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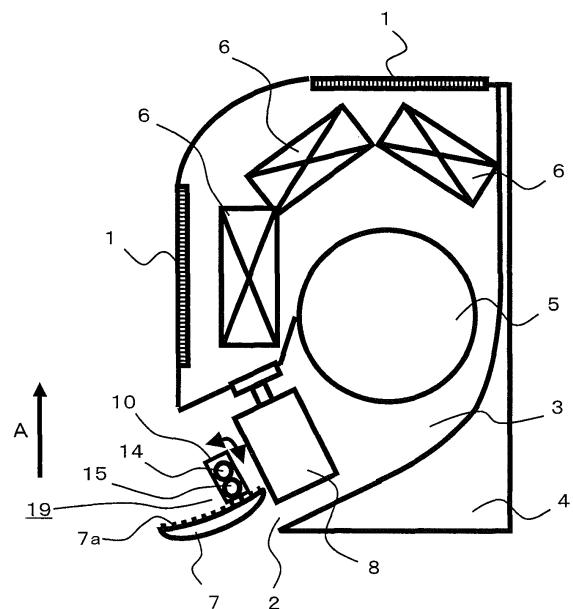
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(54) Air conditioner

(57) Provided is an air conditioner including: a case (4) having an air passage (3) that communicates with an inlet (1) and an outlet (2) therein; a fan (5) that is disposed within the air passage (3) and generates an airflow; a slide motion rotating shaft (9) that is rotatably disposed in the outlet (2) and extends toward a side surface that bounds the outlet (2); a vertical blade (7, 30) that is disposed in the outlet (2), and rotates about the slide motion rotating shaft (9) to deflect a direction of the airflow which is blown out of the outlet (2) in an upward or downward direction; and a vertical blade driving unit (19) that is disposed between the slide motion rotating shaft (9) and the vertical blade (7), changes a relative position between the slide motion rotating shaft (9) and the vertical blade (7), and rotates the vertical blade (7) about the slide motion rotating shaft. Accordingly, for example, a part of the airflow can be prevented from flowing in an upward direction without being deflected in a downward direction when the vertical blade (7) is tilted toward the downward direction to deflect the direction of the airflow and the airflow passes through the vertical blade (7), thereby improving the controllability of the airflow.

FIG.1



Description**BACKGROUND OF THE INVENTION****1. Field of the Invention**

[0001] The present invention relates to an air conditioner having a vertical blade that is disposed at an outlet, and deflects the direction of an airflow which is generated by a fan in an upward or downward direction.

2. Description of the Related Art

[0002] Up to now, there has been known an air conditioner having a case in which an air passage that communicates with an inlet and an outlet is formed, a fan that is disposed within the air passage and generates an airflow, and a vertical blade that is disposed at the outlet and deflects the direction of the airflow blown out of the outlet in the upward or downward direction (for example, refer to JP 03-158 647 A).

[0003] The air conditioner turns the vertical blade in a horizontal direction or a downward direction to control the direction of the airflow in the horizontal direction or the downward direction.

[0004] However, in the above-mentioned air conditioner, for example, when the vertical blade is tilted in the downward direction to deflect the direction of the airflow in the downward direction, a part of an airflow that passes through an upper surface of the vertical blade is caused to flow in the upward direction without being deflected in the downward direction when the airflow passes through the vertical blade. This causes a problem that the controllability of the airflow is deteriorated.

SUMMARY OF THE INVENTION

[0005] The present invention has been made to solve the above-mentioned problem, and therefore an object of the present invention is to provide an air conditioner that, for example, prevents a part of airflow from flowing in the upward direction without being deflected in the downward direction when the vertical blade is tilted toward the downward direction in order to deflect the direction of airflow and the airflow passes through the vertical blade, thereby improving the controllability of the airflow.

[0006] The air conditioner according to the present invention includes:

- a case having an air passage that communicates with an inlet and an outlet therein;
- a fan that is disposed within the air passage and generates an airflow;
- a first rotating shaft that is rotatably disposed in the outlet and extends toward a side surface that bounds the outlet;
- a vertical blade that is disposed in the outlet, and

rotates about the first rotating shaft to deflect a direction of the airflow blown out of the outlet in an upward or downward direction; and
a vertical blade driving means that is disposed between the first rotating shaft and the vertical blade, changes a relative position between the first rotating shaft and the vertical blade, and rotates the vertical blade about the first rotating shaft.

10 **[0007]** According to the air conditioner of the present invention, for example, a part of airflow is prevented from flowing in the upward direction without being deflected in the downward direction when the vertical blade is tilted toward the downward direction to deflect the direction of airflow and the airflow passes through the vertical blade, thereby improving the controllability of the airflow.

BRIEF DESCRIPTION OF THE DRAWINGS

20 **[0008]** In the accompanying drawings:

- Fig. 1 is a structural diagram showing an indoor equipment of an air conditioner according to a first embodiment;
- 25 Fig. 2 is a diagram showing vertical blade driving means of the air conditioner of Fig. 1;
- Fig. 3 is a diagram viewed along an arrow B of Fig. 2;
- Fig. 4 is a diagram showing a main portion of the indoor equipment of the air conditioner of Fig. 2;
- 30 Fig. 5A is an explanatory diagram showing an outlet when the indoor equipment of the air conditioner of Fig. 1 is in a stop state, and
- Fig. 5B is an enlarged diagram showing the vertical blade driving means of Fig. 5A;
- Fig. 6A is an explanatory diagram showing the outlet when the indoor equipment of the air conditioner of Fig. 1 blows an airflow from the outlet in the horizontal direction, and
- 40 Fig. 6B is a diagram showing the vertical blade driving means of Fig. 6A;
- Fig. 7A is an explanatory diagram showing the outlet when the air conditioner of Fig. 1 blows the airflow from the outlet in the downward direction, and
- 45 Fig. 7B is a diagram showing the vertical blade driving means of Fig. 7A;
- Fig. 8 is an explanatory diagram showing another example of the air conditioner according to the first embodiment;
- 50 Fig. 9 is a diagram showing another example of the vertical blade driving means of the air conditioner according to the first embodiment;
- Fig. 10 is a diagram showing still another example of the vertical blade driving means of the air conditioner according to the first embodiment;

Fig. 11 is a diagram showing yet still another example of the vertical blade driving means of the air conditioner according to the first embodiment;

Fig. 12 is a perspective view showing a main portion of an air conditioner according to a second embodiment;

Fig. 13 is a structural diagram showing an indoor equipment of an air conditioner according to a third embodiment;

Fig. 14 is a perspective view showing vertical blade driving means of Fig. 13;

Fig. 15A is a front view showing one end of the vertical blade driving means of Fig. 14;

Fig. 15B is a side view showing the vertical blade driving means viewed along an arrow B of Fig. 15A;

Fig. 15C is a front view showing another end of the vertical blade driving means of Fig. 14, and

Fig. 15D is a side view showing the vertical blade driving means viewed along an arrow D of Fig. 15C;

Fig. 16 is a structural diagram showing the air conditioner of Fig. 13 in a state of blowing the airflow in the horizontal direction;

Fig. 17 is a structural diagram showing the air conditioner of Fig. 13 in a state of blowing the airflow in the downward direction;

Fig. 18 is a structural diagram showing the air conditioner of Fig. 13 in a state of stopping;

Fig. 19 is a perspective view showing another example of the vertical blade driving means of the air conditioner according to the third embodiment;

Fig. 20A is a front view showing one end of the vertical blade driving means of Fig. 19,

Fig. 20B is a side view showing the vertical blade driving means viewed along the arrow B of Fig. 20A,

Fig. 20C is a front view showing another end of the vertical blade driving means of Fig. 19, and

Fig. 20D is a side view showing the vertical blade driving means viewed along an arrow D of Fig. 20C;

Fig. 21 is a perspective view showing vertical blade driving means of an air conditioner according to a fourth embodiment; and

Fig. 22A is a front view showing one end of the vertical blade driving means of Fig. 21,

Fig. 22B is a side view showing the vertical blade driving means viewed along the arrow B of Fig. 22A,

Fig. 22C is a front view showing another end of the vertical blade driving means of Fig. 21, and

Fig. 22D is a side view showing the vertical blade driving means viewed along an arrow D of Fig. 22C.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0009] Hereinafter, a description will be given of respective embodiments of the present invention with reference to the accompanying drawings. In the respective drawings, identical or corresponding members and parts are denoted by the same symbols.

