the downstream of the diffuser 3a1 is away from the imaginary line S that is the line extended from the upstream of the diffuser 3a1. An end portion of the downstream of the diffuser 3a1 reaches the lower surface 1d. With this configuration, a foremost portion of the air outlet 3 is positioned within the lower surface 1d without reaching the front surface 1a.

[0034] In the air conditioner having the above-mentioned configuration, the air outlet is formed only in the lower surface of the main body, but is not formed in the front surface thereof. Accordingly, noises generated by functional components arranged inside the main body (such as a noise generated when driving a motor of the cross-flow fan, a wind noise of the cross-flow fan, and a noise generated when refrigerant in the heat exchanger flows) are prevented from directly leaking frontward.

[0035] Further, in the first embodiment, the second vane 4a2 is accommodated in the outlet air duct 3a during shutdown, whereas the second vane 4a2 projects outward from the air outlet 3 during operation. Accordingly, the second vane 4a2 can have a shape suitable for controlling airflow directions without being restricted by design conditions required for the outer surface of the body, and at least one airflow-direction control vane having a shape suitable for controlling airflow directions is reliably secured. Therefore, there are achieved both noise prevention described above, and increase in airflow-direction controllability exerted by a vane that is not restricted by the design conditions. Further, as described above, the second vane projects outward from the main body, and is aligned with the first vane in series. Accordingly, even in the mode in which the air outlet is not formed in the front surface of the main body, suitable horizontal blowing can be performed, and both noise prevention and comfort can be achieved.

[0036] Further, in view of evaluating a design of the outer surface of the main body, it is preferred that, under external appearance observation, the outer surface of the main body include a smaller portion that can be recognized as an openable/closable portion during shutdown. In the first embodiment, in spite of using two vanes, it is possible to provide the design enabling only one vane to be recognized as the openable/closable portions during shutdown. Further, there are quite a few fears in that dust and the like intrude into the main body from the outer edge of the openable/closable portion during shutdown. However, in the first embodiment, in spite of using two vanes, the number of vanes recognized as the openable/closable portions during shutdown is reduced to one, thereby being capable of expecting prevention of undesirable intrusion of dust and the like into the main body.

[0037] Further, in the first embodiment, the second vane 4a2 is aligned with the first vane 4a1 in series. Accordingly, during horizontal blowing, the first vane 4a1 and the second vane 4a2 form the single imaginary vane having the imaginary chord larger than the chord of each of the first vane 4a1 and the second vane 4a2. During downward blowing, the first vane 4a1 and the second vane 4a2 function as the two separate vanes each having the individual chord. That is, it can be said that it is possible to obtain the mode in which the vane chords are varied in accordance with the airflow directions without exchanging the vanes themselves. As described above, it is possible to obtain the imaginary vane having the imaginary chord larger than the chord of the individual vane. Thus, during horizontal blowing, a flow of the air blown out from the cross-flow fan downward can be turned significantly frontward using the large imaginary chord, with the result that airflow-direction controllability can be significantly enhanced.

[0038] Further, during horizontal blowing, the clearance 20 is secured between the first vane 4a1 and the second vane 4a2 arranged in series. As described above, the first vane 4a1 and the second vane 4a2 are arranged

in series under the state in which the clearance 20 is secured. Thus, after passing over the first vane 4a1, the air during cooling flows over both upper and lower surfaces of the second vane 4a2 beyond the clearance 20 between the first vane 4a1 and the second vane 4a2, thereby reducing the temperature difference between both the upper and lower surfaces of the second vane 4a2. Accordingly, dew condensation can be prevented, and quality can be enhanced. In particular, in the first embodiment, the first vane 4a1 and the second vane 4a2 are moved in a pivoting manner so that, when the first vane 4a1 and the second vane 4a2 are aligned in series, the upper surface (surface on the main body side) of the first vane 4a1 has the upward convex shape (shape convex toward the main body) and the lower surface (surface on the side opposite to the main body) of the second vane 4a2 has the downward convex shape (shape convex toward the side opposite to the main body). Owing to the effects of the directions of the curves of the surfaces of the first vane 4a1 and the second vane 4a2, the airflow further easily flows between the first vane 4a1 and the second vane 4a2. Thus, the effect of preventing dew condensation is further increased.

