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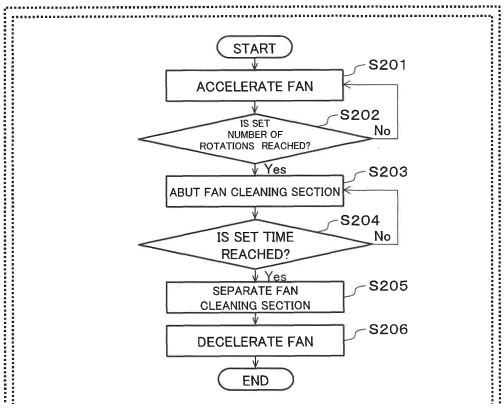
(54) AIR CONDITIONER

(57) An air-conditioner (100) is provided with: an indoor heat exchanger (15); an indoor fan (16); and a fan cleaning section (24) disposed between the indoor heat exchanger (15) and the indoor fan (16) to clean the indoor fan (16). The fan cleaning section (24) contacts the indoor fan (16) after the start of rotation of the indoor fan (16). The indoor fan (16) is structured to rotate about a shaft portion, and contacts the indoor fan (16) by rotating in the same direction as a rotating direction of the indoor fan (16).

FIG. 8



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Description

TECHNICAL FIELD

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

BACKGROUND ART

[0002] An example of a technology for cleaning the indoor fan (fan) of an air-conditioner is described in Patent Document 1. The example is provided with a fan cleaning device for removing dust on the fan. Fig. 1 of Patent Document 1 depicts a configuration in which the fan cleaning device is mounted in the vicinity of a blow port of the indoor fan.

CITATION LIST

PATENT LITERATURE

[0003] Patent Document 1: JP-A-2007-71210

DISCLOSURE OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0004] According to the technology described in Patent Document 1, a fan cleaning section is abutted against the fan prior to the start of rotation of the fan. Accordingly, when the fan starts rotating, the fan cleaning section is subjected to a load, making the fan cleaning section liable to degrade. In addition, as the number of rotations of the fan increases, noise increases, causing the problem of making the user feel unpleasant, for example.

[0005] Accordingly, an object of the present invention is to provide an air-conditioner in which degradation of a fan cleaning section is suppressed and which has improved quietness.

SOLUTIONS TO THE PROBLEMS

[0006] In order to achieve the object, an air-conditioner according to the present invention includes a heat exchanger; a blowing fan; and a fan cleaning section disposed between the heat exchanger and the blowing fan to clean the blowing fan. The fan cleaning section contacts the blowing fan after a start of rotation of the blowing fan.

[0007] An air-conditioner according to the present invention includes a heat exchanger; a blowing fan; and a fan cleaning section which is disposed between the heat exchanger and the blowing fan to clean the blowing fan. The fan cleaning section is separated from the blowing fan before an end of rotation of the blowing fan.

EFFECTS OF THE INVENTION

[0008] According to the present invention, an air-conditioner in which degradation of a fan cleaning section is suppressed and which has improved quietness can be provided.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009]

Fig. 1 is an illustrative diagram of a refrigerant circuit of an air-conditioner according to an embodiment of the present invention.

Fig. 2 is a vertical cross-sectional view of an indoor device of an air-conditioner according to an embodiment of the present invention.

Fig. 3 is a partially cutaway perspective view of the indoor device of the air-conditioner according to the embodiment of the invention.

Fig. 4 is an illustrative diagram depicting an air flow in the vicinity of a fan cleaning section during an air-conditioning operation of the air-conditioner according to the embodiment of the present invention.

Fig. 5 is a functional block diagram of the air-conditioner according to the embodiment of the present invention.

Fig. 6 is a flowchart of a process performed by a control section of the air-conditioner according to the embodiment of the present invention.

Fig. 7A is an illustrative diagram depicting a state of the air-conditioner according to the embodiment of the present invention during cleaning of the indoor fan.

Fig. 7B is an illustrative diagram depicting a state of the air-conditioner according to the embodiment of the present invention during defrosting of an indoor heat exchanger.

Fig. 8 is a flowchart of a process performed by the control section of the air-conditioner according to the embodiment of the present invention.

Fig. 9 is a diagram for describing the periods in which, during cleaning of the fan in the air-conditioner according to the embodiment of the present invention, the fan cleaning section abuts or is separated from the indoor fan.

Fig. 10 is a vertical cross-sectional view of an indoor device of an air-conditioner according to a modification of the present invention.

Fig. 11 is a schematic perspective view of an indoor fan and a fan cleaning section of an air-conditioner according to another modification of the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

«Embodiments»

<Configuration of air-conditioner>

[0010] Fig. 1 is an illustrative diagram of a refrigerant circuit Q of an air-conditioner 100 according to an embodiment.

[0011] In Fig. 1, the solid line arrows indicate the flow of refrigerant during a heating operation.

[0012] In Fig. 1, the dashed line arrows indicate the flow of refrigerant during a cooling operation.

[0013] As depicted in Fig. 1, the air-conditioner 100 is provided with a compressor 11, an outdoor heat exchanger 12, an outdoor fan 13, and an expansion valve 14. The air-conditioner 100 is provided with, in addition to the above-described configuration: an indoor heat exchanger (heat exchanger) 15; an indoor fan (blowing fan) 16; and a four-way valve 17.

[0014] The compressor 11 is an apparatus which, by the driving of a compressor motor 11a, compress a low-temperature, low-pressure gas refrigerant and ejects a high-temperature, high-pressure gas refrigerant.

[0015] The outdoor heat exchanger 12 is a heat exchanger which exchanges heat between the refrigerant flowing through heat transfer pipes thereof (not depicted) and external air delivered from the outdoor fan 13.

[0016] The outdoor fan 13 is a fan which, by the driving of an outdoor fan motor 13a, delivers external air to the outdoor heat exchanger 12, and is mounted in the vicinity of the outdoor heat exchanger 12.

[0017] The expansion valve 14 is a valve which decompresses the refrigerant that has been condensed by a "condenser" (the outdoor heat exchanger 12 in the case of cooling operation, or the indoor heat exchanger 15 in the case of heating operation). The refrigerant that has been decompressed in the expansion valve 14 is guided to an "evaporator" (the indoor heat exchanger 15 in the case of cooling operation, or the outdoor heat exchanger 12 in the case of heating operation).

[0018] The indoor heat exchanger 15 is a heat exchanger which exchanges heat between the refrigerant flowing through heat transfer pipes g (see Fig. 2) and the indoor air (air in the space to be air-conditioned) delivered from the indoor fan 16.

[0019] The indoor fan 16 is a fan which, by the driving of an indoor fan motor 16c (see Fig. 5), delivers the indoor air to the indoor heat exchanger 15, and is mounted in the vicinity of the indoor heat exchanger 15.

[0020] The four-way valve 17 is a valve for switching the flow passageway of refrigerant in accordance with an operation mode of the air-conditioner 100. For example, during cooling operation (see the dashed line arrows in Fig. 1), the refrigerant is circulated in a refrigeration cycle through the refrigerant circuit Q in which the compressor 11, the outdoor heat exchanger 12 (condenser), the expansion valve 14, and the indoor heat exchanger 15 (evaporator) are successively connected annularly via the four-way valve 17.

[0021] On the other hand, during heating operation (see the solid line arrows in Fig. 1), the refrigerant is circulated in a refrigeration cycle through the refrigerant circuit Q in which the compressor 11, the indoor heat exchanger 15 (condenser), the expansion valve 14, and the outdoor heat exchanger 12 (evaporator) are successively connected annularly via the four-way valve 17.

[0022] In the example depicted in Fig. 1, the compressor 11, the outdoor heat exchanger 12, the outdoor fan 13, the expansion valve 14, and the four-way valve 17 are mounted in an outdoor device Uo. On the other hand, the indoor heat exchanger 15 and the indoor fan 16 are mounted in the indoor device Ui.

[0023] Fig. 2 is a vertical cross-sectional view of the indoor device Ui.

[0024] Fig. 2 depicts a state in which cleaning of the indoor fan 16 by a fan cleaning section 24 is not being performed. The indoor device Ui is provided with, in addition to the indoor heat exchanger 15 and the indoor fan 16: a drain pan 18; a housing base 19; filters 20a, 20b; a front-face panel 21; horizontal deflectors 22; vertical deflectors 23; and the fan cleaning section 24.

[0025] The indoor heat exchanger 15 includes a plurality of fins f and a plurality of heat transfer pipes g penetrating through the fins f. Described from another perspective, the indoor heat exchanger 15 includes a front-side indoor heat exchanger 15a and a rear-side indoor heat exchanger 15b. The front-side indoor heat exchanger 15a is disposed on the front side of the indoor fan 16. On the other hand, the rear-side indoor heat exchanger 15b is disposed on the rear side of the indoor fan 16. An upper-end portion of the front-side indoor heat exchanger 15a and an upper-end portion of the rear-side indoor heat exchanger 15b are connected.

[0026] The drain pan 18 is configured to receive the condensed water in the indoor heat exchanger 15, and is disposed under the indoor heat exchanger 15 (the front-side indoor heat exchanger 15a, in the example depicted in Fig. 2).

[0027] The indoor fan 16 is a cylindrical cross-flow fan, for example, and is disposed in the vicinity of the indoor heat exchanger 15. The indoor fan 16 is provided with a plurality of fan blades 16a, partition plates 16b to which the fan blades 16a are mounted, and the indoor fan motor 16c (see Fig. 5) as a drive source.

[0028] Preferably, the indoor fan 16 is coated with a hydrophilic coating agent. An example of the coating material that may be used can be obtained by adding a binder (a silicon compound having a hydrolysable group), butanol, tetrahydrofuran, and an antimicrobial to an isopropyl alcohol-dispersed silica sol which is a hydrophilic material.

[0029] In this way, a hydrophilic film can be formed on a surface of the indoor fan 16. Accordingly, the electric resistance value on the surface of the indoor fan 16 is reduced, and attachment of dust to the indoor fan 16

becomes less likely. That is, when the indoor fan 16 is being driven, generation of static electricity on the surface of the indoor fan 16 due to friction with air becomes less likely, making it possible to suppress the attachment of dust to the indoor fan 16. Thus, the coating agent functions also as an anti-static agent for the indoor fan 16.

[0030] The housing base 19 depicted in Fig. 2 is a housing in which the apparatuses including the indoor heat exchanger 15 and the indoor fan 16 are mounted.

[0031] The filter 20a is configured to remove dust from the air moving toward an air inlet h1 on the front side, and is mounted on the front side of the indoor heat exchanger 15.

[0032] The filter 20b is configured to remove dust from the air moving toward an air inlet h2 on the front side, and is mounted on the front side of the indoor heat exchanger 15.

[0033] The front-face panel 21 is mounted so as to cover the filter 20a on the front side, and is pivotable about the lower end thereof toward the front side. The front-face panel 21 may be configured to not pivot.

[0034] The horizontal deflectors 22 are plate-like members for adjusting the horizontal flow of air that is blown indoors as the indoor fan 16 is rotated.

[0035] The horizontal deflectors 22 are disposed in a blown-air passageway h3, and are configured to pivot horizontally due to a horizontal deflector motor 25 (see Fig. 5).

[0036] The vertical deflectors 23 are plate-like members for adjusting the vertical flow of air that is blown indoors as the indoor fan 16 is rotated. The vertical deflectors 23 are configured to pivot vertically due to a vertical deflector motor 26 (see Fig. 5) disposed in the vicinity of an air blow port h4.

[0037] The air suctioned via the air inlets h1, h2 is subjected to heat exchange with the refrigerant flowing through the heat transfer pipes g of the indoor heat exchanger 15, and the heat-exchanged air is guided to the blown-air passageway h3. The air that flows through the blown-air passageway h3 is guided in a predetermined direction by the horizontal deflectors 22 and the vertical deflectors 23, and is then blown indoors through the air blow port h4.