[0010] In the present invention, a direction of an arrow A of Fig. 1 is called "upward direction".

First Embodiment

[0011] Fig. 1 is a structural diagram showing an air conditioner according to this embodiment, Fig. 2 is a diagram showing vertical blade driving means 19 of the air conditioner shown in Fig. 1, Fig. 3 is a diagram viewed along an arrow B of Fig. 2, and Fig. 4 is a perspective view showing a main portion of the air conditioner shown in Fig. 2.

[0012] The air conditioner according to this embodiment includes a case 4 in which an inlet 1 for sucking air from the outside, an outlet 2 for blowing out the air sucked from the inlet 1 to the outside, and an air passage 3 for communicating the inlet 1 and the outlet 2, formed therein.

[0013] Also, this air conditioner includes a fan 5 that is disposed within the air passage 3 and generates an airflow, a heat exchanger 6 that is disposed between the inlet 1 and the fan 5 and exchanges heat with the air which has been sucked in from the inlet 1, a vertical blade 7 having a circular arc cross section which is disposed at the outlet 2 and deflects the direction of an airflow which is blown out of the outlet 2 in an upward or downward direction, and a horizontal blade 8 that is disposed between the fan 5 and the vertical blade 7 and deflects the direction of an airflow within the air passage 3 in a rightward or leftward direction.

[0014] A slide motion rotating shaft 9 that is a first rotating shaft which extends toward side surfaces which bound the outlet 2 in the horizontal direction is rotatably disposed in the outlet 2.

[0015] A slide motion motor (not shown) that is controlled by a control unit (not shown) is connected to the slide motion rotating shaft 9 through a link mechanism (not shown), and the slide motion rotating shaft 9 rotates due to the drive of the slide motion motor.

[0016] A box connector main body 10a having a cavity formed inside is disposed at an end of the side surface that bounds the outlet 2 on one surface of the vertical blade 7.

[0017] A support 10b that is U-shaped in cross section, and slidably supports the end of the vertical blade 7 is disposed on a lower side of the connector main body 10a.

[0018] The connector 10 is constituted by the connector main body 10a and the support 10b.

[0019] A through-hole is formed in the side surface of the connector main body 10a that faces the side surface

which bounds the outlet 2, and a first bearing 11 is fitted into the through-hole.

[0020] The slide motion rotating shaft 9 is rotatably supported by the first bearing 11, and the end of the slide motion rotating shaft 9 faces the interior of the connector main body 10a.

[0021] Also, the connector main body 10a has both side surfaces of the slide motion rotating shaft 9 in the axial direction, through-holes are formed at the vertical blade 7 side with respect to the first bearing 11, and second bearings 12 are fitted into the respective through-holes.

[0022] A transmission rotating shaft 13 having both ends rotatably supported by the second bearing 12 is fitted to the inner side of the connector main body 10a so as to be in parallel to the slide motion rotating shaft 9.

[0023] A first gear 14 that is fixed to the slide motion rotating shaft 9 and rotates together with the slide motion rotating shaft 9 is disposed inside of the connector main body 10a.

[0024] Also, a second gear 15 that is a rotating body which is fixed to the transmission rotating shaft 13, rotates with the transmission rotating shaft 13, and is meshing with the first gear 14 is disposed inside of the connector main body 10a.

[0025] The first gear 14 and the second gear 15 are made of a resin, but are not limited to this material, and any material with enough strength such as metal may be used instead.

[0026] A surface of the vertical blade 7 which faces the connector main body 10a is formed with convex portions 7a which are an engaged portion which can be meshing with the second gear 15.

[0027] A plurality of convex portions 7a are aligned in a direction orthogonal to the transmission rotating shaft 13.

[0028] The connector 10 houses the first gear 14 and the second gear 15 inside of the connector main body 10a that is a box having a cavity inside so as to prevent dust in the air from being attached to the first gear 14 and the second gear 15, and dew condensation from occurring on the first gear 14 and the second gear 15. However, if there arises no problem of dust in the air being attached to the first gear 14 and the second gear 15, or dew condensation occurring on the first gear 14 and the second gear 15, the connector main body 10a may not be boxy.

[0029] In this case, the connector main body 10a is configured in such a manner that the first bearing 11 and the second bearing 12 can be fitted to the connector main body 10a.

[0030] A third gear 16 having an interior into which the slide motion rotating shaft 9 penetrates is fixed to the outer side of the side wall to which the first bearing 11 of the connector main body 10a is fitted.

[0031] With the above-mentioned configuration, when the third gear 16 rotates about the slide motion rotating shaft 9, the connector 10 also rotates about the slide motion rotating shaft 9 in conjunction with the third gear

16.

[0032] A fourth gear 18 that is fixed to a rotation motion rotating shift 17 which is a second rotating shaft which is disposed in parallel to the slide motion rotating shaft 9 is meshing with the third gear 16.

[0033] The rotation motion rotating shaft 17 is connected with a rotation motion motor (not shown) through a link mechanism (not shown), and the rotation motion rotating shaft 17 rotates due to the drive of the rotation motion motor.

[0034] The fourth gear 18 rotates in conjunction with the rotation of the rotation motion rotating shaft 17, the third gear 16 rotates, and the connector 10 rotates about the slide motion rotating shaft 9.

[0035] The vertical blade driving means 19 is formed of the slide motion rotating shaft 9, the first gear 14, the transmission rotating shaft 13, the second gear 15, the connector 10, the convex portion 7a, the third gear 16, the rotation motion rotating shaft 17, and the fourth gear 18.

[0036] Subsequently, the operation of the air conditioner according to this embodiment will be described below.

[0037] First, a description will be given of a case where changing over from a stop state to a state where the airflow is blown out of the outlet 2 in the horizontal direction.

[0038] Fig. 5A is an explanatory diagram showing the outlet 2 when the air conditioner shown in Fig. 1 is in a stop state, and Fig. 5B is a diagram showing the vertical blade driving means 19 shown in Fig. 5A. Fig. 6A is an explanatory diagram showing the outlet 2 when the air conditioner shown in Fig. 1 blows the airflow from the outlet 2 in the horizontal direction, and Fig. 6B is a diagram showing the vertical blade driving means 19 shown in Fig. 6A.

[0039] In the state where the air conditioner stops, the vertical blade 7 is so tilted as to close the outlet 2.

[0040] In this state, when the air conditioner is operated by a user so as to blow the airflow in the horizontal direction, the airflow occurs due to the rotation of the fan 5, the air is sucked in from the inlet 1, and the sucked air passes through the heat exchanger 6.

[0041] Since the temperature of the heat exchanger 6 is controlled to a given temperature, the air that has passed through the heat exchanger 6 reaches a setting temperature, and is then carried to the outlet 2.

