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(54) **AIR PURIFIER**

(57) Provided is an air purifier that makes it easy to ensure airtightness in a casing by minimizing the number of openings. An air purifier (10) is provided with an air purification filter (20), a humidification unit (30), a fan (air-blowing fan) (12a), and a casing (11). The air purification filter removes dust contained in air. The humidification unit vaporizes water supplied and humidifies the air. The air-blowing fan blows air to the air purification filter and the humidification unit. The casing accommo-

dates the humidification unit, the air purification filter, and the air-blowing fan. The casing has an opening (15) for attaching/detaching the humidification unit. The humidification unit is disposed in alignment with the air purification filter on the downstream side of the air purification filter in a detachment direction in which the air purification filter is detached. The opening enables the air purification filter to be detached after the humidification unit has been detached.

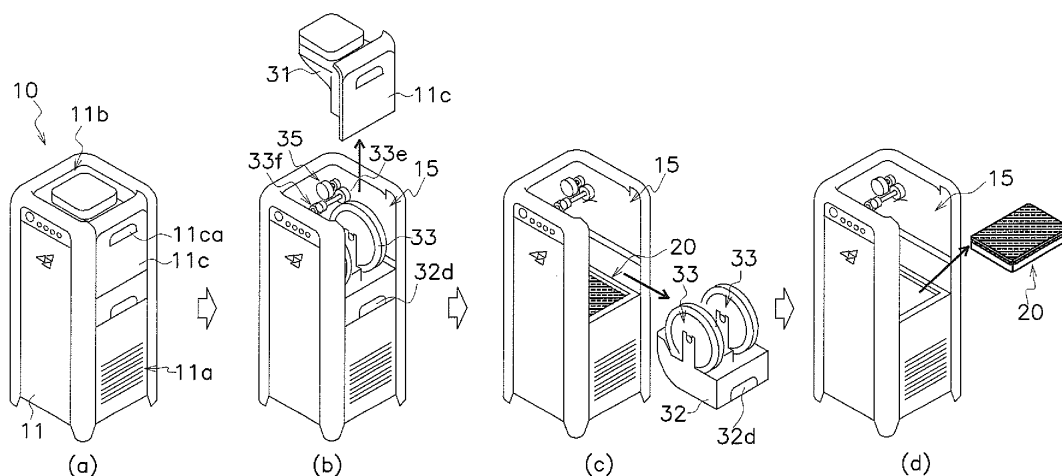


FIG. 7

Description

TECHNICAL FIELD

5 **[0001]** The present invention relates to an air purifier.

BACKGROUND ART

10 **[0002]** There are known air purifiers which filter and purify intake air with an air purification filter. The air purification filter is disposed so that the filter surface of the air purification filter is orthogonal to the direction of airflow, as is indicated in, e.g., Patent Literature 1 (Japanese Laid-open Patent Application No. 2000-283545).

[0003] Recently, there are also known air purifiers which have humidification units. The humidification unit vaporizes water and humidifies air inside a casing. Since the air purifier has both an air purification filter and a humidification unit, it is possible to improve the air-conditioned environment of the indoor space more favorably.

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SUMMARY OF THE INVENTION

<Technical Problem>

20 **[0004]** Generally, the air purification filter is configured to be insertable through an opening disposed on a lateral side of the casing, so that the air purification filter is disposed orthogonal to the direction of air flow, as is indicated in Patent Literature 1. To ensure airtightness in the casing, a lid (door) is provided to the opening. When the air purifier has a humidification unit, an opening for removing the humidification unit is required in addition to the opening for removing the air purification filter. A greater number of openings are undesirable from the standpoint of airtightness.

25 **[0005]** An object of the present invention is to provide an air purifier that makes it easy to ensure airtightness in a casing by minimizing the number of openings.

<Solution to Problem>

30 **[0006]** An air purifier according to a first aspect of the present invention is provided with an air purification filter, a humidification unit, an air-blowing fan, and a casing. The air purification filter is configured to remove dust contained in air. The humidification unit is configured to vaporize water supplied and humidify the air. The air-blowing fan is configured to blow air to the air purification filter and the humidification unit.

35 **[0007]** The casing accommodates the humidification unit, the air purification filter, and the air-blowing fan. An opening to attach/detach the humidification unit is formed on the casing. The humidification unit is disposed in alignment with the air purification filter on a downstream side of the air purification filter with respect to a detachment direction in which the air purification filter is detached. The casing is configured such that the opening allows the air purification filter to be detached after the humidification unit has been detached.

40 **[0008]** In the air purifier according to the first aspect of the present invention, the humidification unit is disposed on the downstream side of the air purification filter in the detachment direction in which the air purification filter is detached. The opening for attaching/detaching the humidification unit is also used to attach/detach the air purification filter after the humidification unit has been detached.

[0009] A single opening can thereby be used both to attach/detach the air purification filter and to attach/detach the air purification filter. As a result, the number of openings can be minimized.

45 **[0010]** An air purifier according to a second aspect of the present invention is the air purifier according to the first aspect, wherein the detachment direction is the thickness direction of the air purification filter.

[0011] In the air purifier according to the second aspect of the present invention, the detachment direction is the thickness direction of the air purification filter. In other words, when the humidification unit is detached, a space for detaching the air purification filter is formed in the thickness direction of the air purification filter.

50 **[0012]** The detaching of the air purification filter can thereby be made easier.

[0013] An air purifier according to a third aspect of the present invention is the air purifier according to the first or second aspect, is further provided with a sealing means.

[0014] The sealing means is configured to seal a gap between the air purification filter and the casing. The sealing means is arranged on an upstream side of the air purification filter with respect to the detachment direction.

55 **[0015]** In the air purifier according to the third aspect of the present invention, the sealing means for sealing the gap between the air purification filter and the casing is arranged on the upstream side of the air purification filter with respect to the detachment direction.

[0016] The air purification filter can thereby be stably held in the casing.

[0017] An air purifier according to a fourth aspect of the present invention is the air purifier according to any of the first through third aspects, wherein the humidification includes a tank, a tray, and a humidification filter. The tank is configured to accumulate the water. The tray is configured to receive the water from the tank.

[0018] The humidification filter is configured to contain the water supplied from the tray and humidify the air by vaporizing the water.

[0019] In the air purifier according to the fourth aspect of the present invention, the humidification unit includes the tank, the tray, and the humidification filter. After the tank, the tray, and the humidification filter have been detached from the casing, the air purification filter can be detached via the opening.

[0020] Sufficient space for detaching the air purification filter can thereby be ensured above the air purification filter.

[0021] An air purifier according to a fifth aspect of the present invention is the air purifier according to any of the first through third aspects, wherein the humidification unit is disposed above the air purification filter in the casing. The humidification unit has a movement restriction part. The movement restriction part is configured to restrict the air purification filter from moving upward when the humidification unit and the air purification filter are attached in the casing.

[0022] In this aspect, because the humidification unit restricts the air purification filter from moving upward, the air purification filter can be prevented from floating up with a simple configuration, without providing a dedicated member for restricting the air purification filter from moving. Further, the number of components can be kept lower than in cases where a dedicated member for restricting movement is provided.

[0023] An air purifier according to a sixth aspect of the present invention is the air purifier according to the fifth aspect, is further provided with a filter case accommodating at least part of the air purification filter. The filter case includes an air flow guide configured to guide the air that has passed through the air purification filter to the humidification unit. The movement restriction part is configured to be in contact with the top part of the air flow guide.

[0024] In this aspect, the air purification filter is restricted from moving upward since the movement restriction part of the humidification unit contacts with the top part of the air flow guide of the filter case. The air purification filter can therefore be prevented from floating up with a simple configuration. Since the air flow guide is in a contact relationship with the movement restriction part, air hardly passes between the air flow guide and the movement restriction part. It can therefore be prevented the air that has passed through the air purification filter from being guided to an unintended route.

[0025] An air purifier according to a seventh aspect of the present invention is the air purifier according to the sixth aspect, wherein the air purification filter includes a first filter and a second filter disposed below the first filter. The filter case accommodates the first filter. The filter case is configured to slide over a top surface of the second filter when the first filter accommodated in the filter case is attached to the casing. The filter case is configured to be in contact with the top surface of the second filter after the first filter accommodated in the filter case has been attached to the casing.

[0026] Because this aspect is so that the filter case accommodating the first filter slides over the top surface of the second filter when the first filter is being attached to the casing, the first filter is easily attached to the casing. Further, because the filter case contacts with the top surface of the second filter after the first filter has been attached, the second filter can be restricted from moving upward.

[0027] An air purifier according to an eighth aspect of the present invention is the air purifier according to the seventh aspect, wherein a case-side convex part or a case-side concave part is formed on the filter case. A casing-side concave part or a casing-side convex part, which is configured to fit with the case-side convex part or the case-side concave part formed on the filter case when the first filter accommodated in the filter case is attached to the casing, is formed on the casing.

[0028] In this aspect, because the casing and the filter case respectively have a convex part and a concave part that fit together, the first filter accommodated in the filter case is easily attached in a predetermined position.

[0029] When the filter case slides over the top surface of the second filter, or in other words, when the filter case is guided by the top surface of the second filter, the convex part and the concave part are easily fitted together. However, when there is no second filter (when the filter case cannot be slid over the top surface of the second filter), it is difficult to positionally align the convex part and the concave part and fit them together. In other words, when the second filter is not present, it is difficult to attach the first filter. Therefore, it is easy to prevent mishaps of forgetting to attach the second filter.

[0030] An air purifier according to a ninth aspect of the present invention is the air purifier according to the eighth aspect, is further provided with a filter detection sensor configured to detect whether or not the first filter is attached to the casing.

[0031] In this aspect, mishaps of forgetting to attach the first filter can be prevented due to the filter detection sensor being provided.

[0032] Because the air purifier is configured so that it is difficult to attach the first filter when the second filter is not present, it is possible to detect mishaps of forgetting to attach the entire air purification filter merely by detecting whether or not the first filter is present.

<Advantageous Effects of Invention>

[0033] In the air purifier according to the first aspect of the present invention, a single opening can thereby be used to attach/detach both the air purification filter and the humidification unit. As a result, the number of openings can be minimized.

[0034] In the air purifier according to the second aspect of the present invention, the detaching of the air purification filter can be made easier.

[0035] In the air purifier according to the third aspect of the present invention, the air purification filter can be stably held in the casing.

[0036] In the air purifier according to the fourth aspect of the present invention, sufficient space for detaching the air purification filter can be ensured above the air purification filter.

[0037] In the air purifier according to the fifth aspect of the present invention, because the humidification unit restricts the air purification filter from moving upward, the air purification filter can be prevented from floating up with a simple configuration, without providing a dedicated member for restricting the air purification filter from moving.

[0038] In the air purifier according to the sixth aspect of the present invention, the air purification filter can be prevented from floating up with a simple configuration.

[0039] In the air purifier according to the seventh aspect of the present invention, the first filter is easily attached to the casing, and the second filter can be restricted from moving upward.

[0040] In the air purifier according to the eighth aspect of the present invention, the first filter is easily attached in a predetermined position.

[0041] In the air purifier according to the ninth aspect of the present invention, mishaps of forgetting to attach the first filter can be prevented.

BRIEF DESCRIPTION OF THE DRAWINGS

[0042]

FIG. 1 is a schematic perspective view of an air purifier according to the first embodiment of the present invention;

FIG. 2 is a schematic view of the internal configuration of the air purifier viewed from the rear;

FIG. 3 is a schematic view of the internal configuration of the air purifier viewed from the right;

FIG. 4 is a schematic view of the internal configuration of the air purifier viewed from the above;

FIG. 5, being a perspective view showing the schematic configuration of the humidification unit, shows the humidification unit as being attached to the casing;

FIG. 6, being a perspective view showing the schematic configuration of the humidification unit, shows the humidification unit as being separated when detached from the casing;

FIG. 7 shows the procedure of the detachment operation;

FIG. 8 shows the procedure of the detachment operation;

FIG. 9 shows the procedure of the detachment operation in the air purifier according to Modification 1B;

FIG. 10 shows the procedure of the detachment operation in the air purifier according to Modification 1C;

FIG. 11 shows the procedure of the detachment operation in the air purifier according to Modification 1C;

FIG. 12 is a schematic perspective view of the air purifier according to Modification 1 D;

FIG. 13 is a schematic view of the internal configuration of the air purifier according to Modification 1 D as seen from the rear;

FIG. 14 is a schematic view of the internal configuration of the air purifier according to Modification 1 D as seen from the above;

FIG. 15 shows a detachment procedure for the air purifier according to Modification 1 D;

FIG. 16 is a schematic perspective view of the air purifier according to Modification 1 E;

FIG. 17 is a schematic view of the internal configuration of the air purifier according to Modification 1 E as seen from the rear;

FIG. 18 is a schematic view of the internal configuration of the air purifier according to Modification 1 E as seen from the right;

FIG. 19 shows a detachment procedure for the air purifier according to Modification 1 E;

FIG. 20 is a perspective view of the air purifier according to the second embodiment of the present invention;

FIG. 21, being a cross-sectional view along line XXI-XXI of the air purifier according to FIG. 20, shows the interior of the air purifier as seen from the right;

FIG. 22, being a cross-sectional view along line XXII-XXII of the air purifier according to FIG. 20, shows the interior of the air purifier as seen from the front;

FIG. 23 is a drawing, as seen from the above, of the periphery of the humidification element accommodated in the

casing of the air purifier according to FIG. 20;

FIG. 24 is a drawing for illustrating the structure of the periphery of the fan and the flow orientation of air blown out from the fan in the air purifier according to FIG. 20;

FIG. 25 is a plan view of the dust-collecting filter used in the air purifier according to FIG. 20;

FIG. 26 is a perspective view, as seen from the left front, of the filter case accommodating the deodorizing filter in the air purifier according to FIG. 20;

FIG. 27 is a perspective view, as seen from the right front, of the filter case according to FIG. 26;

FIG. 28 includes drawings for illustrating the deodorizing filter detection sensor disposed adjacent to the filter case according to FIG. 26, (a) showing the state of the deodorizing filter detection sensor when the deodorizing filter is not accommodated in the filter case, and (b) showing the state of the deodorizing filter detection sensor when the deodorizing filter is accommodated in the filter case;

FIG. 29 is a drawing for illustrating how the humidification tray of the air purifier according to FIG. 20 is attached to the casing, and how the rotor rotating shaft of the humidification element and the drive shaft of the humidification motor are connected together;

FIG. 30, being a drawing for illustrating the flow of air in the air purifier according to FIG. 20, illustrates the flow of air using a cross-sectional view of the interior of the casing as seen from the front;

FIG. 31 is a drawing for illustrating the flow of air particularly around the humidification unit and the bypass opening in the air purifier according to FIG. 20, the humidification element being omitted;

FIG. 32 includes cross-sectional views, as seen from the front, illustrating the procedure of detaching the humidification unit and the air purification filter from the air purifier according to FIG. 20, (a) showing the state before the humidification unit and the air purification filter being detached, (b) showing the state in which humidification tank of the humidification unit being detached, (c) showing the state of the humidification tray of the humidification unit being detached, (d) showing the state of the deodorizing filter of the air purification filter being detached, and (e) showing the state of the dust-collecting filter of the air purification filter being detached;

FIG. 33 includes schematic perspective views, as seen from the front left, of the procedure of detaching the humidification unit of the air purifier according to FIG. 20, (a) showing the state before the humidification unit being detached, (b) showing the state of the humidification tank being detached, (c) showing the state of the humidification tank after being detached, and (d) showing the state of the humidification tray being detached;

FIG. 34 schematically draws a state in which the filter case is attached without attaching the dust-collecting filter, in the air purifier according to FIG. 20.

FIG. 35 is a cross-sectional view of the interior of the air purifier according to Modification 2G as seen from the front. Convex parts are formed on the casing, and concave parts into which the convex parts of the casing fit are formed on the filter case.

FIG. 36 is a cross-sectional view of the interior of the air purifier according to Modification 2H as seen from the right. In the air purifier according to Modification 2H, a humidification rotor dipper system is employed in the humidification unit.

DESCRIPTION OF EMBODIMENTS

[0043] Embodiments of the present invention are described below with reference to the drawings. The following embodiment is a specific example of the present invention and is not intended to limit the technical scope of the invention.

<First Embodiment>

(1) Overall Configuration of Air Purifier

[0044] FIGS. 1 through 4 show a schematic configuration of an air purifier 10 according to a first embodiment of the present invention. Specifically, FIG. 1 is an external perspective view of the air purifier 10. FIG. 2 is a schematic cross-sectional view along line I-I of the air purifier shown in FIG. 1. In other words, FIG. 2 is a schematic view of the internal configuration of the air purifier 10 viewed from the rear. FIG. 3 is a schematic cross-sectional view along line II-II of the air purifier 10 shown in FIG. 1. In other words, FIG. 3 is a schematic view of the internal configuration of the air purifier 10 viewed from the right. FIG. 4 is a schematic view of the internal configuration of the air purifier 10 viewed from the above.

[0045] The air purifier 10 according to the present embodiment has an air purification function and a humidifying function. The air purifier 10 is configured so that the humidifying function can be selectively executed. Specifically, when the humidifying function is not selected by the user, only the air purification function effectively functions in the air purifier 10, and when the humidifying function is selected by the user, the humidifying function effectively functions along with the air purification function. In other words, when the humidifying function is selected by the user, the air purifier 10 functions as a humidifier as well.

[0046] The air purifier 10 is provided with a casing 11 in a quadrangular prism shape, as shown in FIG. 1. Further, the air purifier 10 is primarily provided with an air-blowing device 12, an air purification filter 20, and a humidification unit 30 in the casing 11, as shown in FIG. 2. The configuration of the air purifier 10 is described in detail below.

(2) Detailed Configuration

(2-1) Casing

[0047] The casing 11 accommodates the air-blowing device 12, the air purification filter 20, and the humidification unit 30 as described above. The casing 11 defines an air-blowing chamber R1, an air purification chamber R2, and a humidification chamber R3, as shown in FIGS. 2 and 3. The air-blowing device 12 is disposed in the air-blowing chamber R1. The air purification filter 20 is disposed in the air purification chamber R2. The humidification unit 30 is disposed in the humidification chamber R3. The air-blowing chamber R1, the air purification chamber R2, and the humidification chamber R3 are aligned in the stated order from the bottom upward.

[0048] The casing 11 is in a quadrangular prism shape as described above. In other words, the casing 11 has a shape which elongates in vertical. Therefore, the installation area of the air purifier 10 according to the present embodiment is smaller than the installation area of a conventional air purifier in which the air-blowing chamber R1, the air purification chamber R2, and the humidification chamber R3 are aligned horizontally. Specifically, the casing 11 includes a frame and a plurality of surfaces attached to the frame.

[0049] The casing 11 has an intake port 11 a and a discharge port 11 b, as shown in FIG. 1.

[0050] The intake ports 11 a are openings for drawing air into the casing 11 from the outside of the casing 11. The intake port 11 a is disposed to the lower parts of both the front surface and the back surface of the casing 11 (see FIGS. 1 and 3). The discharge port 11 b is an opening for blowing out air that has passed through the interior of the casing 11. In other words, the discharge port 11 b is an outlet for the air in the casing 11. The discharge port 11 b is disposed to the ceiling portion of the casing 11, as shown in FIG. 1. Specifically, the discharge port 11 b is formed inside the outline of the ceiling portion on the ceiling portion of the casing 11 along the outline of the ceiling portion except for one edge of the front-surface side. In other words, the discharge port 11 b is formed along the edges constituting the left and right sides and the rear side of the ceiling portion of the casing 11, inside these edges (see FIGS. 1 and 2). In the present embodiment, the discharge port 11 b is formed by a frame assembled into a rectangular shape.

[0051] An opening 15 is formed in the casing 11 (see FIGS. 7(b) and (c)). The opening 15 is formed in a location that can be accessed from the front-surface side of the air purifier 10. In the present embodiment, the opening 15 is positioned in the top part of the air purifier 10. The opening 15 can be opened and closed by a door 11c. A handle 11ca is formed on the door 11c. The opening 15 enables the components accommodated in the casing 11 to be attached/detached. Specifically, the opening 15 allows access to the humidification unit 30 and the air purification filter 20 in the casing 11.

[0052] The door 11 c has a configuration that enables detachment from the casing 11. The door 11 c is attached to a tank 31, described hereinafter. Specifically, the door 11 c is attached so that the door 11c and the tank 31 are integrally movable. In other words, when the door 11c is detached from the casing 11, the tank 31 is detached from the casing 11 as well. The door 11c can be detached upward from the air purifier 10 (see FIG. 7(b)). The door 11c may also have a configuration that can be detached to the front side of the air purifier 10. The opening 15 is opened when the door 11 c is detached from the casing 11.

[0053] A straightening plate 36 is disposed inside the casing 11 (see FIG. 3). The straightening plate 36 is disposed in the humidification chamber R3, as shown in FIG. 3. Specifically, the straightening plate 36 is disposed in the humidification chamber R3 in proximity to a humidification element 33, described hereinafter. The straightening plate 36 guides the air flow f3 coming into the humidification chamber R3 from the air purification chamber R2 to the humidification element 33.

[0054] Specifically, the straightening plate 36 guides the air flow f3 to the humidification element 33 so that it is prevented that the air flow f3 from bypassing the humidification element 33 and flowing out directly from the discharge port 11b.

[0055] Furthermore, flange parts 11d, 11f are provided inside the casing 11, as shown in FIG. 2. The flange part 11 d is disposed in the air purification chamber R2. The flange part 11f is disposed in the humidification chamber R3. Specifically, the flange part 11 d is disposed to the inner wall of the casing 11 defining the air purification chamber R2. More specifically, the flange part 11d is disposed at a predetermined height position along the inner periphery of the casing 11. The air purification filter 20, described hereinafter, is placed on the flange part 11d. In other words, the flange part 11d is disposed upstream of the air purification filter 20 with respect to the direction of air flow. The flange part 11 d is provided in order for the air purification filter 20 to be horizontally disposed in the air purification chamber R2. The flange part 11 d, together with a sealing member 11e described hereinafter, functions as sealing means for sealing the gap between the air purification filter 20 and the inner wall of the casing 11. The flange part 11f is disposed along the inner wall of the casing 11 defining the humidification chamber R3. The flange part 11f is disposed at a predetermined

height position along the inner periphery of the casing 11. A tray 32 of the humidification unit 30, described hereinafter, is placed on the flange part 11 f. In other words, the flange part 11f is disposed upstream of the humidification unit 30 with respect to the direction of air flow.

[0056] A control panel 13 is disposed in an upper side surface of the casing 11, as shown in FIG. 1. The control panel 13 is provided with various switches (e.g., a power switch and/or a function selection switch) for operating the air purifier 10. The control panel 13 is connected to a control device (not shown) built into the casing 11. Signals received by the control panel 13 are transmitted to the control device.

(2-2) Air-Blowing Device

[0057] The air-blowing device 12 takes air outside of the casing 11 into the air-blowing chamber R1. The air-blowing device 12 also blows the air taken into the air-blowing chamber R1 toward the air purification chamber R2 and the humidification chamber R3. In other words, the air-blowing device 12 blows air toward the air purification filter 20 and the humidification unit 30 (the humidification element 33).

[0058] The air-blowing device 12 includes a fan (an air-blowing fan) 12a and a fan motor 12b, as shown in FIG. 3. The fan 12a is a Sirocco fan. The fan 12a is configured from a hub part 12aa and a plurality of vanes 12ab. The vanes 12ab are arrayed in a cylindrical formation around the peripheral edge of the hub part 12aa. By rotating the hub part 12aa and the vanes 12ab, air is drawn in along the rotational axis direction, and is then blown out in the centrifugal direction from the vanes 12ab. In other words, by rotating the hub part 12aa and the vanes 12ab, air is drawn from outside the casing 11 into the air-blowing chamber R1 through the intake ports 11 a.

[0059] Air blown out in the centrifugal direction from the vanes 12ab is then sent to the air purification chamber R2.

[0060] The air-blowing device 12 is disposed in the middle of a horizontal plane in the air-blowing chamber R1. Specifically, the air-blowing device 12 is disposed in a middle position with respect to both depth direction and width direction in the air purifier 10 (see FIG. 3). In other words, air drawn into the air-blowing chamber R1 is sent from the middle of the air-blowing chamber R1 toward the middle of the air purification chamber R2 by the air-blowing device 12.

(2-3) Air Purification Filter

[0061] The air purification filter 20 purifies the air drawn into the air purifier 10. Specifically, the air purification filter 20 removes dust contained in the air. The air purification filter 20 is disposed downstream of the air-blowing device 12 with respect to the direction of air flow. Further, the air purification filter 20 is disposed upstream of the humidification unit 30 with respect to the direction of air flow.

[0062] The air purification filter 20 includes a dust collection filter 21 and a deodorizing filter 22, as shown in FIGS. 2 and 3. The dust collection filter 21 is a thin, soft net made of a resin. The dust collection filter 21 removes dust contained in the air. The deodorizing filter 22 absorbs malodorous components contained in the air. The dust collection filter 21 and the deodorizing filter 22 are disposed inside the air purification chamber R2 in the stated order from the upstream side in the direction of air flow.

[0063] Specifically, the dust collection filter 21 and the deodorizing filter 22 are disposed along their thickness direction. The thickness direction of the dust collection filter 21 and the deodorizing filter 22 coincides with the flow direction f2 of the air passing through the air purification chamber R2. In other words, the air purification filter 20 is disposed in a direction orthogonal to the air flow direction f2.

[0064] The air purification filter 20 is placed on the flange part 11 d formed inside the casing 11, as described above. In other words, the air purification filter 20 is held by the flange part 11d. The sealing member 11e is disposed between the air purification filter 20 and the flange part 11d. The sealing member 11e is horizontally disposed on the flange part 11d. Specifically, the sealing member 11e is disposed along the surface of the flange part 11 d. The flange part 11 d and the sealing member 11e function as sealing means for sealing the gap between the air purification filter 20 and the inner wall of the casing 11, as described above. The flange part 11 d and the sealing member 11e are disposed upstream of the air purification filter 20 with respect to the direction of air flow. In other words, the sealing means is disposed upstream of the air purification filter 20 with respect to the direction in which the air purification filter 20 is detached. The sealing means ensures a seal between the air purification filter 20 and the casing 11 when air is sent from the air-blowing chamber R1 to the air purification chamber R2.

[0065] During maintenance, the air purification filter 20 is attached/detached via the opening 15 (see FIG. 7). Specifically, after the humidification unit 30, described hereinafter, is detached via the opening 15, the air purification filter 20 is moved in the space (i.e., the humidification chamber R3) formed inside the casing 11, and is then removed via the opening 15. Specifically, the air purification filter 20 is moved in the thickness direction of the air purification filter 20 and detached from the casing 11. In other words, the thickness direction of the air purification filter 20 coincides with the direction (the attachment/detachment direction) in which the air purification filter 20 is detached. The direction in which the air purification filter 20 is detached coincides with the direction of air flow in the air purification chamber R2. In other

words, the dust collection filter 21 and the deodorizing filter 22 are moved along the direction of air flow in the air purification chamber R2, and are thereby separated from the flange part 11 d and detached from the casing 11.

(2-4) Humidification unit

[0066] The humidification unit 30 vaporizes supplied water and humidifies the air. The humidification unit 30 is disposed downstream of the air-blowing device 12 and the air purification filter 20 with respect to the direction of air flow. In other words, the humidification unit 30 humidifies the air purified by the air purification filter 20.

[0067] FIGS. 5 and 6 show the schematic configuration of the humidification unit 30. FIG. 5 shows the humidification unit 30 as being attached to the casing 11. FIG. 6 shows the humidification unit 30 as being separated when detached from the casing 11.

[0068] The humidification unit 30 is disposed in the humidification chamber R3 inside the casing 11 as described above. In other words, the humidification unit 30 is disposed in an upper position inside the casing 11. When the humidification unit 30 is detached from the casing 11, a large space is created in this upper position inside the casing 11. Specifically, when the humidification unit 30 is detached from the casing 11, a space in which the air purification filter 20 can move is formed in the humidification chamber R3. In other words, when the humidification unit 30 is detached from the casing 11, a space that serves as a movement route through which the air purification filter 20 is detached is formed above the air purification chamber R2. The air purification filter 20 is moved in the thickness direction of the air purification filter 20 (a direction orthogonal to the air purification filter 20) and detached from the flange part 11 d.

[0069] The humidification unit 30 primarily includes the tank 31, the tray 32, and a plurality of humidification elements 33, as shown in FIGS. 5 and 6.

(2-4-1) Tank

[0070] The tank 31 stores water which will be supplied to the humidification elements 33.

[0071] The tank 31 has a filling port 31 a. A water supply valve (not shown) is attached to the filling port 31 a. The water supply valve has a general structure in which a valve body is pushed to a valve port by a spring. Therefore, a detailed description of the water supply valve is not given here.

[0072] During use, the tank 31 is placed in a tank-receiving part 32a of the tray 32, described hereinafter (see FIGS. 4 and 6). Specifically, the tank 31 is mounted in the tray 32 with the water supply valve directing downward. With the water supply valve directing vertically downward, the tank 31 is pushed against a push pin of the tray 32. The weight of the tank 31 itself thereby causes the water supply valve open with the push pin.

[0073] The tank 31 is disposed inside the casing 11 in proximity to the discharge port 11 b, as shown in FIGS. 2 and 3. The tank 31 is also disposed in the middle with respect to the left and right direction inside the casing 11, as shown in FIG. 4. The side surface on the front-surface side of the tank 31 is attached to the door 11c, as described above.

[0074] A plurality of humidification elements 33, which will be described later, are disposed on both widthwise sides of the tank 31, as shown in FIG. 5. In other words, the tank 31 is disposed adjacent to the humidification elements 33. Specifically, the tank 31 is disposed in such a manner so as to partially obstruct the space between a pair of humidification elements 33 which are disposed facing each other. In other words, the tank 31 is partially inserted into the space formed between the pair of humidification elements 33.

[0075] The tank 31 has a plurality of outer surfaces, as shown in FIG. 6. These outer surfaces include a back-surface side vertical surface F1, side vertical surfaces F2, a curved surface F3, and side inclined surfaces F4.

[0076] The back-surface side vertical surface F1 is a hexagonal surface positioned in proximity to the back-surface side of the air purifier 10. The back-surface side vertical surface F1 extends vertically in the up and down direction. The back-surface side vertical surface F1 has six edges, including a pair of top and bottom edges, left and right edges, and two inclined edges joining the top and bottom edges to the left and right edges. The top and bottom edges are parallel with each other.

[0077] The left and right edges are parallel with each other. The dimension d1 of the edge at the top-end side of the back-surface side vertical surface F1 is greater than the dimension d2 of the edge at the bottom-end side.

[0078] The side vertical surfaces F2 extend toward the front-surface side from both left and right sides of the back-surface side vertical surface F1. The side vertical surfaces F2, which are orthogonal to the back-surface side vertical surface F1, extend vertically in the up and down direction. Each of the side vertical surfaces F2 has a shape similar to an inverted letter L. In FIG. 6, only the side vertical surface F2 positioned on the right side of the tank 31 is shown, but the tank 31 has a side vertical surface F2 on the left side as well. The side vertical surfaces F2 have shapes that are in bilateral symmetry.

[0079] The curved surface F3 extends downward from the bottom end of the back-surface side vertical surface F1. The curved surface F3 curves partially forward.

[0080] Specifically, the top end of the curved surface F3 is in a horizontal plane position same as the back-surface

side vertical surface F1, and the bottom end of the curved surface F3 is in a horizontal plane position farther toward the front-surface side than the back-surface side vertical surface F1. In other words, the bottom end of the curved surface F3 is positioned on the front-surface side from the horizontal plane position of the back-surface side vertical surface F1.

[0081] The side inclined surfaces F4 are wall surfaces joining the side vertical surfaces F2 and the curved surface F3. In FIG. 6, only the side inclined surface F4 positioned on the right side is shown, but the tank 31 has a side inclined surface F4 on the left side as well. The side inclined surfaces F4 have shapes that are in bilateral symmetry. The side inclined surfaces F4 are inclined relative to the flow direction of air passing through the air purification filter 20. The flow direction of air passing through the air purification filter 20 is orthogonal to the thickness direction of the humidification elements 33 (see symbol f3 in FIG. 2). Specifically, the side inclined surfaces F4 are inclined from the front-surface side toward the back-surface side, and toward the widthwise middle of the air purifier 10. In other words, the side inclined surfaces F4 extend inward from the outer side of the air purifier 10 in width direction, from the front-surface side of the air purifier 10 toward the back-surface side. The angles of incline of the side inclined surfaces F4 relative to the side vertical surfaces F2 can be decided as appropriate depending on the distance to the adjacent humidification elements 33, the width of the space inside the humidification chamber R3, and other factors. Specifically, the angles of incline are designed such that air sent into the humidification chamber R3 flows along the side inclined surfaces F4 and is thereby suitably guided in the thickness direction of the humidification elements 33.

[0082] The plurality of outer surfaces of the tank 31 change the direction of air flow multiple times in the humidification chamber R3. Specifically, direction change is made by the outer surfaces of the tank 31 so that the air sent into the humidification chamber R3 passes through the humidification elements 33 and then blows out through the discharge port 11 b.

[0083] More specifically, the side inclined surfaces F4 cause air flowing along the tank 31 to flow toward the humidification elements 33 disposed adjacent to both sides of the tank 31. A flow of air directed toward the humidification elements 33 is thereby formed inside the humidification chamber R3. Specifically, the side inclined surfaces F4 change the flow direction of air passing through the air purification filter 20 so as to be guided to the humidification elements 33 (see FIG. 2). In other words, the side inclined surfaces F4 are inclined relative to the flow direction (roughly the vertical direction) of air passing through the air purification filter 20, whereby the roughly vertical air flow is guided in the thickness direction of the humidification elements 33 (see the symbols f3 and f4 in FIGS. 2 and 3). The air flowing in the thickness direction of the humidification elements 33 (the air passing through the humidification elements 33) is then guided to the side vertical surfaces F2 and blown out through the discharge port 11 b.