[0038] Most of the dust that moves toward the air inlets h1, h2 along the air flow is captured by the filters 20a, 20b. However, fine dust may pass through the filters 20a, 20b and become attached to the indoor heat exchanger 15 or the indoor fan 16. Accordingly, it is desirable to clean the indoor heat exchanger 15 and the indoor fan 16 periodically. In the present embodiment, after the indoor fan 16 is cleaned using the fan cleaning section 24 as will be described later, the indoor heat exchanger 15 is washed with water.

[0039] The fan cleaning section 24 depicted in Fig. 2 is configured to clean the indoor fan 16, and is disposed between the indoor heat exchanger 15 and the indoor fan 16. More specifically, the fan cleaning section 24 is disposed in a recessed portion r of the front-side indoor heat exchanger 15a forming a chevron-shape in a vertical cross-sectional view. In the example depicted in Fig. 2, the indoor heat exchanger 15 (the lower portion of the front-side indoor heat exchanger 15a) and also the drain pan 18 are present under the fan cleaning section 24. The fan cleaning section 24 is partly configured from nylon, for example.

[0040] Fig. 3 is a partially cutaway perspective view of the indoor device Ui.

[0041] The fan cleaning section 24 is provided with a fan-cleaning motor 24c (see Fig. 5) as well as a shaft portion 24a and a brush 24b depicted in Fig. 3. The shaft portion 24a is a rod-shaped member running parallel with the axial direction of the indoor fan 16, and is journaled at both ends thereof.

[0042] The brush 24b is configured to remove dust that has become attached to the fan blades 16a, and is mounted to the shaft portion 24a. The fan-cleaning motor 24c (see Fig. 5) is a stepping motor, for example, and has the function of rotating the shaft portion 24a by a predetermined angle.

[0043] When the indoor fan 16 is cleaned using the fan cleaning section 24, the fan-cleaning motor 24c (see Fig. 5) is driven so as to cause the brush 24b to contact the indoor fan 16 (see Fig. 7A), and the indoor fan 16 is rotated in reverse. When the cleaning of the indoor fan 16 by the fan cleaning section 24 is over, the fan-cleaning motor 24c is again driven to cause the brush 24b to pivot into a state in which the brush 24b is separated from indoor fan 16 (see Fig. 2).

[0044] In the present embodiment, the tip of the brush 24b faces the indoor heat exchanger 15 at times other than during the cleaning of the indoor fan 16, as depicted in Fig. 2. Specifically, at times other than during the cleaning of the indoor fan 16 (including during normal air-conditioning operation), the brush 24b is in a laterally (substantially horizontally) oriented state and separated from the indoor fan 16. The reason for arranging the fan cleaning section 24 in this way will be explained with reference to Fig. 4.

[0045] Fig. 4 is an illustrative diagram depicting air flows in the vicinity of the fan cleaning section 24 during an air-conditioning operation.

[0046] In Fig. 4, the direction of each arrow indicates the direction of an air flow. The length of each arrow indicates the velocity of air flow.

[0047] During a normal air-conditioning operation, the indoor fan 16 rotates forward, and the air that has passed through the gaps between the fins f of the front-side indoor heat exchanger 15a moves toward the indoor fan 16. In particular, in the vicinity of the recessed portion r of the front-side indoor heat exchanger 15a, as depicted in Fig. 4, the air flows laterally (in substantially the horizontal direction) toward the indoor fan 16.

[0048] In the recessed portion r, as described above, the fan cleaning section 24 is disposed with the brush 24b in a laterally oriented state. In other words, during a normal air-conditioning operation, the direction of the

brush 24b is parallel with the direction of air flow. Thus, the direction of extension of the brush 24b and the direction of air flow are substantially parallel with each other, and the fan cleaning section 24 hardly poses an obstacle to an air flow.

[0049] In addition, the fan cleaning section 24 is disposed not in a middle-stream region or a downstream region (in the vicinity of the air blow port h4 depicted in Fig. 2) but in an upstream region of the air flow during forward rotation of the indoor fan 16. The air that flows laterally along the brush 24b is accelerated by the fan blades 16a, and the accelerated air moves toward the air blow port h4 (see Fig. 2). Thus, the fan cleaning section 24 is disposed in the upstream region in which the air flows at a relatively low velocity. Accordingly, it is possible to suppress a decrease in air volume due to the fan cleaning section 24. The fan cleaning section 24 may also be maintained in the same state as in Fig. 4 when the indoor fan 16 is at a stop.

[0050] Fig. 5 is a functional block diagram of the air-conditioner 100.

[0051] The indoor device Ui depicted in Fig. 5 is provided with, in addition to the above-described configuration, a remote-controller transmission/reception section 27 and an indoor control circuit 31.

[0052] The remote-controller transmission/reception section 27 exchanges predetermined information with a remote controller 40.

[0053] The indoor control circuit 31 includes, while not depicted, electronic circuits such as a central processing unit (CPU), a read only memory (ROM), a random-access memory (RAM), and various interfaces. A program stored in the ROM is read and loaded into the RAM, and the CPU performs various processes.

[0054] As depicted in Fig. 5, the indoor control circuit 31 is provided with a storage section 31a and an indoor control section 31b.

[0055] In the storage section 31a, data received via the remote-controller transmission/reception section 27 and values detected by various sensors (not depicted), as well as a predetermined program, for example, are stored.

[0056] The indoor control section 31b performs the fan-cleaning motor 24c, the indoor fan motor 16c, the horizontal deflector motor 25, the vertical deflector motor 26 and the like, on the basis of the data stored in the storage section 31a.

[0057] The outdoor device Uo is provided with an outdoor control circuit 32, in addition to the above-described configuration. The outdoor control circuit 32 includes, while not depicted, electronic circuits such as a CPU, a ROM, a RAM, and various interfaces, and is connected to the indoor control circuit 31 via a communication line. As depicted in Fig. 5, the outdoor control circuit 32 is provided with a storage section 32a and an outdoor control section 32b.

[0058] In the storage section 32a, data received from the indoor control circuit 31 are stored, for example, in addition to a predetermined program. The outdoor control section 32b, on the basis of the data stored in the storage section 32a, controls the compressor motor 11a, the outdoor fan motor 13a, the expansion valve 14 and the like. In the following, the indoor control circuit 31 and the outdoor control circuit 32 will be collectively referred to as a "control section 30".

[0059] Fig. 6 is a flowchart of a process performed by the control section 30 (see Fig. 2 as needed).

[0060] In Fig. 6, it is assumed that, at the time of "START", no air-conditioning operation is being performed and the tip of the brush 24b is in the state of facing the front-side indoor heat exchanger 15a (state depicted in Fig. 2).

[0061] In step S101 of Fig. 6, the control section 30 causes the fan cleaning section 24 to clean the indoor fan 16. As a trigger for starting the cleaning of the indoor fan 16, a condition that the accumulated time of air-conditioning operation from the previous cleaning time has reached a predetermined time may be used. However, this is merely a non-limiting example.

[0062] Fig. 7A is an illustrative diagram depicting a state during cleaning of the indoor fan 16.

[0063] In Fig. 7A, the indoor heat exchanger 15, the indoor fan 16, and the drain pan 18 are being depicted, while depiction of the other members is omitted.

[0064] The control section 30 causes the indoor fan 16 to rotate in the opposite direction (reverse rotation) to that during normal air-conditioning operation. When the indoor fan 16 has reached a set number of rotations, the control section 30 causes the fan cleaning section 24 to contact the indoor fan 16.

[0065] That is, the control section 30 causes the brush 24b to pivot about the shaft portion 24a by approximately 180° from the state in which the tip of the brush 24b was facing the indoor heat exchanger 15 (see Fig. 2). As a result, the tip of the brush 24b faces the indoor fan 16 (see Fig. 7A) which causes the brush 24b to contact the fan blades 16a of the indoor fan 16.

[0066] In the example of Fig. 7A, as indicated by a dashed and single-dotted line L, the indoor heat exchanger 15 (front-side indoor heat exchanger 15a) and also the drain pan 18 are present under the contact position K in the state in which the fan cleaning section 24 is in contact with the indoor fan 16.

[0067] As described above, because the indoor fan 16 is rotated in reverse, the tip of the brush 24b becomes warped and the brush 24b is pressed to rub the back surfaces of the fan blades 16a as the fan blades 16a are moved. Accordingly, the dust that has accumulated around the tip (radial ends) of the fan blades 16a is removed by the brush 24b.

[0068] In particular, dust tends to accumulate around the tip of the fan blades 16a. This is because during an air-conditioning operation (see Fig. 4) in which the indoor fan 16 rotates forward, air hits the vicinity of the tip on the front of the fan blades 16a, and dust becomes attached in the vicinity of the tip. The air that has hit the

vicinity of the tip of the fan blades 16a passes through the gaps between adjacent fan blades 16a, 16a, along the curved surfaces of the front of the fan blades 16a.

[0069] In the present embodiment, as described above, the indoor fan 16 is rotated in reverse, and when the indoor fan 16 has reached a set number of rotations, the fan cleaning section 24 is contacted with the fan blades 16a. In this way, the brush 24b contacts the vicinity of the tip on the back surface of the fan blades 16a, and the dust that has accumulated in the vicinity of the tip on the back surface of the fan blades 16a is removed. As a result, it becomes possible to remove most of the dust that has accumulated on the indoor fan 16.

[0070] When the indoor fan 16 is rotated in reverse, a slow air flow is generated in the indoor device Ui (see Fig. 2) in the opposite direction to that during forward rotation (see Fig. 4). Accordingly, dust j removed from the indoor fan 16, instead of moving toward the air blow port h4 (see Fig. 2), is guided to the drain pan 18 through the gap between the front-side indoor heat exchanger 15a and the indoor fan 16, as depicted in Fig. 7A.

[0071] More specifically, the dust j removed from the indoor fan 16 by the brush 24b is lightly pushed toward the front-side indoor heat exchanger 15a by an air pressure. Further, the dust j falls along an inclined surface (the edges of the fins f) of the front-side indoor heat exchanger 15a and into the drain pan 18 (see an arrow in Fig. 7A). Accordingly, hardly any of the dust j becomes attached to the back surface of the vertical deflectors 23 (see Fig. 2) through a small gap between the indoor fan 16 and the drain pan 18. In this way, it is possible to prevent the dust j from being blown indoors during the next air-conditioning operation.

[0072] It is possible that some of the dust j removed from the indoor fan 16 may become attached to the front-side indoor heat exchanger 15a, rather than falling into the drain pan 18. The dust j that has thus become attached to the front-side indoor heat exchanger 15a is washed away by a process of step S103, as will be described later.

[0073] During cleaning of the indoor fan 16, the control section 30 may drive the indoor fan 16 at a rotation speed in intermediate to high velocity regions, or may drive the indoor fan 16 at a rotation speed in a low velocity region.

[0074] The rotation speed in the intermediate to high velocity regions of the indoor fan 16 is, for example, not less than 300 min^{-1} and not more than 1700 min^{-1}. By causing the indoor fan 16 to rotate in the intermediate to high velocity regions, the dust j becomes more likely to move toward the front-side indoor heat exchanger 15a, and, as described above, the dust j becomes less liable to attach to the back surface of the vertical deflectors 23 (see Fig. 2). Accordingly, the dust j can be prevented from being blown indoors during the next air-conditioning operation.

[0075] The rotation speed range of the indoor fan 16 in the low velocity region is not less than 100 min^{-1} and less than 300 min^{-1}, for example. By thus causing the indoor fan 16 to rotate in the low velocity region, the cleaning of the indoor fan 16 can be performed with small noise.

[0076] After the process of step S101 of Fig. 6 is completed, the control section 30 in step S102 causes the fan cleaning section 24 to be moved. That is, the control section 30 causes the brush 24b to pivot about the shaft portion 24a by approximately 180° from the state in which the tip of the brush 24b was facing the indoor fan 16 (see Fig. 7A). As a result, the tip of the brush 24b faces the indoor heat exchanger 15 (see Fig. 7B). In this way, it becomes possible to prevent the fan cleaning section 24 from posing an obstacle to an air flow during a subsequent air-conditioning operation.