[0042] Subsequently, the slide motion motor is driven, the slide motion rotating shaft 9 rotates counterclockwise which is a direction indicated by an arrow 20a, and the first gear 14 that is fixed to the slide motion rotating shaft 9 rotates about the slide motion rotating shaft 9 counterclockwise.

[0043] Also, the second gear 15 that is meshing with the first gear 14 rotates about the transmission rotating shaft 13 clockwise that is a direction indicated by an arrow 21a.

[0044] As a result, the vertical blade 7 that is meshing

with the second gear 15 moves downstream of the slide motion rotating shaft 9 which is a direction indicated by an arrow 22a.

[0045] Then, the rotation motion motor is driven, the rotation motion rotating shaft 17 rotates clockwise, and the fourth gear 18 that is fixed to the rotation motion rotating shaft 17 rotates about the rotation motion rotating shaft 17 clockwise.

[0046] Also, the third gear 16 that is meshing with the fourth gear 18 rotates about the slide motion rotating shaft 9 counterclockwise, and the connector 10 that is fixed to the third gear 16 rotates about the slide motion rotating shaft 9 counterclockwise.

[0047] As a result, the vertical blade 7 that is supported by the connector 10 rotates about the slide motion rotating shaft 9 counterclockwise that is a direction indicated by an arrow 23a.

[0048] The vertical blade 7 rotates so as to be directed in the horizontal direction, and the downstream end of the vertical blade 7 moves toward a downstream side which is a direction away from the slide motion rotating shaft 9. With the above-mentioned operation, even if the vertical blade 7 or the horizontal blade 8 is upsized, the upstream side end of the vertical blade 7 can be prevented from colliding with the horizontal blade 8.

[0049] As a result, the controllability of the airflow when the vertical blade 7 is tilted in the horizontal direction can be improved.

[0050] Subsequently, a description will be given of a case of changing over from the stop state to a state where the airflow is blown out of the outlet 2 in the downward direction.

[0051] Fig. 7A is an explanatory diagram showing the outlet 2 when the air conditioner shown in Fig. 1 blows the airflow from the outlet 2 in the downward direction, and Fig. 7B is a diagram showing the vertical blade driving means 19 of Fig. 7A.

[0052] When the air conditioner is operated by a user so as to blow the airflow in the downward direction from a state where the vertical blade 7 closes the outlet 2, the airflow occurs due to the rotation of the fan 5, and the air that has been sucked in from the inlet 1 passes through the heat exchanger 6, and is then carried to the outlet 2.

[0053] Subsequently, the slide motion motor is driven, the slide motion rotating shaft 9 rotates clockwise which is a direction indicated by an arrow 20b, and the first gear 14 that is fixed to the slide motion rotating shaft 9 rotates about the slide motion rotating shaft 9 clockwise.

[0054] Also, the second gear 15 that is meshing with the first gear 14 rotates about the transmission rotating shaft 13 counterclockwise that is a direction indicated by an arrow 21b.

[0055] As a result, the vertical blade 7 that is meshing with the second gear 15 moves downstream of the slide motion rotating shaft 9 which is a direction indicated by an arrow 22b.

[0056] Then, the rotation motion rotating shaft 17 rotates counterclockwise by the drive of the rotation motion

motor, and the fourth gear 18 that is fixed to the rotation motion rotating shaft 17 rotates about the rotation motion rotating shaft 17 counterclockwise.

[0057] Also, the third gear 16 that is meshing with the fourth gear 18 rotates about the slide motion rotating shaft 9 clockwise, and the connector 10 that is fixed to the third gear 16 rotates about the slide motion rotating shaft 9 clockwise.

[0058] As a result, the vertical blade 7 that is supported by the connector 10 rotates about the slide motion rotating shaft 9 clockwise that is a direction indicated by an arrow 23b.

[0059] The vertical blade 7 rotates so as to be directed in the downward direction, and the downstream end of the vertical blade 7 moves toward a downstream side which is a direction away from the slide motion rotating shaft 9. With the above-mentioned operation, even if the vertical blade 7 or the horizontal blade 8 is upsized, the upstream side end of the vertical blade 7 can be prevented from colliding with the horizontal blade 8.

[0060] As a result, the controllability of the airflow when the vertical blade 7 is tilted in the downward direction can be improved.

[0061] Also, since the upstream end of the vertical blade 7 can approach a ceiling surface of the outlet 2, a part of airflow which passes through the upper side of the vertical blade 7 can be prevented from flowing in the upward direction without being deflected, and the controllability of the airflow can be further improved.

[0062] As described above, according to the air conditioner of this embodiment, a relative position between the slide motion rotating shaft 9 and the vertical blade 7 is changed by the vertical blade driving means 19, and the vertical blade 7 rotates about the slide motion rotating shaft 9. As a result, for example, even if the vertical blade 7 is tilted in the downward direction so as to deflect the direction of the airflow in the downward direction, the upstream end of the vertical blade 7 approaches the ceiling surface of the outlet 2, thereby preventing a part of the airflow that passes through the upper side of the vertical blade 7 from flowing in the upward direction without being deflected. This enables the controllability of the airflow to be improved.

[0063] Also, the vertical blade driving means 19 inverts the vertical blade 7 in the upward or downward direction, and also changes the relative position between the slide motion rotating shaft 9 and the vertical blade 7 in a direction along which the downstream end of the vertical blade 7 is apart from the slide motion rotating shaft 9.

With the above-mentioned operation, even if the vertical blade 7 or the horizontal blade 8 is upsized, the vertical blade 7 is prevented from colliding with the horizontal blade 8. This enables the controllability of the airflow to be improved.

[0064] Also, the vertical blade driving means 19 has the second gear 15 that comes in contact with the vertical blade 7 and rotates in conjunction with the slide motion rotating shaft 9. The second gear 15 rotates while the

vertical blade 7 moves in one direction with respect to the slide motion rotating shaft 9. As a result, the turning force of the slide motion rotating shaft 9 can be transmitted to the vertical blade 7 with the simple configuration.

[0065] Further, since the vertical blade 7 is formed with the convex portion 7a which is meshing with the second gear 15, the turning force of the second gear 15 can be transmitted to the vertical blade 7 with a simple configuration.

[0066] This embodiment exemplifies the vertical blade driving means 19 having the slide motion rotating shaft 9 that is connected to the slide motion motor and the rotation motion rotating shaft 17 that is connected to the rotation motion motor. However, the present invention is not limited to this configuration. As shown in Fig. 8, the vertical blade driving means 19 can be configured in such a manner that a fifth gear 24 is fixed to the slide motion rotating shaft 9, and a sixth gear 25 that is meshing with the fifth gear 24 is fixed to the rotation motion rotating shaft 17 to rotate the slide motion rotating shaft 9 at the same time when the rotation motion rotating shaft 17 rotates.

[0067] Other configurations are identical with those in the first embodiment.

[0068] In this case, the motor can be fitted to any one of the slide motion rotating shaft 9 and the rotation motion rotating shaft 17, thereby enabling the number of motors to be reduced.

[0069] Fig. 9 is a diagram showing another example of the vertical blade driving means 19 of the air conditioner according to this embodiment.

[0070] The support 10b extends horizontally in a direction away from the connector main body 10a, then is bent toward the vertical blade 7, further bent before the vertical blade 7, and again extends horizontally in the direction away from the connector main body 10a.

[0071] The vertical blade 7 includes an L-shaped support receiving portion 26 having a leading end directed toward the connector main body 10a on a surface thereof that faces the connector main body 10a.

[0072] The leading end of the support 10b is slidably disposed inside of the support receiving portion 26.

[0073] With the above-mentioned configuration, the vertical blade 7 is slidably supported to the connector 10.