[0084] Thus, the tank 31 is disposed adjacent to the plurality of humidification elements 33 so that air flowing in a direction orthogonal to the thickness direction of the humidification elements 33 changes its flowing direction and passes through the humidification elements 33, and then flows along the outer surfaces of the tank 31 to be blown out from the discharge port 11 b. In other words, the flow direction of air flowing in proximity to the plurality of humidification elements 33 is changed due to the tank 31 being disposed adjacent to the plurality of humidification elements 33.

[0085] As a result, the flowing direction of the air having passed through the air purification filter 20 is changed so as to pass through the humidification elements 33, and the flowing direction of the air is further changed so as to be blown out from the discharge port 11 b after having passed through the humidification elements 33.

(2-4-2) Tray

[0086] The tray 32 receives and temporarily stores water supplied from the tank 31. The tray 32 supplies water to the plurality of humidification elements 33, described hereinafter. The tray 32 has a roughly U shape in a plan view, as shown in FIG. 4.

[0087] Specifically, the tray 32 includes a portion corresponding to the bottom edge of the U shape (the bottom-edge corresponding portion), and portions extending from both sides of the bottom-edge corresponding portion (extending portions). The bottom-edge corresponding portion extends in the width direction (left and right direction) of the air purifier 10. The extending portions extend in the depth direction (the forward and rearward direction) on both the left and right sides of the air purifier 10. The tray 32 is disposed directly above the air purification filter 20 described above.

[0088] Specifically, the tray 32 is placed on the flange part 11f as described above.

[0089] The tray 32 has primarily the tank-receiving part 32a, water supply parts 32b, and shaft-receiving parts 32c, as shown in FIG. 6.

(a) Tank-Receiving Part

[0090] The tank-receiving part 32a receives the tank 31 described above. The tank-receiving part 32a is positioned in the bottom-edge corresponding portion described above. The tank-receiving part 32a is provided with the support part and the push pin, neither of which are shown. The support part supports a predetermined location of the tank 31 (the corner of the tank 31). The push pin comes into contact with the water supply valve and pushes the water supply

valve open when the tank 31 descends due to its own weight. As a result, the water in the tank 31 is supplied to the tank-receiving part 32a.

[0091] A handle 32d is disposed to the outer wall of the tank-receiving part 32a (see FIG. 1).

[0092] The user puts their fingers into the handle 32d and pulls the tank-receiving part 32a forward (to the front-surface side) to pull the tray 32 out from the casing 11.

(b) Water Supply Parts

[0093] The water supply parts 32b are portions for supplying the humidification elements 33 with water supplied from the tank 31. Specifically, the water supply parts 32b receive the water supplied to the tank-receiving part 32a and then supply the water to the humidification elements 33. The water supply parts 32b are positioned in the extending portions described above.

[0094] The water supply parts 32b and the tank-receiving part 32a described above are partitioned by a dividing wall (not shown). A hole is formed in the dividing wall.

[0095] Water supplied from the tank 31 to the tank-receiving part 32a is sent through the hole to the water supply parts 32b. In other words, water received in the tank-receiving part 32a disposed on the front-surface side of the casing 11 is then sent in the depth direction on both the left and right sides of the casing 11. The water supply parts 32b are filled with water up to a predetermined water level. In other words, water is accumulated up to a predetermined water level in the water supply parts 32b in order for the humidification elements 33 to be immersed. The water accumulated in the water supply parts 32b is automatically regulated so as to maintain the predetermined water level as long as there is water in the tank 31.

[0096] Thus, the water received by one tray 32 from the tank 31 is supplied to the plurality of humidification elements 33.

(c) Shaft-Receiving Parts

[0097] The shaft-receiving parts 32c are portions that receive rotating shafts (rotor rotating shafts) 33d of the humidification elements 33, described hereinafter. The shaft-receiving parts 32c are positioned in the extending portions described above. The shaft-receiving parts 32c are a pair of columns extending vertically upward from the side walls of the water supply parts 32b.

[0098] In the present embodiment, the water supply parts 32b extend on both sides in the width direction of the air purifier 10. Therefore, the shaft-receiving parts 32c are provided to the respective water supply parts 32b positioned on both sides in the width direction. The shaft-receiving parts 32c disposed respectively to the water supply parts 32b are arranged in the same horizontal plane position in the depth direction. In other words, the shaft-receiving parts 32c disposed to the plurality of water supply parts 32b are arranged in positions where they face each other.

[0099] U-shaped recesses are formed in the top ends of the shaft-receiving parts 32c in order to rotatably support the rotor rotating shafts 33d.

(2-4-3) Humidification elements

[0100] The humidification elements 33 vaporize the supplied water and humidify the air.

[0101] Specifically, the humidification elements 33 vaporize the water accumulated in the tray 32 and humidify the air. More specifically, the humidification elements 33 vaporize the water accumulated in the water supply parts 32b described above and humidify the air.

[0102] In the present embodiment, a plurality of humidification elements 33 are used.

[0103] More specifically, two humidification elements 33 are used. The two humidification elements 33 are disposed in parallel. Specifically, the two humidification elements 33 are disposed along the depth direction on the left and right sides of the air purifier 10. The two humidification elements 33 are disposed in proximity to the tank 31 on both sides of the tank 31 as shown in FIGS. 2, 4, and 5. The two humidification elements 33 are also disposed in positions where they face each other.

[0104] The two humidification elements 33 are disposed above the tray 32. Specifically, the humidification elements 33 are disposed above the water supply parts 32b of the tray 32. Water is supplied to the two respective humidification elements 33 by the above-described tank 31 and tray 32. In other words, water is supplied to the two respective humidification elements 33 by a single shared tank 31 and a single shared tray 32.

[0105] The two humidification elements 33 are both rotating elements. Specifically, the humidification elements 33 each include primarily a humidification filter 33a and a humidification rotor 33b. Each of the humidification filters 33a is a vaporizing material formed into disc shapes from a nonwoven fabric. The humidification filters 33a have filter surfaces. The two humidification elements 33 are disposed so that the filter surfaces face each other. The humidification rotors 33b are frames that enclose the outer peripheries of the humidification filters 33a and hold the humidification filters 33a.

The humidification rotors 33b each have a rotor rotating shaft 33d in the center, and have a gear (not shown) in the outer periphery. The gears are configured so that a first drive part 33e and a second drive part 33f each mesh with a gear (see FIGS. 5 and 6).

[0106] The first drive part 33e and the second drive part 33f each have a rotating shaft, as shown in FIGS. 5 and 6. Gears are fixed to both ends of each rotating shaft.

[0107] Specifically, the first drive part 33e includes a drive gear 33ea and a driven gear 33eb. The second drive part 33f includes driven gears 33fa, 33fb. The drive gear 33ea of the first drive part 33e is disposed so as to mesh with the gear of the left-side humidification element 33. The driven gear 33fa of the second drive part 33f is disposed so as to mesh with the gear of the right-side humidification element 33.

[0108] The driven gear 33eb of the first drive part 33e and the driven gear 33fb of the second drive part 33f are disposed so as to mesh with each other.

[0109] The drive gear 33ea of the first drive part 33e is rotated by the transmission of rotational force from a drive motor 35 (see FIG. 7(b)). The rotation of the drive gear 33ea of the first drive part 33e causes the humidification element 33 meshing with the drive gear 33ea to rotate. The driven gear 33eb of the first drive part 33e is also rotated by the rotation of the drive gear 33ea. Furthermore, the driven gear 33fb of the second drive part 33f is rotated by the driven gear 33eb of the first drive part 33e.

[0110] Furthermore, the driven gear 33fa of the second drive part 33f is rotated by the rotation of the driven gear 33fb of the second drive part 33f. The humidification element 33 meshing with the driven gear 33fa of the second drive part 33f thereby rotates. In other words, due to the rotation of a single drive motor 35, the rotational force of this single drive motor 35 is transmitted sequentially to the drive gear 33ea and the driven gears 33eb, 33fb, 33fa. As a result, both of the two humidification elements 33 rotate.

[0111] The humidification elements 33 each comprise a plurality of water-drawing parts 33c, as shown in FIGS. 2, 4, and 6. The water-drawing parts 33c are disposed to the side surfaces of the gears of the humidification rotors 33b. In other words, the water-drawing parts 33c are disposed on the outer side than the outer peripheries of the humidification filters 33a. The water-drawing parts 33c are each in the shape of a cup. The water-drawing parts 33c each have a shape capable of drawing up the water in the tray 32 (in the water supply parts 32b) when the humidification elements 33 rotates.

[0112] The humidification elements 33 are disposed so that the bottom parts of the humidification filters 33a are not immersed in the water in the tray 32, and each of the teeth tips of the gears of the humidification rotors 33b comes in proximity to the bottom surface of the tray 32 when it comes to bottom point, as shown in FIG. 3.

[0113] The water-drawing parts 33c are sequentially immersed in the water in the tray 32 and draw the water up, when the humidification elements 33 rotate. Each of the water-drawing parts 33c then pours the drawn up water over the humidification filter 33a when it comes near the top point of the humidification element 33. Specifically, the water drawn up by the water-drawing parts 33c flows out from the water-drawing parts 33c near the top point of the humidification elements 33, and the water is poured over the humidification filters 33a.

(3) Actions of Air Purifier and Flow of Air

[0114] The actions of the air purifier 10 and the air flow generated by the actions of the air purifier 10 are described below using FIGS. 2 and 3. In FIGS. 2 and 3, the symbols f1 to f5 indicate the flow of air. In FIG. 3, concerning the flow of air that has flowed into the humidification chamber R3 after passing through the air purification filter 20, the solid lines indicate the flow of air passing between the humidification filters 33a, and the dashed lines indicate the flow of air on the outer sides of the humidification filters 33a.

[0115] When the air purifier 10 is turned on, the fan motor 12b of the air-blowing device 12 rotates the fan 12a. Since the rotating fan 12a blows air out in the centrifugal direction, the pressure surrounding the rotational axis therefore drops. Air is thereby drawn into a fan intake port positioned in the center of the fan 12a. As a result, an air flow from the intake ports 11 a to the fan intake port is created. In the air purifier 10 according to the present embodiment, the air-blowing chamber R1 is provided in the lowest part of the casing 11 as described above. The intake ports 11 a are formed in the lower parts of the front and back surfaces of the casing 11.

[0116] Therefore, when the air-blowing device 12 is driven, the air purifier 10 draws air in from the lower parts of the front and back surfaces (see the symbols f1 in FIG. 3). In other words, due to the driving of the air-blowing device 12, air outside the casing 11 is drawn into the air-blowing chamber R1.

[0117] The driving of the air-blowing device 12 causes air to be blown out in the centrifugal direction from the plurality of vanes 12ab, and to flow toward the air purification filter 20 (see the symbols f2 in FIGS. 2 and 3). In other words, the air in the air-blowing chamber R1 is sent to the air purification chamber R2.

[0118] The air sent to the air purification chamber R2 first passes through the dust collection filter 21 on the upstream side. Dust contained in the air is removed by the dust collection filter 21. Air that has passed through the dust collection filter 21 then further passes through the deodorizing filter 22 on the downstream side. The deodorizing filter 22 absorbs malodorous components contained in the air. Static pressure is exerted on all surfaces of the air purification filter 20 by

the air brought in from the air-blowing chamber R1. The air that has passed through the air purification filter 20 is then sent to the humidification chamber R3.

[0119] The air sent to the humidification chamber R3 flows upward (see the symbols f3 in FIGS. 2 and 3). A flow of air along the outer surfaces (outer walls) of the tank 31 is created inside the humidification chamber R3. The air flow f3 is guided by the straightening plate 36 so as to pass through the humidification filters 33a. The air flowing into the humidification chamber R3 thereby flows in the thickness direction of the air purification filter 20 (see the symbols f3), and then branches toward the two humidification elements 33 (see the symbols f4 in FIG. 2). In other words, the air flows orthogonal to the thickness direction of the humidification elements 33 after passing through the air purification filter 20, and then flows along the tank 31 in the humidification chamber R3 so as to change its flowing direction and curve in the thickness direction of the humidification elements 33 (in the axial direction of the rotor rotating shafts 33d). The air then passes through the humidification elements 33 and flows along the outer walls of the tank 31 to be blown out from the discharge port 11 b (see the symbols f5 in FIGS. 2 and 3).

[0120] When the air purifier 10 is turned on while the humidifying function is turned on, the humidification elements 33 rotate. Because the bottom parts of the humidification filters 33a are immersed the water in the tray 32, the next immersed portions of the humidification filters 33a draw up the water in the tray when the humidification elements 33 rotates. The rotation of the humidification elements 33 also causes the water-drawing parts 33c to draw up the water in the tray 32 and drop the water onto the humidification filters 33a near the top point of the humidification elements 33.

[0121] As a result, water permeates entirely throughout the humidification filters 33a. In other words, when the humidifying function is turned on, air coming from the air purification chamber R2 into the humidification chamber R3 causes the water soaked through the humidification elements 33 to vaporize. The air thereby becomes humidified. The humidified air is then blown out from the discharge port 11 b.

[0122] When the air purifier 10 is turned on while the humidifying function is turned off, the humidification elements 33 do not rotate. In other words, air is blown out from the discharge port 11 b without being sufficiently humidified.

(4) Operation of Attaching/Detaching Air Purification Filter

[0123] Next, the operation of attaching/detaching the air purification filter 20 will be described with reference to FIGS. 7 and 8. FIGS. 7 and 8 illustrate, in order, the operation for detaching the air purification filter 20 from the casing 11 (the detachment operation). Specifically, FIGS. 7(a) to (d) use perspective views of the air purifier 10 to show the procedure of the detachment operation, and FIGS. 8(a) to (d) use schematic configuration views of a cross section of the air purifier 10 along line II-II in FIG. 1 to show the procedure of the detachment operation. FIGS. 7(a) to (d) correspond respectively to FIGS. 8(a) to (d). The operation of attaching the air purification filter 20 to the casing 11 is performed by reversing the steps of the detachment operation.

[0124] FIGS. 7(a) and 8(a) show the air purifier 10 before maintenance is started. When maintenance is started, the door 11c is firstly opened as shown in FIGS. 7(b) and 8(b). Specifically, the door 11 c is detached from the casing 11. When the door 11 c is detached, the opening 15 is opened (see FIG. 7(b)). Detaching the door 11c causes the tank 31 attached to the door 11c to be detached from the casing 11. In this embodiment, the tank 31 is detached from the casing 11 by lifting the door 11c upward. The tank 31 may be detached from the casing 11 by pulling the door 11c out toward the front-surface side.

[0125] The tray 32 is then detached from the casing 11 as shown in FIGS. 7(c) and 8(c).

[0126] Specifically, the tray 32 is pulled out forward using the handle 32d. At this time, the humidification elements 33 are taken out of the casing 11 via the opening 15. As a result, a wide space is formed inside the top of the casing 11. In other words, a space in which the air purification filter 20 can move is formed in the humidification chamber R3 by detaching the tray 32 and the humidification elements 33 from the casing 11.

[0127] The air purification filter 20 is then detached from the casing 11 as shown in FIGS. 7(d) and 8(d). After the air purification filter 20 is moved in the thickness direction of the filter and taken off from the flange part 11d, the filter is moved through the humidification chamber R3 and detached from the casing 11. In other words, the air purification filter 20 is pulled up to the downstream side in the direction of air flow, and is then taken out of the casing 11 via the opening 15.

(5) Characteristics

(5-1)

[0128] The air purifier 10 according to the above embodiment is provided with the air purification filter 20, the humidification unit 30, the fan (air-blowing fan) 12a, and the casing 11. The air purification filter 20 removes dust contained in the air. The humidification unit 30 vaporizes water supplied and humidifies the air. The air-blowing device 12 blows air toward the air purification filter 20 and the humidification unit 30. Specifically, the air-blowing device 12 blows air to the air purification filter 20 and the humidification filters 33a. The casing 11 accommodates the humidification unit 30, the

air purification filter 20, and the air-blowing device 12.

[0129] The casing 11 has an opening 15 for attaching/detaching the humidification unit 30.

[0130] The humidification unit 30 is disposed in alignment with the air purification filter 20 on the downstream side of the air purification filter 20 with respect to the direction in which the air purification filter 20 is detached. The opening 15 enables the air purification filter 20 to be detached after the humidification unit 30 has been detached.

[0131] Generally, when an air purifier includes a humidification unit, the air purifier is provided with both an opening for attaching/detaching the humidification unit and an opening for attaching/detaching the air purification filter. The opening for attaching/detaching the air purification filter is formed in a side surface of the casing so that the air purification filter can be inserted in a direction orthogonal to the direction of air flow. The opening for attaching/detaching the humidification unit is formed to be large in the side surface of the casing in order to enable the tank to be detached though it. An opening is provided with a lid (a door) in order to ensure that the casing is airtight. Therefore, when the air purifier includes a humidification unit, doors are required to both the opening for attaching/detaching the air purification filter and the opening for attaching/detaching the humidification unit.

[0132] Some degree of airtightness can be ensured by disposing doors at the openings, but it is undesirable to increase the number of openings when a high degree of airtightness is required.

[0133] In view of this, in the air purifier 10 according to the above embodiment, the opening 15 for attaching/detaching the humidification unit 30 is also used as the opening 15 for attaching/detaching the air purification filter 20. Specifically, the humidification unit 30 is disposed on the downstream side of the air purification filter 20 in the direction in which the air purification filter 20 is detached. After the humidification unit 30 has been detached via the opening 15, the air purification filter 20 can be detached from the casing 11 through the same opening 15. In other words, a single opening can be used to attaching/detaching both the humidification unit 30 and the air purification filter 20. As a result, the number of doors can be kept to a minimum.

[0134] Therefore, a high degree of airtightness can be achieved. Additionally, the number of manufacturing steps can be reduced because there is no need to provide a plurality of openings and/or doors.

(5-2)

[0135] In the air purifier 10 according to the above embodiment, the direction in which the air purification filter 20 is detached is the thickness direction of the air purification filter 20. In other words, the air purification filter 20 is detached in the thickness direction of the air purification filter 20.

[0136] As described above, in a conventional air purifier, the air purification filter is inserted from the lateral side of the casing so as to be orthogonal to the direction of air flow.

[0137] When an air purification filter is provided, it is common to provide a sealing member in order to improve the airtightness of the air purification filter relative to the casing.

[0138] The sealing member is disposed along the outer contours of the air purification filter. When the air purification filter is configured to be inserted from the lateral side of the casing, the sealing member is scraped against the casing or the air purification filter and suffers abrasions, when the air purification filter is detached. As a result, it is difficult to ensure constant airtightness over a long period of time.

[0139] A sealing member is used in order to increase airtightness with the air purification filter 20 in the air purifier 10 according to the above embodiment as well. However, in the air purifier 10 according to the above embodiment, the air purification filter 20 is detached in the thickness direction of the air purification filter 20. Therefore, abrasions to the air purification filter can be suppressed when the air purification filter 20 is removed. As a result, predetermined airtightness can be ensured for a long period of time.

[0140] In the air purifier 10 according to the above embodiment, the large space formed after detaching the humidification unit 30 can be utilized to detach the air purification filter 20. Detaching the air purification filter 20 can thereby be made easier.

(5-3)

[0141] The air purifier 10 according to the above embodiment is further provided with, on the upstream side of the air purification filter 20 with respect to the detachment direction, the sealing means (the flange part 11 d and the sealing member 11 e) for sealing the gap between the air purification filter 20 and the casing 11. Specifically, the air purification filter 20 is placed on top of both the flange part 11 d formed on the inner side of the casing 11, and the sealing member 11 e disposed in a horizontal plane on the flange part 11 d, as shown in FIGS. 2 and 3. The air purification filter 20 can thereby be stably held in the casing 11.

(5-4)

[0142] In the air purifier 10 according to the above embodiment, the humidification unit 30 includes the tank 31 for storing water, the tray 32 for receiving water from the tank 31, and the humidification filters 33a for vaporizing water supplied from the tray 32 and humidifying air. When the humidification unit 30 is detached from the casing 11, a large space is formed above the air purification filter 20 inside the casing 11.

[0143] Therefore, sufficient space for detaching the air purification filter 20 can be ensured during maintenance on the air purifier 10. Further, the air purification filter 20 can be pressed by the humidification unit 30 when the air purifier 10 is in operation. The stability of the air purification filter 20 can thereby be ensured.

(6) Modifications

[0144] Modifications of the above embodiment are described below. In the modifications, the configurations described in the above embodiment are described using the same symbols.

(6-1) Modification 1A

[0145] In the description of the air purifier 10 according to the above embodiment, the direction in which the door 11c was disposed was described as the front side (the front-surface side), but the front surface of the air purifier 10 may be in any direction.

[0146] For example, the direction in which the control panel 13 is disposed may be the front surface.

(6-2) Modification 1 B

[0147] In the air purifier 10 according to the above embodiment, the discharge port 11 b is disposed in the top end part (the ceiling portion) of the casing 11, as shown in FIG. 1. When the door 11c is detached, the portion (frame) defining the discharge port 11 b remains in the top end part of the casing 11 (see FIGS. 7(a) and (b)).

[0148] An air purifier 100, in which a discharge port grill 11 g is attached to the casing 11 as shown in FIG. 9, may be used in this modification. Specifically, in the air purifier 100, the discharge port grill 11 g is attached to the top end of the casing 11. The discharge port 11 b is formed in the discharge port grill 11 g (see FIG. 9(a)). When the discharge port grill 11 g is lifted upward, the top end of the casing 11 is opened as shown in FIG. 9(b). The tank 31 is then detached together with the door 11c as shown in FIG. 9(c). As a result, the top part of the front-surface side of the casing 11 is opened as well. In other words, a large opening 15, spreading from the top end part of the casing 11 to the top part of the front-surface side, is formed in the casing 11. The tray 32 and the humidification elements 33 are detached from the casing 11 through this opening 15, as shown in FIG. 9(d). In FIGS. 9(c) and (d), the movement direction of the tank 31, the tray 32, and the humidification elements 33 is upward, but the movement direction of the tank 31, the tray 32, and the humidification elements 33 is not limited to upward, and may be toward the front of the air purifier 100.

[0149] Similar to the air purifier 10 according to the above embodiment, after the humidification unit 30 is detached from the casing 11, the wide space formed inside the casing 11 can be utilized to move the air purification filter 20 within the casing in the air purifier 100. This configuration allows the air purification filter 20 to be detached from the casing 11 via the opening 15.

[0150] Thus, in the air purifier 100 as well, a single opening 15 can be used to attach/detach both the humidification unit 30 and the air purification filter 20, similar to the air purifier 10 according to the above embodiment.

(6-3) Modification 1C

[0151] The air purifier 10 according to the above embodiment and the air purifier 100 according to Modification B are configured so that the top part of the front surface and the ceiling part can be opened. In other words, the air purifiers 10, 100 have a large opening 15 formed across between the front-surface top part of the casing 11 and the top end part.

[0152] In this modification, the opening 15 may be formed in only the front-surface top part of the casing 11. For example, even when an air purifier 200 has a configuration in which only the front-surface top part of the casing 11 can be opened as shown in FIGS. 10 and 11, the same effects as the air purifier 10 according to the above embodiment can be achieved.

[0153] Specifically, the air purifier 200 is configured so that the top end part of the casing 11 cannot be opened (see FIGS. 10(a) and (b)). FIGS. 10(a) and 11(a) show states in which the door 11 c is closed. The door 11 c has a configuration in which the top end can be turned in a direction away from the casing 11 with the bottom end part as a fulcrum, as shown in FIGS. 10(b) and 11(b). When the handle 11 ca is pulled forward, the top end of the door 11c is separated from the casing 11 and the tank 31 exposes (see FIGS. 10(b) and 11(b)). The tank 31 is then detached from the casing 11

via the opening 15. After that, the tray 32 and the humidification elements 33 are also detached from the casing 11 via the opening 15, as shown in FIGS. 10(c) and 11(c). A space in which the air purification filter 20 can move is thereby formed above the air purification filter 20. As a result, the air purification filter 20 can be detached from the casing 11 via the opening 15 (see FIGS. 10(d) and 11(d)).

[0154] Thus, in the air purifier 200, a single opening 15 can be used to attach/detach both the humidification unit 30 and the air purification filter 20, similar to the air purifier 10 according to the above embodiment.

(6-4) Modification 1 D

[0155] In the air purifier 10 according to the above embodiment, the discharge port 11 b is formed in the ceiling portion of the casing 11 (see FIGS. 1 and 2).

[0156] In this modification, discharge ports 11 b may be formed in the top parts of both side surfaces in the left and right direction of the casing 11 as shown in FIG. 12, and the discharge ports 11 b may be disposed in positions where they face the filter surfaces of a plurality of humidification elements 33, as shown in FIGS. 13 and 14.

[0157] FIG. 12 is an external perspective view showing an example of an air purifier 300 in which discharge ports 11 b are formed in the top parts of both side surfaces in the left and right direction of the casing 11. FIG. 13 is a schematic cross-sectional view along line III-III of the air purifier 300 shown in FIG. 12. In other words, FIG. 13 is a schematic view of the internal configuration of the air purifier 300 as seen from the rear. FIG. 14 is a schematic view of the internal configuration of the air purifier 300 as seen from the above. In the air purifier 300, the intake ports 11 a are formed in the bottom parts of both surfaces in the forward and rearward direction of the casing 11, similar to the air purifier 10 according to the above embodiment.

[0158] In the air purifier 300, the discharge ports 11 b are disposed in positions where they face the filter surfaces of the humidification filters 33a, as shown in FIGS. 13 and 14.

[0159] Therefore, in the air purifier 300, air drawn into the air-blowing chamber R1 from the bottom parts of the front and back surfaces of the casing 11 flows to the air purification chamber R2 above, and the air is then sent to the humidification chamber R3 (see FIG. 13). The air sent to the humidification chamber R3 changes its flow direction to the thickness direction of the humidification elements 33. In other words, the air changes its flow direction to a direction orthogonal to the humidification elements 33, and the air is blown out from the discharge ports 11 b.

[0160] The air purifier 300 also has a configuration in which the door 11c can be turned in a direction such that the top end separates from the casing 11 with the bottom end part as a fulcrum as shown in FIG. 15(a), similar to the air purifier 200 according to Modification C. When the handle 11 ca is pulled forward, the top end of the door 11 c is separated from the casing 11 and the tank 31 exposes. The tank 31 is then detached from the casing 11 via the opening 15. After that, the tray 32 and humidification elements 33 are also detached from the casing 11 via the opening 15 (see FIG. 15(b)). A space in which the air purification filter 20 can move is thereby formed above the air purification filter 20. As a result, the air purification filter 20 can be detached from the casing 11 via the opening 15 (see FIG. 15(c)).

[0161] Thus, in the air purifier 300, a single opening 15 can be used to attach/detach both the humidification unit 30 and the air purification filter 20, similar to the air purifier 10 according to the above embodiment.

[0162] Furthermore, in the air purifier 300, air blown outside of the casing 11 from the discharge ports 11 b passes through the wide area of the humidification filters 33a.

[0163] Specifically, due to the discharge ports 11 b being disposed in positions where they face the filter surfaces of the humidification filters 33a, air can be humidified using the larger part of filter surfaces of the humidification filters 33a. In other words, the utilized area of the filter surfaces can be increased due to such a configuration. As a result, humidifying efficiency can be improved.

(6-5) Modification 1 E

[0164] In the air purifier 10 according to the above embodiment, the air purification filter 20 is horizontally mounted in the casing 11 (see FIG. 2). The air purification filter 20 may be vertically mounted in the casing 11.

[0165] FIG. 16 is an external perspective view showing an example of an air purifier 400 in which air purification filters 20 are vertically mounted in the casing 11. In the air purifier 400, intake ports 11 a are formed in the bottom parts of both side surfaces in the left and right direction of the casing 11, and a discharge port 11 b is formed in the ceiling portion of the casing 11.

[0166] FIGS. 17 and 18 are schematic views showing the internal configuration of the air purifier 400. Specifically, FIG. 17, a schematic cross-sectional view along line IV-IV of the air purifier 400 shown in FIG. 16, shows the internal configuration of the air purifier 400 as seen from the rear. FIG. 18, a schematic cross-sectional view along line V-V of the air purifier 400 shown in FIG. 16, shows the internal configuration of the air purifier 400 as seen from the right. In the air purifier 400, the air-blowing chamber R1 is provided inside the top of the casing 11, and the air purification chamber R2 and humidification chamber R3 are provided inside the bottom of the casing 11, as shown in FIGS. 17 and 18.

[0167] The air purification filters 20 are vertically mounted in the casing 11. In other words, the air purification filters 20 are disposed in a position where they face the intake ports 11 a, as shown in FIG. 17. Specifically, the air purification filters 20 are disposed so that the filter surfaces face the intake ports 11 a. The air purification filters 20 are respectively disposed both on the left and right sides of the casing 11.

[0168] The air purification filters 20 are provided along the forward and rearward direction of the casing 11.

[0169] In the air purifier 400, the humidification elements 33 are disposed both on the left and right sides of the casing 11 as shown in FIG. 17. Specifically, the humidification elements 33 are disposed so that the filter surfaces of the humidification filters 33a face the filter surfaces of the air purification filters 20. In the air purifier 400 as well, the humidification unit 30 is disposed on the downstream side of the air purification filters 20 with respect to the direction of air flow, and is also disposed on the downstream side of the air purification filters 20 with respect to the direction in which the air purification filters 20 are detached.

[0170] Air drawn in from the intake ports 11 a flows toward the lower middle of the casing 11. Specifically, air drawn in from the intake ports 11 a flows in the thickness direction of the air purification filters 20 and the humidification filters 33a, and passes sequentially through the air purification filters 20 and the humidification filters 33a. In other words, the air drawn in from the intake ports 11 a passes through the humidification filters 33a after passing through the air purification filters 20.

[0171] The air flow then changes its flow direction to a direction orthogonal to the thickness direction of the air purification filters 20 and the humidification filters 33a.

[0172] Specifically, air that has passed through the air purification filters 20 and the humidification filters 33a then flows upward toward the air-blowing chamber R1, as shown by the arrows in FIG. 17. The air sent to the air-blowing chamber R1 is drawn in along the rotational axis direction by the rotation of the hub part 12aa and the plurality of vanes 12ab, and the air is then blown out from the vanes 12ab in the centrifugal direction. The air is then blown out from the discharge port 11 b.

[0173] FIGS. 19(a) to (c) show the procedure of the operation for detaching the air purification filters 20 in the air purifier 400. The air purifier 400 also has a configuration in which the door 11 c can be turned in a direction such that the top end separates from the casing 11 with the bottom end part as a fulcrum as shown in FIG. 19(a), similar to the air purifier 200 according to Modification C. When the handle 11 ca is pulled forward, the top end of the door 11c is separated from the casing 11 and the tank 31 exposes. The tank 31 is then detached from the casing 11 via the opening 15. The tray 32 and humidification elements 33 are then also detached from the casing 11 via the opening 15 (see FIG. 19(b)). A space in which the air purification filters 20 can move is thereby formed in the thickness direction of the air purification filters 20. As a result, the air purification filters 20 can be detached from the casing 11 via the opening 15 (see FIG. 19(c)).

[0174] Thus, in the air purifier 400, a single opening 15 can be used to attach/detach both the humidification unit 30 and the air purification filters, similar to the air purifier 10 according to the above embodiment.

[0175] Furthermore, in the air purifier 400, air taken into the casing 11 from the intake ports 11a passes through the wide area of the humidification filters 33a. Specifically, due to the discharge ports 11 b being disposed in positions where they face the humidification filters 33a, air can be humidified using the larger part of filter surfaces of the humidification filters 33a. As a result, humidifying efficiency can be improved.

(6-6) Modification 1 F

[0176] In the above embodiment, the tray 32 is placed on the flange part 11f. In this modification, the outer walls of the water supply parts 32b of the tray 32 may be provided with a long, thin protrusion extending along the direction in which the outer walls extend, and the inner walls of the casing 11 may be provided with a configuration capable of holding this protrusion in addition to the flange part 11f.

[0177] The protrusion is disposed along the direction in which the tray 32 is inserted. The stability of the tray 32 is thereby further improved. Further, the protrusions allow the tray 32 to move more easily along the depth direction of the casing 11.

(6-7) Modification 1 G

[0178] In the above embodiment, the plurality of humidification elements 33 are rotated by a single drive motor 35. Specifically, the rotational force of the single drive motor 35 is transmitted successively to the drive gear 33ea and the driven gears 33eb, 33fb, 33fa. As a result, the two humidification elements 33 both rotate.

[0179] Another configuration may be employed in this modification as a configuration in which a plurality of humidification elements 33 are rotated by a single drive motor 35. For example, a plurality of humidification elements 33 are configured so as to be fixed to a single rotor rotating shaft 33d, and a drive gear is attached to this single rotor rotating shaft 33d. The plurality of humidification elements 33 can thereby be rotated by rotating the drive gear with the single

drive motor 35.

(6-8) Modification 1 H

[0180] In the air purifier 10 according to the above embodiment, the tank 31 is attached to the door 11c so as to be integrated with the door 11c for opening and closing the opening 15. Therefore, when the door 11c is detached from the casing 11, the tank 31 is also detached from the casing 11.

[0181] In this modification, the door 11c and the tank 31 may not be integrated. In other words, the configuration may be such that the door 11c is detached from the casing 11, and the tank 31 is then detached from the opening 15.

<Second Embodiment>

[0182] An air purifier 510 according to a second embodiment of the present invention is described below.

(1) Overall Configuration of Air Purifier

[0183] FIG. 20 is an external perspective view of the air purifier 510 according to the second embodiment of the present invention. In the following description, the expressions "front (front surface)," "rear (back surface)," "right," "left," "up," "down," etc. are used in order to describe directions, arrangements, and the like. When it is not specified these expressions represent to the directions, arrangements, and the like according to the arrows shown in FIG. 20. FIGS. 21 to 23 and 30 to 32 also show arrows representing "front," "rear," "right," "left," "up," and "down". The directions indicated by the arrows in FIGS. 21 to 23 and 30 to 33 coincide with the directions indicated by the arrows in FIG. 20.