[0039] Further, as illustrated in FIG. 4, during downward blowing, a part of the second vane 4a2 is out of the air outlet 3. As illustrated in FIG. 3, during horizontal blowing, the second vane 4a2 is completely out of the air outlet 3 (the entire second vane 4a2 is out of the air outlet 3). Accordingly, the part of the second vane 4a2 out of the air outlet 3 is released from restraining action of the airflow from sides of the side surfaces 1e of the main body 1. Thus, it is possible to obtain such an advantage that airflow-direction control is easily performed.

[0040] Further, during downward blowing, the second vane 4a2 is aligned in parallel to the first vane 4a1. In addition, the first vane 4a1 and the second vane 4a2 are moved in a pivoting manner so that the surface of the second vane 4a2 opposed to the first vane 4a1 has the convex shape swelling toward the first vane 4a1, and that the surface of the first vane 4a1 opposed to the second vane 4a2 has the convex shape swelling toward the second vane 4a2. Accordingly, during heating, the airflow flowing between the first vane 4a1 and the second vane 4a2 flows through a region surrounded by the convex shape of the first vane 4a1 and the convex shape of the second vane 4a2. Thus, the airflow is gradually narrowed so that a separation vortex is prevented. Then, the airflow is gradually enlarged, with the result that disturbance of the airflow is prevented. Therefore, generally speaking, straight flowability of the airflow is increased, and a floor reachable distance of the airflow is extended, thereby increasing an effect of being capable of heating a region around feet of a user.

[0041] The details of the present invention have been described above specifically with reference to the preferred embodiments, but it is apparent that a person skilled in the art may employ various modifications based on the basic technical thoughts and teachings of the

present invention.

Reference Signs List

[0042] 1 main body, 1a front surface, 1b upper surface, 1c rear surface, 1d lower surface, 2a, 2b air inlet, 3 air outlet, 3a1 diffuser, 4a1 first vane, 4a2 second vane, 7 heat exchanger (heat exchange unit), 8 cross-flow fan (air sending unit), 100 air conditioner

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Claims

1. An air conditioner, comprising:
 - a main body having an air inlet and an air outlet formed therein;
 - an air sending unit arranged in the main body;
 - a heat exchange unit arranged in the main body;
 - the main body comprising a front surface, a rear surface, an upper surface, a lower surface, and a pair of side surfaces,
 - the air inlet being formed in any one of the front surface, the upper surface, and the side surfaces,
 - the air outlet being formed in the lower surface without extending to the front surface,
 - an outlet air duct defined on upstream of the air outlet; and
 - a diffuser defining the front surface side of the outlet air duct,
 - wherein in side view, as the diffuser extends, downstream of the diffuser is away from an imaginary line that is a line extended from upstream of the diffuser.
2. An air conditioner according to claim 1, further comprising a first vane and a second vane supported in a movable manner,
 - wherein the first vane opens the air outlet during operation, and closes the air outlet during shutdown, and
 - wherein the second vane is accommodated in the main body during the shutdown, and is out of the air outlet during the operation.
3. An air conditioner according to claim 2, wherein the entire second vane is out of the air outlet during lateral blowing.