[0074] According to the above-mentioned air conditioner, it is not necessary that the support 10b is so disposed as to extend from one surface of the vertical blade 7 to another surface thereof with the result that the support 10b can be simply formed. Also, a position at which the connector 10 is fitted is not limited to the end of the side surface of the outlet 2 of the vertical blade 7, but can be freely provided.

[0075] Fig. 10 is a diagram showing still another example of the vertical blade driving means 19 of the air conditioner according to this embodiment.

[0076] A lower side of the support 10b is U-shaped in cross section.

[0077] The vertical blade 7 has a concave portion 27

along which the leading end of the support 10b is slidable on a surface thereof which faces the side surface that bounds the outlet 2.

[0078] With the above-mentioned configuration, the vertical blade 7 is slidably supported to the connector 10.

[0079] According to the above-mentioned air conditioner, since the support 10b does not extend up to a surface of the vertical blade 7 at an opposite side of the connector main body 10a, the surface of the vertical blade 7 at an opposite side of the connector main body 10a can further approach the ceiling surface or the bottom surface of the outlet 2.

[0080] Fig. 11 is a perspective view showing yet still another example of the vertical blade driving means 19 of the air conditioner according to this embodiment.

[0081] A surface of the vertical blade 7 which faces the connector main body 10a is formed with concave portions 7b which are an engaged portion which can be meshing with the second gear 15.

[0082] A plurality of concave portions 7b are continuously aligned in a direction orthogonal to the transmission rotating shaft 13.

[0083] Since the concave portion 7b reduces collision with the airflow as compared with the convex portion 7a, dust contained in the airflow can be prevented from being attached to the concave portion 7b.

[0084] As a result, the reliability in the driving of the vertical blade 7 can be improved.

[0085] The engaged portion is not limited to the concave portion 7b having a bottom, but can be a through-hole that penetrates the vertical blade 6.

Second Embodiment

[0086] Fig. 12 is a perspective view showing a main portion of an air conditioner according to this embodiment.

[0087] A first cylindrical portion 28 that is fixed to the slide motion rotating shaft 9 and rotates together with the slide motion rotating shaft 9 is disposed inside of the connector main body 10a.

[0088] Also, a second cylindrical portion 29 that is a rotating body which is fixed to the transmission rotating shaft 13, rotates together with the transmission rotating shaft 13, and comes in contact with the vertical blade 7 is disposed inside of the connector main body 10a.

[0089] The first cylindrical portion 28 and the second cylindrical portion 29 have rubber which is a slip stopper member on their peripheries which come in contact with each other. When the first cylindrical portion 28 rotates, the second cylindrical portion 29 also rotates in conjunction with the first cylindrical portion 28, and the vertical blade 7 moves in one direction with respect to the second cylindrical member 29.

[0090] The slip stopper member is not limited to rubber, but can also be made of other materials.

[0091] The vertical blade 7 may have rubber which is the slip stopper member in a region where the vertical

blade 7 comes in contact with the periphery of the second cylindrical portion 29, and the slip stopper member may also be disposed on any one of the second cylindrical portion 29 and the vertical blade 7.

[0092] Other configurations are identical with those in the first embodiment.

[0093] According to the air conditioner of this embodiment, the first cylindrical portion 28, the second cylindrical portion 29, and the vertical blade 7 are not formed with the convex portion or the concave portion which are meshing with each other, and come in contact with surfaces that do not slip on each other. For this reason, the attachment of dust onto the first cylindrical portion 28, the second cylindrical portion 29, and the vertical blade 7 can be reduced as compared with the air conditioner according to the first embodiment.

[0094] As a result, high reliability can be achieved with respect to the driving of the vertical blade 7.

[0095] The respective embodiments exemplify the vertical blade 7 that is formed with the engaged portion which is meshing with the second gear 15, and the vertical blade 7 that comes in contact with the second cylindrical portion 29. However, the present invention is not limited to this configuration, but the vertical blade 7 may have a member formed with the engaged portion which is meshing with the second gear 15, or the vertical blade 7 may have a member that comes in contact with the second cylindrical portion 29.

Third Embodiment

[0096] Fig. 13 is a structural diagram showing an air conditioner according to this embodiment. Fig. 14 is a perspective view showing vertical blade driving means 34 shown in Fig. 13. Fig. 15A is a front view showing one end of the vertical blade driving means 34 shown in Fig. 15A, Fig. 15B is a side view showing the vertical blade driving means 34 viewed along an arrow B in Fig. 15A, and Fig. 15C is a front view showing another end of the vertical blade driving means 34 in Fig. 14, and Fig. 15D is a side view showing the vertical blade driving means 34 viewed along an arrow D in Fig. 15C.

[0097] A slide guide 30a is omitted in Fig. 15, and a slide motion motor 46 and a rotation motion motor 47 is omitted in Fig. 15D.

[0098] The air conditioner according to this embodiment includes a vertical blade 30 having a circular arc configuration in cross section which is disposed at an outlet 2 and deflects the direction of the airflow which is blown out of the outlet 2 in the upward or downward direction, and a horizontal blade 31 which is disposed between a fan 5 and the vertical blade 30 and deflects the airflow within an air passage 3 in the right or left direction.

[0099] A slide motion rotating shaft 32 that is a first rotating shaft which faces the vertical blade 30 and extends in the horizontal direction toward a side surface that bounds the outlet 2, and a rotation motion rotating shaft 33 that is a second rotating shaft which is in parallel

to the slide motion rotating shaft 32 are rotatably supported to the outlet 2.

[0100] Vertical blade driving means 34 that change a relative position between the vertical blade 30 and the slide motion rotating shaft 32, and rotate the vertical blade 30 about the slide motion rotating shaft 32 are disposed between the vertical blade 30 and the slide motion rotating shaft 32.

[0101] The vertical blade driving means 34 include a connector 35 having one end rotatably supported to the slide motion rotating shaft 32 and another end supporting the vertical blade 30, a moving mechanism 36 that relatively moves the vertical blade 30 with respect to the connector 35, and a rotating mechanism 37 that rotates the connector 35 about the slide motion rotating shaft 32.

[0102] The connectors 35 are disposed at both ends of the vertical blade 30, respectively, and the moving mechanisms 36 and the rotating mechanisms 37 are disposed on the respective connectors 35.

[0103] Each of the moving mechanisms 36 includes a first rotating force transmission unit having a seventh gear 38 that is fixed to the slide motion rotating shaft 32 and rotates together with the slide motion rotating shaft 32, an eighth gear 39 that is rotatably supported to the connector 35 and meshing with the seventh gear 38, a ninth gear 40 that is rotatable and meshing with the eighth gear 39, and a transmission rotating shaft 41 which is rotatably supported by the connector 35, and whose one end is fixed to the ninth gear 40, and a tenth gear 42 that is a rotating body which is fixed to another end of the transmission rotating shaft 41.

[0104] The seventh gear 38, the eighth gear 39, and the ninth gear 40 are aligned from the slide motion rotating shaft 32 toward the vertical blade 30 inside of the connector 35 having a cavity therein.

[0105] Ring-shaped slide guides 30a that are flattened are fixed at both side surfaces that bound the outlet 2 on a surface of the vertical blade 30 which faces the slide motion rotating shaft 32.

[0106] Each of the slide guides 30a extends in a direction orthogonal to the slide motion rotating shaft 32, and projections 30b which are triangular first contact portions are continuously formed on a bottom surface of the interior of the slide guide 30a in the longitudinal direction.

[0107] These projections 30b are meshing with the tenth gear 42.

[0108] With the above-mentioned configuration, when the slide motion rotating shaft 32 rotates, the rotating force is transmitted to the tenth gear 42 through the seventh gear 38, the eighth gear 39, the ninth gear 40, and the transmission rotating shaft 41. As a result, the vertical blade 30 relatively moves with respect to the connector 35.