[0184] FIG. 21 is a cross-sectional view along line XXI-XXI of the air purifier 510 shown in FIG. 20. In other words, FIG. 21 is a drawing of the interior of the air purifier 510 of FIG. 20, as seen from the right. FIG. 22 is a cross-sectional view along line XXII-XXII of the air purifier 510 shown in FIG. 20. In other words, FIG. 22 is a drawing of the interior of the air purifier 510 of FIG. 20, as seen from the front.

[0185] The air purifier 510 according to the present embodiment has an air purification function and a humidifying function (moisture regulation function). The air purifier 510 is configured so that the humidifying function can be selectively executed (configured so that the humidifying function can be turned on and off). Specifically, when the user selects the humidifying function (when humidifying function is turned on), the air purification function and the humidifying function of the air purifier 510 function together effectively. When the user does not select the humidifying function (when the humidifying function is turned off), only the air purification function of the air purifier 510 effectively functions. However, no limitation is provided thereby, and the air purifier 510 may always effectively function the air purification function and the humidifying function. It is easier, however, to ensure the comfort of the user with a configuration in which the humidifying function can be executed selectively.

[0186] The air purifier 510 is primarily provided with a casing 511 (see FIG. 20), an air-blowing device 512 (see FIG. 21), an air purification filter 520 (see FIG. 21), a filter case 523 (see FIG. 22), a filter detection sensor 525 (see FIG. 22), and a humidification unit 530 (see FIG. 22). The casing 511 accommodates the air-blowing device 512, the air purification filter 520, the filter case 523, the filter detection sensor 525, and the humidification unit 530. The air-blowing device 512 takes in air from outside the casing 511 and sends the air to the air purification filter 520 and the humidification unit 530. The air purification filter 520 removes dust contained in the air, and also removes odorous components contained in the air.

[0187] The filter case 523 accommodates a deodorizing filter 522 of the air purification filter 520, described hereinafter. The filter detection sensor 525 detects whether or not the deodorizing filter 522 of the air purification filter 520 is attached to the casing 511. The humidification unit 530 vaporizes supplied water and humidifies the air.

(2) Detailed Configuration

[0188] Below is a detailed description of the primary components of the air purifier 510, which are the casing 511, the air-blowing device 512, the air purification filter 520, the filter case 523, the filter detection sensor 525, and the humidification unit 530.

(2-1) Casing

[0189] The casing 511 accommodates the air-blowing device 512, the air purification filter 520, the filter case 523, the filter detection sensor 525, the humidification unit 530, and other components of the air purifier 510. The casing 511 is formed in a quadrangular prism shape having a long and thin outward appearance, i.e., the casing is formed in a quadrangular prism shape which extend long in vertical direction. Space for accommodating components is formed inside the casing 511.

[0190] A control panel 513 is disposed in an upper side surface (the upper front surface) of the casing 511, as shown in FIG. 20. The control panel 513 is provided with various switches (e.g., a power switch and/or a function selection switch) for operating the air purifier 510. The control panel 513 is connected to a control device (not shown) built into the casing 511. Various commands received by the control panel 513 are transmitted as signals to the control device.

The control device controls the actions of the air purifier 510 based on the commands received by the control panel 513 and/or the detection results of various sensors including the filter detection sensor 525.

[0191] The interior of the casing 511 is divided primarily into three spaces, so as to form an air-blowing chamber S1, an air purification chamber S2, and a humidification chamber S3 (see FIGS. 21 and 22).

[0192] The air-blowing device 512 is disposed in the air-blowing chamber S1 (see FIGS. 21 and 22). The air purification filter 520 is disposed in the air purification chamber S2 (see FIGS. 21 and 22). The humidification unit 530 is disposed in the humidification chamber S3 (see FIGS. 21 and 22). The air-blowing chamber S1, the air purification chamber S2, and the humidification chamber S3 are aligned in the stated order from below to above (see FIGS. 21 and 22). In other words, inside the casing 511 of the air purifier 510, the air-blowing device 512, the air purification filter 520, and a humidification element 533 (see FIG. 21) of the humidification unit 530, described hereinafter, are arranged in the stated order from below. In this embodiment, maintenance work is easy because the humidification unit 530 which needs maintenance is disposed in the upper space where work is performed easily, and the humidification unit 530 can be accessed via an opening 515, described hereinafter, disposed in the upper left surface of the casing 511.

[0193] A first opening K1 is disposed between the air-blowing chamber S1 and the air purification chamber S2 (see FIG. 22). Air passes from the air-blowing chamber S1 to the air purification chamber S2 through the first opening K1. A second opening K2 is also disposed between the air purification chamber S2 and the humidification chamber S3 (see FIG. 22). Air passes from the air purification chamber S2 to the humidification chamber S3 through the second opening K2.

[0194] The casing 511 has intake ports 511 a and a discharge port 511b, as shown in FIG. 20. The intake ports 511 a and discharge port 511b are openings formed into rectangular shapes.

[0195] The intake ports 511 a are openings for drawing air from the outside of the casing 511 into the interior of the casing 511. The intake ports 511 a are disposed to the bottom parts of both the left and right surfaces of the casing 511 (see FIG. 22). The intake ports 511 a are each provided with an inner grating 511aa and an intake grill 511ab for preventing invasion of foreign objects and the user's fingers (see FIG. 22). The inner gratings 511 aa are disposed on the inner sides of the intake grills 511 ab which are provided to the outer-surfaces sides of the casing 511 (see FIG. 22). A pre-filter 511ac for removing large particles of dust from the air taken into the casing 511 is disposed on the inner side of each intake grill 511 ab (see FIG. 22).

[0196] The discharge port 511 b is an opening for blowing out air that has passed through the interior of the casing 511. In other words, the discharge port 511 b is an outlet for the air in the casing 511. The discharge port 511 b blows out air that has been purified by the air purification filter 520, or air that has been humidified by the humidification unit 530 after being purified by the air purification filter 520. The discharge port 511 b is disposed in the top surface (the ceiling portion) of the casing 511, as shown in FIG. 20. The discharge port 511 b is provided with a metal mesh 511ba and a discharge grill 511 bb for preventing invasion of foreign objects and the user's fingers (see FIG. 22). The metal mesh 511ba is disposed on the inner side of (below) the discharge grill 511 bb which is provided in the outer-surface side of the casing 511 (see FIG. 22).

[0197] The opening 515 is formed in the upper left surface of the casing 511 (see FIGS. 22 and 33(d)). The opening 515 can be opened and closed by attaching/detaching a first side plate 511c and a second side plate 511d (see FIG. 20). The first side plate 511 c is formed integrally with a humidification tank 531 of the humidification unit 530, described hereinafter (see FIG. 22). The second side plate 511d defines part (the left side wall) of a humidification tray 532 of the humidification unit 530, described hereinafter (see FIG. 22). A handle 511ca, which is used when the first side plate 511c is attached/detached (when the humidification tank 531 is attached/detached), is formed on the first side plate 511c (see FIG. 20). A handle 511 da, which is used when the second side plate 511d is attached/detached (when the humidification tray 532 is attached/detached), is formed on the second side plate 511 d (see FIG. 20).

[0198] The opening 515 is an opening for attaching/detaching components accommodated in the casing 511. Specifically, the opening 515 is an opening used in order to mount/dismount (attach/detach) the humidification unit 530 and the air purification filter 520 in the casing 511. In this embodiment, both the humidification unit 530 and the air purification filter 520 are configured to be accessible through a single opening 515 instead of providing a work opening designated for maintenance of the humidification unit 530 and a work opening designated for maintenance of the air purification filter 520 separately. Therefore, it is easy to improve the airtightness of the casing 511 and to prevent air from flowing out through the gap created at the opening for maintenance. Attachment/detachment of the humidification unit 530 and the air purification filter 520 through the opening 515 is described hereinafter.

[0199] A flange part 511e for putting a dust-collecting filter 521 of the air purification filter 520, described hereinafter, is provided inside the casing 511 (see FIGS. 21 and 22).

[0200] The flange part 511e is disposed on the inner wall of the casing 511 in the air purification chamber S2. The flange part 511e is a horizontal supporting surface which supports the dust-collecting filter 521 from below. The flange

part 511e is disposed below the dust-collecting filter 521 of the air purification filter 520, or in other words, on the upstream side with respect to the direction of air flow (see FIGS. 21 and 22).

[0201] The flange part 511e is provided along the entire periphery of the inner wall of the casing 511. The flange part 511e closely contacts with a bottom surface 521ba (see

[0202] FIG. 21) of a peripheral edge part 521 b (see FIG. 25) of the dust-collecting filter 521 of the air purification filter 520, and functions as a sealing means for sealing the gap between the dust-collecting filter 521 and the casing 511. A sealing member (not shown) made of, e.g., a resin, may also be disposed between the flange part 511e and the air purification filter 520 in order to further improve the sealing of the gap between the dust-collecting filter 521 and the casing 511.

[0203] Inside the casing 511, a support part 511f (see FIG. 22) is disposed for putting the filter case 523 accommodating the deodorizing filter 522 of the air purification filter 520, described hereinafter. The support part 511f is disposed on the inner wall on the left side of the casing 511 in the air purification chamber S2 (see FIG. 22). The support part 511f is provided above the flange part 511 e (see FIG. 22). The support part 511f is a horizontal supporting surface for supporting the filter case 523 accommodating the deodorizing filter 522 from below (see FIG. 22).

[0204] Concave parts 511 g, that engage with convex parts 523a provided to the filter case 523, described hereinafter, are also disposed on the inner wall of the casing 511 (see FIG. 22). The concave parts 511 g are disposed at two locations on the inner wall on the right side of the casing 511. Concave parts 511g are respectively formed so that one of the two convex parts 523a (see FIG. 27) provided to the filter case 523 is fitted into each concave part 511 g. The concave parts 511 g are provided above the flange part 511e (see FIG. 22). The concave parts 511g are disposed at positions where the filter case 523 will be substantially horizontal in a state where the convex parts 523a provided on the right side of the filter case 523 are engaged in the concave parts 511g and the left side of the filter case 523 is placed on the support part 511 f. In a state that the filter case 523 is attached to the casing 511 (in a state that the convex parts 523a engage to the concave parts 511 g and the left side of the filter case 523 is placed on the support part 511f), the bottom surface of the filter case 523 is in contact with a top surface 521 bb (see FIG. 21) of the peripheral edge part 521 b (see FIG. 25) of the dust-collecting filter 521, described hereinafter. The attachment of the filter case 523 to the casing 511 is described hereinafter.

[0205] A straightening plate 511 h is disposed inside the casing 511 (see FIG. 22). The straightening plate 511 h is disposed in the humidification chamber S3, as shown in FIG. 22. The straightening plate 511 h is disposed above the second opening K2.

[0206] In the humidification chamber S3, the straightening plate 511 h is disposed on the right of the humidification element 533, described hereinafter, and is adjacent to the humidification element 533. The straightening plate 511 h has a flat surface formed so as to gradually rise from the right side toward the left side. The straightening plate 511 h guides the air flow coming from the second opening K2 into the humidification chamber S3 to the humidification element 533.

[0207] A bypass opening 511 ha is formed on the straightening plate 511 h (see FIG. 31).

[0208] The bypass opening 511 ha is disposed above the second opening K2 (see FIG. 31).

[0209] The bypass opening 511 ha guides some of the air that has passed through the air purification filter 520 out of the casing 511 without letting the air pass from the humidification chamber S3 through the humidification element 533, as shown by the one-dot-chain-line arrows in FIG. 31. The bypass opening 511 ha provided in this manner makes it possible to increase the flow rate of air through the air purification filter 520, in comparison with all of the air being guided to the humidification element 533 which causes relatively large pressure loss. An ion generator 540 is provided to the surface of the straightening plate 511 h on the side opposite to the humidification chamber S3 (see FIG. 22). When the ion generator 540 is instructed to operate through the control panel 513, the ion generator 540 generates plasma ions. The plasma ions are led out of the casing 511 by the air passing through the bypass opening 511 ha and then blowing out of the casing 511.

(2-2) Air-Blowing Device

[0210] The air-blowing device 512 is disposed in the air-blowing chamber S1 (see FIG. 22).

[0211] The air-blowing device 512 takes air on the outside of the casing 511 into the air-blowing chamber S1, and blows the air into the air purification chamber S2 and the humidification chamber S3. In other words, the air-blowing device 512 is a device which blows air to the air purification filter 520 and the humidification unit 530 (the humidification element 533).

[0212] The air-blowing device 512 has primarily a fan 512a, a fan motor 512b, and a scroll casing 512c (see FIG. 22). The fan 512a is disposed on the left side of the air-blowing chamber S1, and the fan motor 512b is disposed on the right side of the air-blowing chamber S1 (see FIG. 22). The scroll casing 512c defines an air duct for guiding air blown by the fan 512a to the first opening K1 positioned above the fan 512a.

[0213] The fan 512a is a Sirocco fan having a stable air-blowing rate. The fan 512a has a hub part 512aa and a plurality

of vanes 512ab (see FIG. 24). The vanes 512ab are arrayed in a cylindrical formation around the peripheral edge of the hub part 512aa.

[0214] The fan 512a is driven by the fan motor 512b to rotate the hub part 512aa and the vanes 512ab and air is drawn into the fan 512a along the rotational axis direction.

[0215] At this time, air is taken into the air-blowing chamber S1 from outside the casing 511, via the intake ports 511 a. In the fan 512a, air is blown out in the centrifugal direction from the vanes 512ab. Air blown out in the centrifugal direction from the vanes 512ab is then guided through the scroll casing 512c to the first opening K1, and sent to the air purification chamber S2.

[0216] Because the air is blown out in the centrifugal direction from a plurality of vanes 512ab as described above, air flows, not upward but upward obliquely, to the dust-collecting filter 521 of the air purification filter 520, as shown by the one-dot-chain-line arrows in FIG. 24.

(2-3) Air Purification Filter

[0217] The air purification filter 520 purifies air taken into the air purifier 510. Specifically, the air purification filter 520 removes dust contained in the air. The air purification filter 520 also removes components that cause odors.

[0218] The air purification filter 520 is disposed in the air purification chamber S2 (see FIG. 22). The air purification filter 520 is disposed above the air-blowing device 512 and below the humidification unit 530 (see FIG. 22). The air purification filter 520 is also disposed on the downstream side of the air-blowing device 512 and on the upstream side of the humidification unit 530 with respect to the direction of air flow.

[0219] The air purification filter 520 includes primarily the dust-collecting filter 521 and the deodorizing filter 522 (see FIG. 21). The dust-collecting filter 521 removes dust contained in the air. The deodorizing filter 522 removes components that cause odors contained in the air.

[0220] The deodorizing filter 522 is disposed above the dust-collecting filter 521. In other words, the deodorizing filter 522 is disposed on the downstream side relative to the dust-collecting filter 521 with respect to the direction of air flow.

[0221] The thickness direction of the dust-collecting filter 521 and the deodorizing filter 522 is the vertical direction. That is, the thickness direction of the air purification filter 520 is the vertical direction. Air passes through the air purification filter 520 primarily in the thickness direction. In other words, the air purification filter 520 is disposed so that the air purification filter 520 (the dust-collecting filter 521 and the deodorizing filter 522) spreads in a direction orthogonal to the air passage direction.

(2-3-1) Dust-Collecting Filter

[0222] The dust-collecting filter 521 is a filter for removing fine dust that was not removed by the pre-filters 511 ac disposed at the intake ports 511 a. The dust-collecting filter 521 is formed into a rectangular shape.

[0223] A pleated filter, folded at a plurality of creases 521 a and having a plurality of "pleats" formed therein, is used as the dust-collecting filter 521 (see FIG. 25). When the dust-collecting filter 521 is viewed in a cross section orthogonal to the creases 521 a, the cross section is formed into a shape having a plurality of continuous peaks and troughs. Usage of a pleated filter makes it possible to secure a larger surface area (ventilation area) of the dust-collecting filter 521 in the same installation area, in comparison with using a filter with a flat plate having no "pleats" formed therein.

[0224] The dust-collecting filter 521 is placed on the flange part 511 e so that the direction in which the creases 521 a of the pleated filter extend is orthogonal with the direction in which a tongue part 512ca of the scroll casing 512c of the air-blowing device 512 extends, or in other words, the rotational axis direction of the fan 512a of the air-blowing device 512 (see FIG. 24).

[0225] The dust-collecting filter 521 of the air purification filter 520 is placed on the flange part 511e formed inside the casing 511, as described above. In other words, the dust-collecting filter 521 of the air purification filter 520 is held on the casing 511 with the flange part 511e. The flange part 511e is in contact (see FIG. 21) with the bottom surface 521ba of the peripheral edge part 521 b (see FIG. 25) of the dust-collecting filter 521 through which the air does not pass, and the flange part 511e thereby functions as a sealing means for sealing the gap between the air purification filter 520 and the inner wall of the casing 511. The sealing means ensures a seal between the air purification filter 520 and the casing 511 when air is sent from the air-blowing chamber S1 to the air purification chamber S2. The flange part 511e is disposed on the upstream side of the air purification filter 520 with respect to the direction of air flow. In other words, the sealing means is disposed on the upstream side of the air purification filter 520 with respect to the direction in which the air purification filter 520 is detached. The attachment/detachment of the dust-collecting filter 521 to the casing 511 is described hereinafter.

(2-3-2) Deodorizing Filter

[0226] The deodorizing filter 522 removes components that cause odors contained in the air. The deodorizing filter 522 is formed into a rectangular shape.

[0227] The deodorizing filter 522 is accommodated in the filter case 523, described hereinafter, as shown in FIGS. 26 and 27. The deodorizing filter 522 can be attached/detached from the filter case 523. The attached state of the filter case 523 to the casing 511 and the attachment/detachment of the deodorizing filter 522 (the filter case 523) to the casing 511 are described hereinafter. Further, the filter detection sensor 525 for confirming whether or not the deodorizing filter 522 is present is described hereinafter.

(2-4) Filter Case

[0228] The filter case 523 accommodates the air purification filter 520. Specifically, the filter case 523 accommodates the deodorizing filter 522 which is part of the air purification filter 520 (see FIG. 26).

[0229] The filter case 523 is a rectangular ring-shaped member, inside of which the deodorizing filter 522 is accommodated. The filter case 523 has side wall parts 523b (see FIGS. 21 and 22), which have the rough C-shape in cross section, for enclosing and holding the peripheral edge part of the accommodated deodorizing filter 522 from above and below and from the sides (the outer peripheral sides). In other words, the side wall parts 523b opens on the inner peripheral sides. The entire periphery of the deodorizing filter 522 is enclosed by the side wall parts 523b.

[0230] The top and bottom surfaces of the filter case 523 have large openings, and air that has passed through the dust-collecting filter 521 passes from below through the deodorizing filter 522 accommodated in the filter case 523, and blows out above the deodorizing filter 522.

[0231] The right surface of the side wall part 523b of the filter case 523 is disposed with convex parts 523a that engage with the concave parts 511g disposed in the inner walls of the casing 511. The convex parts 523a are disposed at two locations on the right surface of the side wall part 523b. This number of convex parts 523a is one example, and is not provided by way of limitation and may be decided as appropriate. The number of the concave parts 511g disposed in the inner walls of the casing 511 may also be decided as appropriate in accordance with the number of convex parts 523a. The convex parts 523a are formed so as to each fit into one of the two concave parts 511 g (see FIG. 25) disposed to the casing 511.

[0232] When the filter case 523 is attached to the casing 511, the convex parts 523a engage with the concave parts 511 g, and the left-surface side of the filter case 523 is placed on the support part 511f disposed to the interior of the casing 511. In other words, when the filter case 523 is attached to the casing 511, the filter case 523 is supported from below by the concave parts 511g into which the convex parts 523a are fitted, and by the support part 511 f. When the filter case 523 is attached to the casing 511, the deodorizing filter 522 is attached to the casing 511 in a horizontal state, or in other words, the deodorizing filter 522 is attached such that the vertical direction coincides with the thickness direction of the filter. The attachment of the filter case 523 to the casing 511 and detachment of the filter case 523 from the casing 511 are described hereinafter.

[0233] In the middle of the left side of the side wall part 523b of the filter case 523, a cut-out part 523ba is formed, in which the side wall part 523b is cut out (see FIG. 26). In the cut-out part 523ba, the side wall part 523b is cut out with the upper side (the top surface and upper side of the side surface) remaining (see FIG. 26). When the deodorizing filter 522 is accommodated in the filter case 523, the deodorizing filter 522 is exposed at the cut-out part 523ba.

[0234] The filter case 523 includes an air flow guide 524 disposed above the air purification filter. The air flow guide 524 is formed integrally with the filter case 523.

[0235] The air flow guide 524 is disposed above the left side of the filter case 523 (see FIG. 22). The air flow guide 524 is disposed above the first opening K1 formed in the casing 511. The air flow guide 524 has vertical surfaces 524a extending upward from the left parts of the front and back side wall parts 523b, and a first guide surface 524b extending at an upward-right slant from the side wall part 523b on the left side (see FIG. 27). The first guide surface 524b is a curved surface for guiding air that has passed through the deodorizing filter 522 of the air purification filter 520 to the humidification element 533 of the humidification unit 530. Due to the first guide surface 524b being formed from a smooth curved surface, air that has passed through the deodorizing filter 522 can be guided to the second opening K2 and further to the humidification element 533, while suppressing the increase in pressure loss. The vertical surfaces 524a of the air flow guide 524 prevent air that has passed through the deodorizing filter 522 from passing through front and rear gaps of the first guide surface 524b of the air flow guide 524, heading upward to pass through the gaps between the casing 511 and the humidification tray 532, described hereinafter, and flowing out of the casing 511. The vertical surfaces 524a and the first guide surface 524b guide primarily air that has passed through the left side of the deodorizing filter 522 to the humidification element 533.

[0236] A concave part 524d formed so as to be downwardly concave is provided in the top part of the air flow guide 524 (see FIG. 27). The concave part 524d is formed so as to be concave not only downward, but also into the area

underneath the top surface 524c on the left side of the air flow guide 524 (see FIG. 27). The concave part 524d functions as a hold for the user to grasp when attaching/detaching the filter case 523.

[0237] When the air purification filter 520 and the humidification unit 530 are attached to the casing 511, the top surface 524c (see FIGS. 26 and 27) of the air flow guide 524 is in contact with the bottom surface 532b of the humidification tray 532 of the humidification unit 530 (see FIG. 22), described hereinafter. Therefore, even if air is blown from the air-blowing device 512 and a force that would cause the air purification filter 520 to float up (move upward) is generated, the humidification tray 532 restricts the air purification filter 520 from moving upward. In other words, the bottom surface 532b of the humidification tray 532 functions as a movement-restricting part for restricting the air purification filter 520 from moving upward.

(2-5) Filter Detection Sensor

[0238] The filter detection sensor 525 (see FIG. 22) detects whether or not the air purification filter 520 is attached to the casing 511. Specifically, the filter detection sensor 525 detects whether or not the deodorizing filter 522 of the air purification filter 520 is attached to the casing 511.

[0239] The filter detection sensor 525 has primarily a detection lever 525a and a detection switch 525b (see FIGS. 28(a) and (b)). The detection lever 525a is configured to be rotatable about a rotating shaft 525c (see FIGS. 28(a) and (b)). At the end on one side, the detection lever 525a has a contact arm 525d that extends in a direction intersecting the direction in which the detection lever 525a extends, and that comes into contact with the deodorizing filter 522. A detection switch contact part 525aa that comes into contact with the detection switch 525b is disposed at the end on the other side of the detection lever 525a (the end disposed on the opposite side of the end where the contact arm 525d is provided, with the rotating shaft 525c in between). The contact arm 525d in this embodiment extends in an arcuate shape from the detection lever 525a, but this contact arm 525d is not provided by way of limitation and may be formed so as to extend perpendicular to the direction in which the detection lever 525a extends.

[0240] The detection lever 525a is configured so that force is exerted in a direction around the rotating shaft 525c by a torsion spring (not shown) (so that the detection switch contact part 525aa separates from the detection switch 525b). When the contact arm 525d is not in contact with the deodorizing filter 522 (when the deodorizing filter 522 is not accommodated in the filter case 523), the contact arm 525d passes through the cut-out part 523ba of the filter case 523 and protrudes into the filter case 523, as shown in FIG. 28(a). In this state, the detection switch contact part 525aa of the detection lever 525a is not in contact with the detection switch 525b. Therefore, when the deodorizing filter 522 is not accommodated in the filter case 523, the filter detection sensor 525 does not transmit to the control device (not shown) of the air purifier 510 the signal that is transmitted when the deodorizing filter 522 is present.

[0241] In such a state, the control device determines that the deodorizing filter 522 is not attached to the air purifier 510 and executes the necessary control, such as stopping the operation of the air purifier 510, or issuing an alarm indicating that the deodorizing filter 522 is not attached. Though illustrations or descriptions are not given here, when not only the deodorizing filter 522 but also the filter case 523 is not attached to the casing 511, the detection switch contact part 525aa is not in contact with the detection switch 525b, and the signal transmitted when the deodorizing filter 522 is present is not transmitted to the control device.

[0242] When the deodorizing filter 522 is accommodated in the filter case 523, the contact arm 525d is in contact with the deodorizing filter 522 in the cut-out part 523ba of the side wall part 523b of the filter case 523. The detection lever 525a then resists the force of the torsion spring (not shown) and rotates in a direction in which the detection switch contact part 525aa of the detection lever 525a comes into contact with the detection switch 525b. When the detection switch contact part 525aa contacts with the detection switch 525b, the detection switch 525b is turned on, and the signal to be transmitted when the deodorizing filter 522 is present is transmitted from the filter detection sensor 525 to the control device of the air purifier 510. When the control device determines that the deodorizing filter 522 is attached to the air purifier 510, the air purifier 510 is allowed to operate if there are no other abnormalities.

[0243] The filter detection sensor 525 which detects the presence of the deodorizing filter 522 is only provided to this air purifier 510 as a sensor for detecting the presence of the filter, but no limitation is provided thereby. For example, a sensor that uses the same principle as the filter detection sensor 525 or another detection principle may be provided in order to detect the presence of the dust-collecting filter 521. However, as is described hereinafter, when the dust-collecting filter 521 is not present in this air purifier 510, it becomes difficult to attach the filter case 523 accommodating the deodorizing filter 522, and it is therefore possible to also detect when the dust-collecting filter 521 is not attached, merely by detecting the presence of the deodorizing filter 522.

(2-6) Humidification unit

[0244] The humidification unit 530 vaporizes supplied water and humidifies air. Specifically, the humidification element 533 of the humidification unit 530 in particular vaporizes supplied water and humidifies air. The humidification unit 530

is disposed on the downstream side of the air-blowing device 512 and the air purification filter 520 with respect to the direction of air flow. In other words, the humidification unit 530 humidifies the air that has been purified by the air purification filter 520. The humidification unit 530 is a rotary-type humidification unit. In the humidification unit 530, the peripheral edge of the humidification element 533 is rotated so as to pass through the water accumulated in the humidification tray 532, described hereinafter, and the water is vaporized from the humidification element 533 containing the water, thereby the air is humidified.

[0245] The humidification unit 530 is disposed in the humidification chamber S3 inside the casing 511 (see FIG. 22). In other words, the humidification unit 530 is disposed in an upper position inside the casing 511 (see FIG. 22). The humidification tank 531, the humidification tray 532, and the humidification element 533, all described hereinafter, of the humidification unit 530 are detachable from the casing 511.

[0246] When the humidification tank 531, the humidification tray 532, and the humidification element 533 are detached from the opening 515 (see FIG. 22) of the casing 511, a large space is created in an upper position inside the casing 511. Specifically, when the humidification unit 530 is detached from the casing 511, a space in which the air purification filter 520 can move is formed in the humidification chamber S3. In other words, when the humidification unit 530 is detached from the casing 511, a space is formed above the air purification chamber S2, and this space serves as a movement path for the air purification filter 520 when the air purification filter 520 is detached.

[0247] The attachment/detachment of the air purification filter 520 is described hereinafter.

[0248] The humidification unit 530 has primarily the humidification tank 531, the humidification tray 532, and the humidification element 533, as shown in FIGS. 22 and 23. The humidification unit 530 also has a humidification motor 534 (see FIG. 22) for rotatably driving the humidification element 533. The humidification motor 534 is installed inside the casing 511. The humidification tank 531, the humidification tray 532, and the humidification element 533 are detachable from the casing 511.

(2-6-1) Humidification Tank

[0249] The humidification tank 531 accumulates water to be supplied to the humidification element 533. The humidification tank 531 is formed integrally with the first side plate 511 c of the casing 511. Therefore, the humidification tank 531 is configured to be detached from the humidification unit 530 (the humidification tray 532) by detaching the first side plate 511 c from the casing 511 (see FIG. 32(b)).

[0250] The humidification tank 531 is disposed on the left side of the humidification tray 532.

[0251] Because the humidification tray 532 is disposed on the left side of the casing 511, the humidification tank 531 is disposed on the left side of the casing 511.

[0252] In this air purifier 510, the fan motor 512b of the air-blowing device 512, which is a heavy object as previously described, is disposed on the right side of the casing 511 (see FIG. 22). On the other hand, the humidification tank 531, which is also a heavy object, is disposed on the left side of the casing 511 (see FIG. 22). In other words, the fan motor 512b is shifted to one side (the right) from the center of the air purification filter 520, and the humidification tank 531 is shifted to the opposite side (the left) of the aforementioned one side from the center of the air purification filter 520. The heavy fan motor 512b and humidification tank 531 are not one-sided when seen in a top view, but are separated in opposite directions each other. This air purifier 510 therefore has good weight balance.

[0253] The humidification tank 531 has a filling port 531 a. A water supply valve (not shown) is attached to the filling port 531 a. The water supply valve has a general structure in which a valve body is pushed into a valve port by a spring. Therefore, a detailed description of the water supply valve is not given here.

[0254] During use, the humidification tank 531 is disposed in a tank-receiving part 532c, described hereinafter, on the left side of the humidification tray 532. Specifically, the humidification tank 531 is mounted in the tank-receiving part 532c of the humidification tray 532 with the filling port 531 a directing downward. When the humidification tank 531 is mounted in the tank-receiving part 532c a push pin (not shown) disposed on the humidification tray 532 is pushed against the water supply valve at the filling port 531 a which is oriented downward. Due to the weight of the humidification tank 531, the water supply valve is pushed by the push pin, and the valve port is pushed and opened, and the filling port 531 a is opened. As a result, water is supplied to the humidification tray 532 described hereinafter, and the water for immersing the humidification element 533 accumulates up to a predetermined height in the humidification tray 532.

[0255] The humidification tank 531 is formed into a mostly rectangular shape as seen from the right side (see FIG. 21). The left side of the humidification tank 531 is formed into a flat-surface shape extends roughly vertically as seen from the front side (see FIG. 22). The right side of the humidification tank 531 is formed into a curved surface shape as seen from the front side (see FIG. 22). The right-side surface 531 b (see FIG. 22) of the humidification tank 531, formed into a curved surface, functions as a guide surface for guiding air that has passed through the humidification element 533 to the discharge port 511 b. Specifically, the bottom part of the right-side surface 531 b (the right-side surface bottom part 531 ba) is a curved surface that concaves to the left and downward. The right-side surface bottom part 531ba is a curved surface formed so as to rise higher toward the left (see FIG. 22).

[0256] The right-side surface bottom part 531ba is a curved surface which changes its slant so as to approach to vertical at the left side (see FIG. 22). The top part of the right-side surface 531 b (the right-side surface top part 531 bb) is a vertical surface smoothly connected to the right-side surface bottom part 531 ba (see FIG. 22). Due to being formed in such a shape, the right-side surface 531 b guides air that has passed through the humidification element 533 at a left-upward slant to the discharge port 511b in the top part of the casing 511, without causing great pressure loss.

(2-6-2) Humidification Tray

[0257] The humidification tray 532 receives and temporarily accumulates the water supplied from the humidification tank 531. Specifically, the water to be supplied to the humidification element 533, described hereinafter, is accumulated in the humidification tray 532. The second side plate 511 d of the casing 511 also serves as a left side wall of the humidification tray 532.

[0258] The humidification tray 532 is disposed below the humidification element 533 (see

[0259] FIG. 22). The humidification tray 532, as shown in FIG. 22, is formed roughly in a U-shape as seen from the side (the front in FIG. 22). The humidification tray 532 is disposed on the left side of the casing 511 (see FIG. 22). A second opening K2 is formed between the right side wall of the humidification tray 532 and the inner wall of the casing 511 (see FIG. 22).

[0260] The humidification tray 532 has a curved second guide surface 532a for guiding air that has passed through the air purification filter 520 to the humidification element 533, at the lower right-side corner of the humidification tray 532 (see FIG. 22). In other words, the humidification tray 532 has a curved second guide surface 532a for guiding air that has passed through the air purification filter 520 to the humidification element 533, at the bottom-side corner of the humidification tray 532 that is adjacent to the second opening K2 (see FIG. 22). Specifically, curved surface machining is applied on the lower right-side corner of the humidification tray 532.

[0261] The second guide surface 532a and the previously described first guide surface 524b of the air flow guide 524 form a continuous curve, with a small gap G created between the air flow guide 524 and the humidification tray 532. The bottom surface 532b of the humidification tray 532 functions as a movement-restricting part for restricting the air purification filter 520 from moving upward, when the humidification unit 530 and the air purification filter 520 have been attached inside the casing 511.

[0262] In other words, the bottom surface 532b of the humidification tray 532, as a movement-restricting part, contacts with the top surface 524c of the air flow guide 524 and restricts the air purification filter 520 from moving upward. Therefore, the gap created between the air flow guide 524 and the humidification tray 532 is extremely small. Therefore, most of the air passing through the deodorizing filter 522 and guided to the first guide surface 524b is guided through the second opening K2 to the humidification element 533. In other words, the air guided to the first guide surface 524b hardly flows through the gap between the air flow guide 524 and the humidification tray 532 and leaks out from the casing 511 through gaps such as the gaps between the casing 511 and the first side plate 511c and/or second side plate 511 d.