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FIG. 1

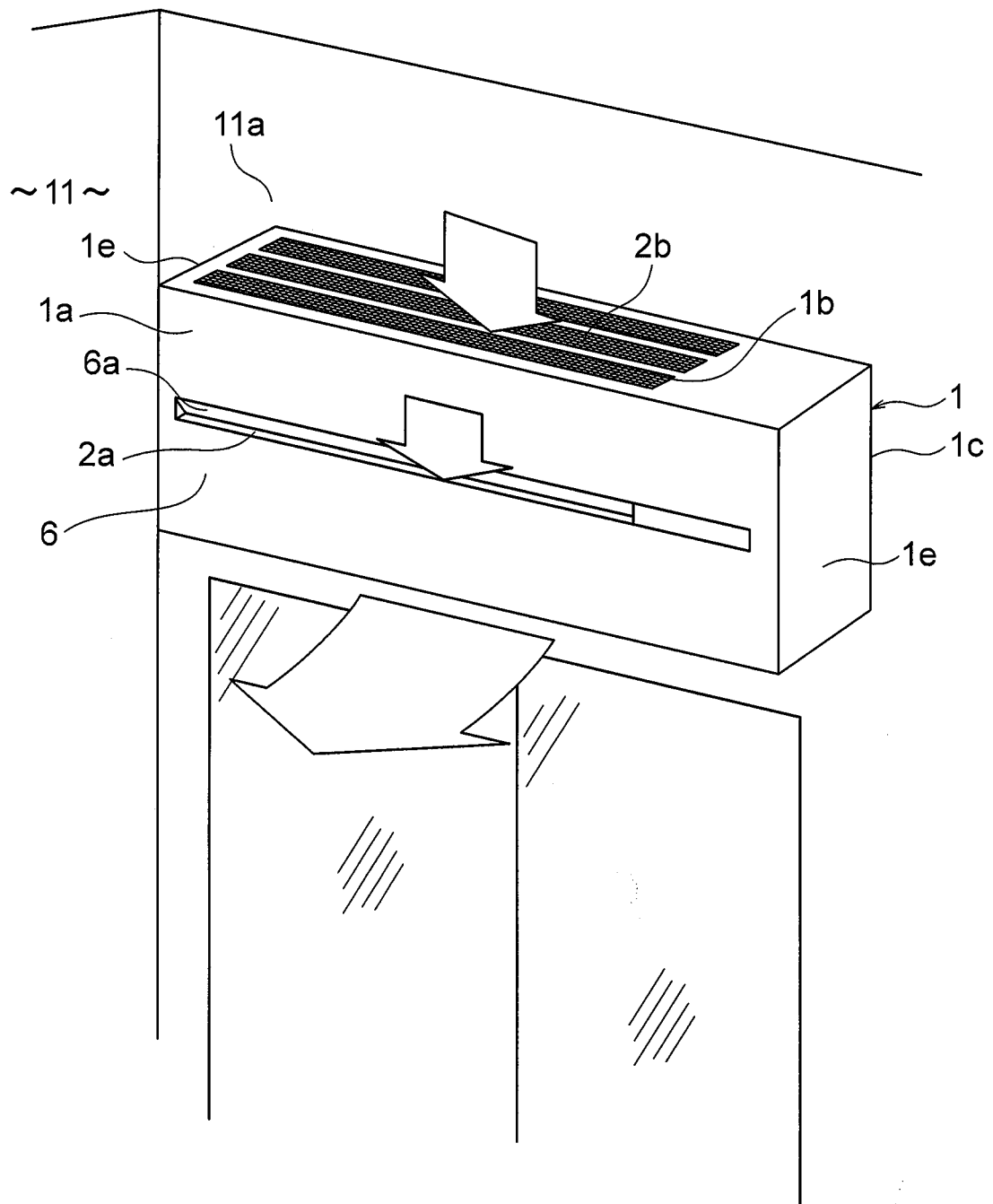