[0109] The above-mentioned embodiment exemplifies the vertical blade 30 having the slide guide 30a on which the projections 30b are formed. However, the present invention is not limited to the above-mentioned configuration, and the vertical blade 30 may be directly formed

with the projections.

[0110] The rotating mechanism 37 includes an eleventh gear 43 that is a second contact portion which is fixed to the connector 35 about the slide motion rotating shaft 32, and a second rotating force transmission unit having a twelfth gear 44 that is rotatable and meshing with the eleventh gear 43, and a thirteenth gear 45 that is fixed to the rotating motion rotating shaft 33 and meshing with the twelfth gear 44.

[0111] The eleventh gear 43, the twelfth gear 44, and the thirteenth gear 45 are aligned from the slide motion rotating shaft 32 toward the rotation motion rotating shaft 33.

[0112] With the above-mentioned configuration, when the rotation motion rotating shaft 33 rotates, the rotating force is transmitted to the eleventh gear 43 through the thirteenth gear 45 and the twelfth gear 44, and the connector 35 rotates about the slide motion rotating shaft 32.

[0113] The eleventh gear 43 can be integrated with the connector 35.

[0114] The projections 30b, the seventh gear 38, the eighth gear 39, the ninth gear 40, the tenth gear 42, the eleventh gear 43, the twelfth gear 44, and the thirteenth gear 45 are made of copper-based metal. However, the present invention is not limited to the above-mentioned configuration, so these gears can be made of other materials such as iron-based metal, polyacetal resin, and nylon resin.

[0115] One end of the slide motion rotating shaft 32 is connected with a slide motion motor 46 which is a first motor that rotates the slide motion rotating shaft 32, and one end of the rotation motion rotating shaft 33 is connected with a rotation motion motor 47 which is a second motor that rotates the rotation motion rotating shaft 33.

[0116] Other configurations are identical with those in the first embodiment.

[0117] Subsequently, the operation of the air conditioner according to this embodiment will be described.

[0118] Fig. 16 is a structural diagram showing a state in which the air conditioner shown in Fig. 13 is in a stop state. Fig. 17 is a structural diagram showing a state where the air conditioner shown in Fig. 13 blows the airflow out of the outlet 2 in the horizontal direction. Fig. 18 is a structural diagram showing a state where the air conditioner shown in Fig. 13 blows the airflow out of the outlet 2 in the downward direction.

[0119] In a state where the air conditioner stops, the vertical blade 30 is so tilted as to close the outlet 2.

[0120] With the above-mentioned configuration, a simply designed structure can be provided.

[0121] In the above-mentioned state, when the air conditioner is operated by a user so as to conduct a heater operation, the rotation operation motor 47 is driven to rotate the rotation operation rotating shaft 33. The rotating force of the rotation operation rotating shaft 33 is transmitted to the eleventh gear 43 through the thirteenth gear 45 and the twelfth gear 44, and the connector 35 rotates about the slide motion rotating shaft 32 in such a

direction that the concave portion of the vertical blade 30 is directed downwards in conjunction with the eleventh gear 43.

[0122] Since the airflow can be deflected in the downward direction along the concave portion of the vertical blade 30, hot air is prevented from soaring from the downstream end of the vertical blade 30 with the result that hot air arrival property in floor surface direction can be improved.

[0123] Also, since the vertical blade 30 rotates at a large angle, the vertical blade 30 can approach the ceiling surface of the outlet 2. Accordingly, the airflow that has passed through the upper side of the vertical blade 30 is prevented from flowing in the upward direction. As a result, it is possible to improve the controllability of the airflow.

[0124] Then, the slide motion motor 46 is driven to rotate the slide motion rotating shaft 32, and the rotating force of the slide motion rotating shaft 32 is transmitted to the tenth gear 42 through the seventh gear 38, the eighth gear 39, the ninth gear 40, and the transmission rotating shaft 41.

[0125] Since the tenth gear 42 rotates while meshing with the projections 30b, the vertical blade 30 relatively moves in a direction along which the downstream end is apart from the slide motion rotating shaft 32 with respect to the connector 35.

[0126] With the above-mentioned operation, the vertical blade 30 can be prevented from colliding with the horizontal blade 31 or the ceiling surface of the outlet 2.

[0127] Subsequently, when the air conditioner is operated by the user so as to conduct cooler operation, the rotation operation motor 47 is driven in an opposite direction to that at the time of the heater operation to rotate the rotation operation rotating shaft 33. The rotating force of the rotation operation rotating shaft 33 is transmitted to the eleventh gear 43 through the thirteenth gear 45 and the twelfth gear 44, and the connector 35 rotates about the slide motion rotating shaft 32 in such a direction that the concave portion of the vertical blade 30 is directed upwards in conjunction with the eleventh gear 43.

[0128] Since the airflow can be deflected in the horizontal direction along the concave portion of the vertical blade 30, cold air is prevented from blowing down the downstream end of the vertical blade 30.

[0129] Also, since the vertical blade 30 rotates at a large angle, the vertical blade 30 can approach the bottom surface of the outlet 2. Accordingly, the airflow that has passed through the lower side of the vertical blade 30 is prevented from flowing in the downward direction. As a result, it is possible to improve the controllability of the airflow.

[0130] Then, the slide motion motor 46 is driven in an opposite direction to that at the time of the heater operation to rotate the slide motion rotating shaft 32. The rotating force of the slide motion rotating shaft 32 is transmitted to the tenth gear 42 through the seventh gear 38, the eighth gear 39, the ninth gear 40, and the transmis-

sion rotating shaft 41.

[0131] Since the tenth gear 42 rotates while meshing with the projections 30b, the vertical blade 30 relatively moves in a direction in which the downstream end is apart from the slide motion rotating shaft 32 with respect to the connector 35.

[0132] With the above-mentioned operation, the vertical blade 30 can be prevented from colliding with the horizontal blade 31 or the ceiling surface of the outlet 2.

[0133] As described above, in the air conditioner according to this embodiment, the relative position between the slide motion rotating shaft 32 and the vertical blade 30 is changed by the vertical blade driving means 34, and the vertical blade 30 rotates about the slide motion rotating shaft 32. For this reason, for example, even if the vertical blade 30 is tilted in the downward direction so as to deflect the direction of airflow in the downward direction, the upstream end of the vertical blade 30 is made to approach the ceiling surface of the outlet 2 to prevent a part of the airflow that passes through the upper side of the vertical blade 30 from flowing in the upward direction without being deflected. As a result, the controllability of the airflow can be improved.

[0134] Also, the slide motion motor 46 and the vertical blade 30 can be disposed apart from each other by the first rotating force transmitting means, and the rotation motion motor 47 and the vertical blade 30 can be disposed apart from each other by the second rotating force transmitting means. For this reason, a pressure loss of the airflow within the air passage 3 due to the slide motion motor 46 or the rotation motion motor 47 can be reduced, and dew condensation that is produced by the generation of a turbulent flow can be prevented.

[0135] Further, the slide motion rotating shaft 32 is rotated by the drive of the slide motion motor 46, and the rotation motion rotating shaft 33 is rotated by the drive of the rotation motion motor 47. For this reason, the vertical blade 30 can be rotated in order that the vertical blade 30 does not collide with the outlet 2 or the horizontal blade 31.

[0136] Still further, only the slide motion motor 46 is driven, thereby making it possible to protrude the vertical blade 30 to the downstream side, or retract the vertical blade 30 to the upstream side. As a result, for example, the flow passage of the outlet 2 is narrowed to reduce the air flow, thereby making it possible to accelerate the flow rate of the airflow to extend the arrival distance of the airflow, and to further improve the controllability of the airflow.