[0263] The humidification tray 532 has the tank-receiving part 532c for receiving the humidification tank 531 on the left side (see FIG. 23). The humidification tank 531 is disposed in the tank-receiving part 532c with the filling port 531 a oriented downward (see FIG. 22). The water supply valve at the filling port 531 a of the humidification tank 531 mounted in the tank-receiving part 532c is pushed against a push pin (not shown) disposed on the tank-receiving part 532c. Due to the weight of the humidification tank 531, the water supply valve is pushed by the push pin, the valve port is pushed open, the filling port 531 a opens, and water is supplied to the humidification tray 532.

[0264] The water supplied from the humidification tank 531 is supplied to a water supply part 532d on the right side of the humidification tray 532 (see FIG. 23). The water supply part 532d is disposed below the humidification element 533 (see FIG. 22). The water supply part 532d is a portion for supplying to the humidification element 533 the water that has been supplied from the humidification tank 531 in the tank-receiving part 532c.

[0265] The water supply part 532d and the tank-receiving part 532c are separated by a partition (not shown). A notch is formed in the partition, and water supplied from the humidification tank 531 to the tank-receiving part 532c is sent to the water supply part 532d via the notch. In other words, the water supplied to the tank-receiving part 532c disposed in the left-surface side of the casing 511 is then sent to the water supply part 532d on the right side of the casing 511. In order to immerse the humidification element 533, the water supply part 532d accumulates the water up to a predetermined water level. The water level of the water supply part 532d is automatically regulated so as to be maintained at the predetermined water level when there is water in the humidification tank 531.

[0266] The humidification tray 532 has a bearing part 532e (see FIG. 29). The bearing part 532e rotatably supports the rotor rotating shaft 533c (see FIG. 29) of the humidification element 533, described hereinafter. The bearing part 532e is configured to allow the rotor rotating shaft 533c to be removed so that the humidification element 533 can be detached during maintenance and other times.

[0267] Specifically, the bearing part 532e is formed in a U-shape opening upward, and is configured to enable the

rotor rotating shaft 533c to be attached/detached through the U-shaped opening (see FIG. 29).

[0268] One guide pin 532f each is provided to the front and rear side surfaces of the water supply part 532d of the humidification tray 532 (see FIG. 29). When the humidification tray 532 is attached to the casing 511, the humidification tray 532 is easily set in the predetermined position by pushing the humidification tray 532 into the interior of the casing 511 so that the guide pins 532f fit into C-shaped guides 511 i (see FIG. 29), disposed on the front and back inner walls of the casing 511, through the C-shaped openings.

(2-6-3) Humidification Element

[0269] The humidification element 533 vaporizes supplied water and humidifies air. Specifically, the humidification element 533 receives the supply of water accumulated in the humidification tray 532, vaporizes the supplied water, and humidifies the air.

[0270] The humidification element 533 is disposed on the right side of the humidification tray 532. Specifically, the humidification element 533 is disposed above the water supply part 532d disposed on the right side of the humidification tray 532.

[0271] The humidification element 533 is formed into a circular shape. The humidification element 533 has primarily a humidification filter 533a, a humidification rotor 533b, and the rotor rotating shaft 533c (see FIG. 29).

[0272] The humidification filter 533a is a vaporizing material made from a nonwoven fabric.

[0273] The humidification filter 533a is formed into a circular shape. The humidification filter 533a contains water supplied from the humidification tray 532, and humidifies the air by vaporizing the water.

[0274] The humidification rotor 533b is a frame that encloses the outer peripheral edge of the humidification filter 533a and holds the humidification filter 533a. The humidification rotor 533b is linked with a rotor rotating shaft 533c disposed in the center of the humidification rotor 533b.

[0275] One side (the left side) of the rotor rotating shaft 533c is rotatably supported by the bearing part 532e disposed to the humidification tray 532. A hexagonal linking part 533d is formed in the other side (the right side). Further, a distal end part 533e that is continuous with the linking part 533d and formed so as to taper toward the end is formed at the end on the right side.

[0276] When the humidification tray 532 is attached to the casing 511, the rotor rotating shaft 533c is inserted from the distal end part 533e side into a hole 534ba in a link-receiving part 534b of the humidification motor 534, described hereinafter (see FIG. 29). The rotor rotating shaft 533c is then inserted through the hole 534ba until the linking part 533d reaches the link-receiving part 534b, whereby the linking part 533d and the link-receiving part 534b are linked together. Specifically, the hole 534ba in the link-receiving part 534b is a hexagonal hole substantially the same as the outer contours of the linking part 533d. When the linking part 533d is inserted into the hole 534ba formed in the link-receiving part 534b, the linking part 533d fit into the link-receiving part 534b and the two are linked together. When the link-receiving part 534b and the linking part 533d are linked together, the rotor rotating shaft 533c and a drive shaft 534a of the humidification motor 534, described hereinafter, are linked together. When the humidification motor 534 is then driven and the drive shaft 534a rotates, the rotor rotating shaft 533c also rotates. Because the linking part 533d and the hole 534ba of the link-receiving part 534b are formed into hexagonal shapes in this embodiment, the link-receiving part 534b rotates without idling relative to the linking part 533d when the drive shaft 534a rotates.

[0277] Because the rotor rotating shaft 533c has the distal end part 533e which is formed so as to taper towards the end in this embodiment, the distal end part 533e functions as a guide, and it is easy to insert the rotor rotating shaft 533c into the hole 534ba in the link-receiving part 534b.

[0278] When rotational drive force is transmitted to the rotor rotating shaft 533c from the humidification motor 534, described hereinafter, and the humidification element 533 rotates, the peripheral edge of the humidification filter 533a of the humidification element 533 passes through the water accumulated in the water supply part 532d of the humidification tray 532. When the peripheral edge of the humidification filter 533a passes through the water accumulated in the water supply part 532d of the humidification tray 532, the humidification filter 533a receives the supply of water from the water supply part 532d. When the humidification element 533 rotates, air blown by the air-blowing device 512 (air that has passed through the air purification filter 520) is supplied to the portion of the humidification filter 533a that has moved above the water supply part 532d. When the air passes through the humidification filter 533a, the water contained in the humidification filter 533a vaporizes, and the air is thereby humidified.

(2-6-4) Humidification Motor

[0279] The humidification motor 534 is a motor for rotatably driving the humidification element 533.

[0280] The humidification motor 534 is installed inside the casing 511. Specifically, the humidification motor 534 is secured to the casing 511 in the right side of the humidification unit 530.

[0281] The humidification motor 534 is configured so as to transmit drive force to the drive shaft 534a (see FIG. 22).

When the humidification motor 534 rotates, the drive shaft 534a rotates.

[0282] The drive shaft 534a has the link-receiving part 534b on the left side (see FIG. 22).

[0283] The hexagonal hole 534ba is formed in the link-receiving part 534b (see FIG. 29).

[0284] The shape of the hole 534ba is substantially the same as the cross-sectional shape of the rotor rotating shaft 533c. The hole 534ba is formed into a hexagonal shape slightly larger than the cross-sectional shape of the linking part 533d of the rotor rotating shaft 533c, so that the linking part 533d can be inserted. As previously described, the drive shaft 534a and the rotor rotating shaft 533c are linked together by inserting the linking part 533d of the rotor rotating shaft 533c into the hole 534ba.

(3) Actions of Air Purifier and Flow of Air

[0285] The actions of the air purifier 510 and the air flow caused by the actions of the air purifier 510 will be described below with reference to FIGS. 30 and 31. In FIGS. 30 and 31, the flow of air is indicated by one-dot-chain-line arrows.

[0286] When the air purifier 510 is turned on, the fan motor 512b of the air-blowing device 512 rotates the fan 512a. Because the rotating fan 512a blows air out in the centrifugal direction, the pressure surrounding the rotational axis of the fan 512a drops, and air is drawn into a fan intake port positioned in the center of the fan 512a.

[0287] As a result, a flow of air is produced from the intake ports 511 a toward the fan intake port positioned in the center of the fan 512a. In other words, due to the rotation of the fan 512a, air is drawn into the air-blowing chamber S1 from the intake ports 511 a formed in the bottom parts of the left and right surfaces. At this time, comparatively large dust particles are removed with the pre-filters 511ac disposed in the intake ports 511 a.

[0288] Air is blown out in the centrifugal direction from the plurality of vanes 512ab (see FIG. 24) of the fan 512a of the air-blowing device 512. This air blown out in the centrifugal direction is guided to the first opening K1 by the scroll casing 512c, and sent from the first opening K1 into the air purification chamber S2 (see FIG. 30).

[0289] The air sent to the air purification chamber S2 first passes through the dust-collecting filter 521 of the air purification filter 520, disposed on the upstream side with respect to the direction of air flow. The dust-collecting filter 521 removes dust contained in the air.

[0290] Having passed through the dust-collecting filter 521, the air further passes through the deodorizing filter 522 on the downstream side with respect to the direction of air flow. Components that cause odors are removed by the deodorizing filter 522.

[0291] The air that has passed through the air purification filter 520 is then sent through the second opening K2 to the humidifying chamber S3. At this time, particularly, the air that has passed through the left side of the deodorizing filter 522 is smoothly guided to the second opening K2 by the first guide surface 524b of the air flow guide 524 and the second guide surface 532a formed in the bottom part of the humidification tray 532 (see FIG. 30). As described above, because the top surface 524c of the air flow guide 524 and the bottom surface 532b of the humidification tray 532 are in contact relationship, there is virtually no gap formed between the air flow guide 524 and the humidification tray 532. Air hardly passes through this gap, passes through the gap between the opening of the casing 511 and the first side plate 511c and/or second side plate 511d, and escapes from the casing 511. The first guide surface 524b and the second guide surface 532a form a continuous curve with a slight gap G in between, and air is smoothly guided along this curve to the second opening K2 (see FIG. 30).

[0292] The air sent to the humidifying chamber S3 flows upward, and this air is guided to the humidification element 533 by the straightening plate 511 h disposed in the upper area of the casing 511. Because bypass openings 511 ha are formed at two locations in the straightening plate 511 h (see FIG. 31), some of the air (for example, 20% of the air that has flowed into the humidifying chamber S3) passes through the bypass openings 511 ha and is guided out of the casing 511 without passing through the humidification element 533 (see FIG. 31). The ion generator 540 is disposed on the surface of the straightening plate 511 h on the side opposite the humidifying chamber S3, and plasma ions generated by the ion generator 540 are carried out of the casing 511 along with the air passing through the bypass openings 511 ha.

[0293] When the humidifying function of the air purifier 510 is functioning, the humidification element 533 is rotated by the humidification motor 534. Because the humidification element 533 is disposed so that the bottom part of the humidification element 533 is immersed in the water in the water supply part 532d of the humidification tray 532, when the humidification element 533 rotates, the portion of the humidification filter 533a that is newly immersed in the water draws up the water in the humidification tray 532. The air passing through the humidification element 533 facilitates vaporization of the water soaked into the humidification filter 533a. The air thereby becomes humidified air.

[0294] The air that has passed through the humidification element 533 and been humidified, flows in left-upward direction and changes its flow direction to vertical upward with the right-side surface 531 b of the humidification tank 531 functioning as a guide surface, and the air is blown out from the discharge port 511 b (see FIG. 30).

[0295] A case in which the humidifying function is turned on is described above. When the humidifying function is turned off, the humidification element 533 does not rotate, and air passing through the humidification element 533 is

blown out through the discharge port 511 b, mostly without being humidified.

(4) Detachment of the Humidification Unit and Air Purification Filter

[0296] Next, the detachment of the humidification unit 530 and the air purification filter 520 is described, primarily with reference to FIGS. 32 and 33. FIG. 32 illustrates the detachment work, in which the humidification unit 530 and the air purification filter 520 are detached from the casing 511. In FIG. 32, cross-sectional views of the interior of the casing 511 as seen from the front are used to illustrate the detachment work of the humidification unit 530 and the air purification filter 520. FIG. 33 illustrates detachment work in which the humidification unit 530 is detached from the casing 511. In FIG. 33, perspective views of the casing 511 as seen from the front left are used to illustrate the detachment work of the humidification unit 530.

[0297] FIGS. 32(a) and 33(a) show the air purifier 510 before the detachment work of the humidification unit 530 and the air purification filter 520 is started.

[0298] When the humidification unit 530 and the air purification filter 520 are detached, first, the user grasps the handle 511 ca of the first side plate 511 c, and opens the first side plate 511 c so that the top part of the first side plate 511 c leans to the left as shown in FIGS. 32(b) and 33(b). The humidification tank 531, which is formed integrally with the first side plate 511c, is then detached from the casing 511 by pulling out the humidification tank 531 at a left-upward slant (see FIGS. 32(b) and 33(c)).

[0299] Next, the humidification tray 532 is detached from the casing 511 as shown in FIGS. 32(c) and 33(d). Specifically, the user grasps the handle 511 da disposed on the second side plate 511 d which constitute part of the humidification tray 532, and pulls the humidification tray 532 forward (to the left). At this time, the linking part 533d of the rotor rotating shaft 533c of the humidification element 533 is detached from the link-receiving part 534b provided to the drive shaft 534a linked to the humidification motor 534. In this embodiment, because the linking part 533d is merely inserted into the hole 534ba of the link-receiving part 534b and not particularly secured by a securing member (e.g., a screw or the like), the linking part 533d can be easily pulled out of the hole 534ba (see FIG. 29). Additionally, because the guide pins 532f disposed on the side surface of the humidification tray 532 move along the guides 511 i formed in the inner surface of the casing 511 in this embodiment, the user can pull the humidification tray 532 out horizontally to the left (see FIG. 29).

[0300] Thus, the humidification tray 532 in which the humidification element 533 is mounted in the bearing part 532e is detached from the casing 511, whereby the opening 515 in the left of the casing 511 is opened wide (see FIGS. 32(d) and 33(d)). A large space is formed in the upper interior of the casing 511 when the humidification tray 532 has been detached. In other words, detachment of the humidification tray 532 and the humidification element 533 from the casing 511 ensures a space in which the air purification filter 520 can be moved in the humidifying chamber S3.

[0301] After this step, the deodorizing filter 522 of the air purification filter 520 is firstly detached from the casing 511 as shown in FIG. 32(d). Specifically, the user grasps the concave part 524d in the top surface of the air flow guide 524 formed integrally with the filter case 523, lifts the filter case 523 up from the support part 511f of the casing 511, and pulls the convex parts 523a disposed on the right surface of the filter case 523 out from the concave parts 511g of the casing 511. Next, after having moved the filter case 523 in the thickness direction of the deodorizing filter 522 (upward) while grasping the concave part 524d, the user moves the filter case 523 through the humidifying chamber S3 and detaches the filter case 523 from the interior of the casing 511. In other words, the deodorizing filter 522 is pulled up on the downstream side with respect to the direction of air flow, and is then taken out of the casing 511 through the opening 515.

[0302] Finally, the dust-collecting filter 521 of the air purification filter 520 is detached from the casing 511 as shown in FIG. 32(e). Specifically, after the user lifts the dust-collecting filter 521 up from the flange part 511e of the casing 511 and moves the dust-collecting filter 521 in its own thickness direction (upward), the user moves the dust-collecting filter 521 through the humidifying chamber S3 and detaches the dust-collecting filter 521 from the casing 511. In other words, the dust-collecting filter 521 is pulled up on the downstream side with respect to the direction of air flow, and is then taken out of the casing 511 via the opening 515.

(5) Attachment of Humidification Unit and Air Purification Filter

[0303] Next, the attachment of the humidification unit 530 and the air purification filter 520 is described. When the drawings of FIGS. 32 and 33 are seen in reversing order, they illustrate the attachment work of the humidification unit 530 and the air purification filter 520. Drawings illustrating the states of the attachment work of the humidification unit 530 and the air purification filter 520 are therefore omitted.

[0304] The attachment of the humidification unit 530 and the air purification filter 520 is described on the basis of the state of the air purification filter 520 and the humidification unit 530 having been fully detached.

[0305] First, the dust-collecting filter 521 of the air purification filter 520 is attached inside the casing 511. Specifically, the user inserts the dust-collecting filter 521 into the humidifying chamber S3 through the opening 515, then moves the

dust-collecting filter 521 downward and places the dust-collecting filter 521 on the flange part 511e of the casing 511 (see FIGS. 32(d) and (e)).

[0306] Next, the user attaches the deodorizing filter 522 accommodated in the filter case 523 to the casing 511, above the dust-collecting filter 521.

[0307] Specifically, the user grasps the concave part 524d of the air flow guide 524 formed integrally with the filter case 523, and inserts the filter case 523 into the humidifying chamber S3 through the opening 515 with the right side lowered. Then, while sliding the right side of the bottom surface of the filter case 523 over the top surface 521 bb (see FIG. 32(d)) of the peripheral edge part 521 b (see FIG. 25) of the dust-collecting filter 521, the user moves the filter case 523 from the left side toward the right side. At this time, the user moves the filter case 523 from the left side toward the right side while gradually lowering the left side of the filter case 523 downward.

[0308] The filter case 523 is moved to the right over the dust-collecting filter 521 until the convex parts 523a formed in the filter case 523 fit into the concave parts 511g provided on the casing 511. With the convex parts 523a fitted into the concave parts 511 g, the left side of the filter case 523 can be lowered and placed on the support part 511 f. Without the convex parts 523a fitted into the concave parts 511 g, the left side of the filter case 523 interferes with the inner surface of the casing 511 and the filter case 523 cannot be accommodated in the casing 511.

[0309] Should an attempt be made to attach the filter case 523 without having attached the dust-collecting filter 521, there is no structure to support the filter case 523 on the lower side, nor is there a structure to guide the convex parts 523a of the filter case 523 to the concave parts 511 g. Therefore, when an attempt is made to attach the filter case 523 with the dust-collecting filter 521 still unattached, the right side of the filter case 523 easily falls down as shown in FIG. 34, and it is difficult to attach the filter case 523 in the correct position.

[0310] When the deodorizing filter 522 accommodated in the filter case 523 is attached to the casing 511, i.e., when the convex parts 523a of the filter case 523 are fitted into the concave parts 511g of the casing 511 and the left side of the filter case 523 is supported on the support part 511 f, the filter case 523 is in a state of contact with the top surface 521 bb (see FIG. 21) of the peripheral edge part 521 b (see FIG. 25) of the dust-collecting filter 521. Furthermore, as is described hereinafter, when the humidification tray 532 and the humidification tank 531 are attached to the casing 511, the bottom surface 532b of the humidification tray 532 is in a state of contact with the top surface 524c of the air flow guide 524 formed integrally with the filter case 523. Because the filter case 523 is restricted from moving upward by the humidification tray 532 and the humidification tank 531 and the filter case 523 is in a state of contact with the top surface 521 bb of the peripheral edge part 521 b of the dust-collecting filter 521, the dust-collecting filter 521 is prevented from moving upward even if the flow of air exerts a force that would cause the dust-collecting filter 521 to float up.

[0311] After the attachment of the air purification filter 520 is completed, the humidification tray 532 is attached to the casing 511 (see FIGS. 32(c) and 33(d)). Specifically, the user grasps the handle 511 da disposed on the second side plate 511 d constituting part of the humidification tray 532 and moves the humidification tray 532 horizontally to the right, so that the guide pins 532f disposed on the humidification tray 532 fit into the guides 511i disposed to the front and rear inner walls of the casing 511, and the distal end part 533e of the rotor rotating shaft 533c of the humidification element 533 is inserted into the hole 534ba of the link-receiving part 534b of the drive shaft 534a linked with the humidification motor 534 (see FIG. 29). In this embodiment, as the guides 511i and the link-receiving part 534b function as guides, it is easy to move the humidification tray 532 horizontally. When the linking part 533d is inserted into the hole 534ba, and the orientation of the hexagonal shape of the linking part 533d and the orientation of the hexagonal hole 534ba do not coincide, the humidification element 533 rotates so that the orientation of the hexagonal shape of the linking part 533d and the orientation of the hexagonal hole 534ba come to coincide, whereby the linking part 533d and the link-receiving part 534b are linked together.

[0312] With the humidification tray 532 attached to the casing 511, the bottom surface 532b of the humidification tray 532 is in a state of contact with the top surface 524c of the air flow guide 524 formed integrally with the filter case 523. Because the humidification tray 532 and the top surface 524c of the air flow guide 524 are in a state of contact, the air purification filter 520 is prevented from moving upward even if the flow of air exerts a force that would cause the air purification filter 520 to float up. In other words, in this embodiment, the bottom surface 532b of the humidification tray 532 functions as a movement-restricting part for restricting the air purification filter 520 from moving upward.

[0313] Finally, the user grasps the handle 511 ca of the first side plate 511 c, and causes the bottom side of the first side plate 511 c formed integrally with the humidification tank 531 to engage with the top side of the second side plate 511 d, with the top part of the first side plate 511c leaning to the left (see FIGS. 32(b) and 33(b)). The first side plate 511c is then stood upright so as to be vertical, thereby the opening 515 of the casing 511 is closed (see FIGS. 32(a) and 33(a)).

(6) Characteristics

(6-1)

[0314] The air purifier 510 according to the above embodiment is provided with the air purification filter 520, the humidification unit 530, the fan 512a, and the casing 511.

[0315] The air purification filter 520 removes dust contained in air. The humidification unit 530 vaporizes supplied water and humidifies the air. The air-blowing device 512 blows air toward the air purification filter 520 and the humidification unit 530. Specifically, the air-blowing device 512 blows air to the air purification filter 520 and a humidification filter 533a. The casing 511 accommodates the humidification unit 530, the air purification filter 520, and the fan 512a. The casing 511 has an opening 515 for attaching/detaching the humidification unit 530. The humidification unit 530 is disposed in alignment with the air purification filter 520 on the downstream side with respect to the direction in which the air purification filter 520 is detached. The opening 515 enables the air purification filter 520 to be detached after the humidification unit 530 has been detached.

[0316] In the air purifier 510 according to the above embodiment, the opening 515 for attaching/detaching the humidification unit 530 is also used as an opening 515 for attaching/detaching the air purification filter 520. Specifically, the humidification unit 530 is disposed on the downstream side of the air purification filter 520 with respect to the direction in which the air purification filter 520 is detached. After the humidification unit 530 has been detached via the opening 515, the air purification filter 520 can be detached from the casing 511 via the same opening 515. In other words, a single opening 515 can be used to attach/detach both the humidification unit 530 and the air purification filter 520. As a result, the number of openings can be minimized and a high airtightness can be achieved in the casing 511. Because there is no need to provide a plurality of openings or doors, the number of manufacturing steps can also be reduced.

(6-2)

[0317] In the air purifier 510 according to the above embodiment, the direction in which the air purification filter 520 is detached is the thickness direction of the air purification filter 520. In other words, in this embodiment, the direction in which the air purification filter 520 is detached is vertical.

[0318] In the air purifier 510 according to the above embodiment, the air purification filter 520 is detached in the thickness direction of the air purification filter 520. Therefore, the abrasion of air purification filter 520 and the casing 511 (the abrasion of the sealing member when a sealing member is placed between the air purification filter 520 and the casing 511) is less likely generated than in a case where the air purification filter 520 is pulled out horizontally from the casing 511. As a result, predetermined airtightness can be ensured for a long period of time.

[0319] In the air purification filter 510 according to the above embodiment, the large space formed after the humidification unit 530 is detached can be utilized to detach the air purification filter 520. The air purification filter 520 can thereby be easily detached.

(6-3)

[0320] The air purifier 510 according to the above embodiment is provided with, on the upstream side of the air purification filter 520 with respect to the detachment direction, a flange part 511 e as a sealing means for sealing the gap between the air purification filter 520 and the casing 511.

[0321] Specifically, the air purification filter 520 is placed on the flange part 511 e formed on the inner side of the casing 511. The air purification filter 520 can thereby be stably held relative to the casing 511. A sealing material may be disposed between the air purification filter 520 and the casing 511.

(6-4)

[0322] In the air purifier 510 according to the above embodiment, the humidification unit 530 includes the humidification tank 531 for accumulating the water, the tray 532 for receiving the water from the humidification tank 531, and the humidification filter 533a which contains the water supplied from the humidification tray 532 and humidifies the air by vaporizing the water.

[0323] When the humidification tank 531, the humidification tray 532, and the humidification element 533 of the humidification unit 530 are detached from the casing 511, a large space is formed in the casing 511, above the air purification filter 520. Therefore, sufficient space for detaching the air purification filter 520 can be ensured during maintenance on the air purifier 510. Further, the air purification filter 520 can be pressed by the humidification unit 530 when the air purifier 510 is in operation. The stability of the air purification filter 520 can thereby be ensured.

(6-5)

[0324] In the air purifier 510 according to the above embodiment, the humidification unit 530 is disposed above the air purification filter 520 in the casing 511. The humidification unit 530 has the bottom surface 532b of the humidification tray 532 as a movement-restricting part. The bottom surface 532b of the humidification tray 532 restricts the air purification filter 520 from moving upward when the humidification unit 530 and the air purification filter 520 are attached inside the casing 511.

[0325] In this embodiment, because the humidification unit 530 restricts the air purification filter 520 from moving upward, the air purification filter 520 can be prevented from floating up with a simple configuration, without providing a dedicated member for restricting the air purification filter 520 from moving. Further, the number of components can be kept lower than in cases where a dedicated member for restricting movement is provided.

(6-6)

[0326] The air purifier 510 according to the above embodiment is provided with the filter case 523 for accommodating the air purification filter 520, or specifically for accommodating the deodorizing filter 522 of the air purification filter 520. The filter case 523 includes an air flow guide 524 for guiding air that has passed through the air purification filter 520 to the humidification unit 530. The bottom surface 532b of the humidification tray 532 is in contact with the top part of the air flow guide 524 (the top surface 524c of the air flow guide 524).

[0327] In this embodiment, the air purification filter 520 is restricted from moving upward since the bottom surface 532b of the humidification unit 532 contacts with the top surface 524c of the air flow guide 524 of the filter case 523. The air purification filter 520 can therefore be prevented from floating up with a simple configuration. Since the air flow guide 524 is in a contact relationship with the bottom surface 532b of the humidification tray 532, air hardly pass between the air flow guide 524 and the bottom surface 532b of the humidification tray 532. It can therefore be prevented air that has passed through the air purification filter 520 from being guided to an unintended route.

(6-7)

[0328] In the air purifier 510 according to the above embodiment, the air purification filter 520 includes the deodorizing filter 522 as an example of a first filter, and the dust-collecting filter 521 as an example of a second filter. The dust-collecting filter 521 is disposed below the deodorizing filter 522. The filter case 523 accommodates the deodorizing filter 522. The filter case 523 slides over the top surface 521 bb of the peripheral edge part 521 b of the dust-collecting filter 521 when the deodorizing filter 522 accommodated in the filter case 523 is attached to the casing 511. The filter case 523 is in contact with the top surface 521 bb of the peripheral edge part 521 b of the dust-collecting filter 521 after the deodorizing filter 522 accommodated in the filter case 523 has been attached to the casing 511.

[0329] Because this embodiment is configured so that the filter case 523 accommodating the deodorizing filter 522 slides over the top surface 521 bb of the peripheral edge part 521 b of the dust-collecting filter 521 when the deodorizing filter 522 is attached to the casing 511, the deodorizing filter 522 is easily attached to the casing 511. Further, because the filter case 523 contacts with the top surface 521 bb of the peripheral edge part 521 b of the dust-collecting filter 521 after the deodorizing filter 522 has been attached, the dust-collecting filter 521 can be restricted from moving upward.

(6-8)

[0330] In the air purifier 510 according to the above embodiment, convex parts 523a as an example of case-side convex parts are formed on the filter case 523. The concave parts 511g as an example of casing-side concave parts, which fit with the convex parts 523a formed on the filter case 523 when the deodorizing filter 522 accommodated in the filter case 523 is attached to the casing 511, are formed on the casing 511.

[0331] In this embodiment, because the convex parts 523a are provided to the filter case 523 and the concave parts 511 g into which the convex parts 523a fit are provided to the casing 511, the deodorizing filter 522 accommodated in the filter case 523 is easily attached in a predetermined position.

[0332] When the filter case 523 slides over the top surface 521 bb of the peripheral edge part 521 b of the dust-collecting filter 521, or in other words, when the filter case 523 is guided by the top surface 521 bb of the peripheral edge part 521 b of the dust-collecting filter 521, the convex parts 523a and concave parts 511g are easily fitted together. However, when there is no dust-collecting filter 521 (when the filter case 523 cannot be slid over the top surface 521 bb of the peripheral edge part 521 b of the dust-collecting filter 521), it is difficult to positionally align the convex parts 523a and concave parts 511 g and fit them together. In other words, in this embodiment, when the dust-collecting filter 521 is not present, it is difficult to attach the deodorizing filter 522. Therefore, it is easy to prevent mishaps of forgetting to attach the dust-collecting filter 521.

(6-9)

[0333] The air purifier 510 according to the above embodiment is provided with the filter detection sensor 525 for detecting whether or not the deodorizing filter 522 is attached to the casing 511.

[0334] In this embodiment, mishaps of forgetting to attach the deodorizing filter 522 can be prevented due to the filter detection sensor 525 being provided.

[0335] Because the air purifier 510 is configured so that it is difficult to attach the deodorizing filter 522 when the dust-collecting filter 521 is not present, it is possible to detect mishaps of forgetting to attach the entire air purification filter 520 merely by detecting whether or not the deodorizing filter 522 is present.

(7) Modifications

[0336] The configuration of the air purifier 510 of the second embodiment may be combined, as appropriate, with the configuration of the air purifier 10 of the first embodiment or the specifics of the modifications of the first embodiment, as long as there are no contradictions.

[0337] Modifications of the air purifier 510 of the second embodiment are presented below. The following modifications may be applied to the air purifier 10 of the first embodiment as long as there are no contradictions.

(7-1) Modification 2A

[0338] In the above embodiment, the bottom surface 532b of the humidification tray 532 functions as a movement-restricting part for restricting the air purification filter 520 from moving upward, but no limitation is provided thereby. For example, the humidification unit 530 may have a movement-restricting part formed so as to protrude downward from the humidification tray 532. However, when the movement of the air purification filter 520 is restricted by the bottom surface 532b of the humidification tray 532, the movement of the air purification filter 520 can be restricted with a simple structure.

(7-2) Modification 2B

[0339] In the above embodiment, the bottom surface 532b of the humidification tray 532, one example of a movement-restricting part, is in contact with the air flow guide 524 of the filter case 523, but no limitation is provided thereby. For example, the bottom surface 532b of the humidification tray 532 may restrict the air purification filter 520 from moving upward by being in contact with a portion of the filter case 523 other than the air flow guide 524.

[0340] For example, the filter case 523 may not have an air flow guide 524, and the bottom surface 532b of the humidification tray 532 may restrict the air purification filter 520 from moving upward by being in contact with the filter case 523 having no air flow guide 524. However, it is preferable to provide the air flow guide 524 because providing the air flow guide 524 makes it possible for air that has passed through the deodorizing filter 522 to be guided to the humidification unit 530 with less pressure loss.

(7-3) Modification 2C

[0341] In the above embodiment, the air flow guide 524 is formed integrally with the filter case 523, but no limitation is provided thereby. For example, the air flow guide 524 may be provided to the bottom surface 532b of the humidification tray 532. In this case, the air purification filter 520 may be restricted from moving upward by making the air flow guide 524 to function as a movement-restricting part and bringing the bottom part of the air flow guide 524 and the top part of the filter case 523 into contact.

[0342] However, when the air flow guide 524 is disposed to the bottom surface of the humidification tray 532, the opening 515 of the casing 511 need to be formed larger. It is therefore preferable for the air flow guide 524 to be formed integrally with the filter case 523.

(7-4) Modification 2D

[0343] In the above embodiment, the deodorizing filter 522 is included in the air purification filter 520, but no limitation is provided thereby. The air purification filter 520 may have only the dust-collecting filter 521. In this case, the dust-collecting filter 521 may be configured so as to be accommodated in the filter case 523. The bottom surface 532b of the humidification tray 532 may restrict the air purification filter 520 from moving upward by coming into contact with the top part of the air flow guide 524 contained in the filter case 523 accommodating the dust-collecting filter 521.

(7-5) Modification 2E

[0344] In the above embodiment, the air purification filter 520 includes the dust-collecting filter 521 and the deodorizing filter 522, but no limitation is provided thereby, and the air purification filter may be configured to include another filter.

(7-6) Modification 2F

[0345] The configuration of the filter detection sensor 525 of the above embodiment is merely one example, and a sensor that applies another principle may be used as the filter detection sensor.

(7-7) Modification 2G

[0346] In the above embodiment, the convex parts 523a are provided to the filter case 523 and the concave parts 511g are provided to the casing 511, and the convex parts 523a fit into the concave parts 511 g, but no limitation is provided thereby.

[0347] For example, as illustrated in FIG. 35, concave parts 523c as an example of case-side concave parts may be provided to the filter case 523, convex parts 511j as an example of casing-side convex parts may be provided to the casing 511, and the convex parts 511j of the casing 511 may be fitted into the concave parts 523c of the filter case 523.

(7-8) Modification 2H

[0348] In the above embodiment, the humidification unit 530 uses a system in which the humidification filter 533a of the humidification element 533 is immersed in the water in the water supply part 532d of the humidification tray 532, but no limitation is provided thereby.

[0349] For example, a humidification rotor dipper system may be employed in the humidification unit 530.

[0350] Specifically, in a humidification unit 530 using a humidification rotor dipper system, a plurality of dippers 533ba are arranged to the humidification rotor 533b of the humidification element 533 (see FIG. 36). In the humidification rotor dipper system, the humidification filter 533a is not immersed directly in the water, and when the humidification rotor 533b rotates, the dippers 533ba scoop up the water in the water supply part 532d of the humidification tray 532. The humidification rotor 533b further rotates and when the dippers 533ba move near to the highest position, the dippers 533ba drop the water onto the humidification filter 533a, whereby water is supplied to the humidification filter 533a.

INDUSTRIAL APPLICABILITY

[0351] The air purifier according to the present invention is useful as an air purifier in which airtightness in a casing is easily ensured.