FIG. 2

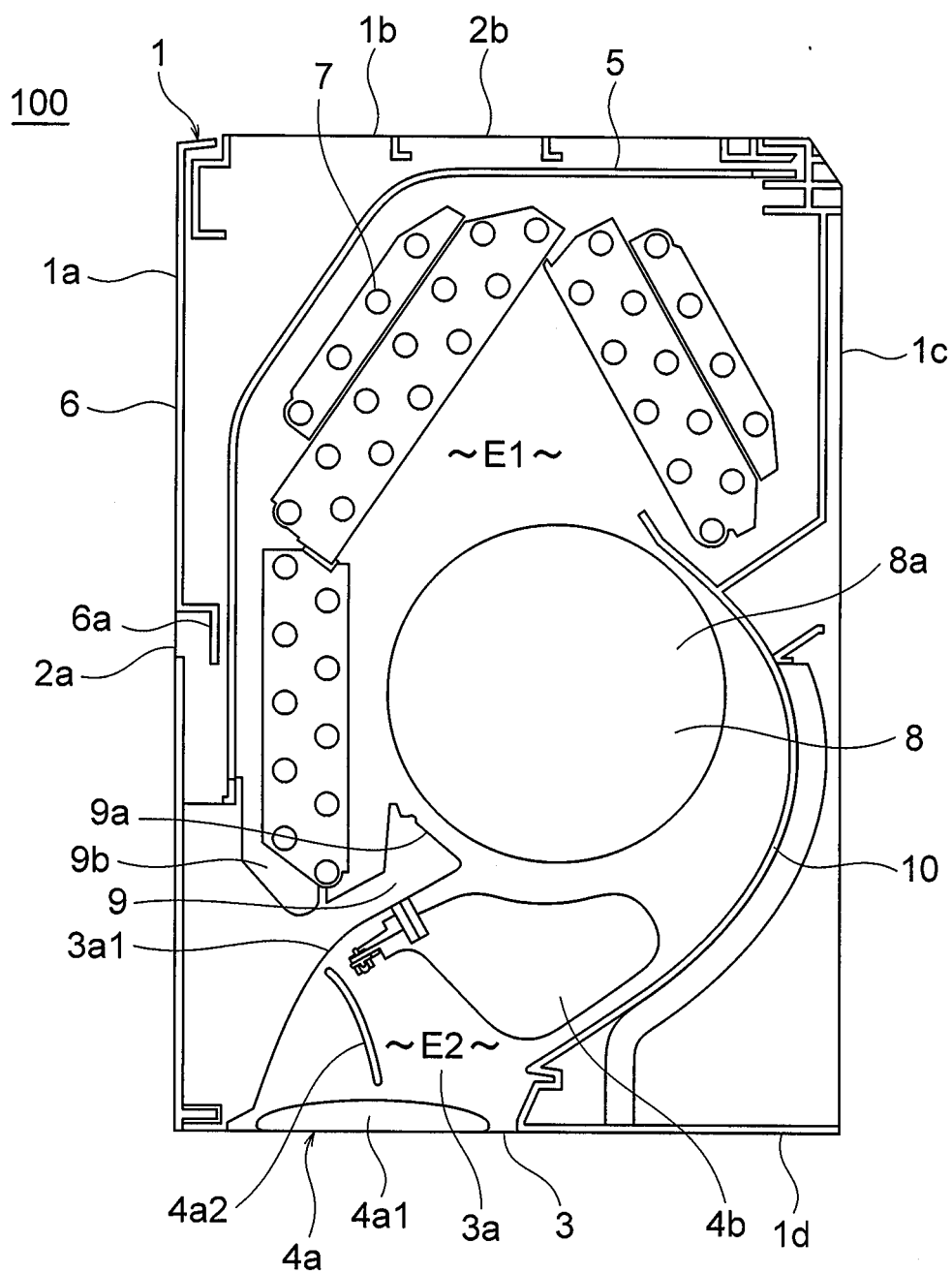


FIG. 3