[0137] Fig. 19 is a perspective view showing another example of the vertical blade driving means 34 in the air conditioner according to this embodiment. Fig. 20A is a front view showing one end of the vertical blade driving means 34 shown in Fig. 19. Fig. 20B is a side view showing the vertical blade driving means 34 viewed along the arrow B in Fig. 20A. Fig. 20C is a front view showing another end of the vertical blade driving means 34 shown in Fig. 19. Fig. 20D is a side view showing the vertical

blade driving means 34 viewed along an arrow D in Fig. 20C.

[0138] The slide guide 30a is omitted in Fig. 20, the rotation motion motor 47 is omitted in Fig. 20B, and the slide motion motor 46 is omitted in Fig. 8D.

[0139] The slide motion motor 46 is disposed at one side surface of the outlet 2, and the rotation motion motor 47 is disposed at another side surface of the outlet 2.

[0140] The rotation motion rotating shaft 33 extends between the rotation motion motor 47 and one of the connectors 35 which is closer to the rotation motion motor 47, and the rotating mechanism 37 is disposed on the one connector 35.

[0141] The connector 35, the rotating mechanism 37, and the vertical blade 30 are made of a material having mechanical rigidity to the degree that the vertical blade 30 and another connector 35 can rotate about the slide motion rotating shaft 32 when one connector 35 rotates about the slide motion rotating shaft 32.

[0142] According to the above-mentioned air conditioner, the slide motion motor 46 and the rotation motion motor 47 are disposed apart from each other, the degree of freedom of the sizes of the slide motion motor 46 and the rotation motion motor 47 is improved.

[0143] Also, the rotation motion rotating shaft 33 extends between the rotation motion motor 47 and one of the connectors 35 which is closer to the rotation motion motor 47, and is not disposed between the respective connectors 35. As a result, the airflow that flows along the vertical blade 30 can be prevented from being obstructed by the rotation motion rotating shaft 33.

Fourth Embodiment

[0144] Fig. 21 is a perspective view showing vertical blade driving means 34 of an air conditioner according to this embodiment. Fig. 22A is a front view showing one end of the vertical blade driving means 34 of Fig. 21. Fig. 22B is a side view showing the vertical blade driving means 34 viewed along the arrow B of Fig. 22A. Fig. 22C is a front view showing another end of the vertical blade driving means 34 of Fig. 21. Fig. 22D is a side view showing the vertical blade driving means 34 viewed along an arrow D of Fig. 22C.

[0145] The slide guide 30a is omitted in Figs. 22, and the motor 50 is omitted in Fig. 22D.

[0146] In the vertical blade driving means 34 of the air conditioner according to this embodiment, a third rotating force transmission unit having a fourteenth gear 48 that is fixed to the slide motion rotating shaft 32 and rotates together with the slide motion rotating shaft 32, and a fifteenth gear 49 that is fixed to the rotation motion rotating shaft 33, rotates together with the rotation motion rotating shaft 33, and is meshing with the fourteenth gear 48 is disposed in each of the connectors 35.

[0147] The slide motion rotating shaft 32 extends between the respective connectors 35, and the motor 50 is fitted to one end of the slide motion rotating shaft 32. No

motor is fitted to the rotation motion rotating shaft 33.

[0148] When the slide motion rotating shaft 32 is rotated by the drive of the motor 50, the rotating force of the slide motion rotating shaft 32 is transmitted to each rotation motion rotating shaft 33 through the fourteenth gear 48 and the fifteenth gear 49.

[0149] This embodiment exemplifies the air conditioner in which the rotation motion rotating shaft 33 is disposed in each of the connectors 35. Alternatively, there can be applied an air conditioner having one rotation motion rotating shaft 33 that extends between the respective connectors 35.

[0150] Also, there can be applied the air conditioner in which the motor is fitted to the rotation motion rotating shaft 33, and no motor is fitted to the slide motion rotating shaft 32. Even in this case, the rotating force of the rotation motion rotating shaft 33 can be transmitted to the slide motion rotating shaft 32 by the aid of the third rotating force transmission unit.

[0151] Other configurations are identical with those of the third embodiment.

[0152] Next, the operation of the air conditioner according to this embodiment is described.

[0153] First, when the air conditioner is so operated as to conduct heater operation from a stop state, the motor 50 is driven to rotate the slide motion rotating shaft 32, and the rotating force of the slide motion rotating shaft 32 is transmitted to the tenth gear 42 as in the air conditioner according to the third embodiment.

[0154] As a result, the vertical blade 30 relatively moves in such a direction that the downstream end is apart from the slide motion rotating shaft 32 with respect to the connector 35.

[0155] At the same time, the rotating force of the slide motion rotating shaft 32 is transmitted to the rotation motion rotating shaft 33 through the fourteenth gear 48 and the fifteenth gear 49.

[0156] When the rotation motion rotating shaft 33 rotates, the rotating force of the rotation motion rotating shaft 33 is transmitted to the eleventh gear 43 as in the air conditioner according to the third embodiment.

[0157] As a result, the vertical blade 30 rotates in a direction along which the concave portion is directed downwardly.

[0158] When the air conditioner is so operated as to conduct cooling operation, the motor 50 is driven in an opposite direction to that at the time of the heating operation, and the vertical blade 30 relatively moves in a direction in which the downstream end is apart from the slide motion rotating shaft 32 with respect to the connector 35. Also, the vertical blade 30 rotates in a direction in which the concave portion is directed upwardly.

[0159] As a result, the vertical blade 30 can rotate so as not to collide with the outlet 2 or the horizontal blade 31.

[0160] According to the air conditioner of this embodiment, the number of motors can be reduced as compared with the air conditioner of the third embodiment, and the air conditioner can be downsized.

[0161] The third embodiment and the fourth embodiment exemplify the moving mechanism 36 in which the rotating force of the slide motion rotating shaft 32 is transmitted to the vertical blade 30 through the projections

5 30b, the seventh gear 38, the eighth gear 39, the ninth gear 40, the transmission rotating shaft 41, and the tenth gear 42 to move the vertical blade 30. However, the present invention is not limited to the above-mentioned configuration.

[0162] There can be applied a moving mechanism 36 in which the rotating force of the slide motion rotating shaft 32 is transmitted to the vertical blade 30 by the aid of a frictional force of, for example, a rubber roller, a metal roller, or a resin roller to move the vertical blade 30.

[0163] Also, there can be applied a moving mechanism 36 in which the rotating force of the slide motion rotating shaft 32 is transmitted to the vertical blade 30 by the aid of a belt drive of a geared belt, a V-belt, or the like to move the vertical blade 30.

[0164] Also, the third embodiment and the fourth embodiment exemplify the rotating mechanism 37 in which the rotating force of the rotation motion rotating shaft 33 is transmitted to the connector 35 through the eleventh gear 43, the twelfth gear 44, and the thirteenth gear 45 to rotate the connector 35. However, the present invention is not limited to the above-mentioned configuration.

[0165] There can be applied a rotating mechanism 37 in which the rotating force of the rotation motion rotating shaft 33 is transmitted to the connector 35 by the aid of a frictional force of, for example, a rubber roller, a metal roller, or a resin roller to rotate the connector 35.

[0166] Also, there can be applied a rotating mechanism 37 in which the rotating force of the rotation motion rotating shaft 33 is transmitted to the connector 35 by the aid of a belt drive of a geared belt, a V-belt, or the like to rotate the connector 35.