[0077] In step S103, the control section 30 performs freezing and defrosting of the indoor heat exchanger 15 successively. First, the control section 30 causes the indoor heat exchanger 15 to function as an evaporator so as to cause moisture contained in the air taken into the indoor device Ui to form frost on the indoor heat exchanger 15 and freeze the same. The process of freezing the indoor heat exchanger 15 is included in the matter of "causing condensed water to become attached" to the indoor heat exchanger 15.

[0078] When the indoor heat exchanger 15 is being frozen, the control section 30 preferably lowers the evaporation temperature of the refrigerant that flows into the indoor heat exchanger 15. That is, the control section 30, when causing the indoor heat exchanger 15 to function as an evaporator and freezing (attachment of condensed water) the indoor heat exchanger 15, adjusts the temperature of the refrigerant that flows into the indoor heat exchanger 15 so that the evaporation temperature of the refrigerant becomes lower than during normal air-conditioning operation.

[0079] For example, the control section 30 decreases the degree of opening of the expansion valve 14 (see Fig. 1) to cause a low-pressure, low-evaporation-temperature refrigerant to flow into the indoor heat exchanger 15. In this way, the growth of frost and ice (indicated by sign i in Fig. 7B) on the indoor heat exchanger 15 is facilitated, making it possible to wash the indoor heat exchanger 15 with a large volume of water during subsequent defrosting.

[0080] Preferably, in the indoor heat exchanger 15, the region positioned under the fan cleaning section 24 does not correspond to the downstream region (i.e., it corresponds to either an upstream region or a middle-stream region) of the flow of refrigerant flowing through the indoor heat exchanger 15. In this way, at least under (on the lower side of) the fan cleaning section 24, a low-temperature, gas-liquid two-phase refrigerant flows, which makes it possible to increase the thickness of frost and ice that becomes attached to the indoor heat exchanger 15. Accordingly, it becomes possible to wash the indoor heat exchanger 15 with a large volume of water during subsequent defrosting.

[0081] In the indoor heat exchanger 15, in the region positioned under the fan cleaning section 24, the dust

that has been scraped off the fan 16 by the fan cleaning section 24 tends to become attached. By causing the low-temperature, gas-liquid two-phase refrigerant to flow through the region positioned under the fan cleaning section 24 in the indoor heat exchanger 15, the growth of frost and ice is facilitated. Further, by melting the frost and ice, it becomes possible to wash away the dust on the indoor heat exchanger 15 in an appropriate manner.

[0082] When the indoor heat exchanger 15 is being caused to function as an evaporator, and the indoor heat exchanger 15 is being frozen (attachment of condensed water), the control section 30 preferably causes the vertical deflectors 23 (see Fig. 2) to be closed, or makes the vertical deflectors 23 angled more upward than horizontal. In this way, it becomes possible to suppress the leakage indoors of the low-temperature air cooled by the indoor heat exchanger 15, and to freeze the indoor heat exchanger 15 in a state comfortable to the user, for example.

[0083] After the indoor heat exchanger 15 has been thus made frozen (S103 of Fig. 6), the control section 30 defrosts the indoor heat exchanger 15 (S103). For example, the control section 30 maintains the stopped state of each apparatus to thereby let the indoor heat exchanger 15 naturally defrost at room temperature. The control section 30 may perform a blowing operation to melt the frost and ice attached to the indoor heat exchanger 15.

[0084] Fig. 7B is an illustrative diagram depicting the state of the indoor heat exchanger 15 during defrosting.

[0085] As the indoor heat exchanger 15 is defrosted, the frost and ice attached to the indoor heat exchanger 15 are melted, a large volume of water w flows down into the drain pan 18 along the fins f. In this way, it is possible to wash away the dust j that has become attached to the indoor heat exchanger 15 during an air-conditioning operation.

[0086] Together with the cleaning of the indoor fan 16 by the brush 24b, the dust j attached to the front-side indoor heat exchanger 15a is also washed away and flows down into the drain pan 18 (see an arrow in Fig. 7B). The water w that has flowed down into the drain pan 18, together with the dust j (see Fig. 7A) that has directly fallen into the drain pan 18 during the cleaning of the indoor fan 16, is discharged outside via a drain hose (not depicted). As described above, during defrosting, a large volume of water flows down from the indoor heat exchanger 15, and there is hardly any chance of the drain hose and the like (not depicted) becoming clogged with the dust j.

[0087] While omitted in Fig. 6, after the indoor heat exchanger 15 has been subjected to freezing and defrosting (S103), the control section 30 may cause a blowing operation to be performed to dry the interior of the indoor device Ui. In this way, it becomes possible to suppress the growth of bacteria on the indoor heat exchanger 15 and the like.

<Operation of fan cleaning section>

[0088] With reference to Fig. 8 and Fig. 9, the operation of the fan cleaning section 24 will be described. Fig. 8 is a flowchart of a process performed by the control section 30. Fig. 9 is a diagram for describing the positional relationship between the indoor fan (blowing fan) 16 and the fan cleaning section 24 of the air-conditioner 100.

[0089] In step S201, the control section 30 controls the indoor fan motor 16c to start rotation of the indoor fan 16 and to accelerate the indoor fan 16.

[0090] In step S202, the control section 30 determines whether the number of rotations (rotation speed) of the indoor fan 16 has reached a set number of rotations R_{Th} (for example, set number of rotations R_{Th} = 800 min^{-1}). The control section 30, upon determining that the number of rotations of the indoor fan 16 has reached the set number of rotations R_{Th} (step S202 →Yes), proceeds to the process of step S203. The control section 30, upon determining that the number of rotations of the indoor fan 16 has not reached the set number of rotations R_{Th} (step S202→No), proceeds to the process of step S201.

[0091] In step S203, the control section 30 controls the fan-cleaning motor 24c to cause the fan cleaning section 24 to be abutted against the indoor fan 16. That is, the control section 30 controls the fan-cleaning motor 24c so that the fan cleaning section 24 and the indoor fan 16 are disposed at positions to contact each other after the indoor fan 16 has been accelerated.

[0092] The control section 30 also controls the indoor fan motor 16c so that the indoor fan 16 rotates in a state in which the cleaning section 24 is abutted against the indoor fan 16. In this way, it becomes possible to increase the durability of the fan cleaning section 24, and to remove dust that has become attached to the vanes of the indoor fan 16.

[0093] The control section 30 also controls the angle of the fan cleaning section 24 so that, while the fan cleaning section 24 and the indoor fan 16 are abutted against each other, the fan cleaning section 24 can rub the tip surface of the vanes of the indoor fan 16. Preferably, the angle of the fan cleaning section 24 is a predetermined angle, with respect to the state in which the fan cleaning section 24 is oriented in the horizontal direction as depicted in Fig. 2, in the direction of rotation (reverse rotation direction) of the indoor fan 16 during cleaning. In this way, it becomes possible to improve the quietness of the air-conditioner 100. Further, it becomes possible to reduce the load applied to each motor.

[0094] The control section 30 also controls the horizontal deflector motor 25 so that the horizontal deflectors 22 are closed while the fan cleaning section 24 and the indoor fan 16 are abutted against each other. Similarly, the control section 30 controls the vertical deflector motor 26 so that the vertical deflectors 23 are closed while the fan cleaning section 24 and the indoor fan 16 are abutted against each other. In this way, it becomes possible to improve the quietness of the air-conditioner 100, prevent

the scattering of dust, and prevent the user from putting his or her hand into the indoor device Ui.

[0095] In step S204, the control section 30 determines whether the rotation time of the indoor fan 16 has reached a set time T_{Th} (for example, set time T_T = 5 seconds). That is, the control section 30 determines the time for which the fan cleaning section 24 is in contact with the indoor fan 16. The control section 30, upon determining that the rotation time of the indoor fan 16 has reached the set time T_{Th} (step S204→Yes), proceeds to the process of step S205. The control section 30, upon determining that the rotation time of the indoor fan 16 has not reached the set time T_{Th} (step S204→No), proceeds to the process of step S203.

[0096] In step S205, the control section 30 controls the fan-cleaning motor 24c to cause the fan cleaning section 24 to be separated from the indoor fan 16. That is, the control section 30 controls the fan-cleaning motor 24c so that the fan cleaning section 24 and the indoor fan 16 are disposed at positions separated from each other prior to deceleration of the indoor fan 16.

[0097] In step S206, the control section 30 controls the indoor fan motor 16c to decelerate the indoor fan 16 and end the rotation of the indoor fan 16.

[0098] According to the above-described process, the control section 30 causes the fan cleaning section 24 and the indoor fan 16 to be separated from each other in the period from time 0 to time t_1 (during acceleration of the indoor fan 16) in Fig. 9. In the period from time t_1 to time t_2 in Fig. 9 (during rotation of the indoor fan 16 at the set number of rotations R_{Th}), the control section 30 causes the fan cleaning section 24 and the indoor fan 16 to be abutted against each other. In the period from time t_2 to time t_3 in Fig. 9 (during deceleration of the indoor fan 16), the control section 30 causes the fan cleaning section 24 and the indoor fan 16 to be separated from each other.

[0099] In this way, during acceleration when the indoor fan 16 starts rotating, or during deceleration when the indoor fan 16 ends rotating, the fan cleaning section 24 and the indoor fan 16 can be separated from each other. Thus, it becomes possible to avoid the problem that a load is applied to the fan cleaning section 24 and the fan cleaning section 24 becomes liable to degrade. In addition, it becomes possible to avoid the problem that, as the number of rotations of the indoor fan 16 is increased or decreased, noise increases and the user is made to feel unpleasant.

<Effects>

[0100] According to the air-conditioner 100 of the present embodiment, compared to conventional air-conditioners, it is possible to reduce the time for which the fan cleaning section 24 and the indoor fan 16 are abutted against each other. Thus, degradation of the fan cleaning section can be suppressed, and an air-conditioner having improved quietness can be provided.

[0101] According to the air-conditioner 100 of the present embodiment, while the fan cleaning section 24 and the indoor fan 16 are abutted against each other, the fan cleaning section 24 and the indoor fan 16 are rotated in the same direction. Accordingly, the durability of the fan cleaning section 24 can be increased.

[0102] According to the air-conditioner 100 of the present embodiment, while the fan cleaning section 24 and the indoor fan 16 are abutted against each other, the angle of the fan cleaning section 24 is adjusted in accordance with the tip surface of the indoor fan 16. Accordingly, quietness can be improved.

[0103] According to the air-conditioner 100 of the present embodiment, while the fan cleaning section 24 and the indoor fan 16 are abutted against each other, the horizontal deflectors 22 and the vertical deflectors 23 are closed. Accordingly, it is possible to improve the quietness of the air-conditioner 100, prevent the scattering of dust, and prevent a user from erroneously putting his or her hand into the indoor device Ui.

[0104] According to the present embodiment, the indoor fan 16 is cleaned by the fan cleaning section 24 (S101 in Fig. 6). Thus, the dust j can be suppressed from being blown indoors. The fan cleaning section 24 is disposed between the front-side indoor heat exchanger 15a and the indoor fan 16. Thus, the dust j that has been scraped off the indoor fan 16 by the brush 24b can be guided to the drain pan 18.

[0105] Further, during cleaning of the indoor fan 16, the control section 30 causes the indoor fan 16 to be rotated in reverse. In this way, the dust j can be prevented from moving toward the air blow port h4.

[0106] During a normal air-conditioning operation, the brush 24b is in a laterally oriented state (see Fig. 4). Accordingly, an air flow is hardly blocked by the influence of the brush 24b. In addition, the fan cleaning section 24 is disposed in the upstream region of an air flow. Thus, during a normal air-conditioning operation, a decrease in air volume due to the fan cleaning section 24 is suppressed, and an increase in power consumption by the indoor fan 16 is also suppressed.

[0107] If a large amount of dust becomes attached to the indoor fan 16, a decrease in air volume may be caused, and the indoor heat exchanger 15 may become excessively cooled (over-cooled). As a result, dew dripping may occur during cooling operation. In this respect, according to the present embodiment, the indoor fan 16 is cleaned in an appropriate manner as described above, and a decrease in air volume of the indoor fan 16 due to attachment of dust is suppressed. Thus, according to the present embodiment, it is possible to prevent dew dripping due to the dust on the indoor fan 16.