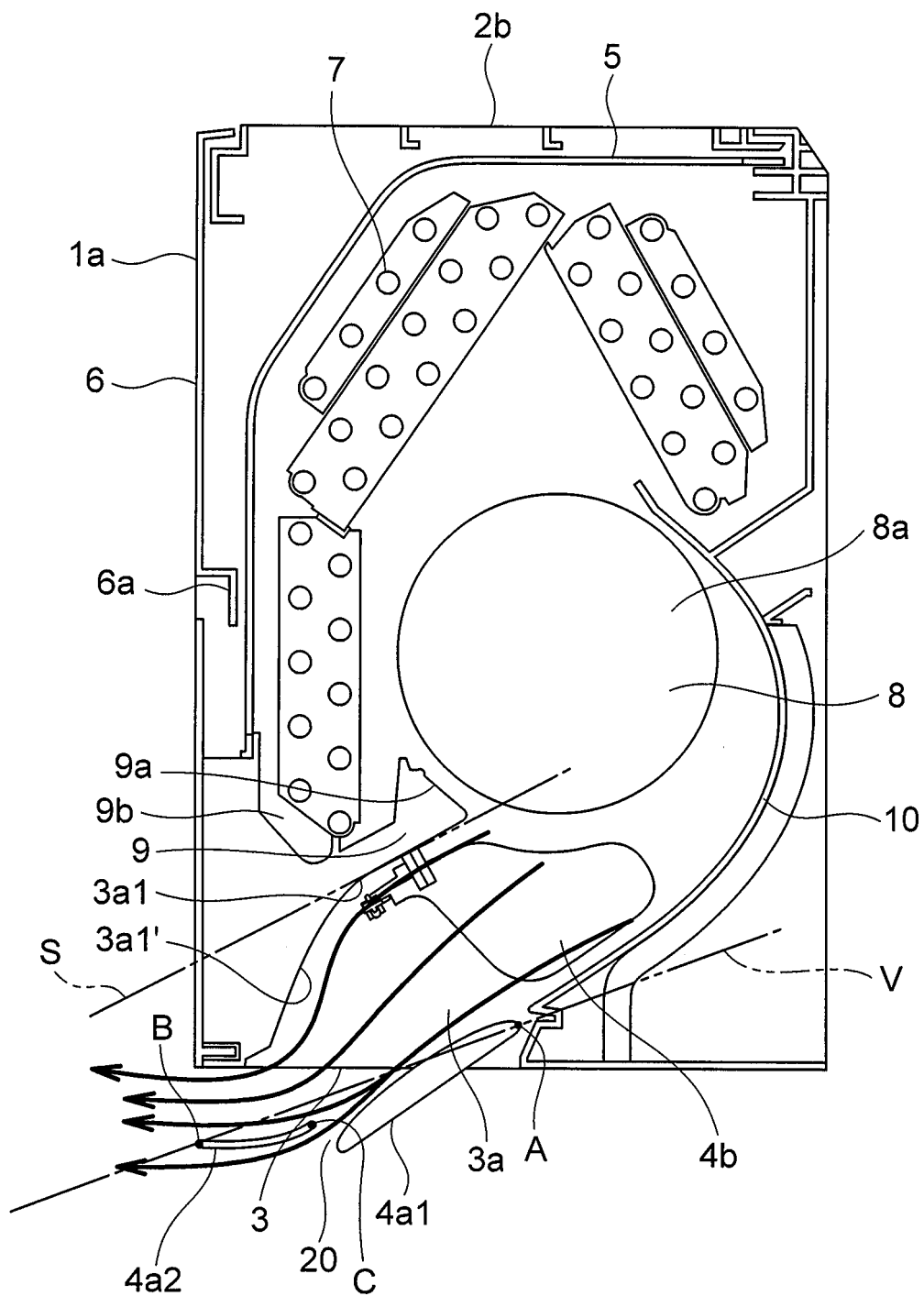
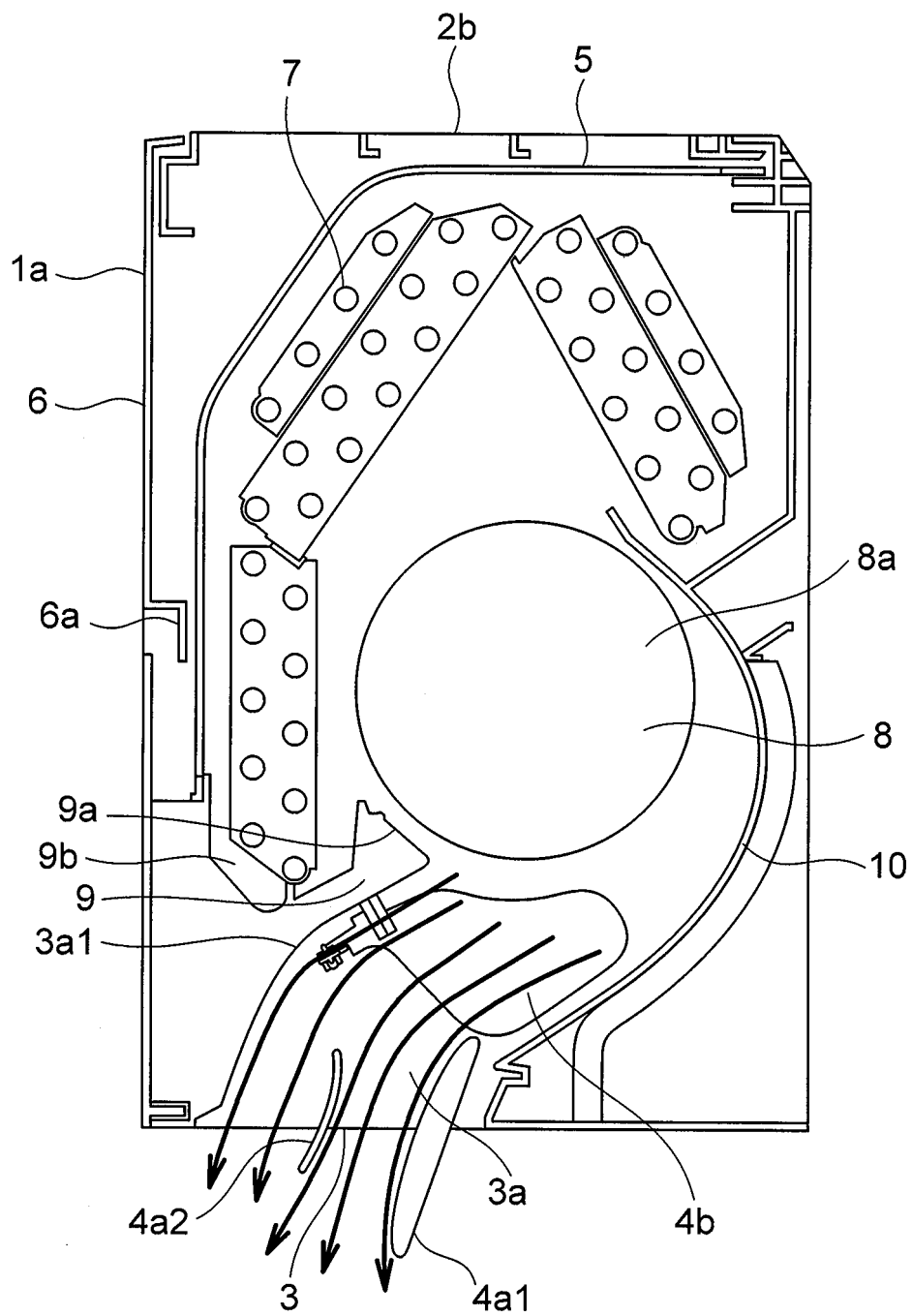