[0167] The third embodiment and the fourth embodiment exemplify the air conditioner having the seventh gear 38, the eighth gear 39, the ninth gear 40, the tenth gear 42, the eleventh gear 43, the twelfth gear 44, the thirteenth gear 45, the fourteenth gear 48, and the fifteenth gear 49. However, the number of gears is not limited to the above-mentioned example.

[0168] Also, the fourth embodiment exemplifies the third rotating force transmission unit having the fourteenth gear 48 and the fifteenth gear 49 that transmit the rotating force of the slide motion rotating shaft 32 to the rotation motion rotating shaft 33 between the slide motion rotating shaft 32 and the rotation motion rotating shaft 33. However, the present invention is not limited to the above-mentioned example.

[0169] There can be applied a third rotating force transmission unit in which the rotating force of the slide motion rotating shaft 32 is transmitted to the rotation motion rotating shaft 33 by the aid of a frictional force of, for example, a rubber roller, a metal roller, or a resin roller.

[0170] Also, there can be applied a third rotating force transmission unit in which the rotating force of the slide

motion rotating shaft 32 is transmitted to the rotation motion rotating shaft 33 by the aid of a belt drive of a geared belt, a V-belt, or the like.

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Claims

1. An air conditioner **characterized by** comprising:

- a case (4) having an air passage (3) that communicates with an inlet (1) and an outlet (2) therein;
- a fan (5) that is disposed within the air passage (3) and generates an airflow;
- a first rotating shaft (9, 32) that is rotatably disposed in the outlet (2) and extends toward a side surface that bounds the outlet (2);
- a vertical blade (7, 30) that is disposed in the outlet (2), and rotates about the first rotating shaft (9, 32) to deflect a direction of the airflow blown out of the outlet (2) in an upward or downward direction; and
- a vertical blade driving means (19, 34) that is disposed between the first rotating shaft (9, 32) and the vertical blade (7, 30), changes a relative position between the first rotating shaft (9, 32) and the vertical blade (7, 30), and rotates the vertical blade (7, 30) about the first rotating shaft (9, 32).

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2. The air conditioner according to claim 1, **characterized in that** the vertical blade driving means (19, 34) changes the relative position so that the downstream end of the vertical blade (7, 30) is apart from the first rotating shaft (9, 32), and inverts the vertical blade (7, 30) in the upward or downward direction.

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3. The air conditioner according to claim 1 or 2, **characterized in that** the vertical blade driving means (34) includes:

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- a connector (10, 35) that is disposed between the vertical blade and the first rotating shaft (32) and supports the vertical blade (30);
- a moving mechanism (36) that relatively moves the vertical blade (30) with respect to the connector (35); and
- a rotating mechanism (37) that rotates the connector (35) about the first rotating shaft (32).

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4. The air conditioner according to claim 3, **characterized in that:**

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- the moving mechanism (36) includes a first contact portion (30b) that is disposed on the vertical blade (30), a rotating body (42) that is rotatable and comes in contact with the first con-

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tact portion (30b), a first rotating force transmission unit that transmits a rotating force to the rotating body (42) from the first rotating shaft (32), and a first motor (46) that rotates the first rotating shaft (32); and

- the rotating mechanism (37) includes a second rotating shaft (33) that is rotatably disposed in parallel to the first rotating shaft (32), a second contact portion (43) that is disposed in the connector (35) and rotates about the first rotating shaft (32) together with the connector (35), a second rotating force transmission unit that transmits the rotating force from the second rotating shaft (33) to the second contact portion (43), and a second motor (47) that rotates the second rotating shaft (33).

5. The air conditioner according to claim 3, **characterized in that:**

- the moving mechanism (36) includes the first contact portion (30b) that is disposed on the vertical blade (30), the rotating body (42) that is rotatable and comes in contact with the first contact portion, and the first rotating force transmission unit that transmits the rotating force from the first rotating shaft (32) to the rotating body;

- the rotating mechanism (37) includes the second rotating shaft (33) that is rotatably disposed in parallel to the first rotating shaft (32), the second contact portion that is disposed on the connector (35) and rotates about the first rotating shaft (32) together with the connector (35), and the second rotating force transmission unit that transmits the rotating force to the second contact portion (43) from the second rotating shaft (33); and

- a third rotating force transmission unit that transmits the rotating force that is transmitted to one of the first rotating shaft (32) and the second rotating shaft (33) to another of the first rotating shaft (32) and the second rotating shaft (33) is disposed between the first rotating shaft (32) and the second rotating shaft (33).

6. The air conditioner according to claim 4 or 5, **characterized in that** the rotating body (42) rotates, and the vertical blade (30) moves in one direction with respect to the first rotating shaft (32).

7. The air conditioner according to claim 6, **characterized in that** the rotating body (42) comprises a gear, and the first contact portion (30b) is formed with an engaged portion that is engaged with the gear.

8. The air conditioner according to claim 6, **characterized in that** at least one of the rotating

body (42) and the first contact portion (30b) has a slip stopping member in a region where the rotating body and the first contact portion come in contact with each other.