[0108] As the control section 30 performs freezing and defrosting of the indoor heat exchanger 15 successively (S103 in Fig. 6), the dust j that has been attached to the indoor heat exchanger 15 is washed away by the water w and flows down into the drain pan 18. Thus, according to the present embodiment, the indoor fan 16 can be placed in a clean state, and the indoor heat exchanger

15 can also be placed in a clean state. Accordingly, the air-conditioner 100 can perform comfortable air-conditioning. Further, it is possible to reduce the labor required from a user to clean the indoor heat exchanger 15 or the indoor fan 16, and the cost of maintenance.

«Modification s»

[0109] While the air-conditioner 100 according to the present invention has been described with reference to an embodiment, the present invention is not limited to the foregoing description, and various modifications may be made.

[0110] Fig. 10 is a vertical cross-sectional view of an indoor device UAi of an air-conditioner according to a modification.

[0111] In the modification depicted in Fig. 10, a groove member M having a recessed shape in a vertical cross-sectional view is mounted under the front-side indoor heat exchanger 15a. A rib 28 extending upward from a bottom surface of the groove member M is disposed on the groove member M. The modification is similar to the embodiment in other respects.

[0112] Of the groove member M depicted in Fig. 10, the portion on the front side of the rib 28 functions as a dew receiver 18A for receiving condensed water from the indoor heat exchanger 15. Of the groove member M, the portion on the rear side of the rib 28 functions as a dust receiver 29 for receiving dust that has fallen from the indoor heat exchanger 15 or the indoor fan 16. The dust receiver 29 is disposed under the indoor heat exchanger 15.

[0113] Further, under the fan cleaning section 24, the indoor heat exchanger 15 (the lower portion of the front-side indoor heat exchanger 15a) is present, and the dust receiver 29 is also present. More specifically, while not depicted, the indoor heat exchanger 15 and also the dust receiver 29 are present under the position of contact in a state in which the fan cleaning section 24 is in contact with the indoor fan 16. With this configuration, it is also possible to obtain effects similar to those of the embodiment.

[0114] During defrosting of the indoor heat exchanger 15, water flows down into the dew receiver 18A and also into the dust receiver 29. Accordingly, the discharge of the dust that has accumulated in the dust receiver 29 is not hindered.

[0115] In the example depicted in Fig. 10, the upper end of the rib 28 is not in contact with the front-side indoor heat exchanger 15a. However, this is not a limitation, and the upper end of the rib 28 may be in contact with the front-side indoor heat exchanger 15a.

[0116] Fig. 11 is a schematic perspective view of the indoor fan 16 and the fan cleaning section 24A with which an air-conditioner according to another modification is provided.

[0117] In the modification depicted in Fig. 11, the fan cleaning section 24A is provided with: a rod-shaped shaft portion 24d parallel with the axial direction of the indoor fan 16; a brush 24e mounted to the shaft portion 24d; and a pair of support portions 24f, 24f mounted at both ends of the shaft portion 24d. The fan cleaning section 24A is also provided with a moving mechanism, not depicted, for moving the fan cleaning section 24A in the axial direction, for example.

[0118] As depicted in Fig. 11, the length of the fan cleaning section 24A in a direction parallel with the axial direction of the indoor fan 16 is smaller than the length in the axial direction of the indoor fan 16 per se. During cleaning of the indoor fan 16, the fan cleaning section 24A is moved in the axial direction of the indoor fan 16 (the horizontal direction as viewed from the front of the indoor device). That is, the indoor fan 16 is cleaned successively for each predetermined region thereof corresponding to the length of the fan cleaning section 24A in the axial direction of the indoor fan 16. Thus, by adopting the configuration in which the fan cleaning section 24A having a relatively short length is moved, it becomes possible to reduce the manufacturing cost of the air-conditioner compared to the first embodiment.

[0119] A rod (not depicted) extending in parallel with the shaft portion 24d may be provided in the vicinity of the fan cleaning section 24A (for example, on the front side of the shaft portion 24d), and the fan cleaning section 24A may be moved along the rod by a predetermined moving mechanism (not depicted). After cleaning by the fan cleaning section 24A, a moving mechanism (not depicted) may cause the fan cleaning section 24A to pivot or be translated, as appropriate, so as to cause the fan cleaning section 24A to be withdrawn from the indoor fan 16.

[0120] According to an embodiment, the process has been described in which the control section 30 causes the fan cleaning section 24 to contact the indoor fan 16, and causes the indoor fan 16 to rotate in the opposite direction (reverse rotation) to that during normal air-conditioning operation. However, this is not a limitation, and the control section 30 may cause the fan cleaning section 24 to contact the indoor fan 16, and cause the indoor fan 16 to rotate in the same direction (forward rotation) as that during normal air-conditioning operation.

[0121] By thus causing the brush 24b to contact the indoor fan 16, and causing the indoor fan 16 to rotate forward, it is possible to remove effectively the dust that has become attached to the vicinity of the tip on the front of the fan blades 16a. In addition, because the need for a circuit element for rotating the indoor fan 16 in reverse is eliminated, the manufacturing cost of the air-conditioner 100 can be reduced. The rotation speed of the indoor fan 16 being rotated forward during cleaning may be in any of a low velocity region, an intermediate-velocity region, and a high velocity region, as in the embodiment.

[0122] According to an embodiment, the configuration has been described in which the brush 24b pivots about the shaft portion 24a of the fan cleaning section 24. However, this is not a limitation. For example, when the indoor

fan 16 is cleaned, the control section 30 may cause the shaft portion 24a to be moved toward the indoor fan 16 so as to cause the brush 24b to contact the indoor fan 16. After the cleaning of the indoor fan 16 is completed, the control section 30 may cause the shaft portion 24a to be withdrawn so as to cause the brush 24b to be separated from the indoor fan 16.

[0123] According to an embodiment, the configuration has been described in which the fan cleaning section 24 is provided with the brush 24b. However, this is not a limitation. That is, any member with which the indoor fan 16 can be cleaned, such as sponge, may be used.

[0124] According to an embodiment, the configuration has been described in which, in the indoor heat exchanger 15, the region positioned under the fan cleaning section 24 does not correspond to the downstream region of the flow of refrigerant. However, this is not a limitation. For example, a configuration may be adopted in which, in the indoor heat exchanger 15, a region of which the height is higher than the fan cleaning section 24 does not correspond to the downstream region of the flow of refrigerant flowing through the indoor heat exchanger 15 (i.e., it corresponds to either the upstream region or the middle-stream region). More specifically, in the front-side indoor heat exchanger 15a, a region which is positioned on the downstream side of the air flow during normal air-conditioning operation and of which the height is higher than the fan cleaning section 24 preferably does not correspond to the downstream region of the flow of refrigerant flowing through the indoor heat exchanger 15. In this configuration, as the indoor heat exchanger 15 is frozen, a thick frost becomes attached to the region, in the front-side indoor heat exchanger 15a, that is positioned on the downstream side of the air flow during normal air-conditioning operation (the right portion in the sheet of drawing of the front-side indoor heat exchanger 15a depicted in Fig. 2) and of which the height is higher than the fan cleaning section 24. When later the indoor heat exchanger 15 is defrosted, a large volume of water flows down along the fins f. As a result, it is possible to wash away the dust that has become attached to the indoor heat exchanger 15 (including the dust removed from the indoor fan 16) into the drain pan 18.

[0125] According to an embodiment, the configuration has described in which, during cleaning of the indoor fan 16, the control section 30 causes the brush 24b of the fan cleaning section 24 to contact the indoor fan 16. However, this is not a limitation. That is, during cleaning of the indoor fan 16, the control section 30 may cause the brush 24b of the fan cleaning section 24 to be in proximity to the indoor fan 16. More specifically, the control section 30 may cause the brush 24b to be in proximity to the indoor fan 16 to such an extent that the dust that has accumulated on the tip of the fan blades 16a and has grown radially outside beyond the tip can be removed. With this configuration, it is also possible to remove appropriately the dust that has accumulated on the indoor fan 16.

[0126] Embodiments have been described with reference to a process in which the indoor heat exchanger 15 is cleaned by freezing the indoor heat exchanger 15, for example. However, this is not a limitation. For example, the indoor heat exchanger 15 may be subjected to dew condensation, and the indoor heat exchanger 15 may be cleaned with the dew condensation water (condensed water). For example, the control section 30 calculates the dew point of the indoor air on the basis of the temperature and relative humidity of the indoor air. Then, the control section 30 controls the degree of opening and the like of the expansion valve 14 so that the temperature of the indoor heat exchanger 15 becomes not higher than the dew point and higher than a predetermined freezing temperature.

[0127] The "freezing temperature" refers to a temperature at which, when the temperature of the indoor air is decreased, the moisture contained in the indoor air starts to become frozen on the indoor heat exchanger 15. Thus, by subjecting the indoor heat exchanger 15 to dew condensation, it is possible to wash away the dust on the indoor heat exchanger 15 using the dew condensation water (condensed water).

[0128] The control section 30 may also perform a cooling operation or a dehumidification operation to subject the indoor heat exchanger 15 to dew condensation, so that the indoor heat exchanger 15 can be cleaned with the dew condensation water (condensed water).

[0129] According to an embodiment (see Fig. 2), the configuration has been described in which the indoor heat exchanger 15 and the drain pan 18 are present under the fan cleaning section 24. However, this is not a limitation. That is, a configuration may be adopted in which at least one of the indoor heat exchanger 15 and the drain pan 18 is present under the fan cleaning section 24. For example, in a configuration in which the lower portion of the indoor heat exchanger 15 having the chevron-shape in a vertical cross-sectional view extends vertically, the drain pan 18 may be present under (immediately below) the fan cleaning section 24.

[0130] According to the modification depicted in Fig. 10, the configuration has been described in which the indoor heat exchanger 15 and the dust receiver 29 are present under the fan cleaning section 24. However, this is not a limitation. That is, a configuration may be adopted in which at least one of the indoor heat exchanger 15 and the dust receiver 29 is present under the fan cleaning section 24.

[0131] According to an embodiment, the configuration has been described in which one indoor device Ui (see Fig. 1) and one outdoor device Uo (see the same) are provided. However, this is not a limitation. That is, a plurality of indoor devices connected in parallel may be provided, and a plurality of outdoor devices connected in parallel may be provided.

[0132] While the embodiment has been described with reference to a wall-hanging-type air-conditioner 100, the present invention may be applied to other types of air-

conditioner.

[0133] The embodiments have been described to facilitate an understanding of the present invention, and are not necessarily limited to those being provided with all of the configurations described. With respect to a part of the configuration of each embodiment, addition, deletion, and/or substitution of other configurations may be possible.

[0134] The mechanisms, configurations and the like that have been described above are those considered necessary for the purpose of illustration, and do not necessarily indicate all of the mechanisms or configurations of a product.

DESCRIPTION OF REFERENCE SIGNS

[0135]

100	Air-conditioner
11	Compressor
12	Outdoor heat exchanger
13	Outdoor fan
14	Expansion valve
15	Indoor heat exchanger (heat exchanger)
15a	Front-side indoor heat exchanger (heat exchanger)
15b	Rear-side indoor heat exchanger (heat exchanger)
16	Indoor fan (blowing fan)
17	Four-way valve
18	Drain pan
22	Horizontal deflector
23	Vertical deflector
24	Fan cleaning section
24a	Shaft portion
24b	Brush
29	Dust receiver
30	Control section
K	Contact position
Q	Refrigerant circuit
r	Recessed portion

Claims

1. An air-conditioner comprising:

a heat exchanger;
a blowing fan; and
a fan cleaning section disposed between the heat exchanger and the blowing fan to clean the blowing fan,
wherein the fan cleaning section contacts the blowing fan after a start of rotation of the blowing fan.

2. The air-conditioner according to claim 1, wherein the fan cleaning section is structured to rotate about a shaft portion, and contacts the blowing fan by rotating in the same direction as a rotating direction of the blowing fan.

3. The air-conditioner according to claim 1, wherein:

the fan cleaning section contacts the blowing fan after a number of rotations of the blowing fan has reached a predetermined number of rotations; and
a contact time in which the fan cleaning section and the blowing fan are in contact with each other is shorter than a time until the predetermined number of rotations is reached after the start of rotation of the blowing fan.