REFERENCE SIGNS LIST

[0352]

10, 100, 200, 300, 400, 510	Air purifier
11, 511	Casing
11a, 511a	Intake port
11b, 511b	Discharge port
11c	Door
11ca	Handle
11d, 511e	Flange (Sealing means)
11e	Sealing member (Sealing means)
12, 512	Air-blowing device
12a, 512a	Fan (air-blowing fan)
12b, 512b	Fan motor
12aa, 512aa	Hub part
12ab, 512ab	Vane
15, 515	Opening
20, 520	Air purification filter
30, 530	Humidification unit
31	Tank

	32	Tray
	32a, 532c	Tank-receiving part
	32b, 532d	Water supply part
	32c, 532e	Bearing part
5	32d, 511	da Handle
	33, 533	Humidification element
	33a, 533a	Humidification filter
	33b, 533b	Humidification rotor
	33c	Water-drawing part
10	33d, 533c	Rotor rotating shaft
	33e	First drive part
	33ea	Drive gear
	33eb	Driven gear
	33f	Second drive part
15	33fa	Driven gear
	33fb	Driven gear
	35	Drive motor
	511c	First side plate
	511ca	Handle
20	511g	Concave part (Casing-side concave part)
	511j	Convex part (Casing-side convex part)
	521	Dust-collecting filter (Second filter)
	521bb	Top surface (Top surface of second filter)
	522	Deodorizing filter (First filter)
25	523	Filter case
	523a	Convex part (Case-side convex part)
	523c	Concave part (Case-side concave part)
	524	Air flow guide
	525	Filter detection sensor
30	531	Humidification tank (Tank)
	532	Humidification tray (Tray)
	532b	Bottom surface (Movement restriction part)
	534	Humidification motor
	R1, S1	Air-blowing chamber
35	R2, S2	Air purification chamber
	R3, S3	Humidification chamber

CITATION LIST

40 PATENT LITERATURE

[0353] [Patent Literature 1] Japanese Laid-open Patent Application No. 2000-283545

45 **Claims**

1. An air purifier (10, 510), comprising:

- 50 an air purification filter (20, 520) configured to remove dust contained in air;
 a humidification unit (30, 530) configured to vaporize water supplied and humidify the air;
 an air-blowing fan (12a, 512a) configured to blow air to the air purification filter and the humidification unit; and
 a casing (11, 511) accommodating the humidification unit, the air purification filter and the air-blowing fan, and
 an opening (15, 515) being formed on the casing to attach/detach the humidification unit,
- 55 the humidification unit being disposed in alignment with the air purification filter on a downstream side of the air
 purification filter with respect to a detachment direction in which the air purification filter is detached, and
 the casing being configured such that the opening allows the air purification filter to be detached after the humidifi-
 cation unit has been detached.

2. The air purifier according to claim 1, wherein

the detachment direction is the thickness direction of the air purification filter.

3. The air purifier according to claim 1 or 2, further comprising

a sealing means (11d, 11e, 511e) arranged on an upstream side of the air purification filter with respect to the detachment direction and configured to seal a gap between the air purification filter and the casing.

4. The air purifier according to any of claims 1 to 3, wherein

the humidification unit includes:

a tank (31, 531) configured to accumulate the water;

a tray (32, 532) configured to receive the water from the tank; and

a humidification filter (33a, 533a) configured to contain the water supplied from the tray and humidify the air by vaporizing the water.

5. The air purifier (510) according to any of claims 1 to 3, wherein

the humidification unit (530) is disposed above the air purification filter (520) in the casing (511), and the humidification unit has a movement restriction part (532b) configured to restrict the air purification filter from moving upward when the humidification unit and the air purification filter are attached in the casing.

6. The air purifier according to claim 5, further comprising

a filter case (523) accommodating at least part of the air purification filter, wherein

the filter case includes an air flow guide (524) configured to guide the air that has passed through the air purification filter to the humidification unit, and

the movement restriction part is configured to be in contact with a top part of the air flow guide.

7. The air purifier according to claim 6, wherein

the air purification filter includes a first filter (522) and a second filter (521) disposed below the first filter,

the filter case accommodating the first filter,

the filter case is configured to slide over a top surface (521 bb) of the second filter when the first filter accommodated in the filter case is attached to the casing, and

the filter case is configured to be in contact with the top surface of the second filter after the first filter accommodated in the filter case has been attached to the casing.

8. The air purifier according to claim 7, wherein

a case-side convex part (523a) or a case-side concave part (523c) is formed on the filter case (523), and

a casing-side concave part (511g) or a casing-side convex part (511j), which is configured to fit with the case-side convex part or the case-side concave part formed on the filter case when the first filter accommodated in the filter case is attached to the casing, are formed on the casing (523).

9. The air purifier according to claim 8, further comprising

a filter detection sensor (525) configured to detect whether or not the first filter is attached to the casing.