FIG. 4



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2014/059193

A. CLASSIFICATION OF SUBJECT MATTER

F24F1/00(2011.01)i, F24F13/06(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F24F1/00, F24F13/06

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

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2014

Kokai Jitsuyo Shinan Koho 1971-2014 Toroku Jitsuyo Shinan Koho 1994-2014

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	JP 3-156221 A (Daikin Industries, Ltd.),	1
Y	04 July 1991 (04.07.1991),	2
A	page 6, upper right column, line 7 to page 7, lower right column, line 4; fig. 1 & US 5211219 A & EP 469563 A2	3
X	JP 10-19289 A (Daikin Industries, Ltd.),	1
Y	23 January 1998 (23.01.1998),	2
A	paragraphs [0015] to [0033]; fig. 1 to 4 (Family: none)	3
Y	JP 6-193959 A (Sharp Corp.),	2
	15 July 1994 (15.07.1994), claim 1; fig. 1 to 2 (Family: none)	

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

* Special categories of cited documents:

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Date of the actual completion of the international search
18 June, 2014 (18.06.14)Date of mailing of the international search report
01 July, 2014 (01.07.14)Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2014/059193

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 6-159702 A (Toshiba Corp.), 07 June 1994 (07.06.1994), paragraphs [0015] to [0026]; fig. 1 (Family: none)	1
A	JP 2004-53196 A (Mitsubishi Electric Corp.), 19 February 2004 (19.02.2004), paragraphs [0017] to [0019]; fig. 2 to 3 (Family: none)	3

Form PCT/ISA/210 (continuation of second sheet) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2009079846 A [0003]