4. An air-conditioner comprising:

a heat exchanger;
a blowing fan; and
a fan cleaning section which is disposed between the heat exchanger and the blowing fan to clean the blowing fan,
wherein the fan cleaning section is separated from the blowing fan before an end of rotation of the blowing fan.

5. The air-conditioner according to claim 4, wherein the fan cleaning section is structured to rotate about a shaft portion, and is separated from the blowing fan by rotating in an opposite direction to a rotating direction of the blowing fan.

6. The air-conditioner according to claim 4, wherein:

the fan cleaning section is separated from the blowing fan when a number of rotations of the blowing fan is a predetermined number of rotations; and
a contact time in which the fan cleaning section and the blowing fan are in contact with each other is shorter than a time until the end of rotation after the blowing fan has decelerated from the predetermined number of rotations.

7. The air-conditioner according to claim 1 or 4, wherein:

the fan cleaning section is structured to rotate about a shaft portion;
the blowing fan includes a blade having a convex shape with respect to a rotating direction of the blowing fan during cleaning; and
the fan cleaning section, when the fan cleaning section and the blowing fan are in contact with each other, is held in a position of being inclined on a rotating direction side of the blowing fan with respect to a horizontal direction.

8. The air-conditioner according to any one of claims 1 to 7, wherein the fan cleaning section is at least partly nylon.

9. The air-conditioner according to any one of claims 1 to 8, wherein, when the fan cleaning section and the blowing fan are in contact with each other, a deflector is in a closed state or in a direction greater than or equal to being horizontal.

Amended claims under Art. 19.1 PCT

1. (Amended) An air-conditioner comprising:

an indoor heat exchanger including a front-side indoor heat exchanger and a rear-side indoor heat exchanger;
a blowing fan; and
a fan cleaning section disposed between the front-side indoor heat exchanger and the blowing fan to clean the blowing fan,
wherein, when the fan cleaning section cleans the blowing fan, the blowing fan is rotated in a reverse direction to that in a normal air-conditioning operation, and the fan cleaning section contacts the blowing fan during the reverse rotation after a start of the reverse rotation of the blowing fan.

2. (Deleted).

3. (Amended) The air-conditioner according to claim 1, wherein:

the fan cleaning section contacts the blowing fan after a number of rotations of the blowing fan has reached a predetermined number of rotations; and
a contact time of the fan cleaning section and the blowing fan is longer than a time until the predetermined number of rotations is reached after a start of rotation of the blowing fan.

4. (Amended) An air-conditioner comprising:

an indoor heat exchanger including a front-side indoor heat exchanger and a rear-side indoor heat exchanger;
a blowing fan; and
a fan cleaning section disposed between the front-side indoor heat exchanger and the blowing fan to clean the blowing fan,
wherein, when the fan cleaning section cleans the blowing fan, the blowing fan is rotated in a reverse direction to that in a normal air-conditioning operation, and the fan cleaning section is separated from the blowing fan during the reverse rotation before an end of the reverse rotation of the blowing fan.

5. (Deleted).

6. (Amended) The air-conditioner according to claim 4, wherein:

the fan cleaning section is separated from the blowing fan when a number of rotations of the blowing fan is a predetermined number of rotations; and
a contact time of the fan cleaning section and the blowing fan is longer than a time until the end of rotation after the blowing fan has decelerated from the predetermined number of rotations.

7. (Amended) The air-conditioner according to claim 1 or 4, wherein:

the fan cleaning section is structured to rotate about a shaft portion;
the blowing fan includes a blade having a convex shape with respect to a rotating direction of the blowing fan during cleaning; and
the fan cleaning section, when the fan cleaning section and the blowing fan are in contact with each other, is held in a position of being inclined on a rotating direction side of the blowing fan with respect to a horizontal direction.

8. The air-conditioner according to any one of claims 1 to 7, wherein the fan cleaning section is at least partly nylon.

9. (Amended) The air-conditioner according to any one of claims 1 to 8, wherein, when the fan cleaning section and the blowing fan are in contact with each other, a vertical deflector is in a closed state.

Statement under Art. 19.1 PCT

Claim 1 clarifies the arrangement position of the fan cleaning part and when the fan cleaning part contacts the blower fan. Correction is based on Figure 2, paragraphs 0018, 0076 and paragraph 0047.
References 1 to 3 of the cited examples do not show a configuration including "a fan cleaning part arranged between the front indoor heat exchanger and the blower fan to clean the blower fan".
The present invention includes "a fan cleaning part arranged between the front indoor heat exchanger and the blower fan to clean the blower fan", and "when the fan cleaning part cleans the blower fan,

the blower fan rotates in the opposite direction to the normal air conditioning operation ". As described in paragraph 0076, there is a remarkable effect that it is possible to suppress the dust blowing out into the room, and to guide the dust scraped off from the blower fan by the fan cleaning section to the dew receiving tray.

Claim 2 is cancelled.

Claim 3 clarifies the contact time between the fan cleaning part and the blower fan. Correction is based on paragraph 0070, Figure 9.

Claim 4 clarifies the arrangement position of the fan cleaning part and when the fan cleaning part is separated from the blower fan. Correction is based on Fig. 2, paragraphs 0018 and 0076, paragraphs 0047, 0067 to 0069, Figures 8 and 9.

The present invention includes "a fan cleaning part arranged between the front indoor heat exchanger and the blower fan to clean the blower fan", and "when the fan cleaning part cleans the blower fan, the blower fan rotates in the opposite direction to the normal air conditioning operation ". As described in paragraph 0076, there is a remarkable effect that it is possible to suppress the dust blowing out into the room, and to guide the dust scraped off from the blower fan by the fan cleaning section to the dew receiving tray.

Claim 5 is cancelled.

Claim 6 clarifies the contact time between the fan cleaning part and the blower fan.

Correction is based on paragraph 0070, Figure 9.

Claim 7 clarifies the inclination side of the fan cleaning part. Correction is based on Figure 7A.

Claim 9 clarifies the condition of the vertical wind direction plate. As shown in the paragraph 0066, in order to prevent the user from inserting hands inside the indoor unit Ui, the vertical wind direction plate is closed. Therefore the intention of the invention was clarified.