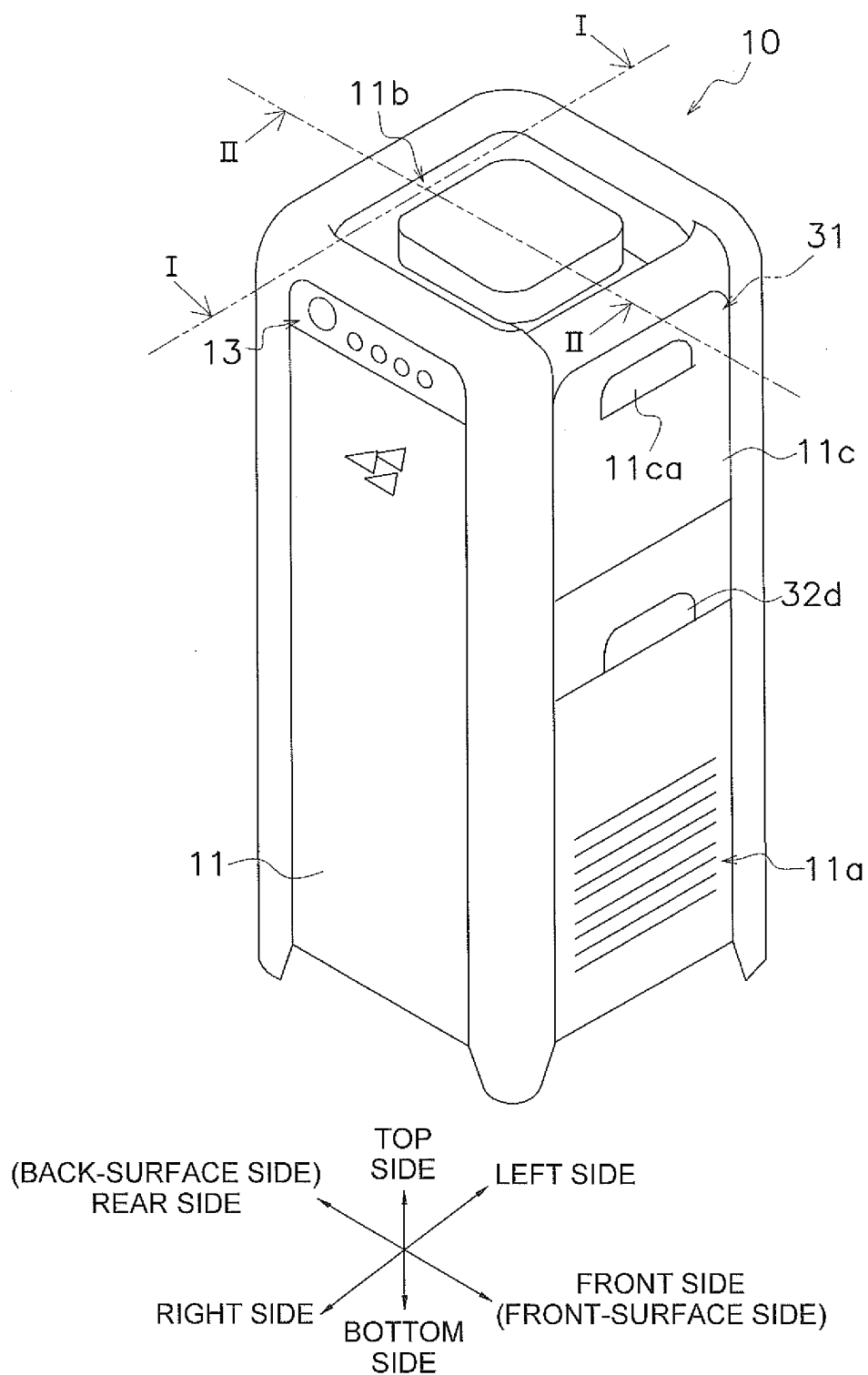


FIG. 1

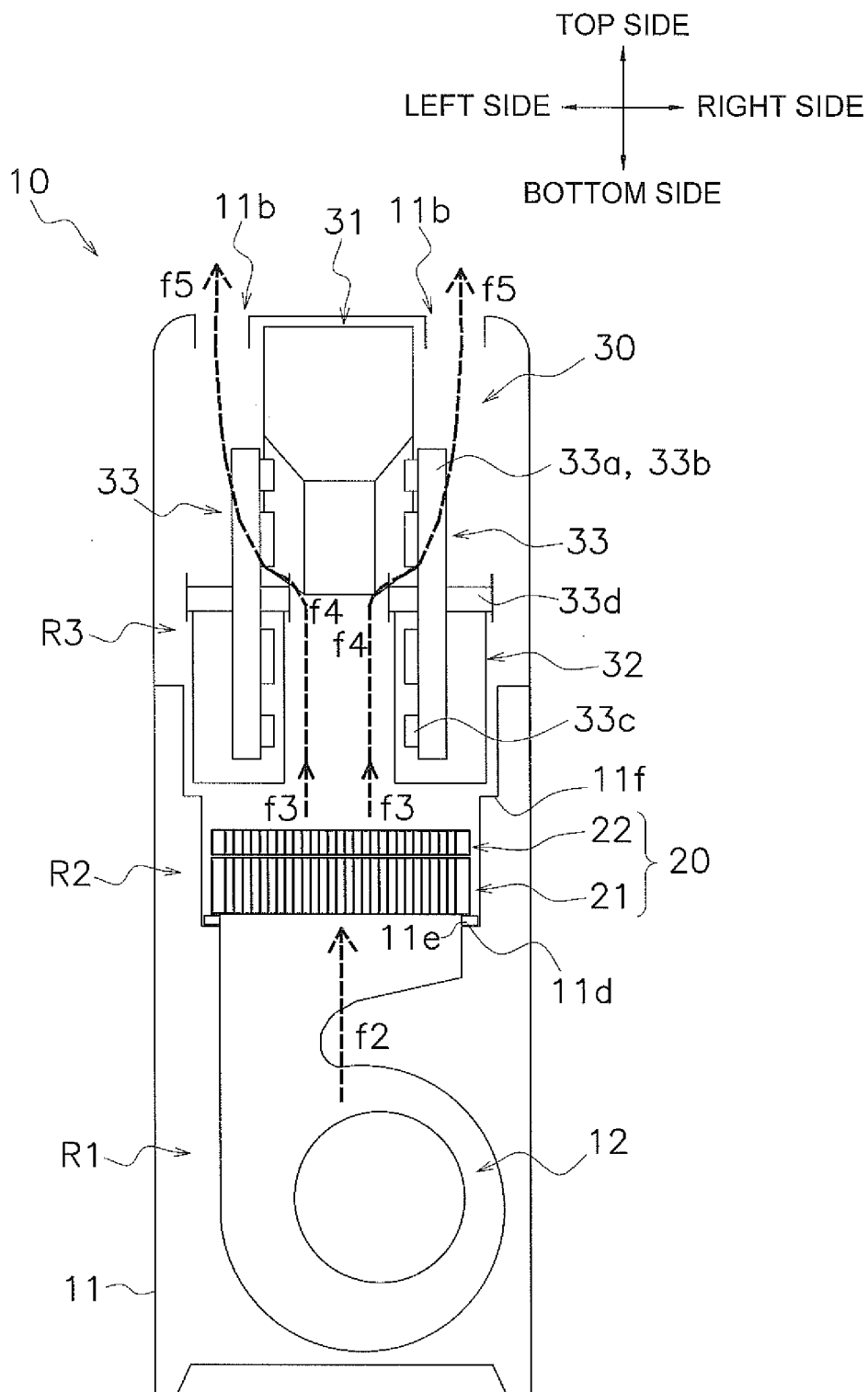


FIG. 2

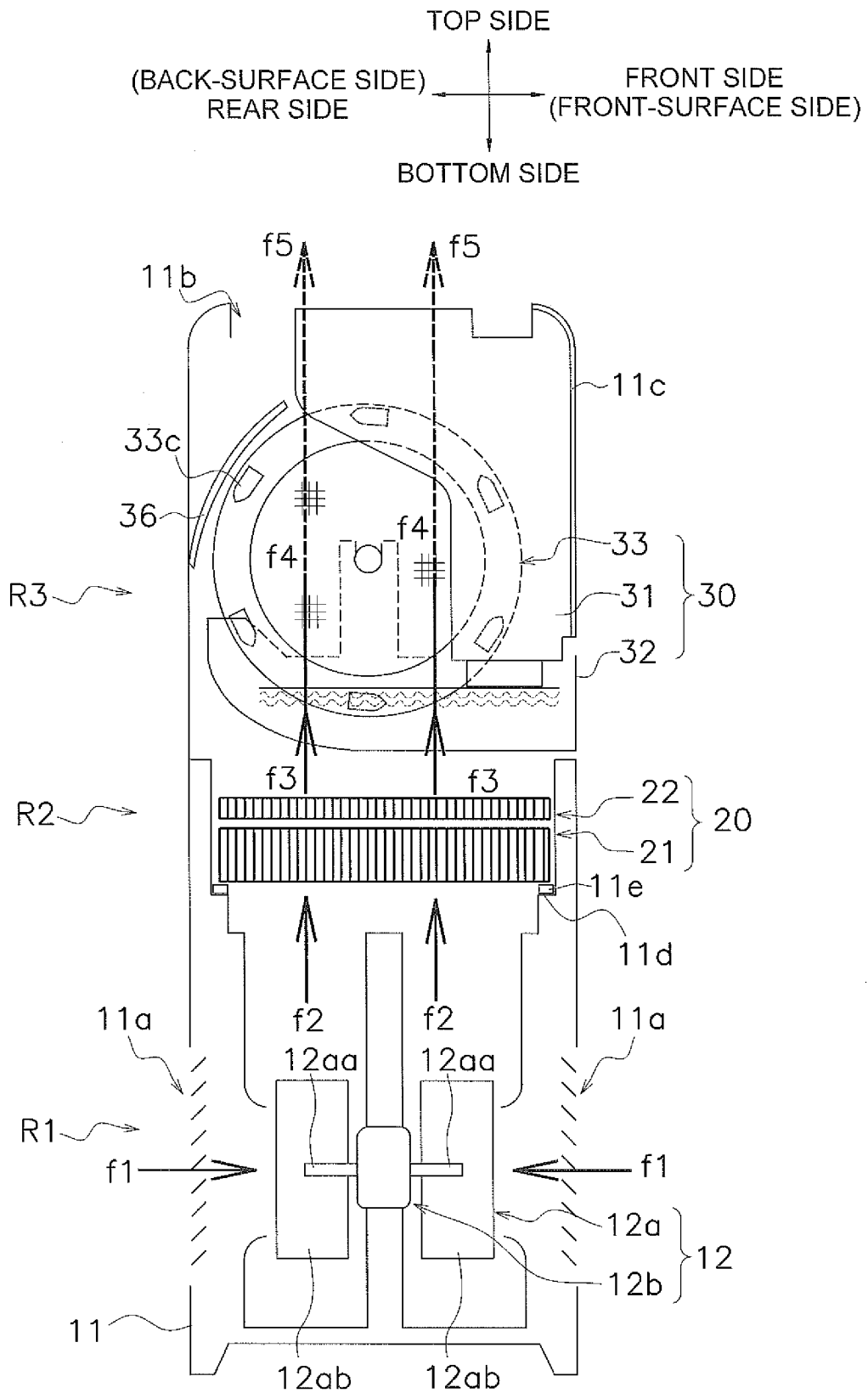


FIG. 3

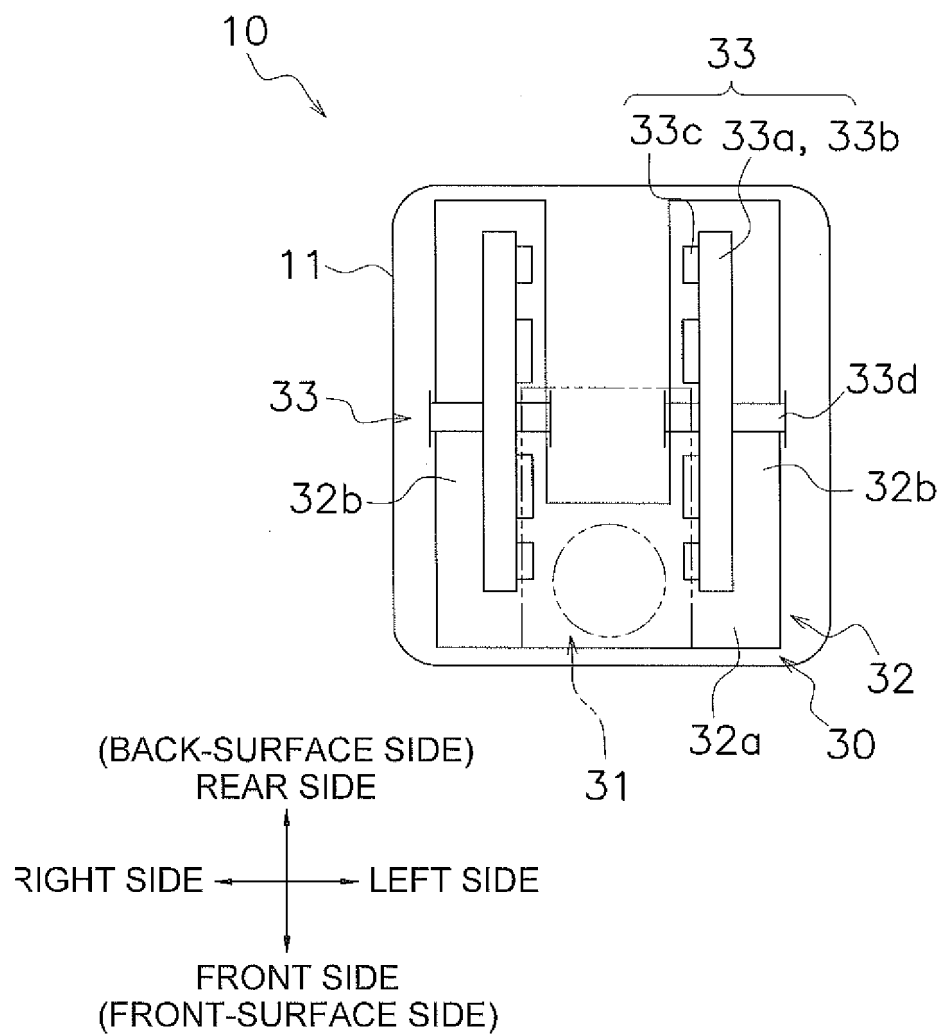


FIG. 4

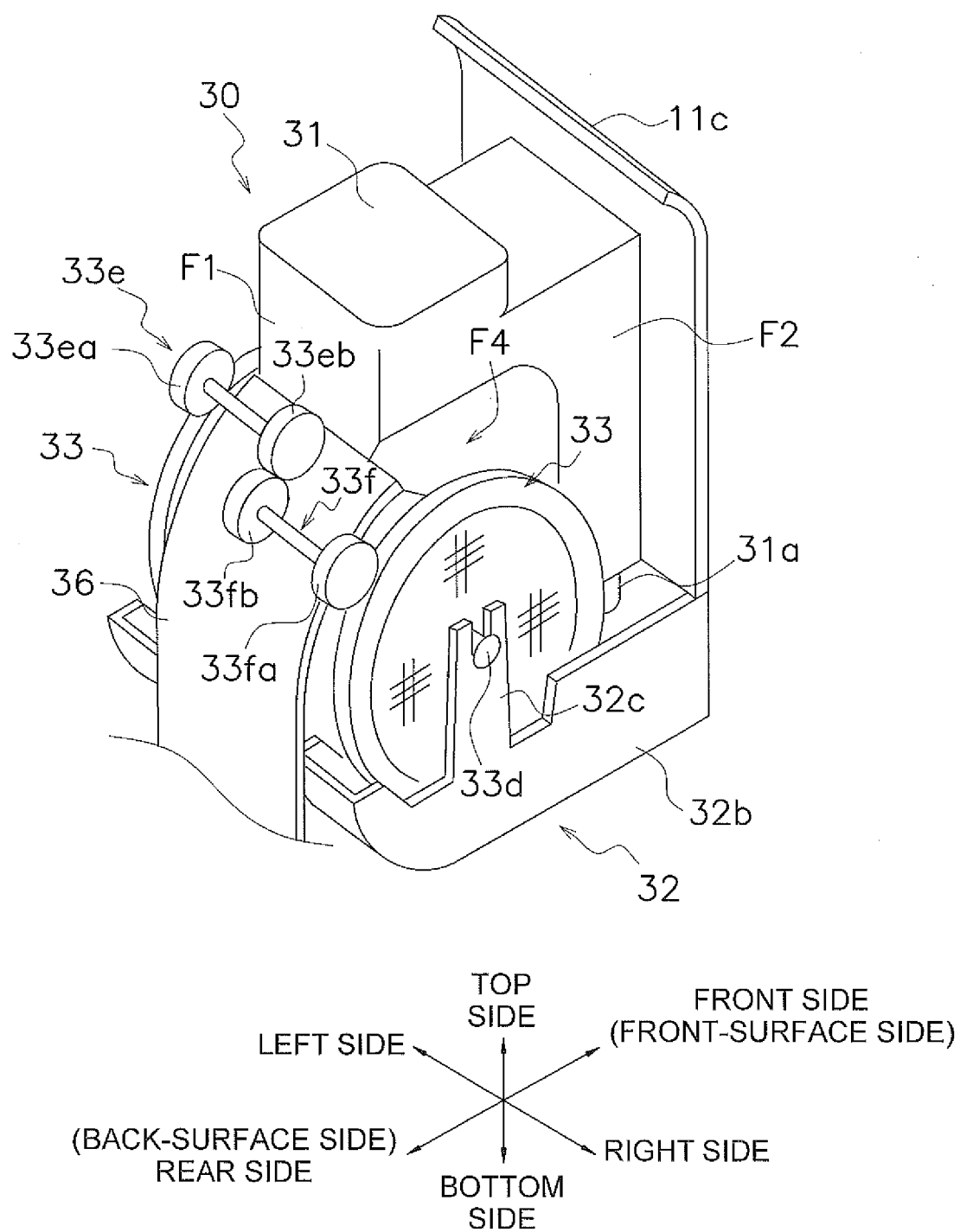


FIG. 5

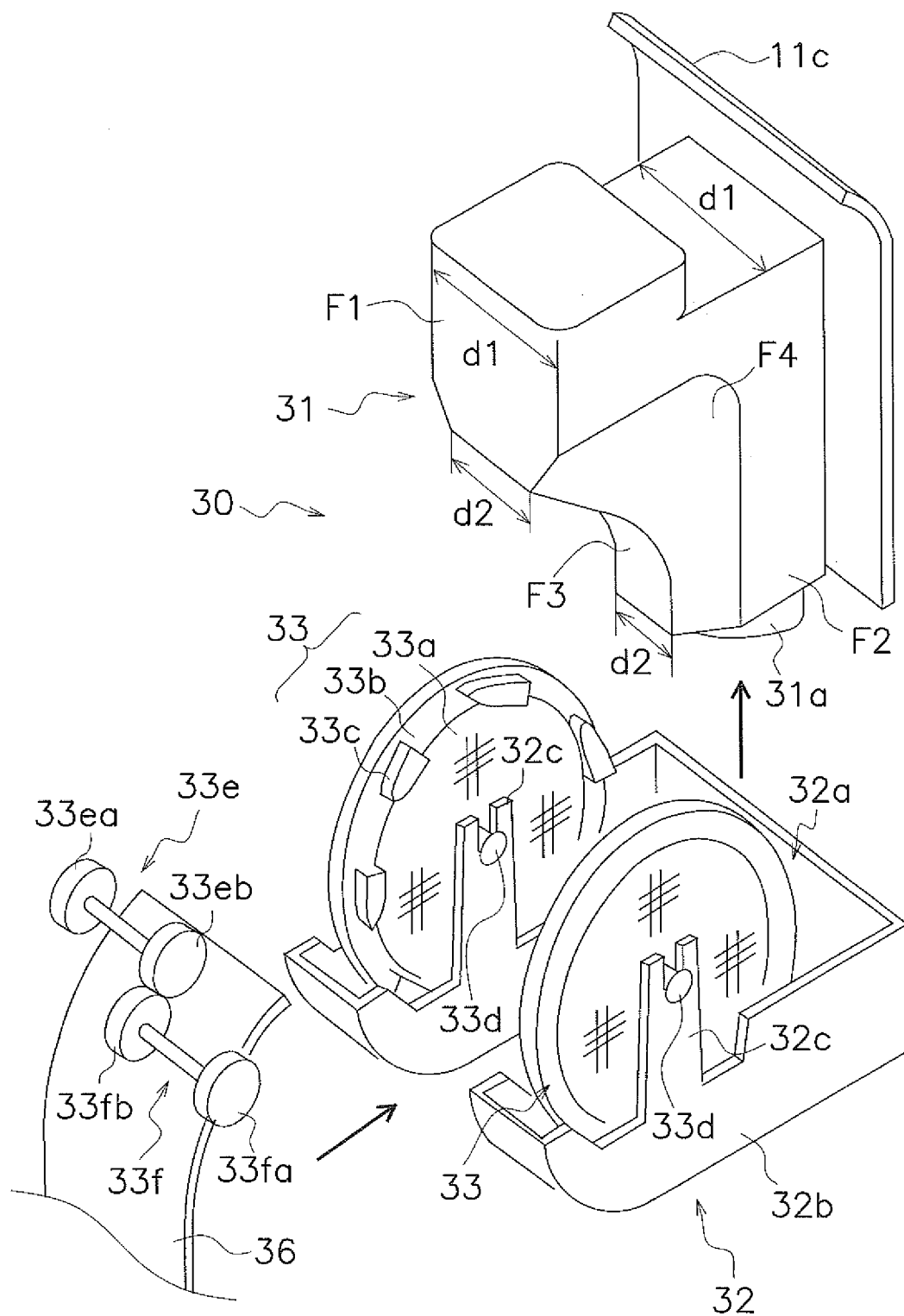


FIG. 6

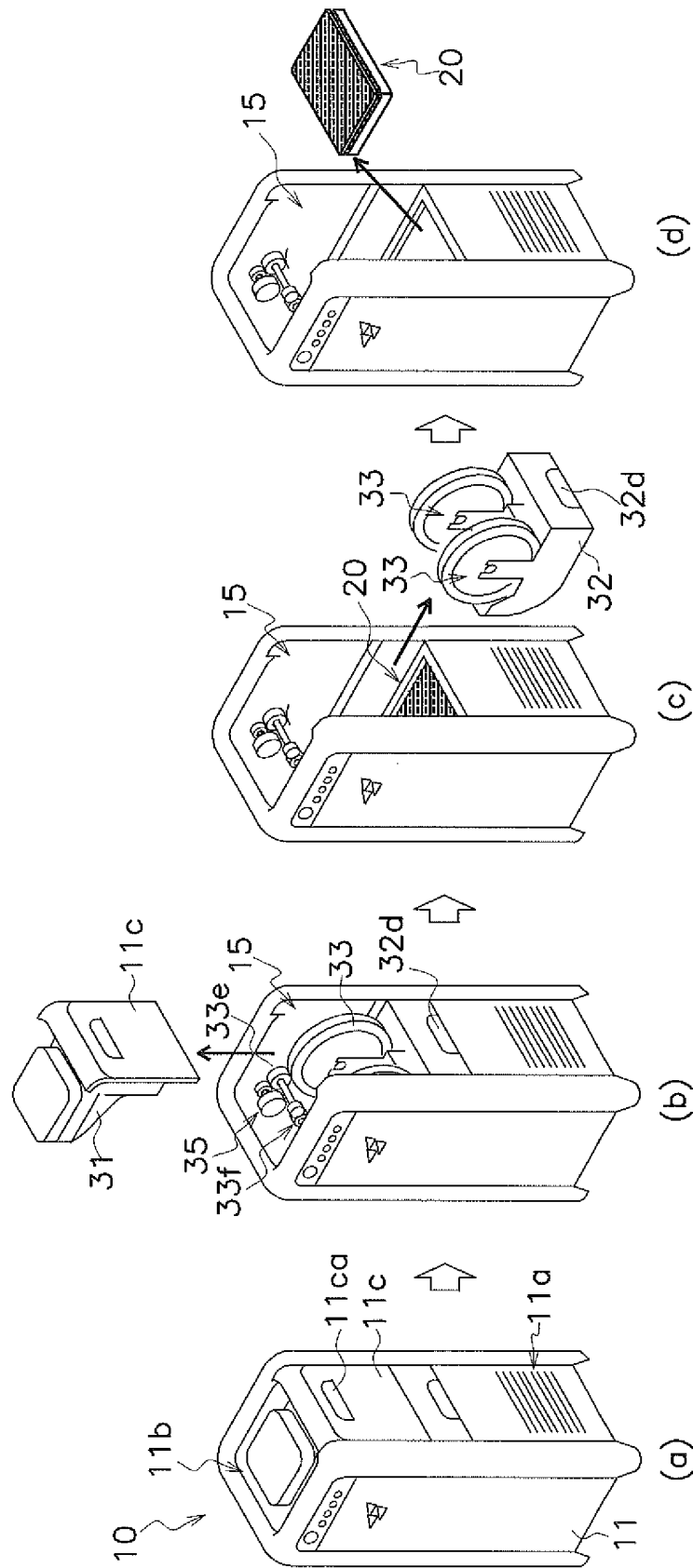


FIG. 7

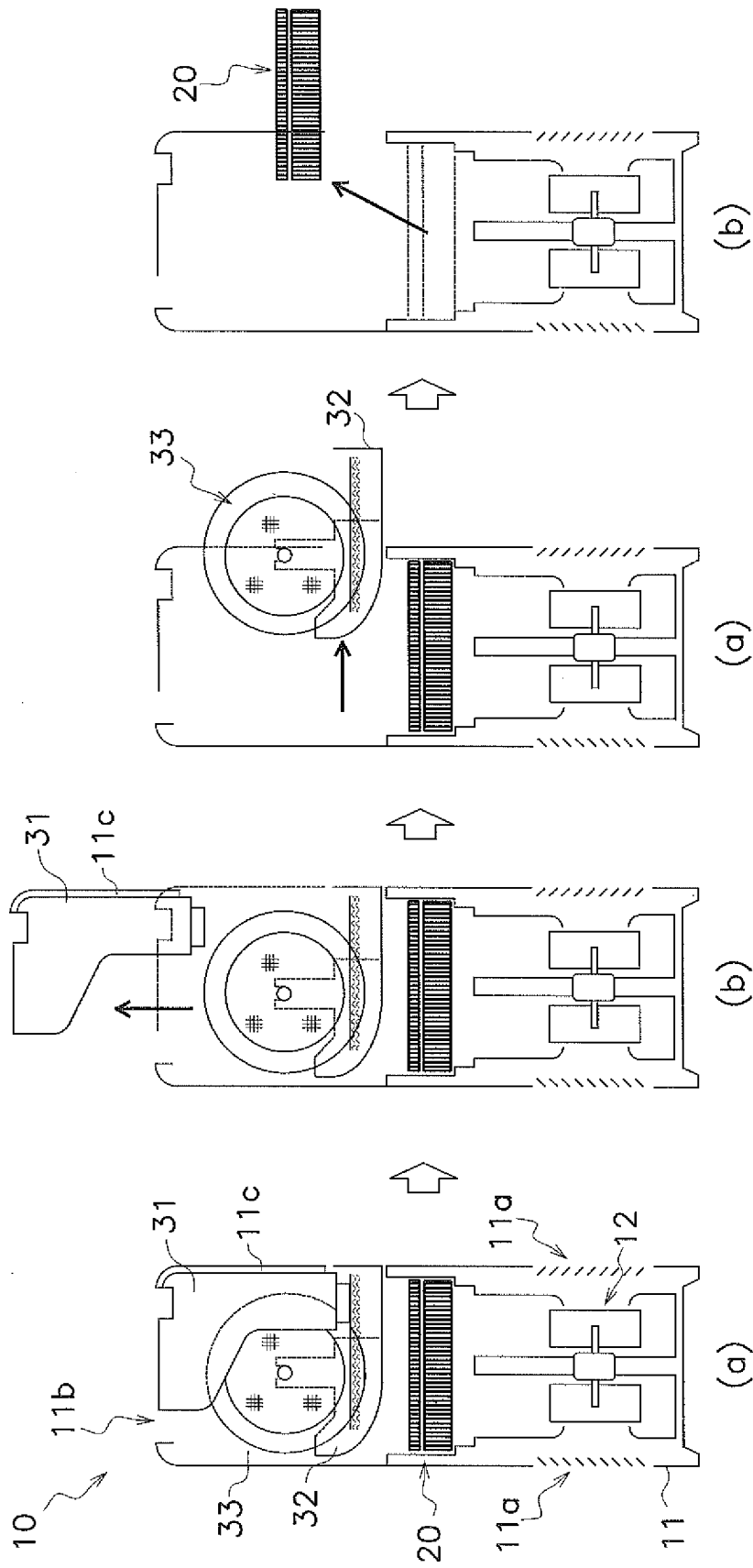


FIG. 8

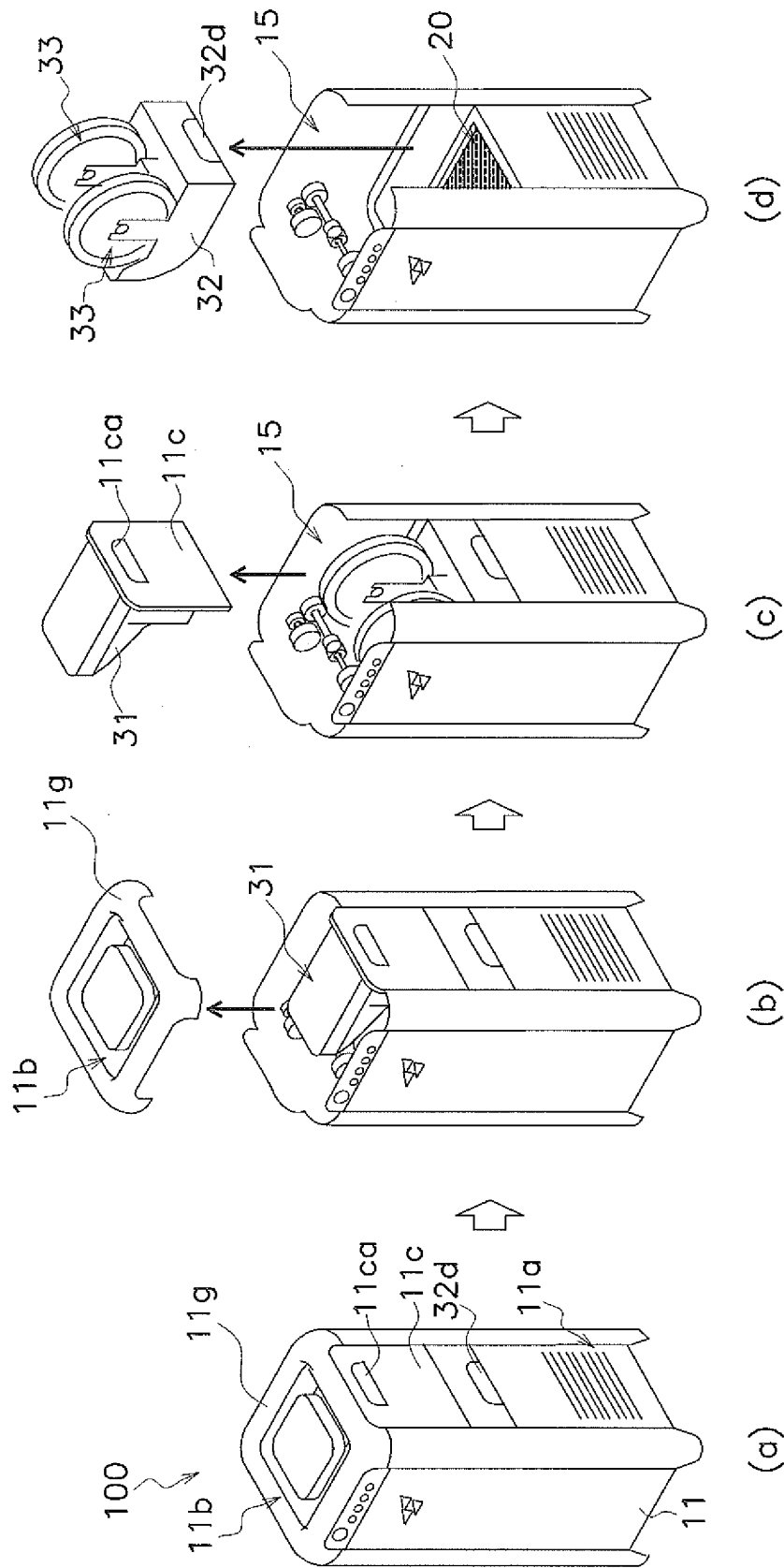
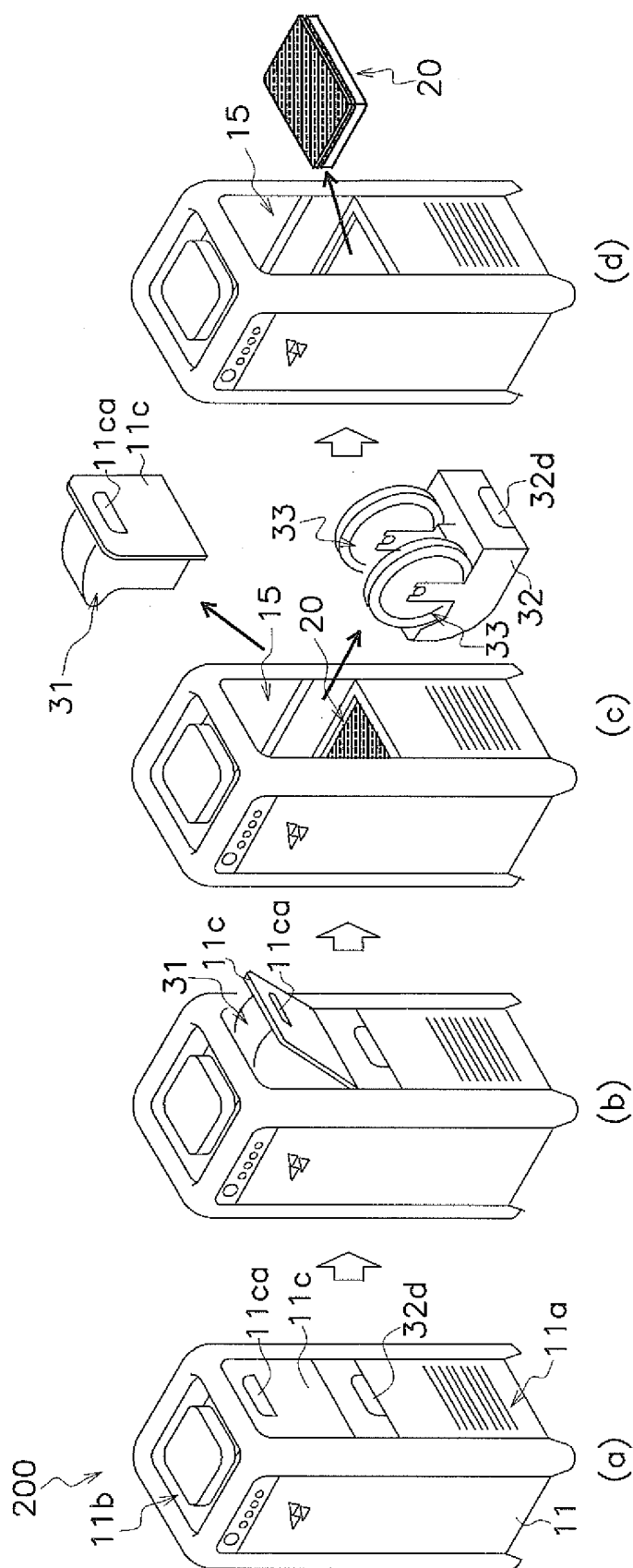


FIG. 9



OTIG

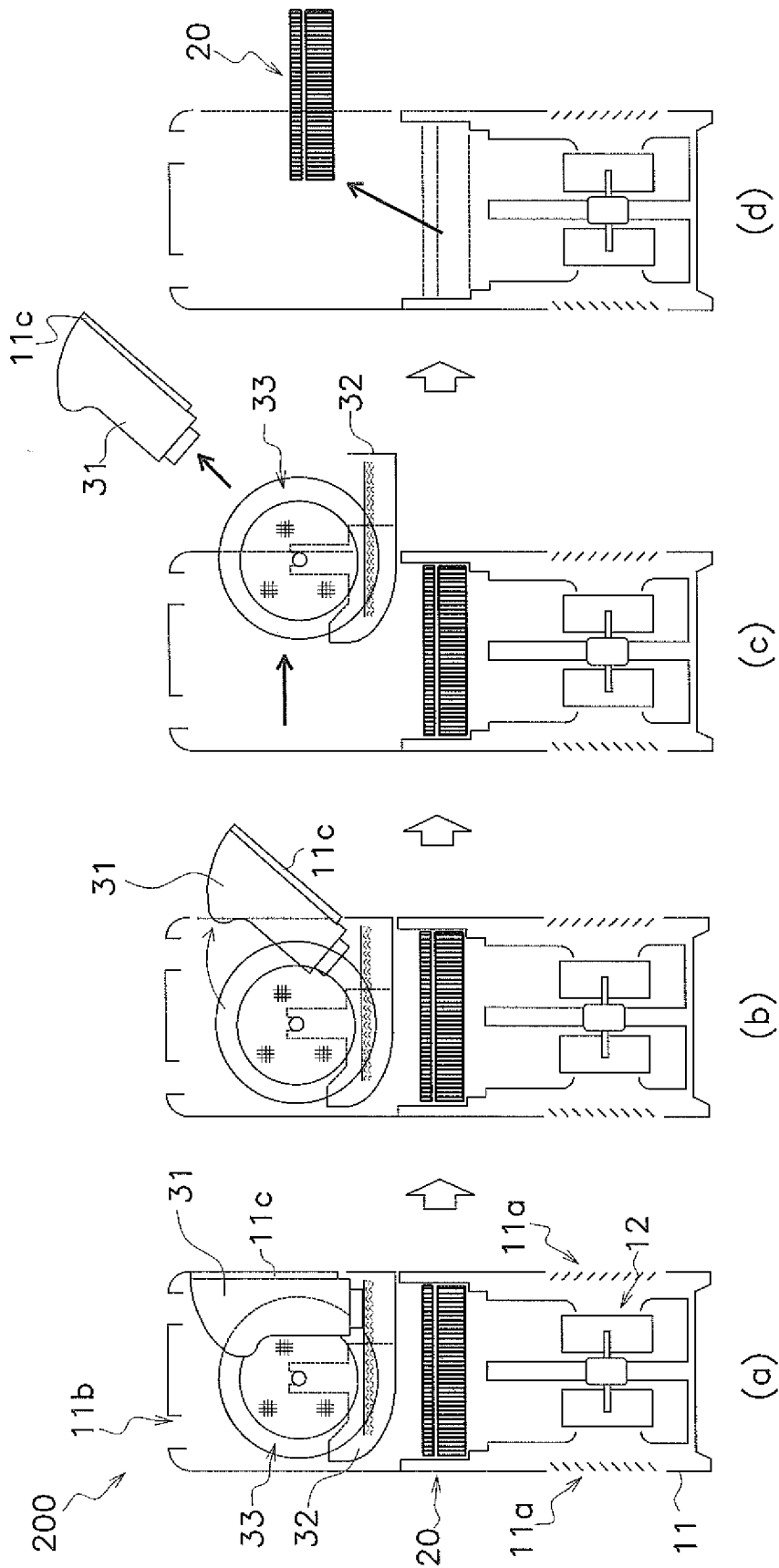


FIG. 11

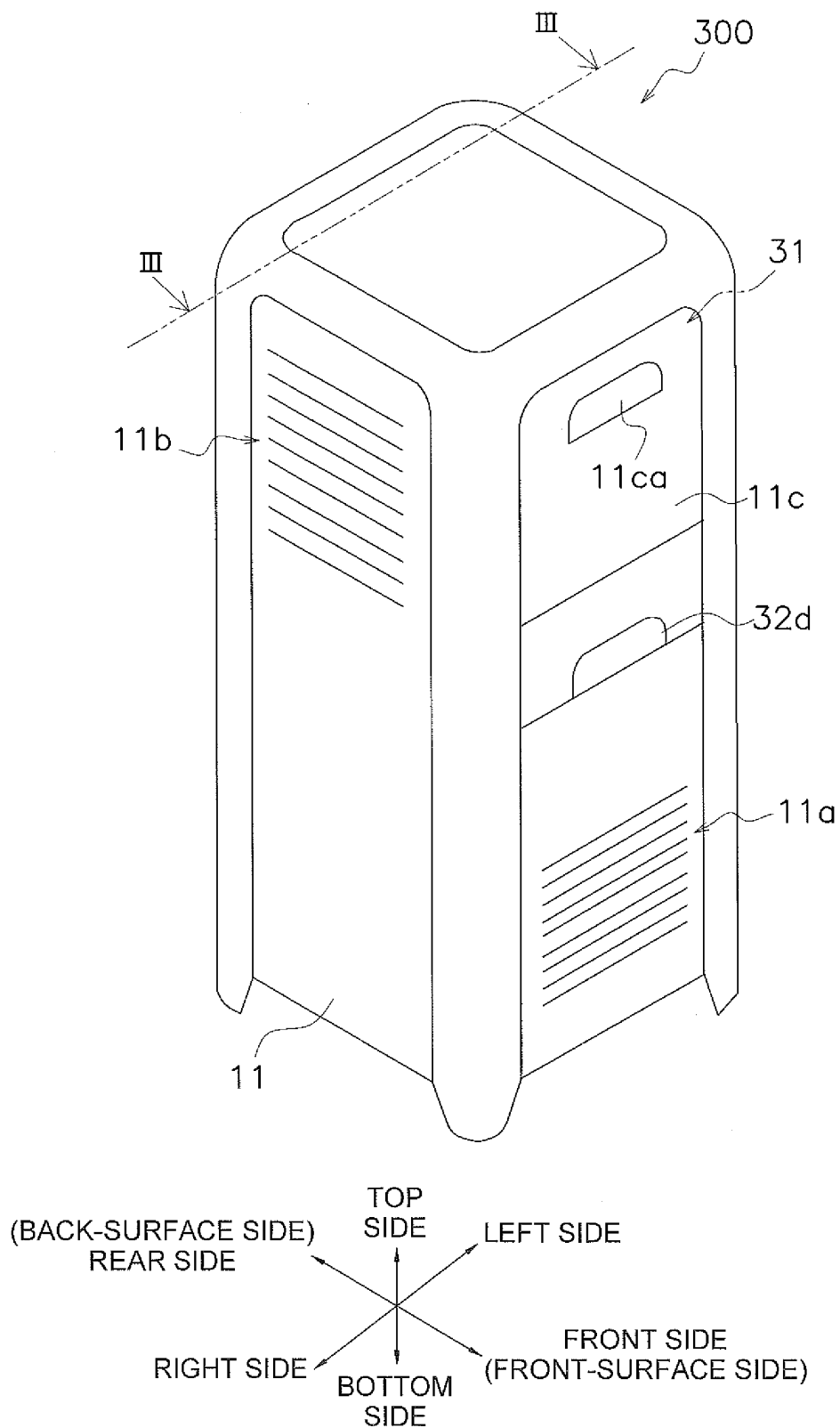


FIG. 12

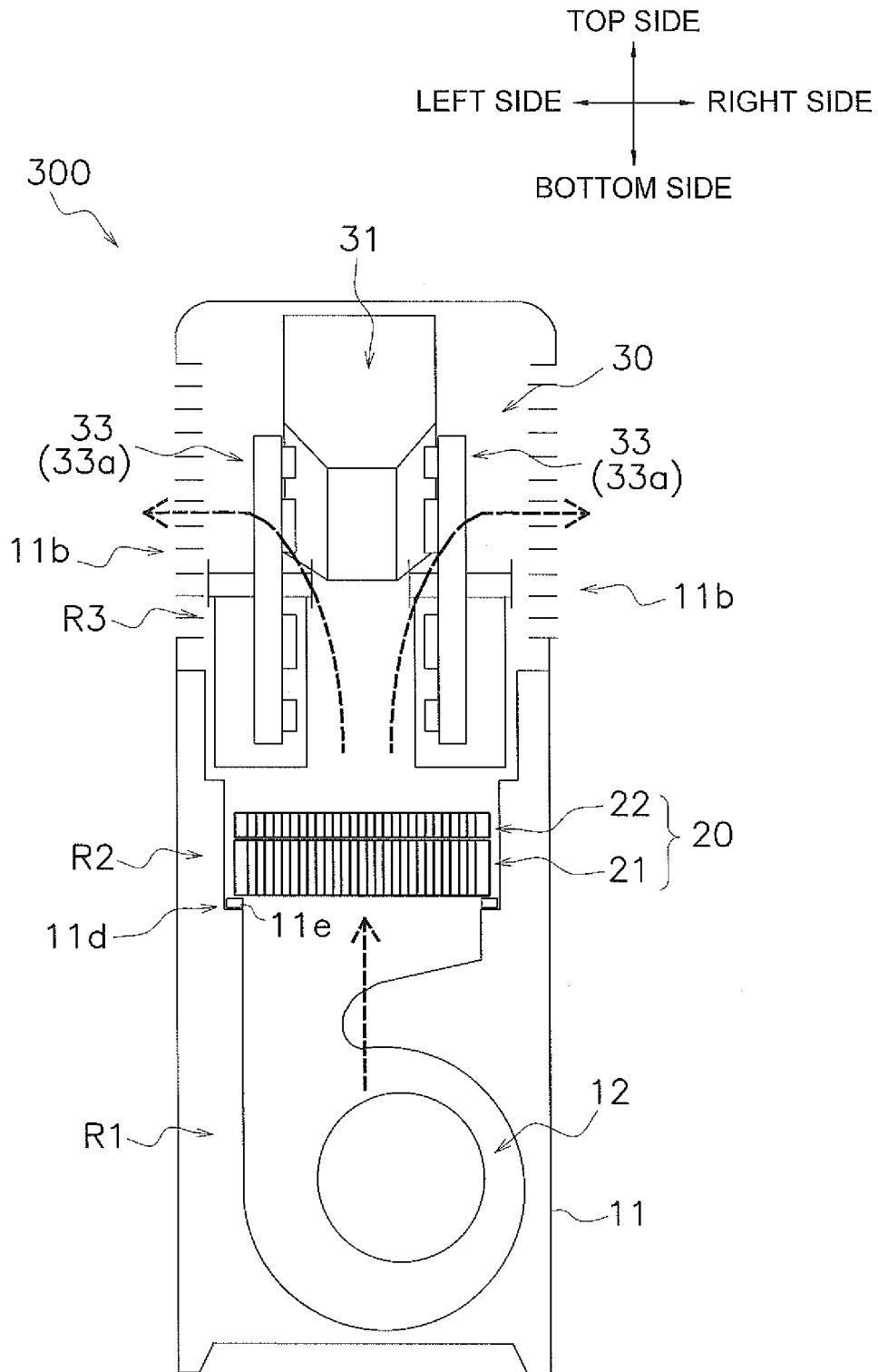


FIG. 13

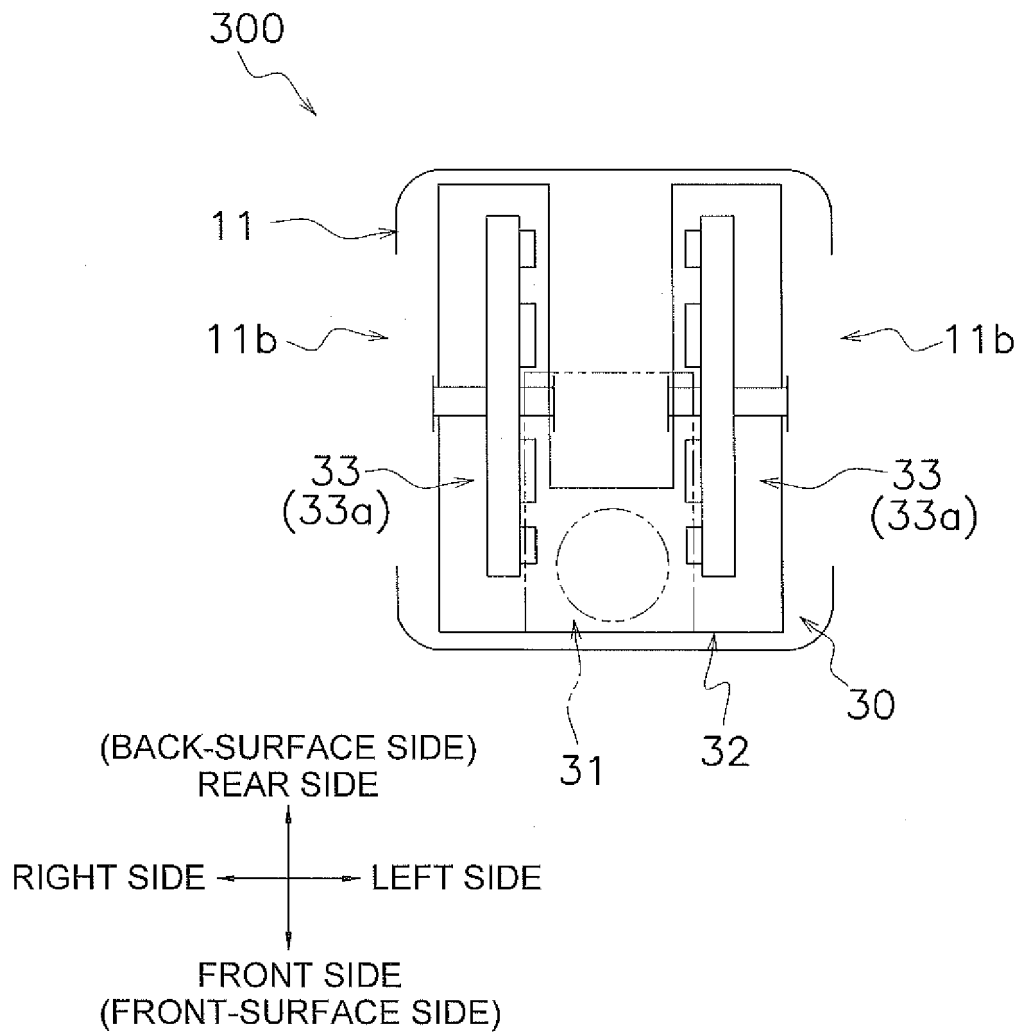


FIG. 14

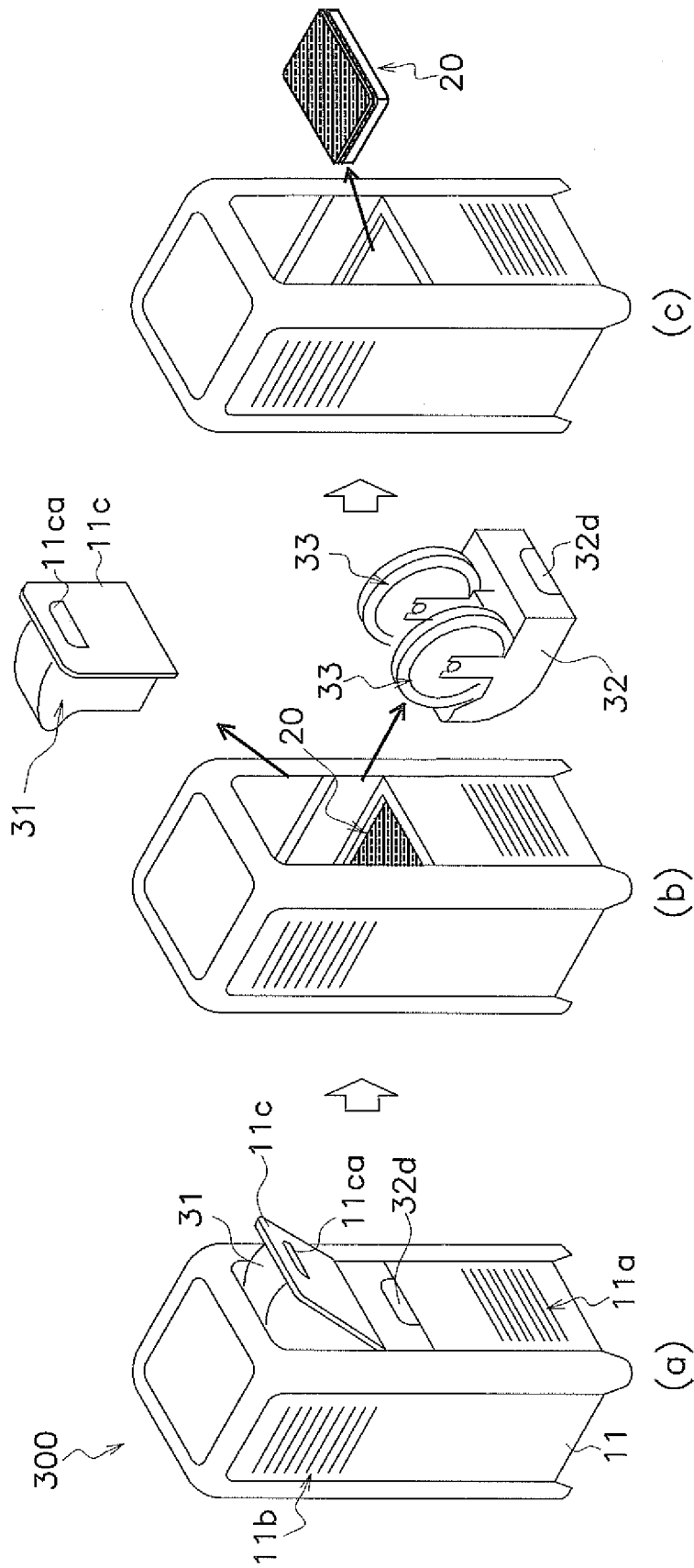


FIG. 15

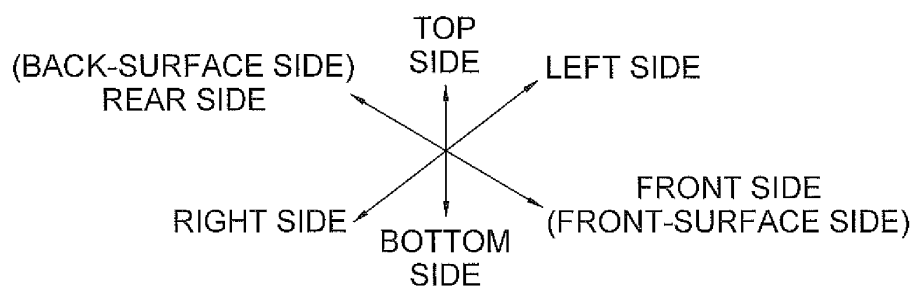
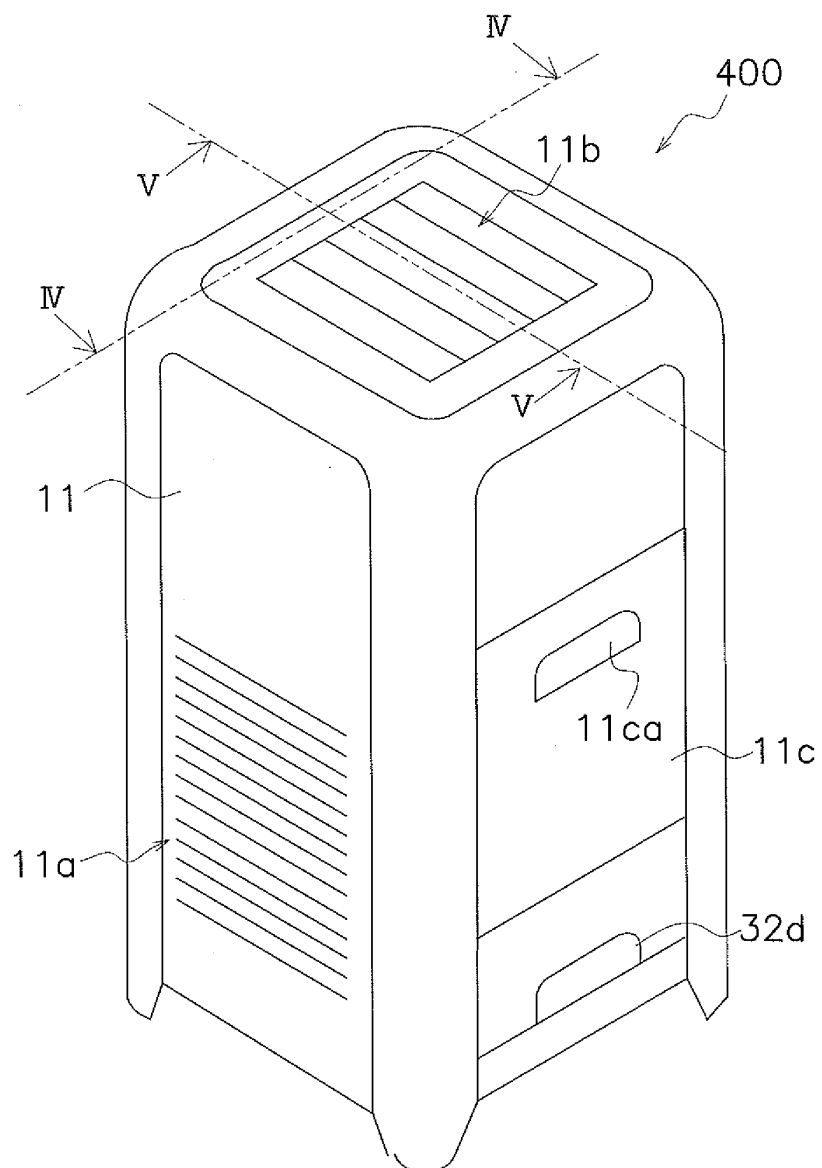