FIG. 1

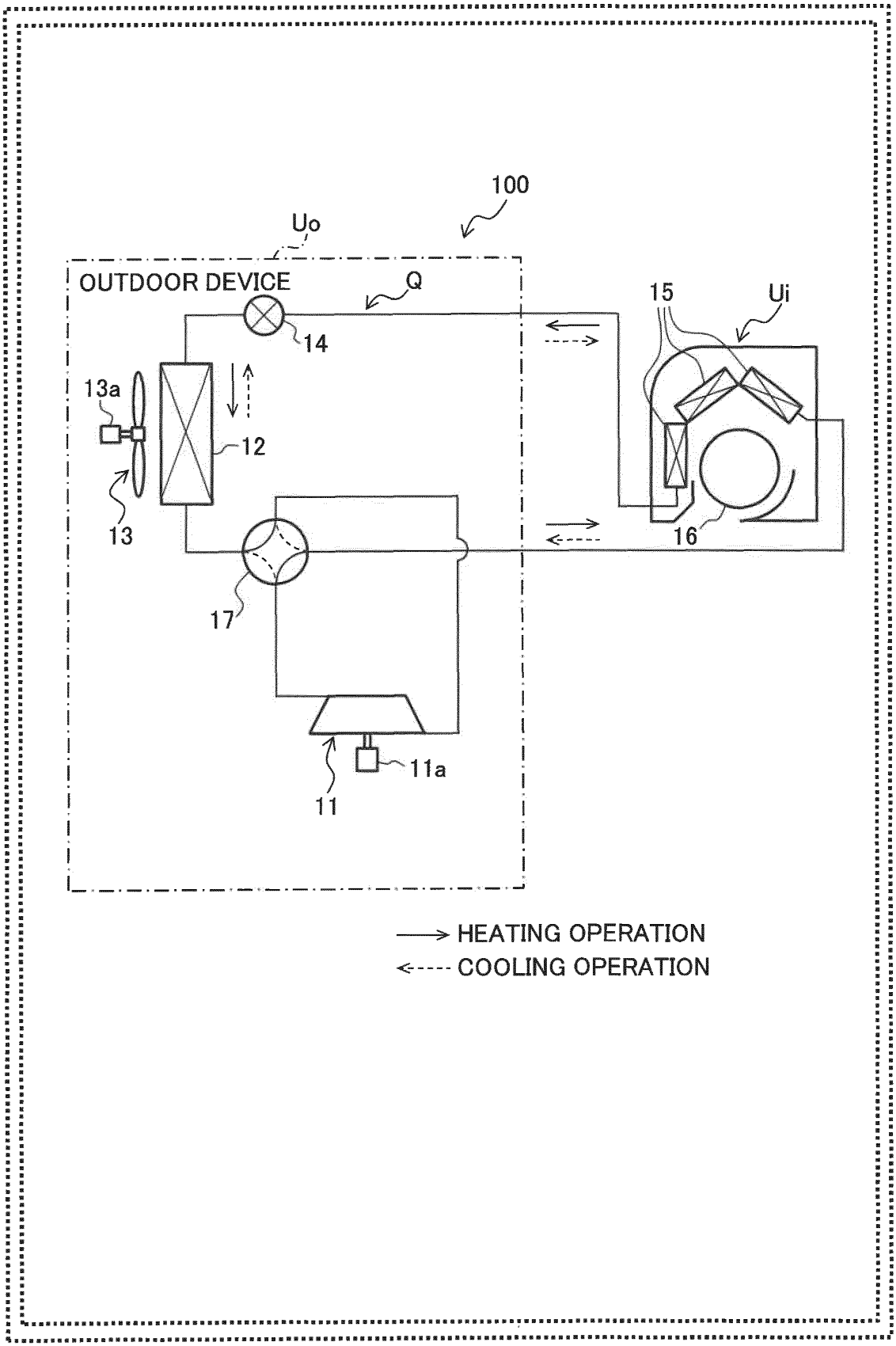

100
Uo
OUTDOOR DEVICE
Q
14
15
Ui
13a
12
13
16
17
11a
11
HEATING OPERATION
COOLING OPERATION

FIG. 2

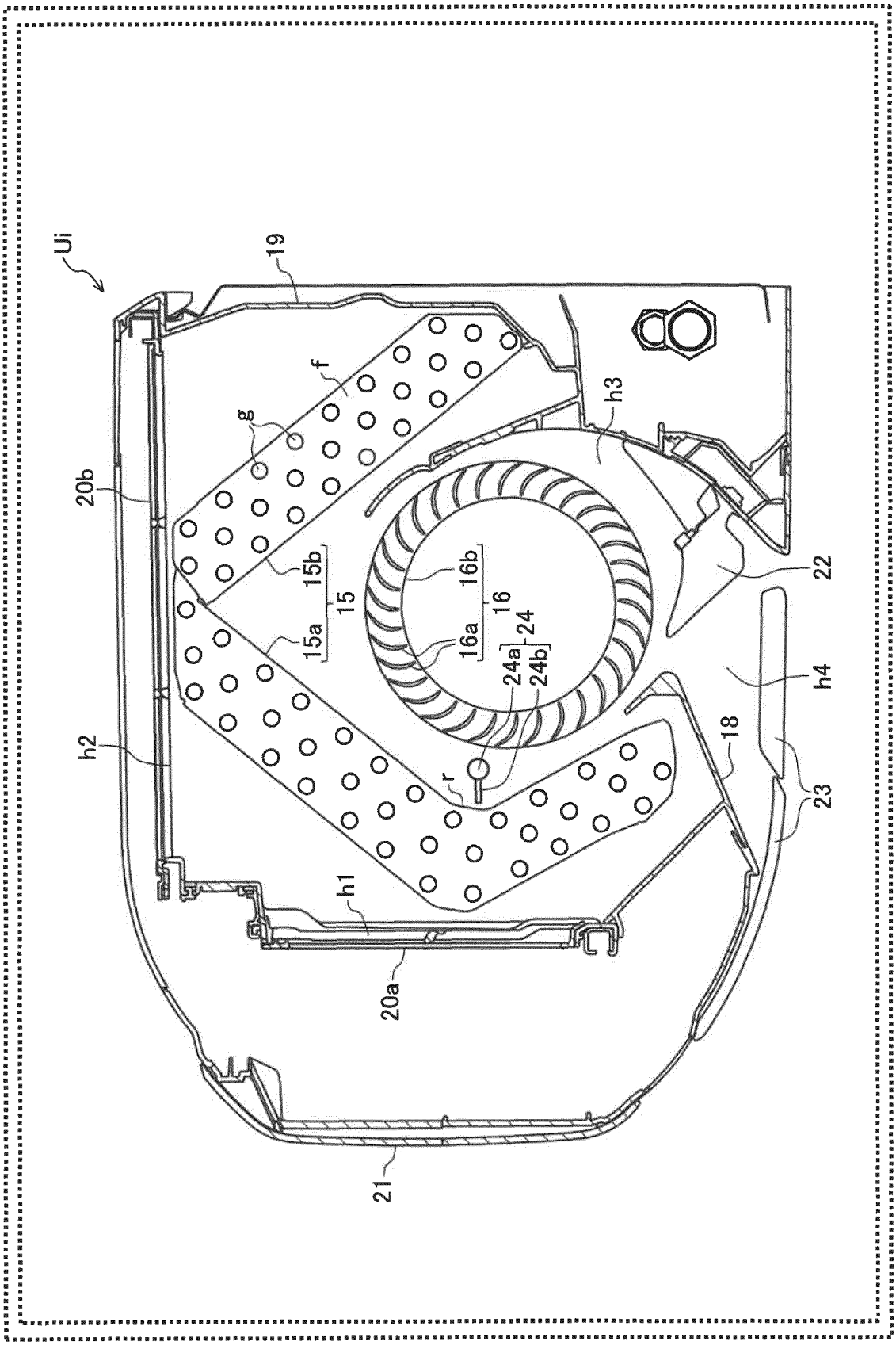

Ui
19
f
g
h3
20b
15b
15
16b
16
22
15a
16a
24
24a
24b
h4
h2
18
r
23
h1
20a
21

FIG. 3

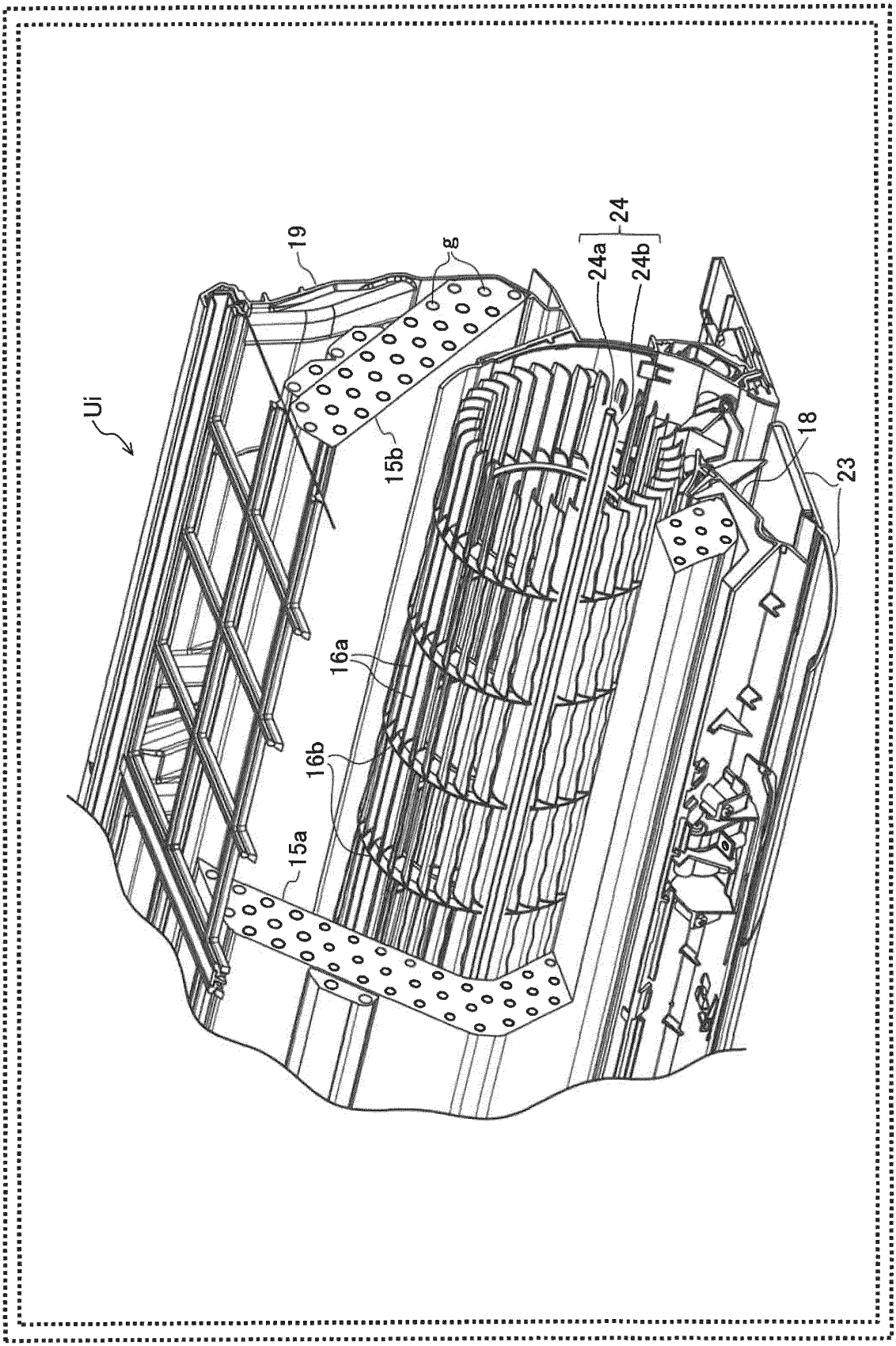


FIG. 4

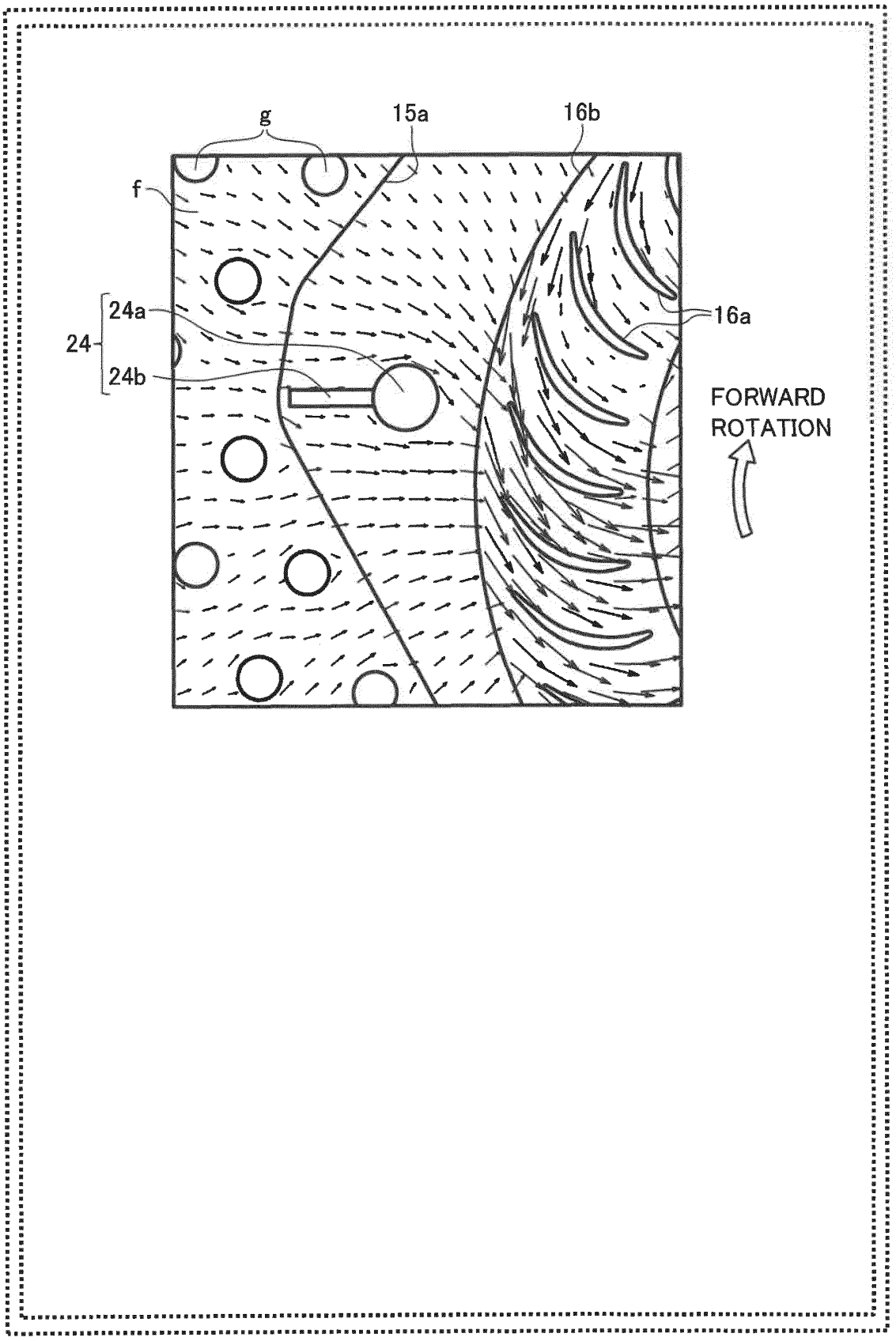


FIG. 5

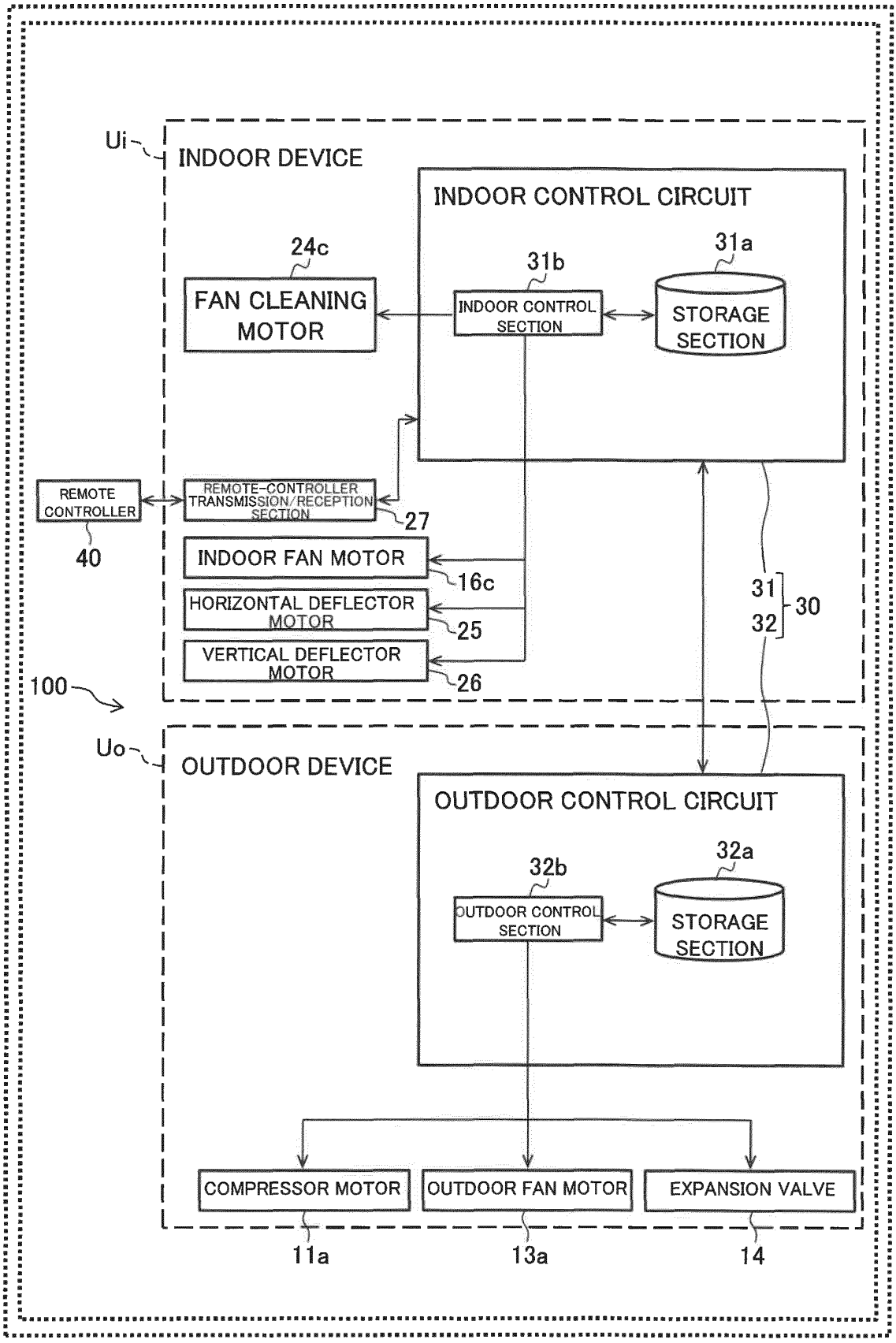

Ui
INDOOR DEVICE
INDOOR CONTROL CIRCUIT
24c
FAN CLEANING MOTOR
31b
INDOOR CONTROL SECTION
31a
STORAGE SECTION
REMOTE CONTROLLER
40
REMOTE-CONTROLLER TRANSMISSION/RECEPTION SECTION
27
INDOOR FAN MOTOR
16c
HORIZONTAL DEFLECTOR MOTOR
25
VERTICAL DEFLECTOR MOTOR
26
31
32
30
100
Uo
OUTDOOR DEVICE
OUTDOOR CONTROL CIRCUIT
32b
OUTDOOR CONTROL SECTION
32a
STORAGE SECTION
COMPRESSOR MOTOR
OUTDOOR FAN MOTOR
EXPANSION VALVE
11a
13a
14