FIG. 16

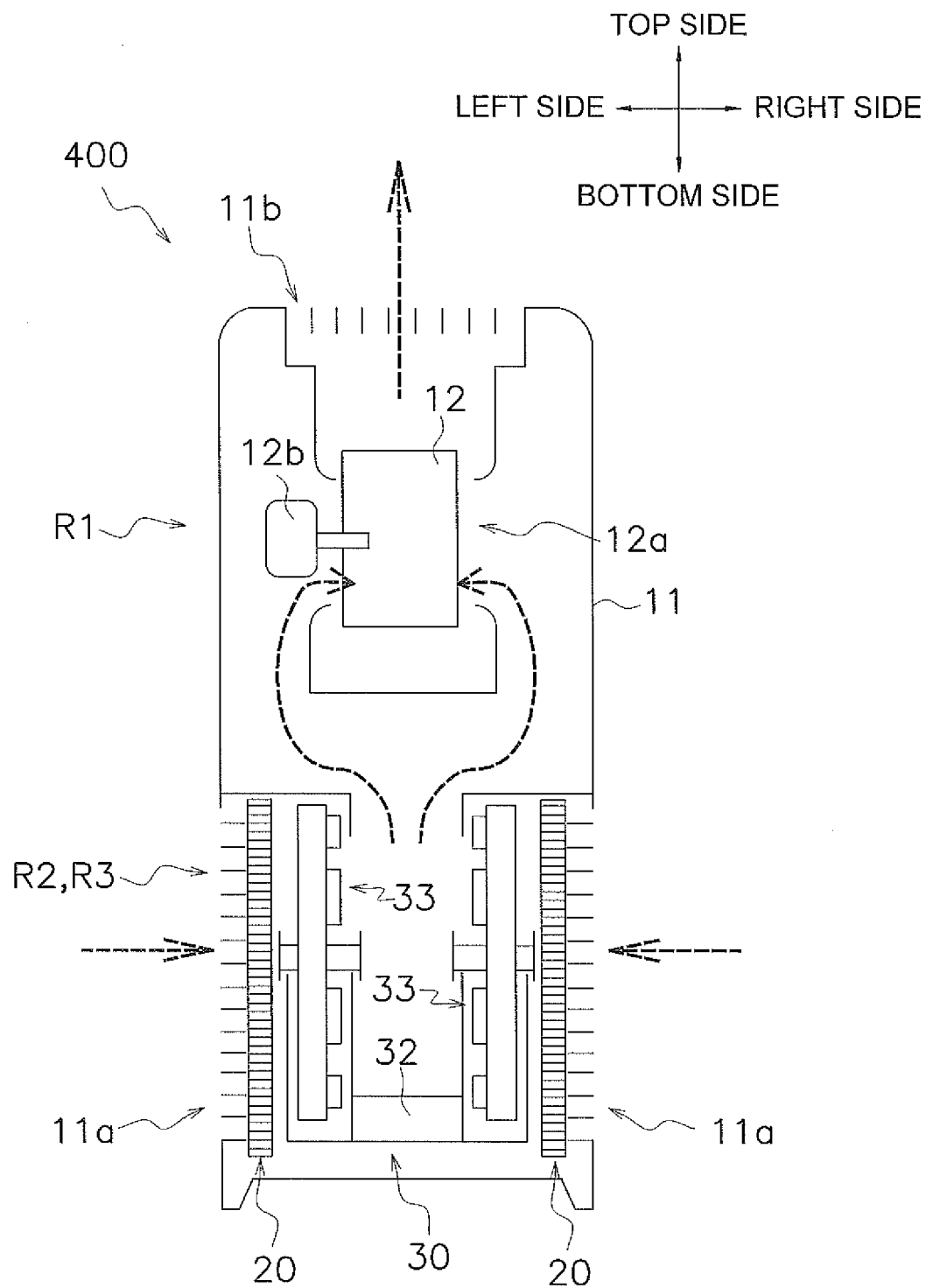


FIG. 17

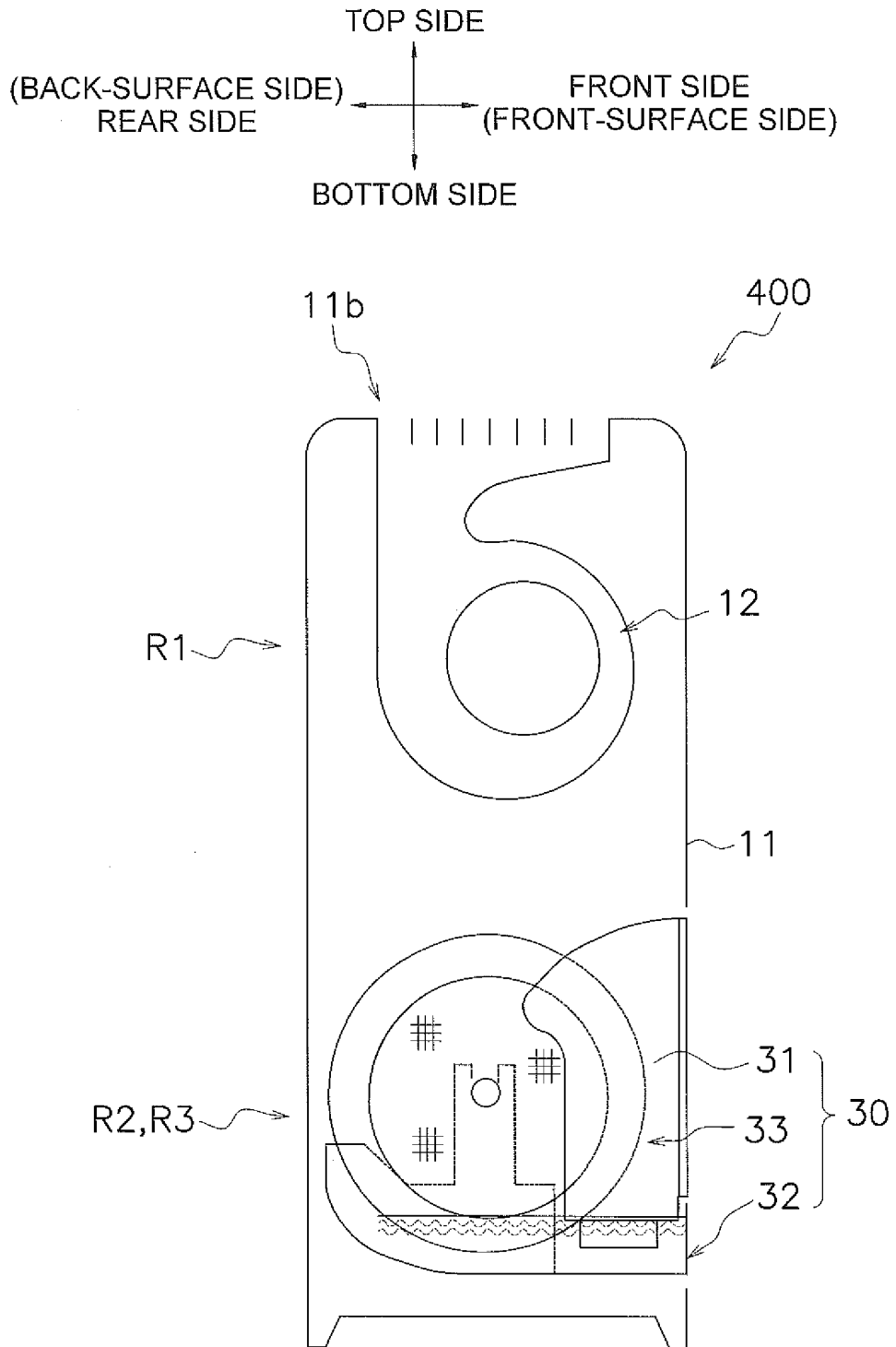


FIG. 18

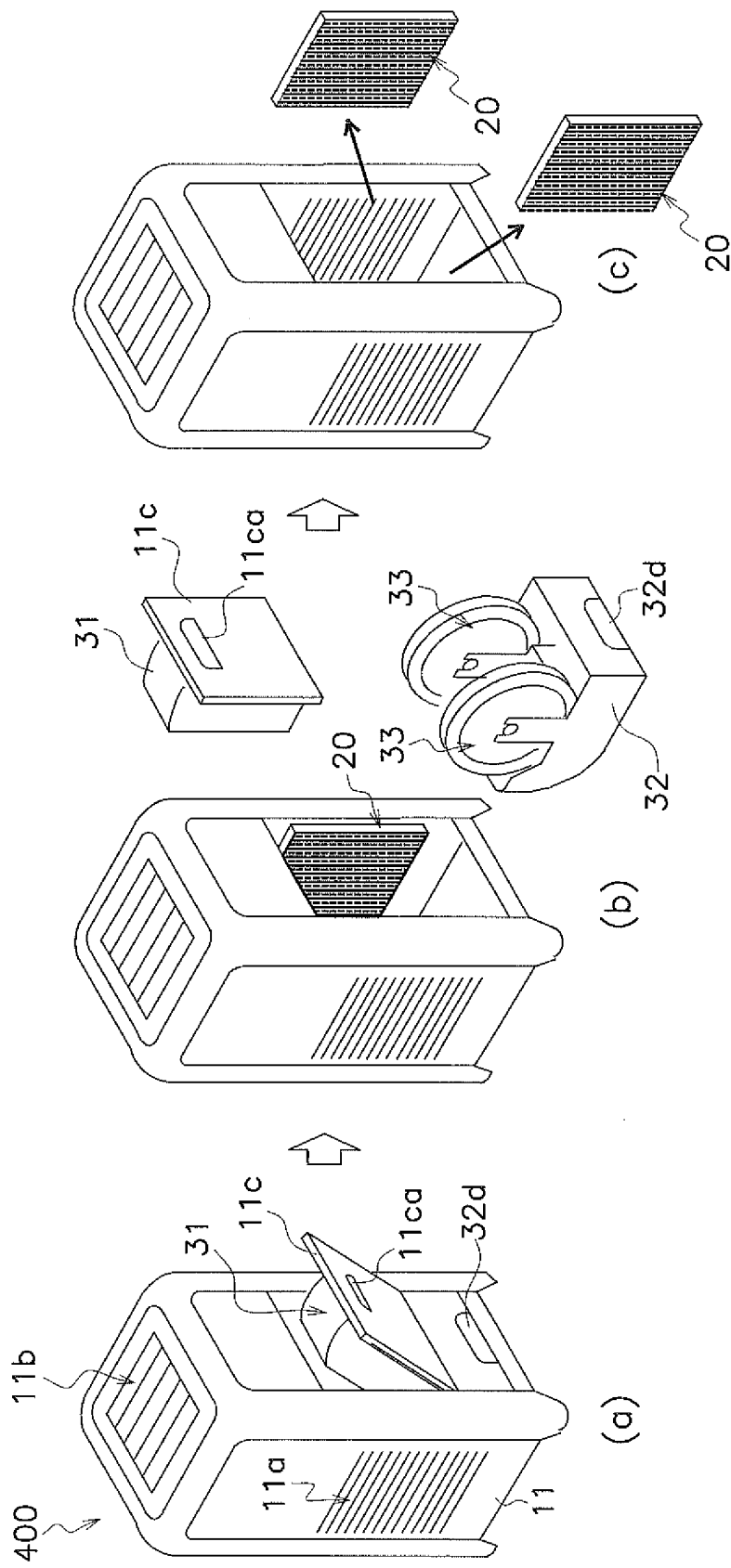


FIG. 19

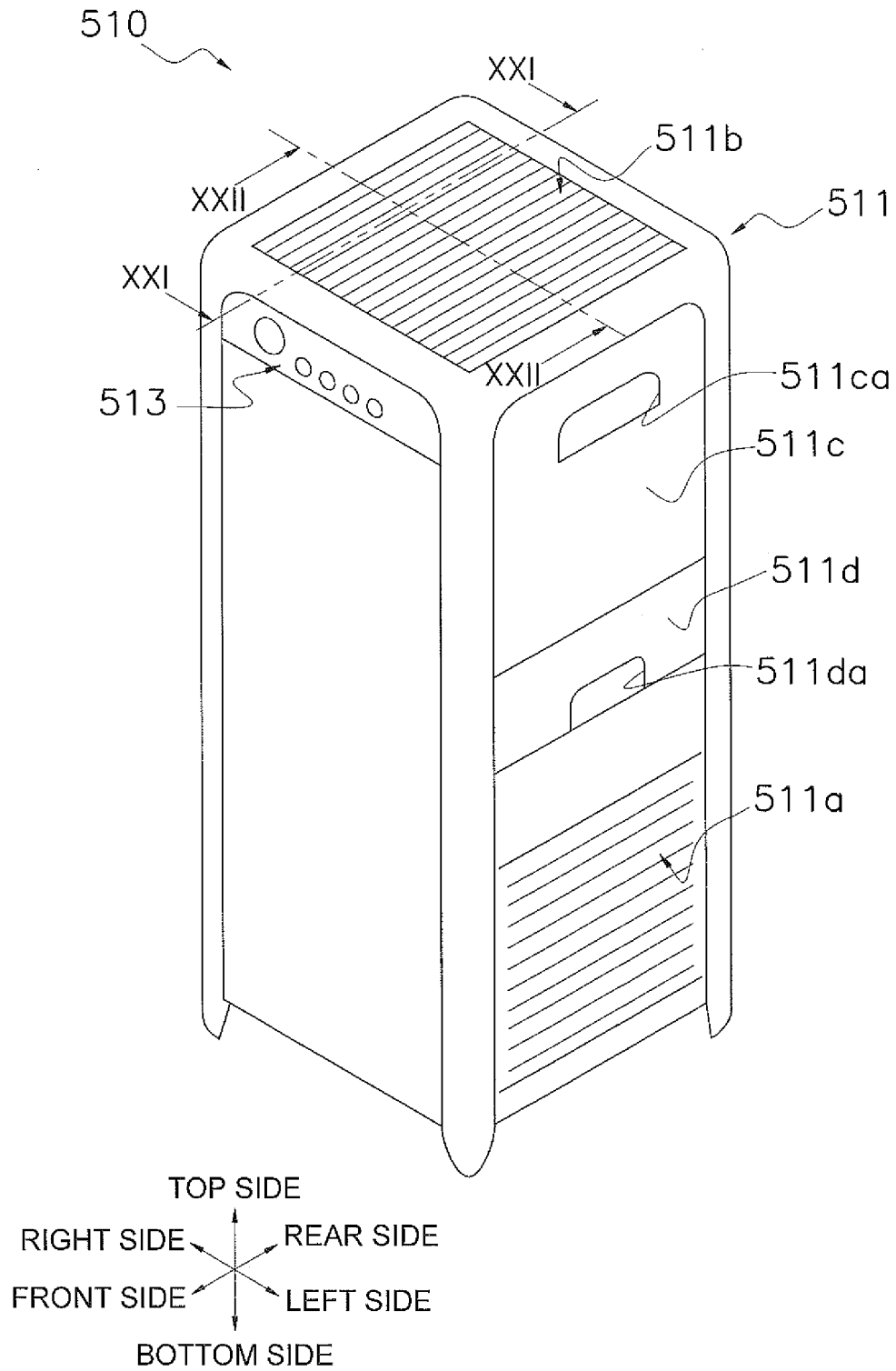


FIG. 20

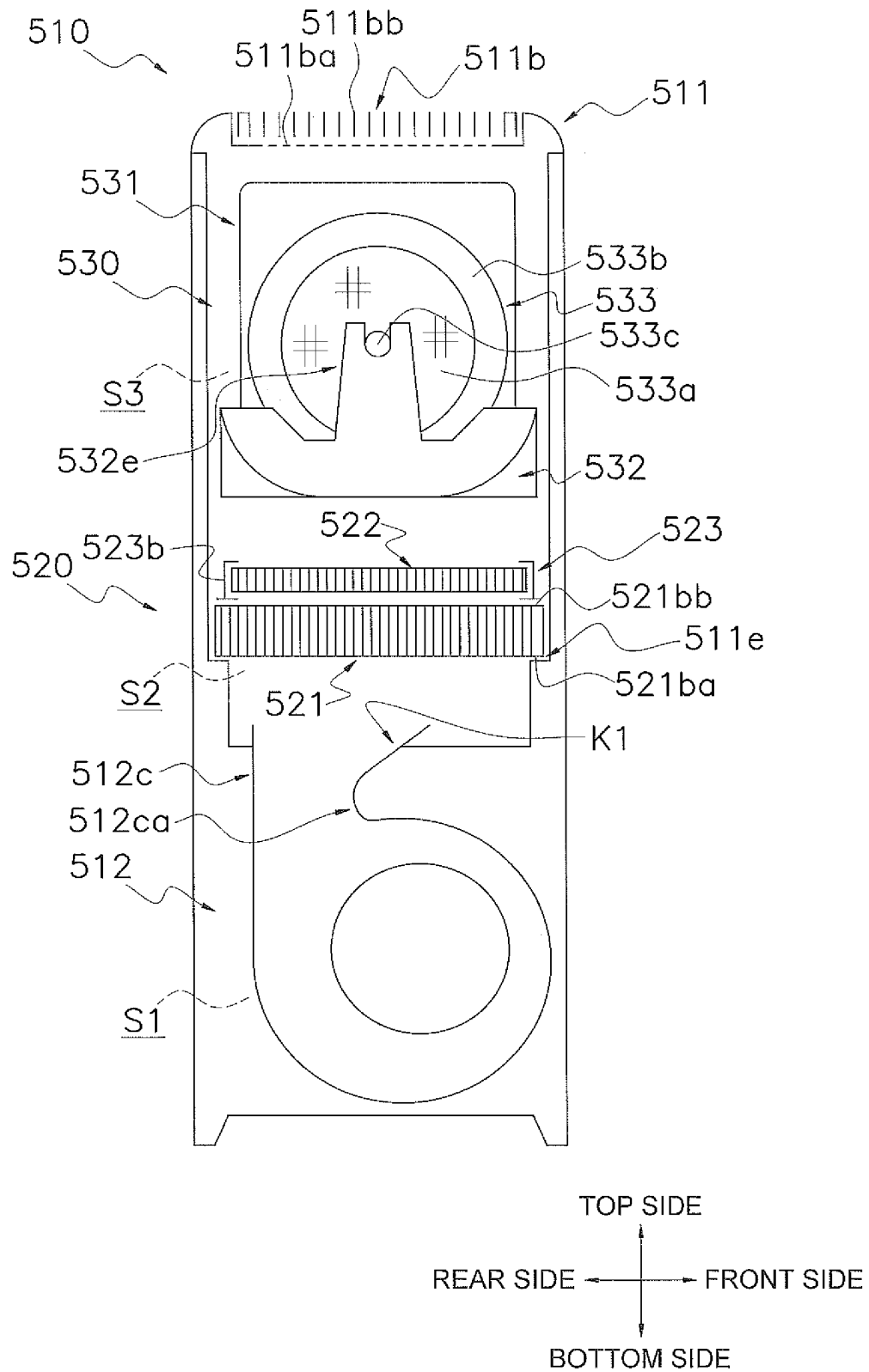


FIG. 21

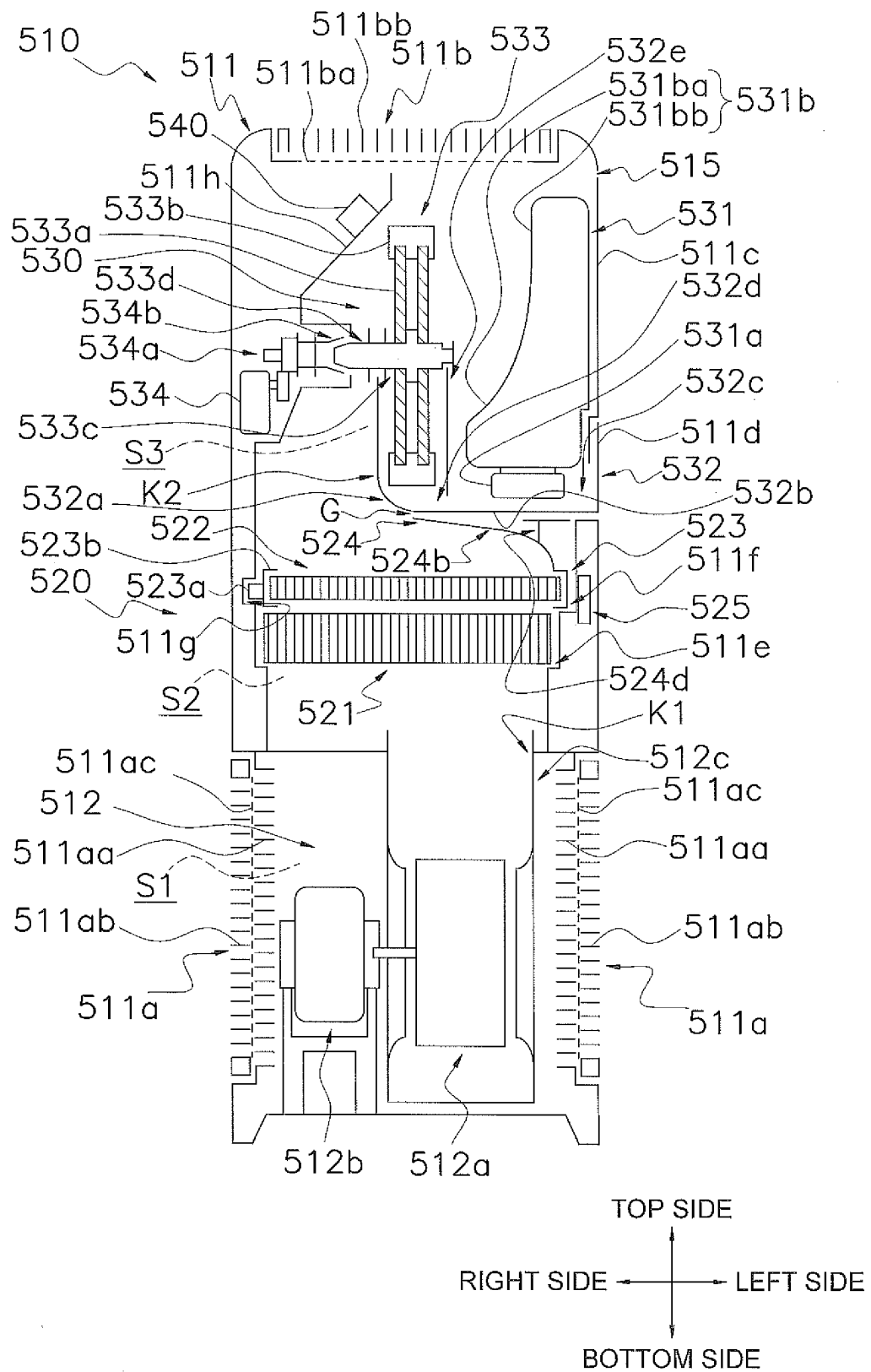


FIG. 22

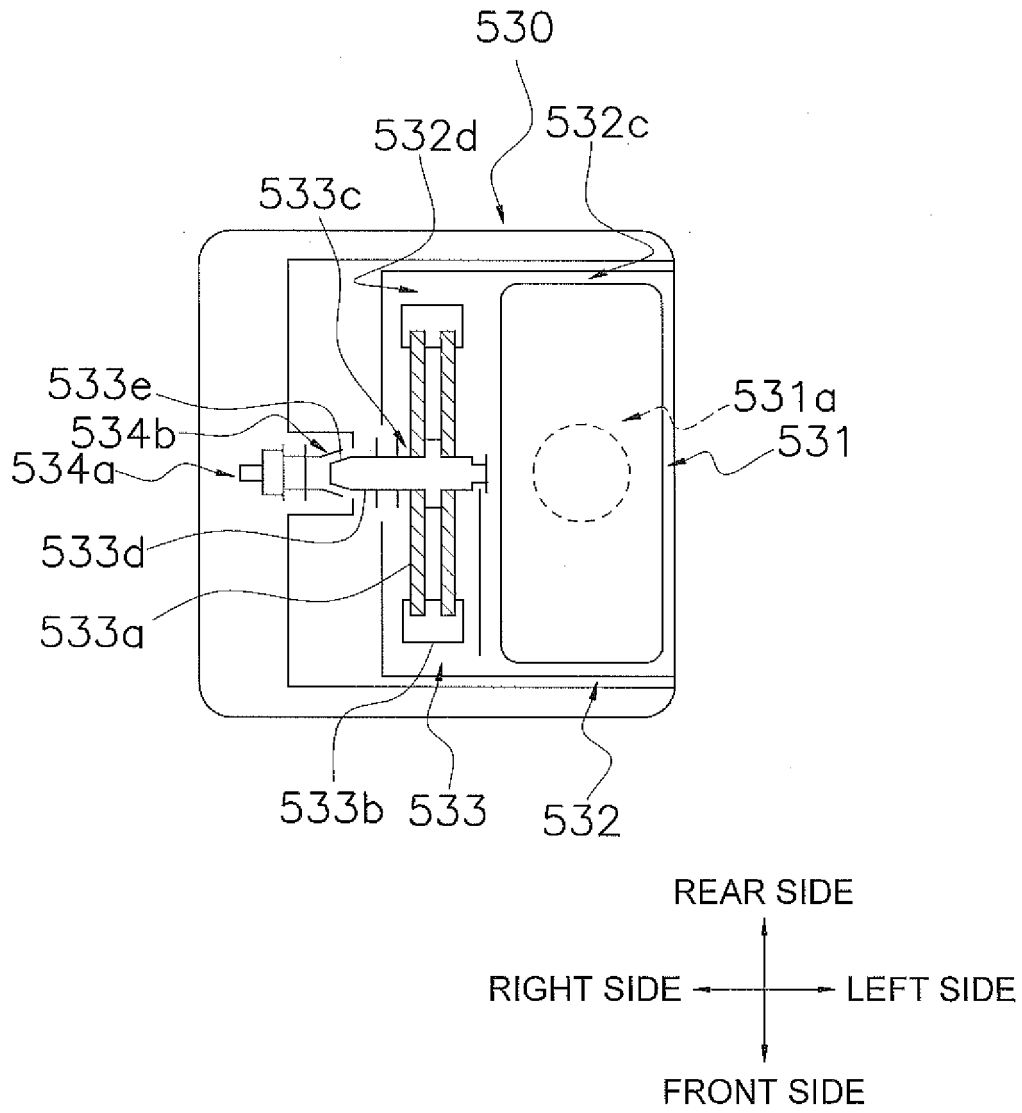


FIG. 23

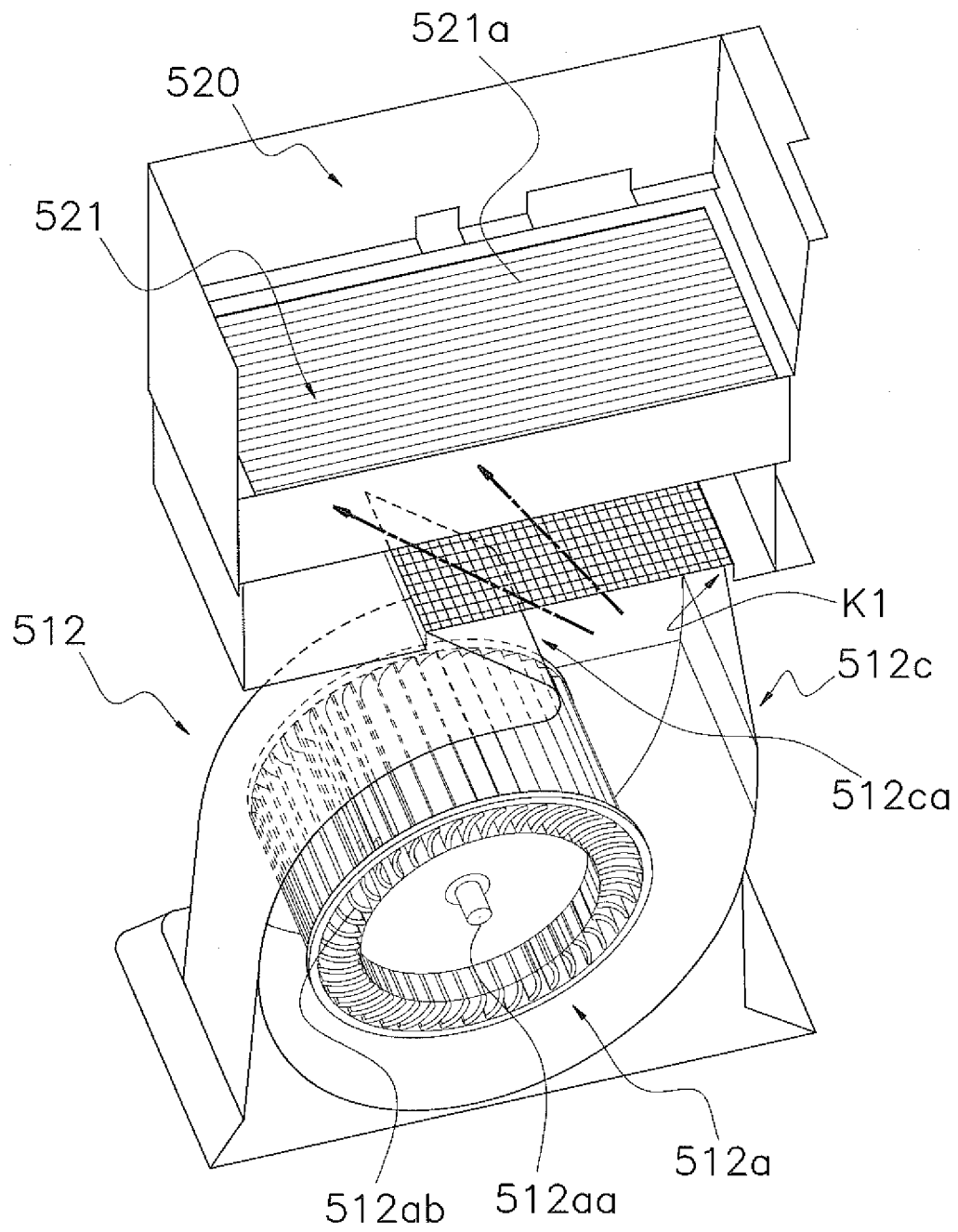


FIG. 24

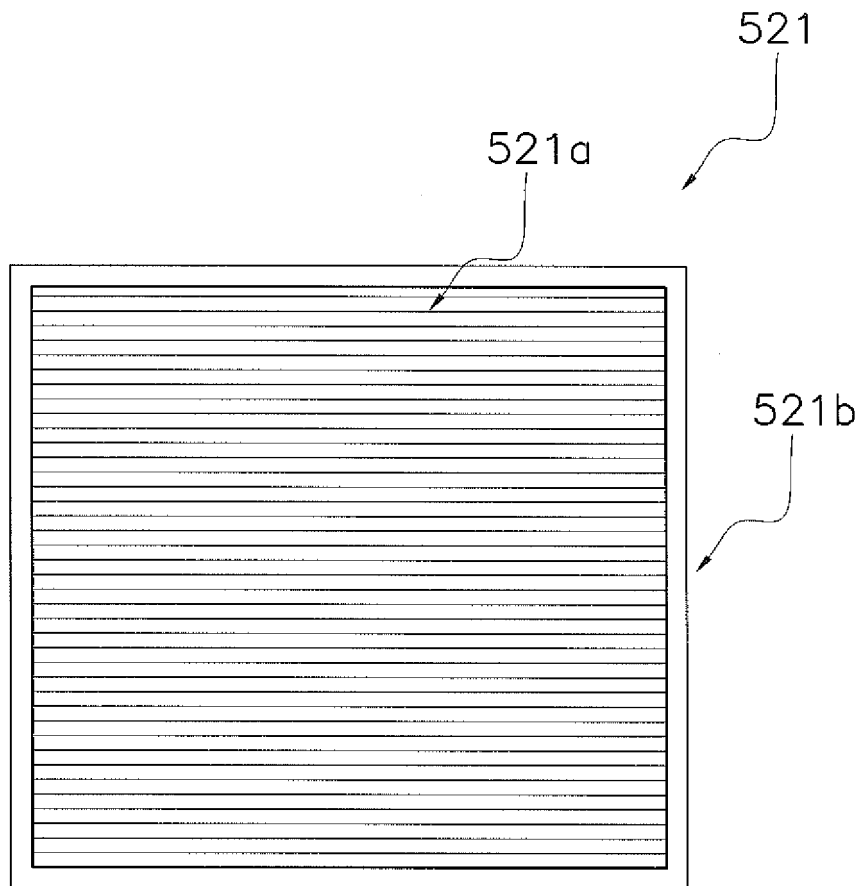


FIG. 25

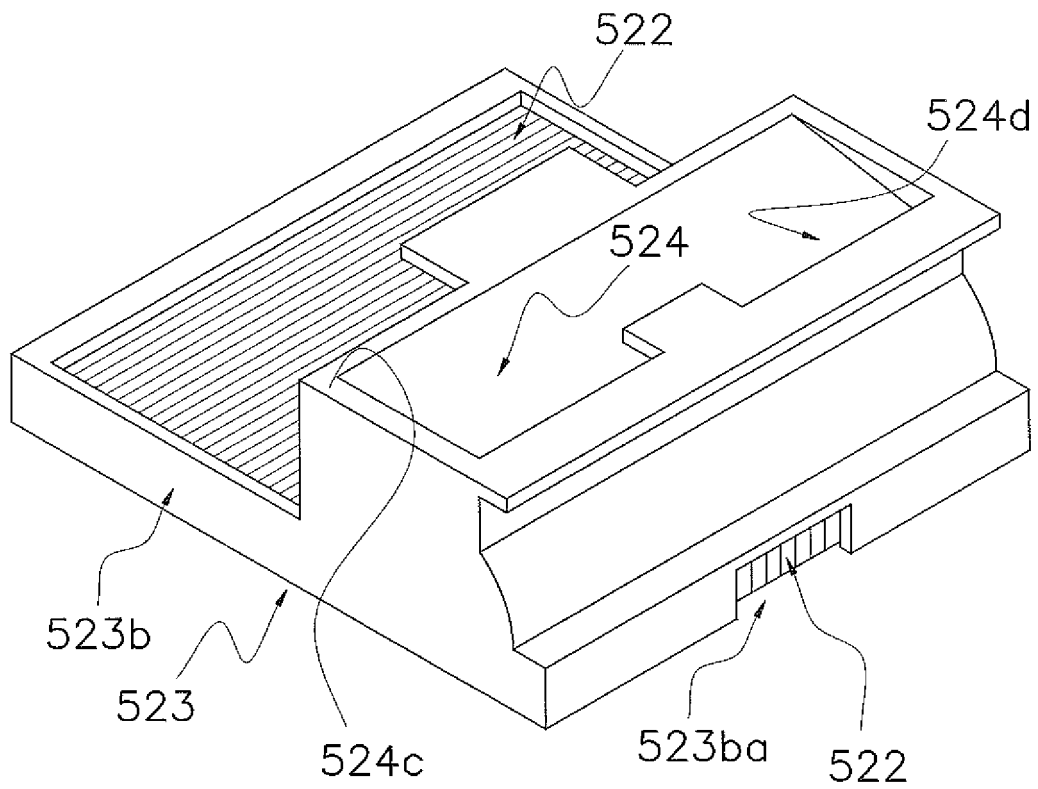


FIG. 26

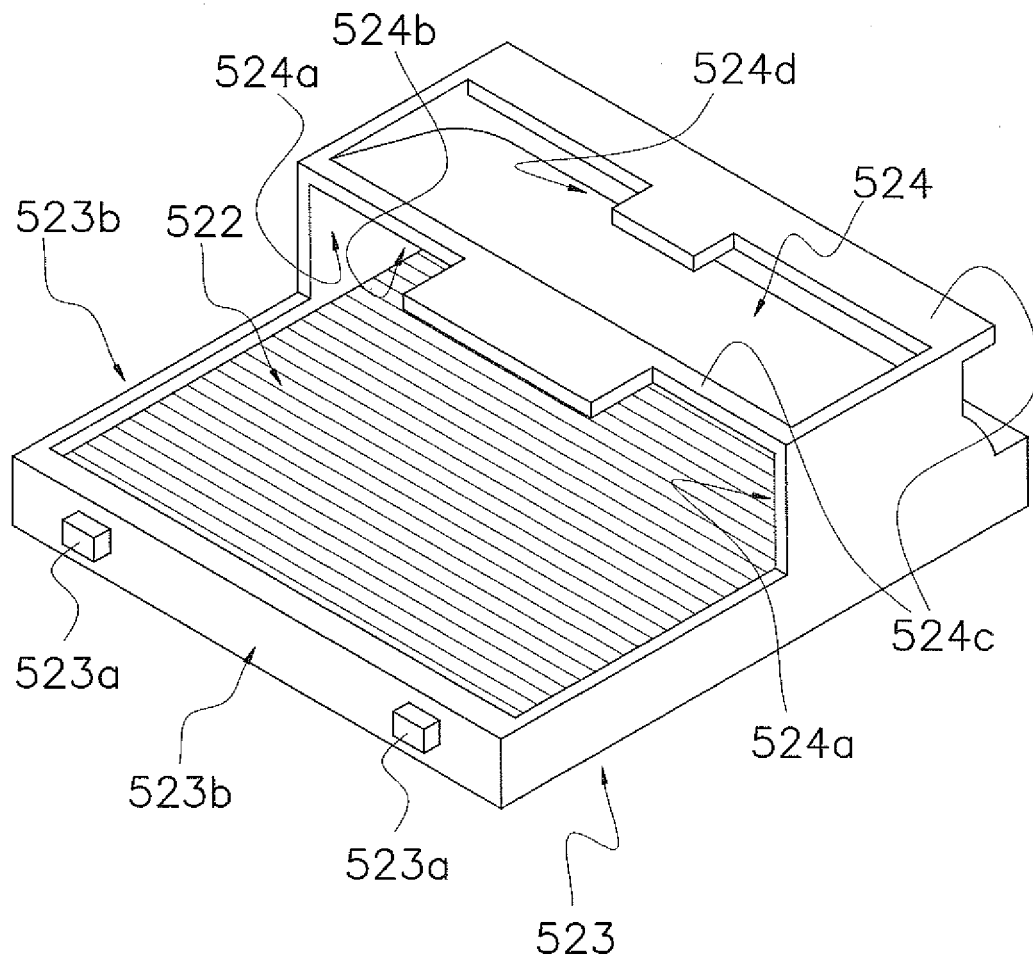


FIG. 27

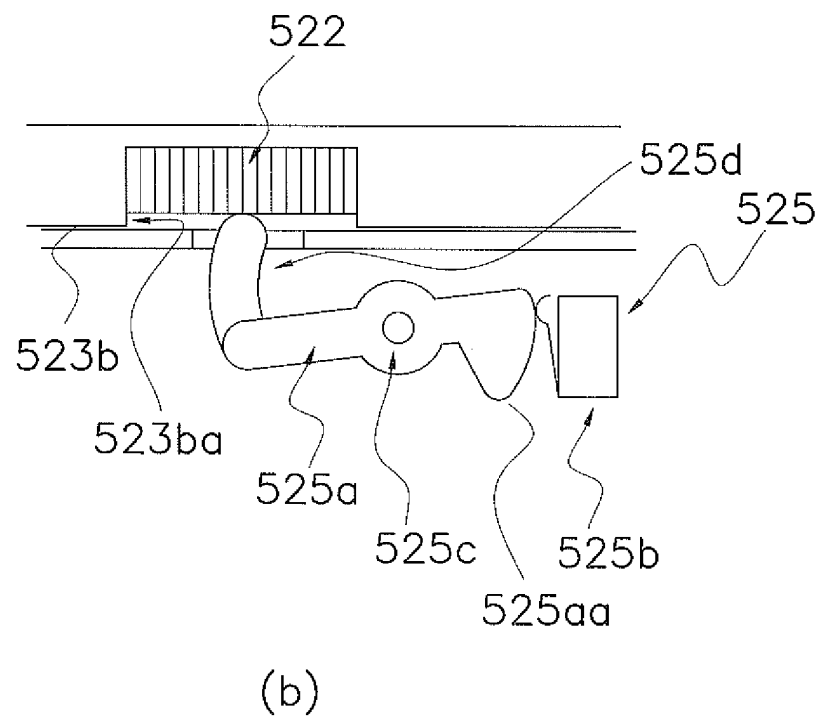
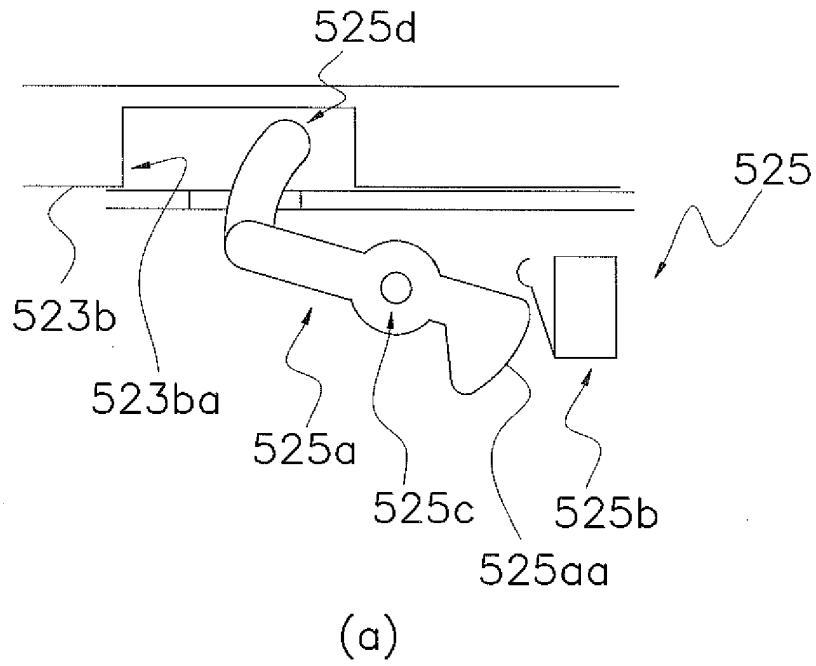


FIG. 28

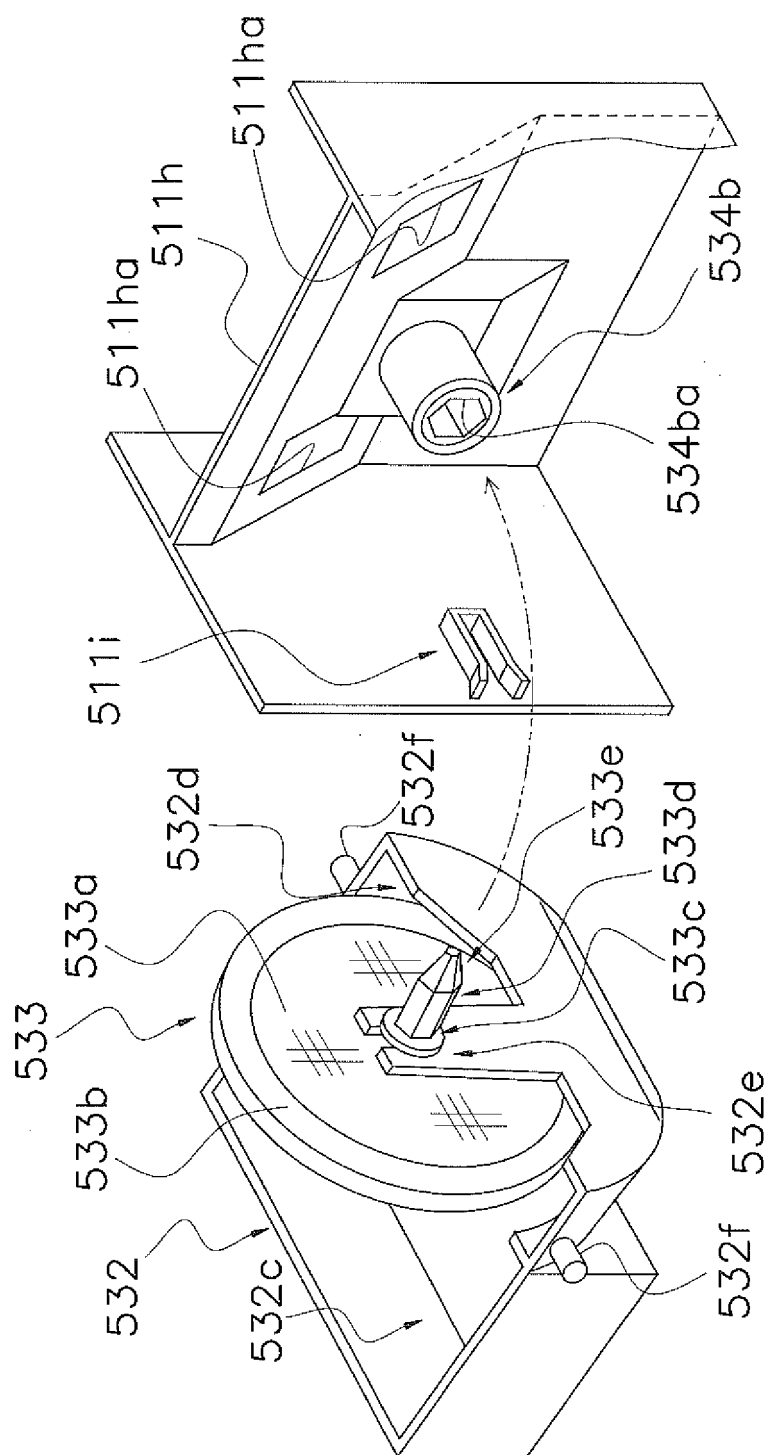


FIG. 29

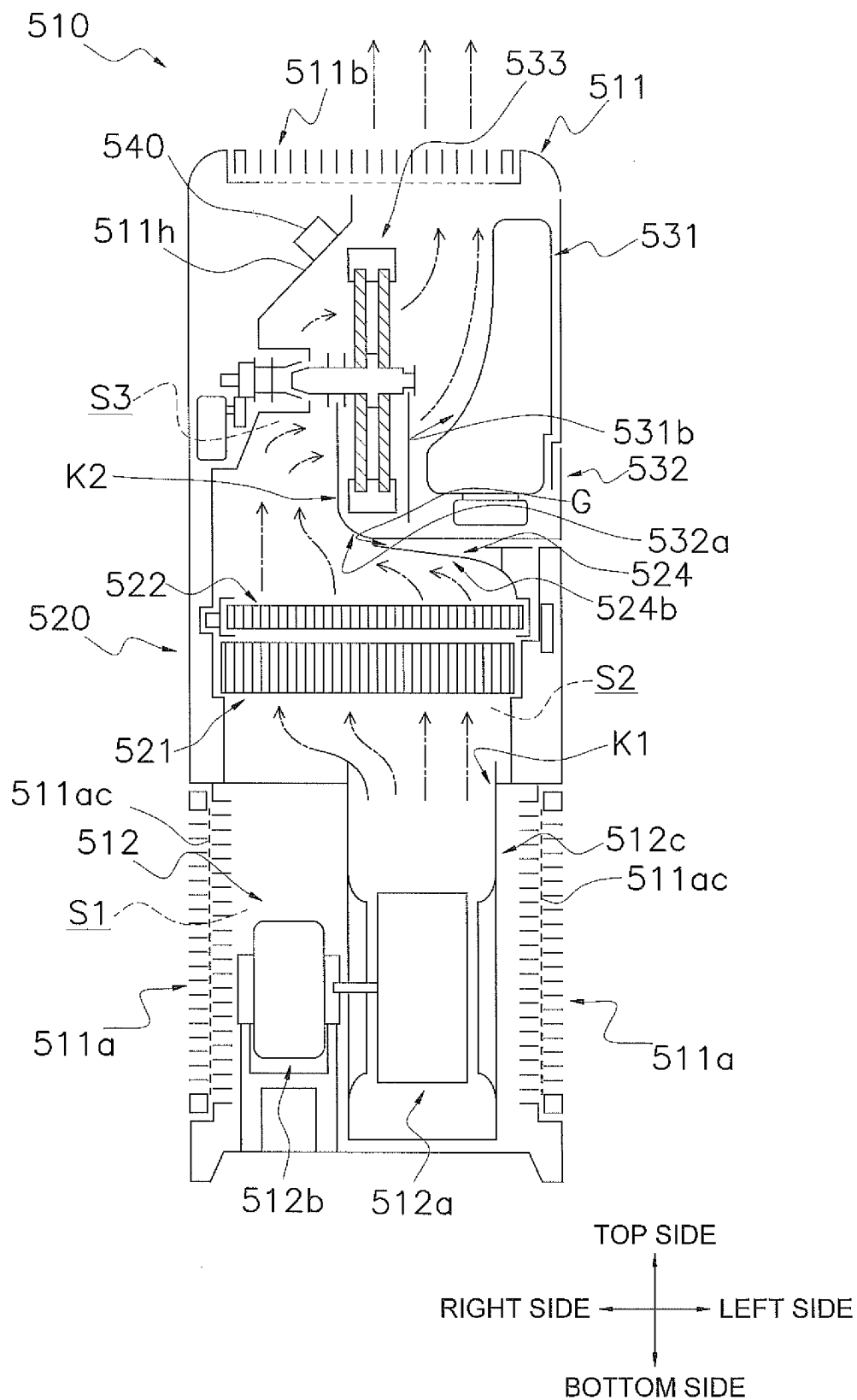


FIG. 30

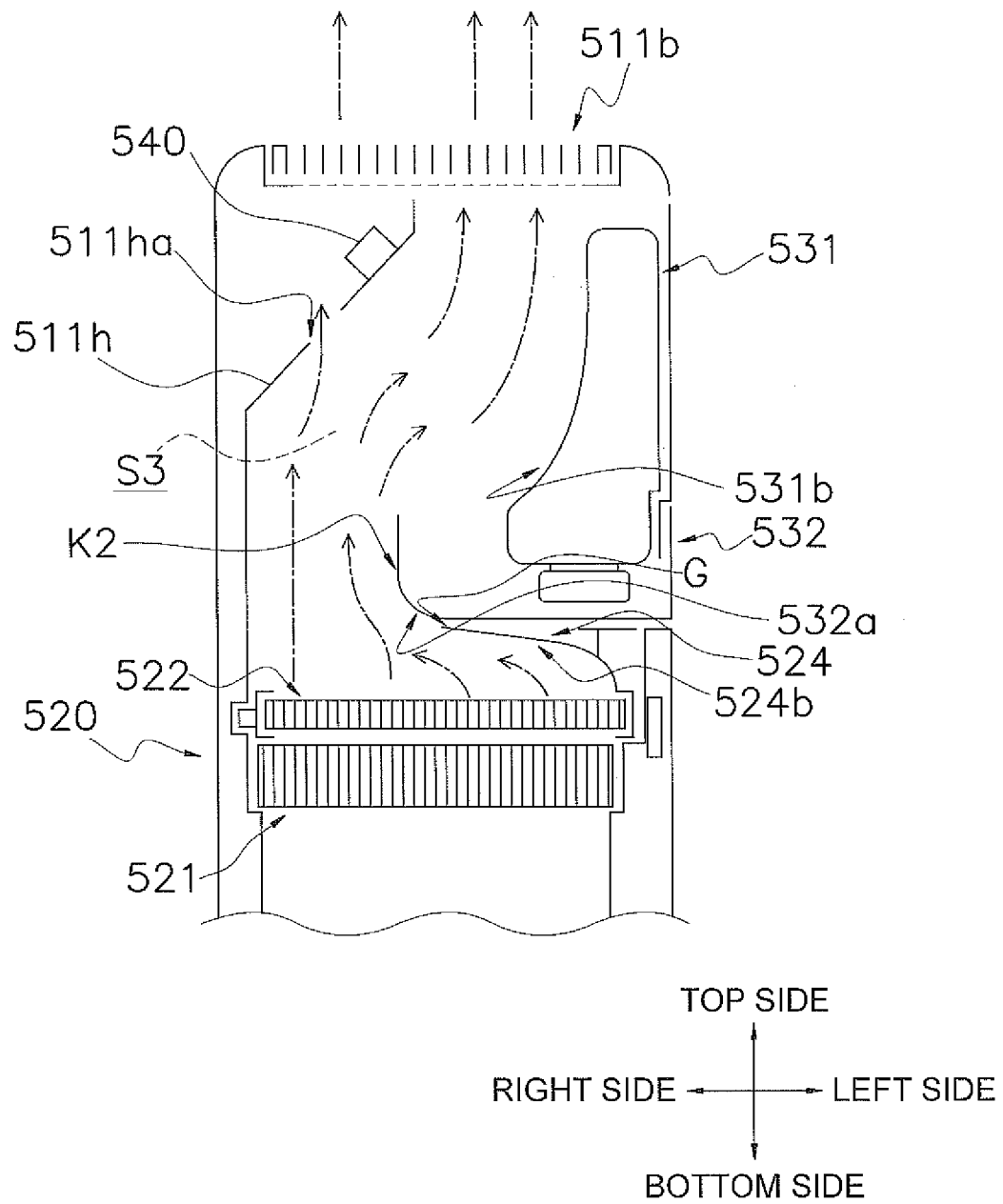


FIG. 31

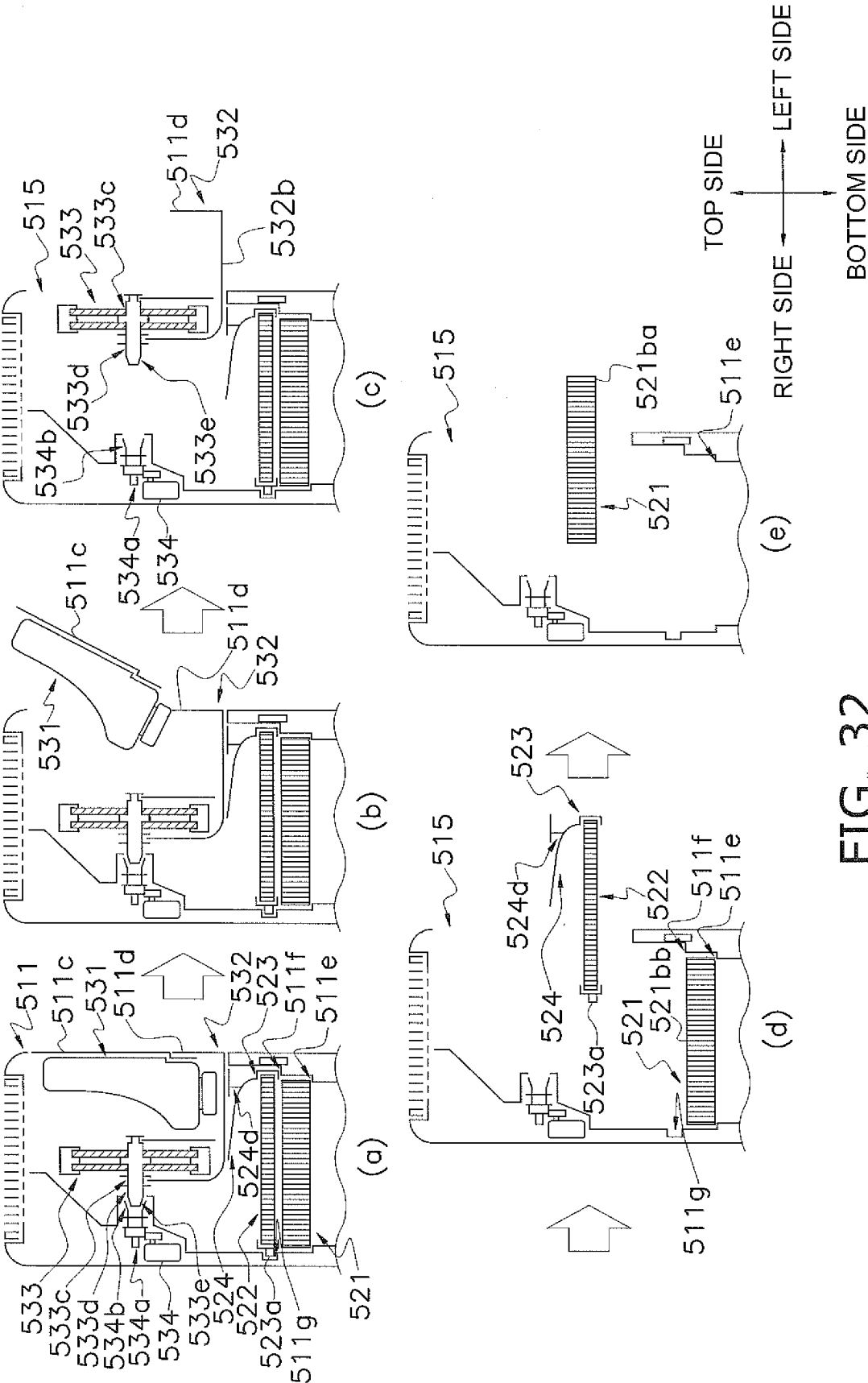


FIG. 32

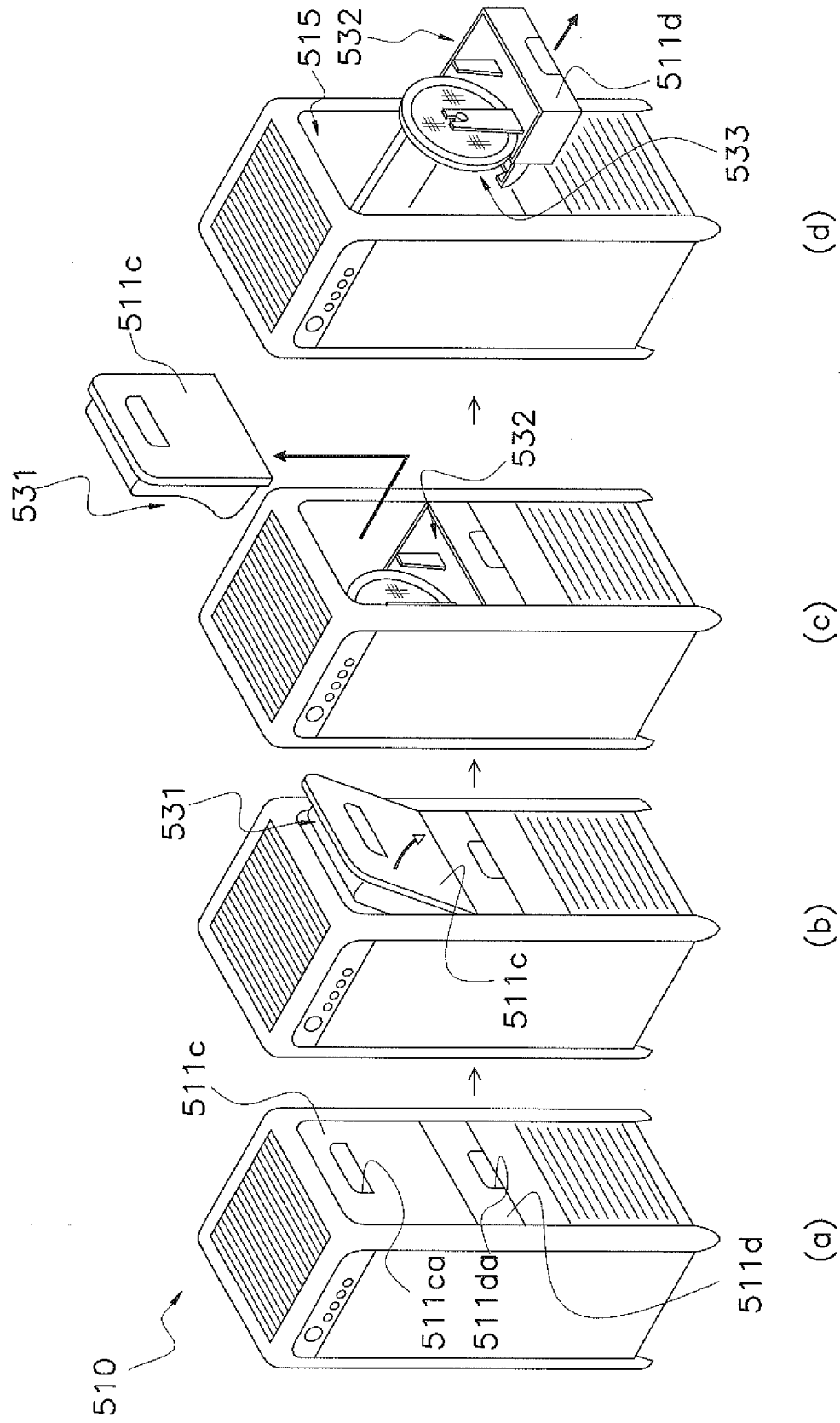


FIG. 33

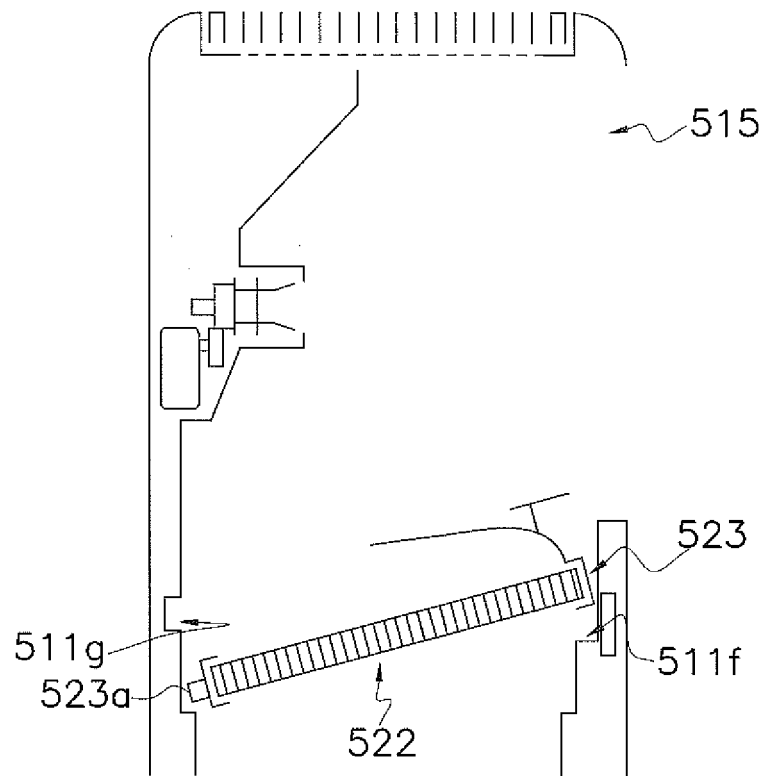


FIG. 34

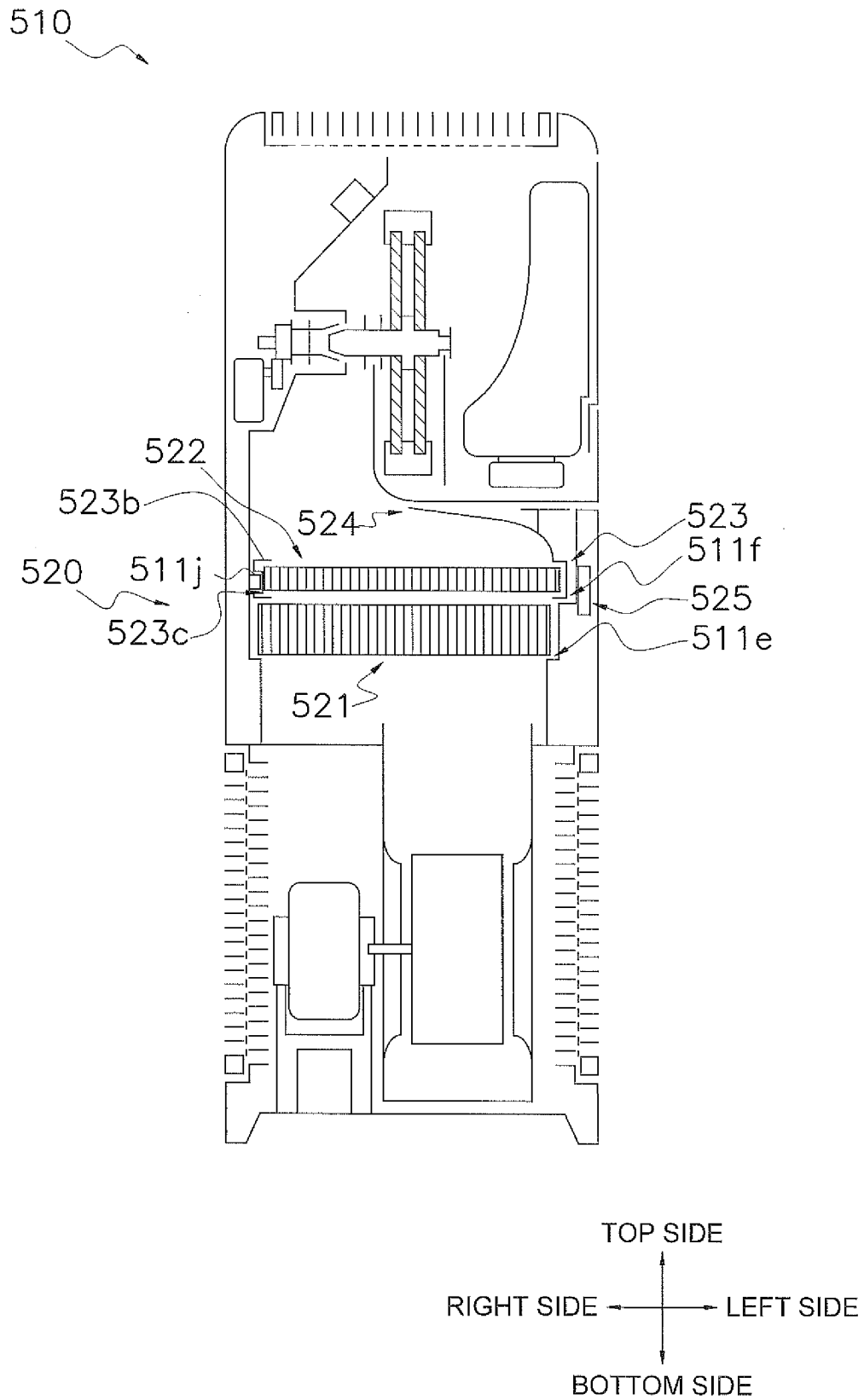


FIG. 35

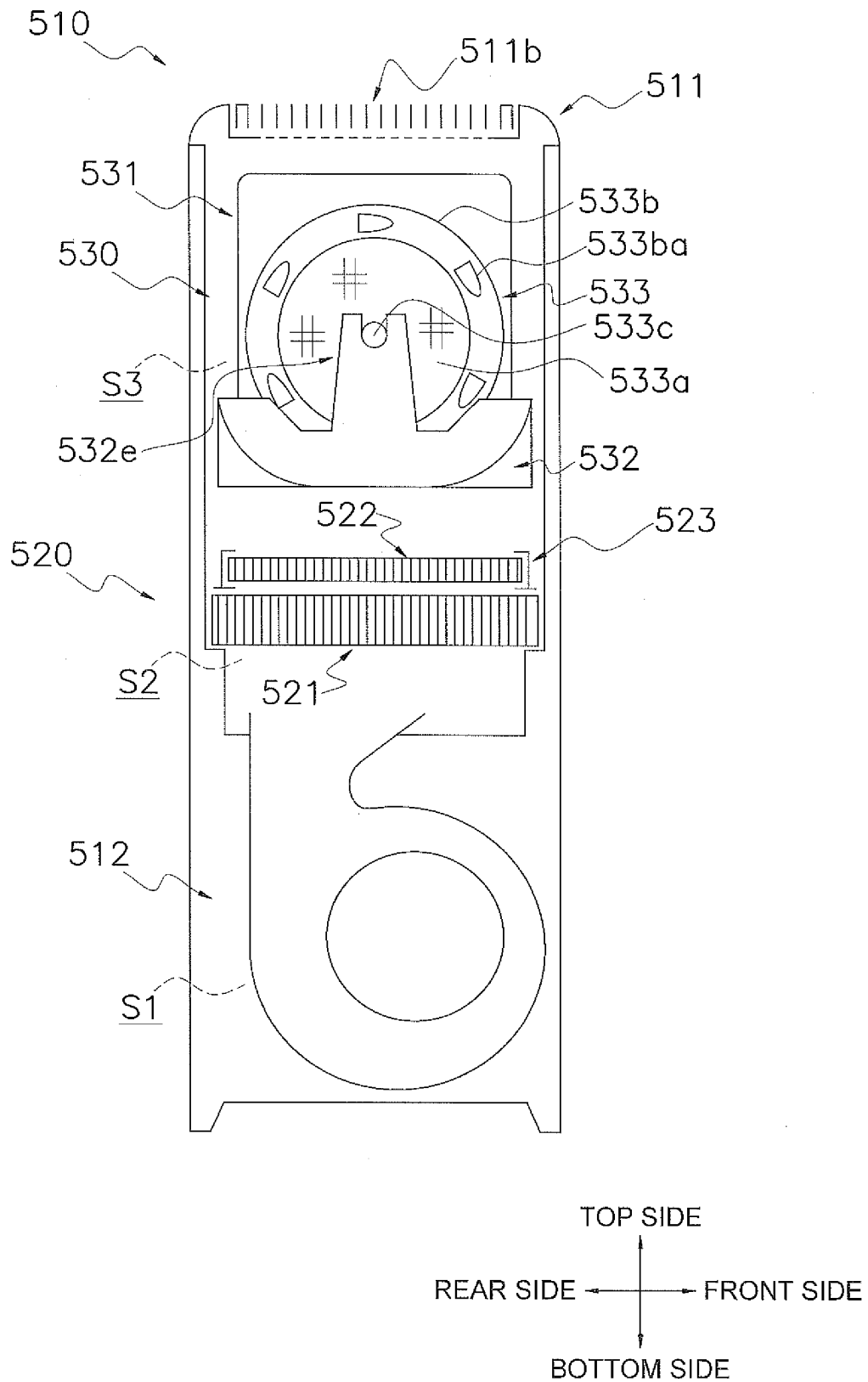


FIG. 36

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2014/084186

A. CLASSIFICATION OF SUBJECT MATTER

F24F7/00(2006.01)i, F24F6/00(2006.01)i, F24F6/06(2006.01)i, F24F6/16(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)

F24F7/00, F24F6/00, F24F6/06, F24F6/16

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 1996-2015
Kokai Jitsuyo Shinan Koho 1971-2015 Toroku Jitsuyo Shinan Koho 1994-2015

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	JP 2012-013361 A (Panasonic Corp.), 19 January 2012 (19.01.2012), paragraphs [0033] to [0071]; fig. 1 to 8 (Family: none)	1, 4 2-3, 5-9
Y	JP 2013-204858 A (Chofu Seisakusho Co., Ltd.), 07 October 2013 (07.10.2013), paragraphs [0019] to [0037]; fig. 1 to 4 (Family: none)	3, 5-9
Y	JP 2013-220399 A (Toshiba Home Technology Corp.), 28 October 2013 (28.10.2013), paragraph [0138]; fig. 12 to 13 (Family: none)	3, 5-9

☒ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

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Date of the actual completion of the international search
11 March 2015 (11.03.15)

Date of mailing of the international search report
24 March 2015 (24.03.15)

Name and mailing address of the ISA/
Japan Patent Office
3-4-3, Kasumigaseki, Chiyoda-ku,
Tokyo 100-8915, Japan

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2014/084186

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 2010-107164 A (Daikin Industries, Ltd.), 13 May 2010 (13.05.2010), paragraphs [0040] to [0041]; fig. 21 (Family: none)	2-3, 5-9
Y	JP 2001-054717 A (Sekisui Chemical Co., Ltd.), 27 February 2001 (27.02.2001), fig. 1 (Family: none)	5-9
Y	JP 02-213631 A (Mitsubishi Electric Corp.), 24 August 1990 (24.08.1990), fig. 1 (Family: none)	5-9
Y	US 2013/0330238 A1 (LG HAUSYS, LTD.), 12 December 2013 (12.12.2013), paragraphs [0032] to [0099]; fig. 1 to 2 & JP 2014-506988 A & EP 2682684 A2 & WO 2012/118329 A2 & KR 10-2012-0099903 A & CN 103403461 A	7-9
Y	JP 2011-179801 A (Panasonic Corp.), 15 September 2011 (15.09.2011), fig. 2 (Family: none)	8-9
Y	JP 2008-064443 A (Sharp Corp.), 21 March 2008 (21.03.2008), paragraph [0010]; fig. 1 to 2 (Family: none)	8-9
Y	JP 2008-145047 A (Sharp Corp.), 26 June 2008 (26.06.2008), paragraph [0049] (Family: none)	9
Y	JP 2010-048511 A (Sharp Corp.), 04 March 2010 (04.03.2010), paragraph [0033] (Family: none)	9
A	JP 2007-143937 A (Sanyo Electric Co., Ltd.), 14 June 2007 (14.06.2007), entire text; all drawings & EP 1788315 A2 & CN 1966089 A & KR 10-2007-0053132 A	1

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Patent documents cited in the description

- JP 2000283545 A [0002] [0353]