FIG. 6

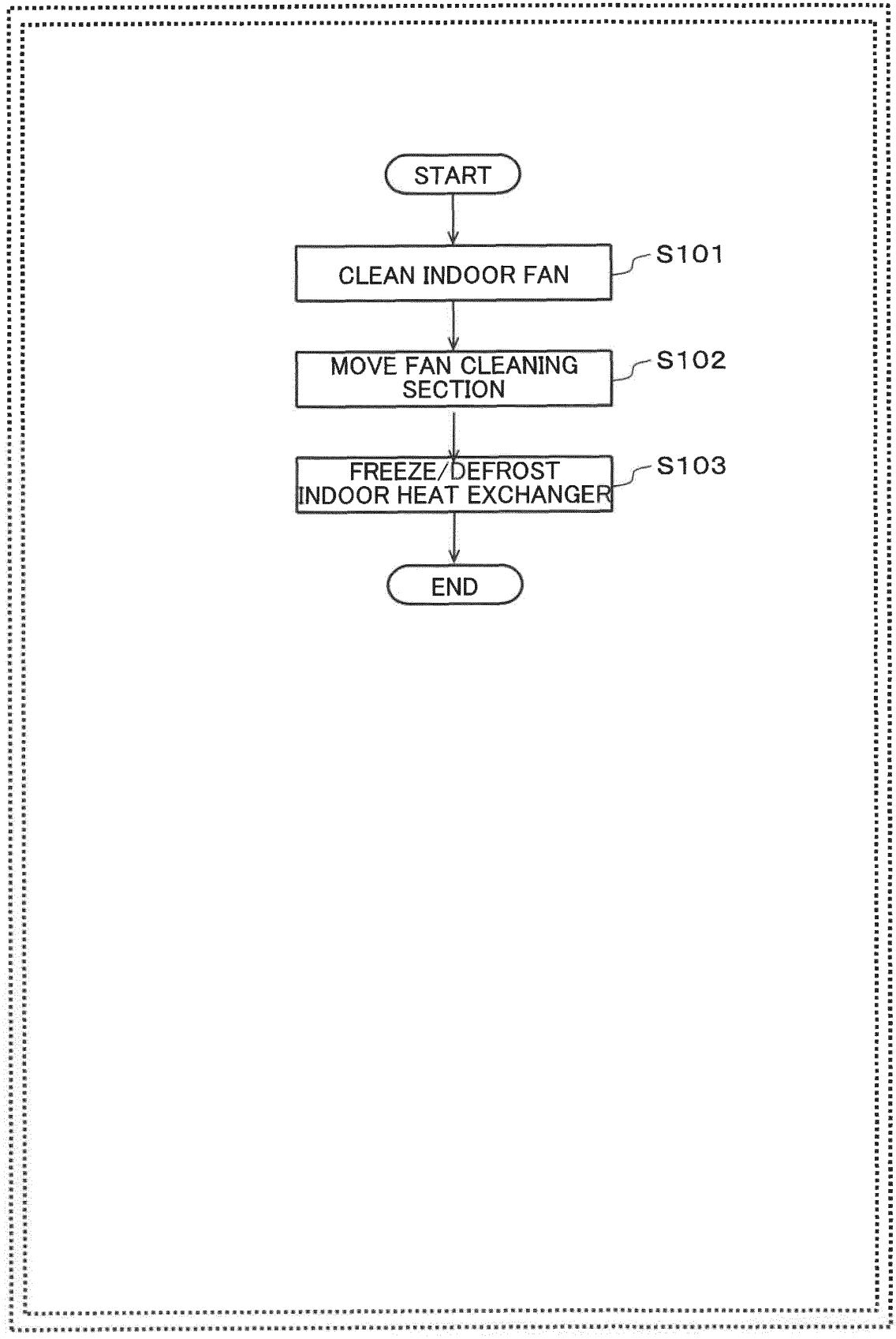

START
CLEAN INDOOR FAN
S101
MOVE FAN CLEANING SECTION
S102
FREEZE/DEFROST INDOOR HEAT EXCHANGER
S103
END

FIG. 7A

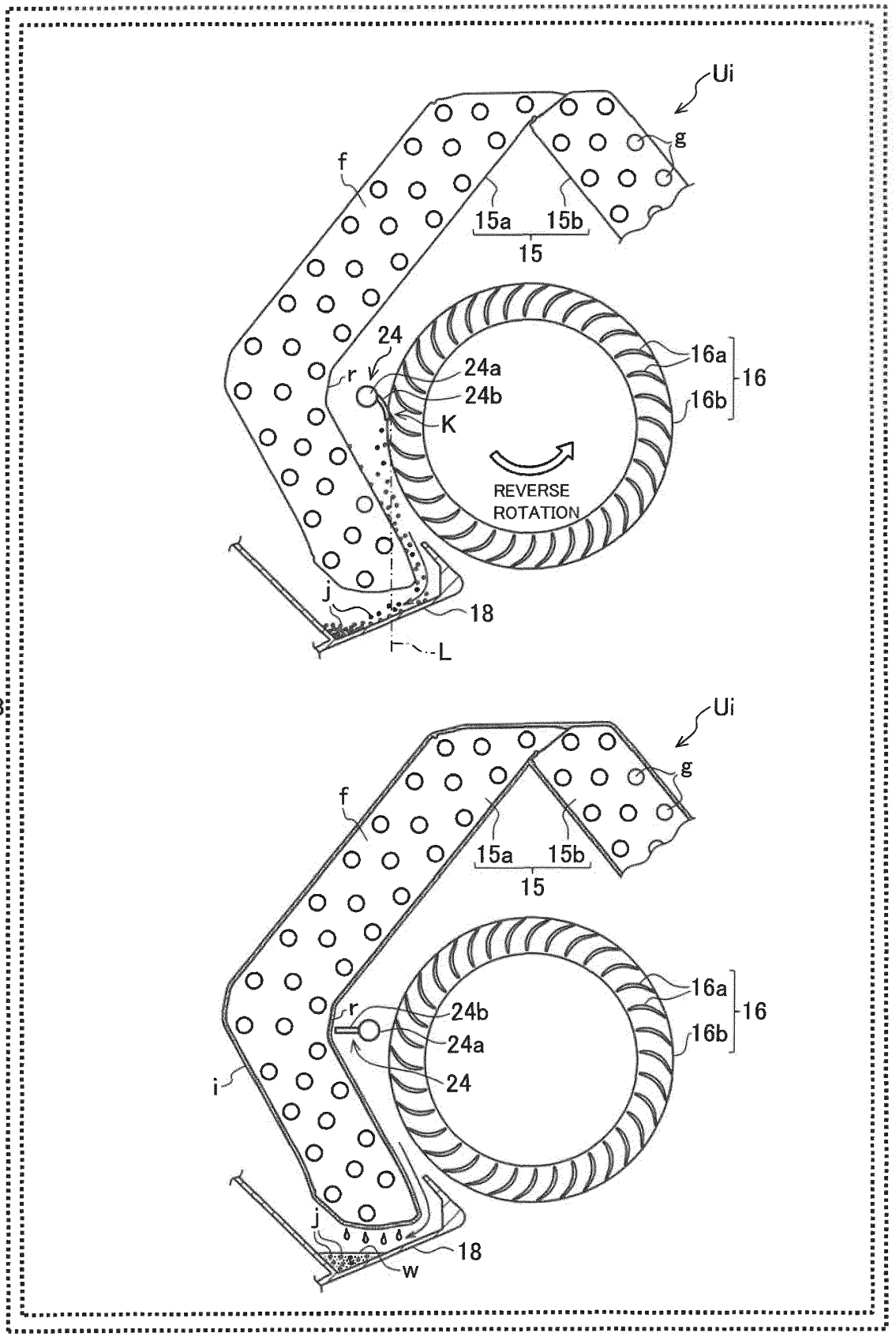

Ui
g
f
15a
15b
15
24
r
24a
24b
K
16a
16
16b
REVERSE
ROTATION
j
18
L

FIG.. 7B

Ui
g
f
15a
15b
15
16a
16
16b
r
24b
24a
24
i
j
18
w

FIG. 8

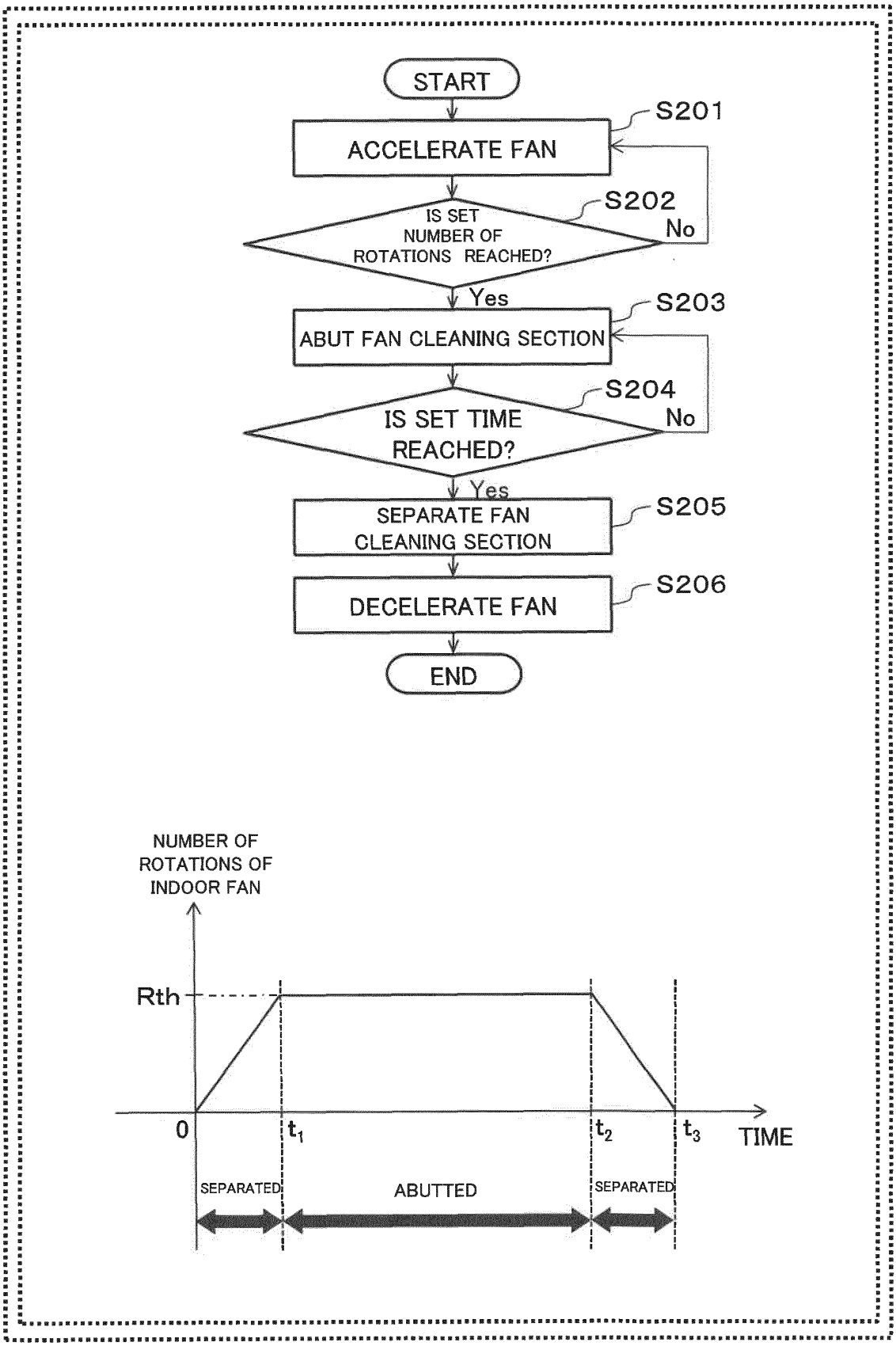

START
S201
ACCELERATE FAN
S202
IS SET NUMBER OF ROTATIONS REACHED?
No
Yes
S203
ABUT FAN CLEANING SECTION
S204
IS SET TIME REACHED?
No
Yes
S205
SEPARATE FAN CLEANING SECTION
S206
DECELERATE FAN
END

FIG. 9

NUMBER OF ROTATIONS OF INDOOR FAN
Rth
0
t1
t2
t3
TIME
SEPARATED
ABUTTED
SEPARATED

FIG. 10

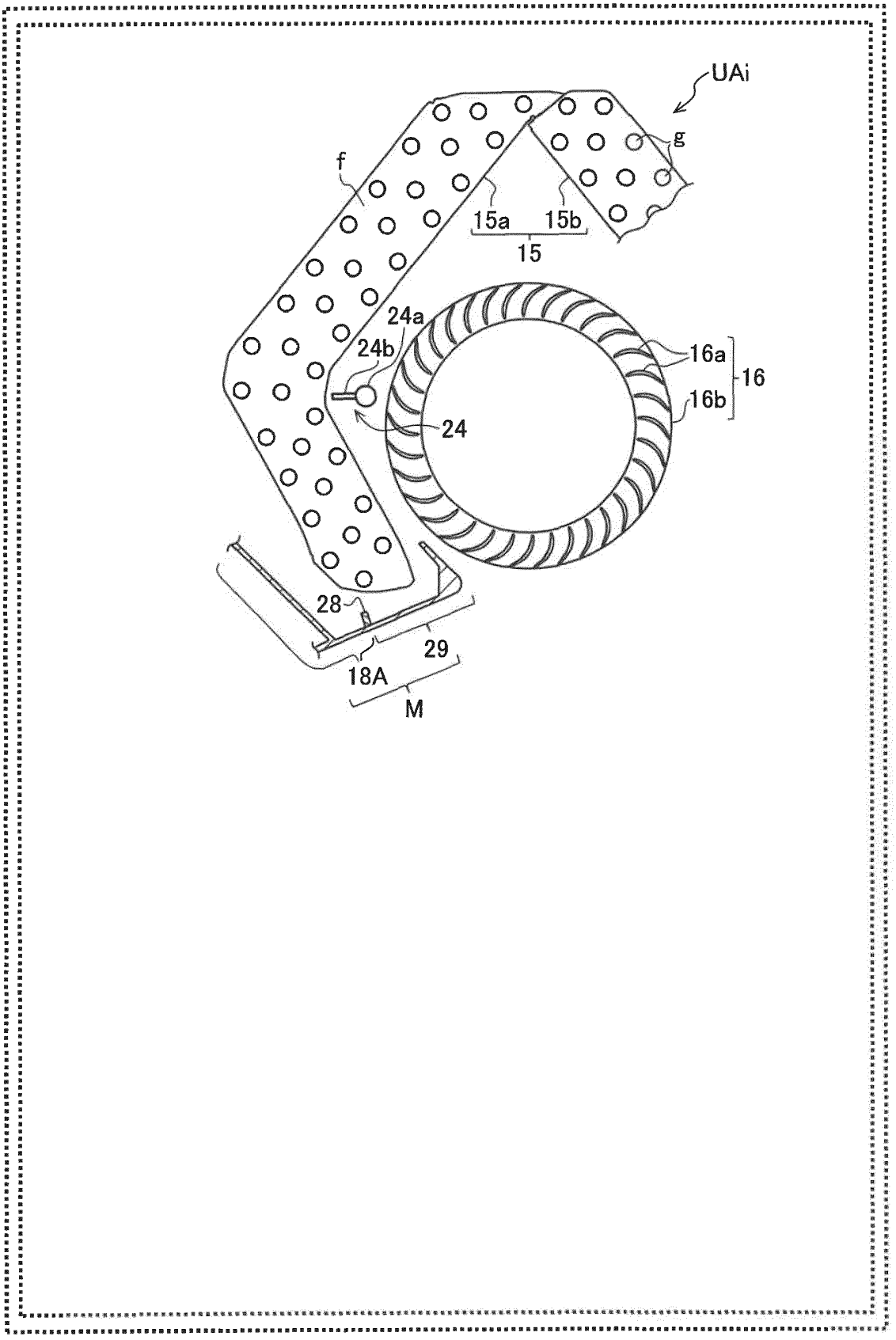
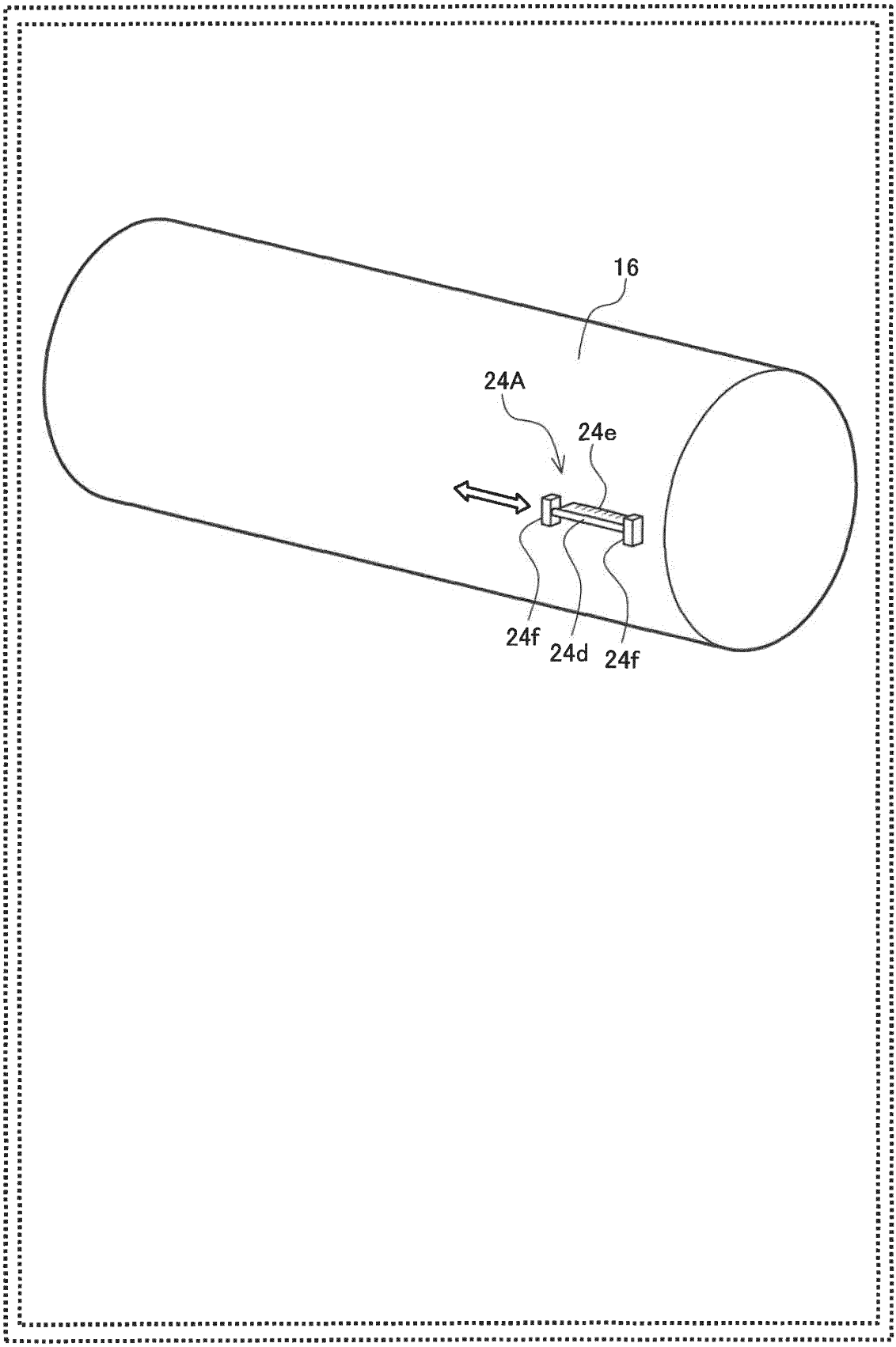


FIG. 11



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2018/015520

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl. F24F1/00(2011.01)i, F04D29/70(2006.01)i, F24F11/48(2018.01)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)
Int.Cl. F24F1/00, F04D29/70, F24F11/48

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

Published examined utility model applications of Japan	1922-1996
Published unexamined utility model applications of Japan	1971-2018
Registered utility model specifications of Japan	1996-2018
Published registered utility model applications of Japan	1994-2018

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	JP 2002-267249 A (SHARP CORPORATION) 18 September 2002, claims 1, 3, 8, paragraphs [0044], [0047]-[0052], [0057]-[0060], fig. 1, 3, 9, 10, 19-22 (Family: none)	1-2, 4-5, 7-9 3, 6
Y A	JP 3-206400 A (HITACHI, LTD.) 09 September 1991, page 1, lower right column, line 1 to page 3, upper left column, line 17, fig. 1-3 & JP 3-258928 A	1-2, 4-5, 7-9 3, 6
Y A	JP 2008-2767 A (TOSHIBA CARRIER CORPORATION) 10 January 2008, paragraphs [0025], [0026], [0031], fig. 2 (Family: none)	7-9 3, 6

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

* Special categories of cited documents:
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"P" document published prior to the international filing date but later than the priority date claimed
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Date of the actual completion of the international search	Date of mailing of the international search report
04.06.2018	19.06.2018

Name and mailing address of the ISA/	Authorized officer
Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2018/015520

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2014-25667 A (HITACHI APPLIANCES INC.) 06 February 2014, paragraph [0023], fig. 5 (Family: none)	8-9
A	JP 2008-138913 A (TOSHIBA CARRIER CORPORATION) 19 June 2008, paragraphs [0028]-[0038], [0047]-[0052], fig. 3-6 (Family: none)	1-9

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2007071210 A **[0003]**