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FIG.1

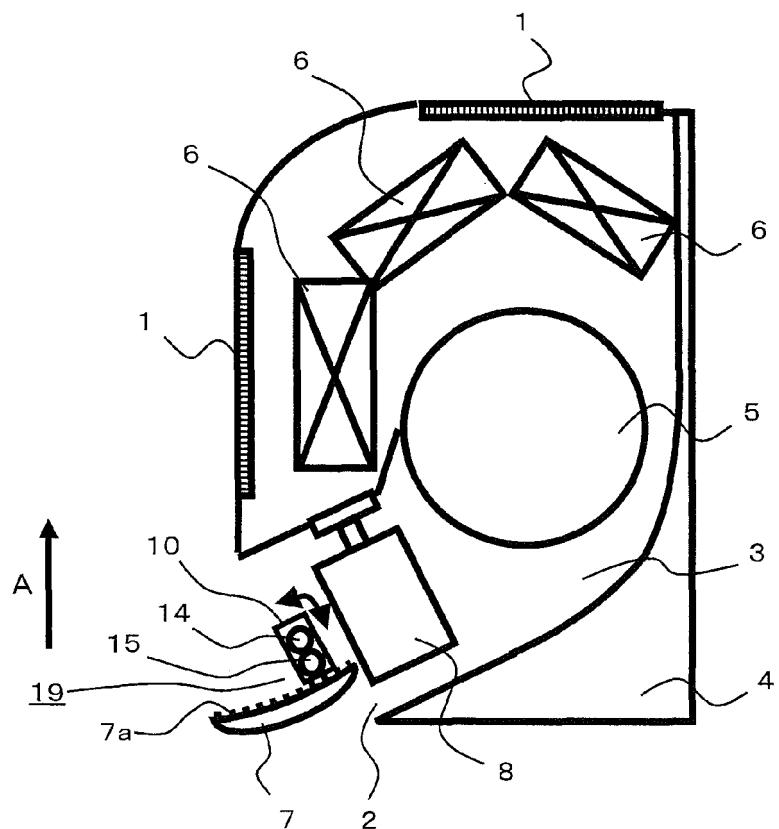


FIG.2

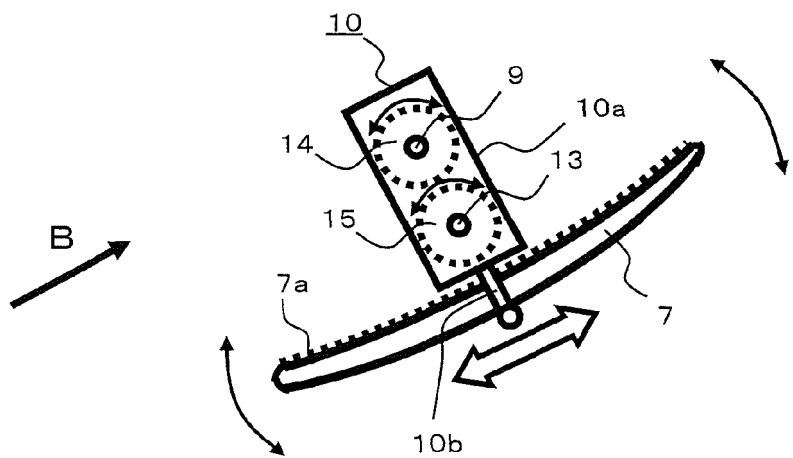


FIG.3

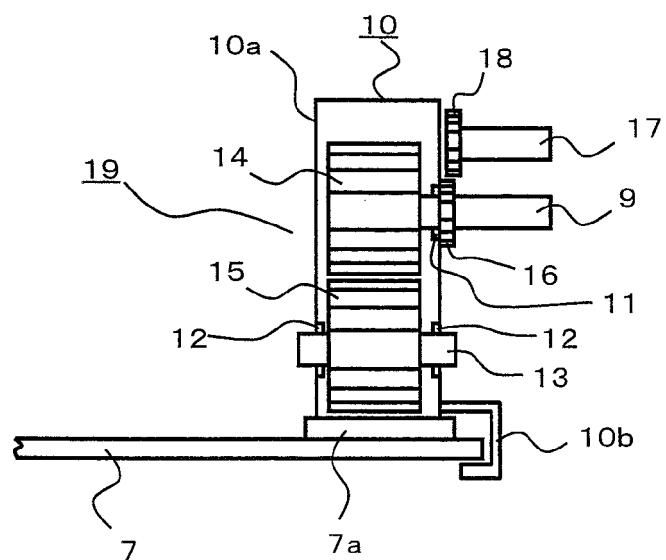


FIG.4

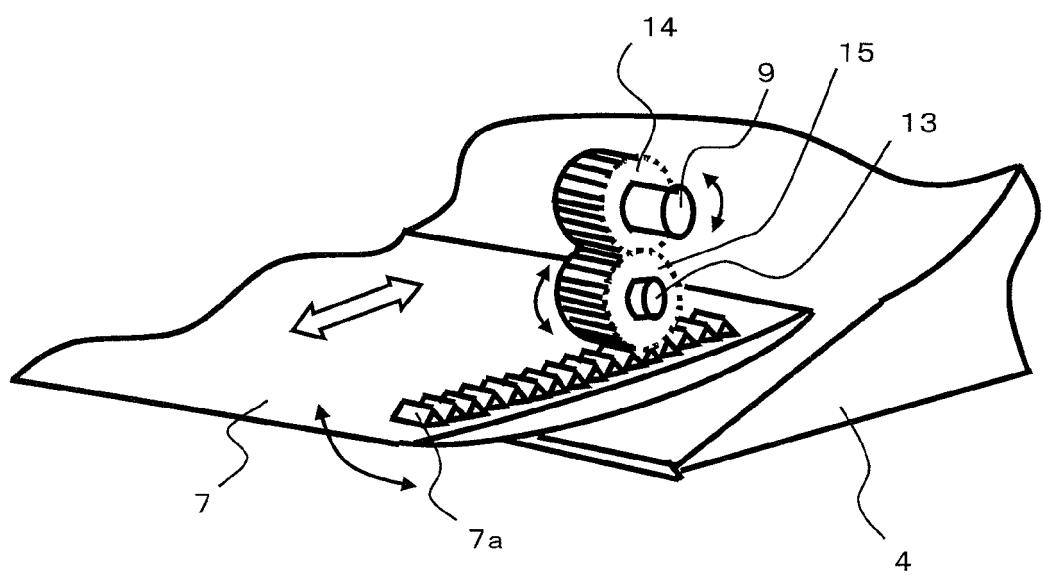


FIG.5A

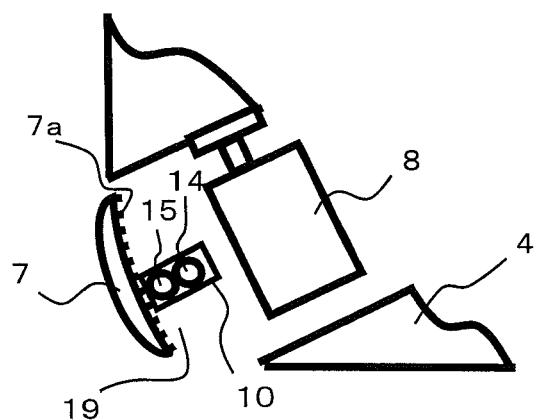


FIG.5B

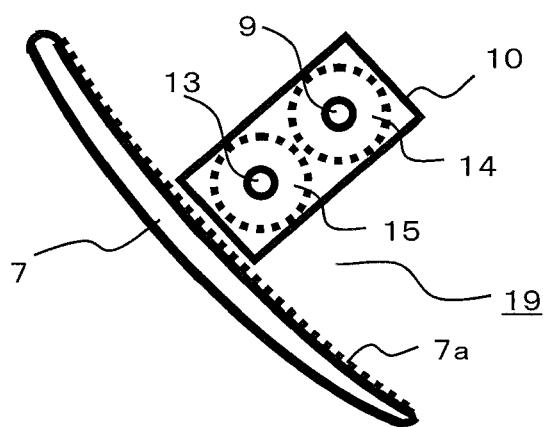


FIG.6A

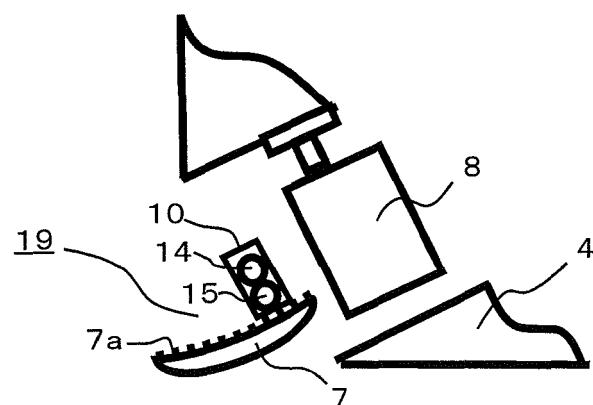


FIG.6B

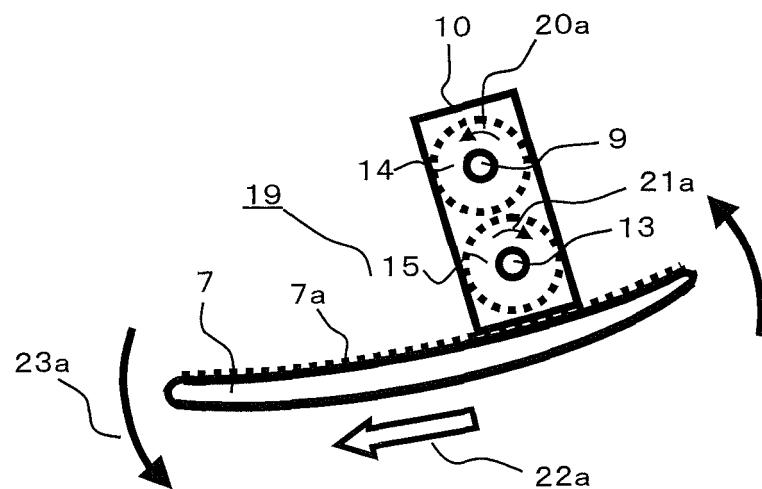


FIG.7A

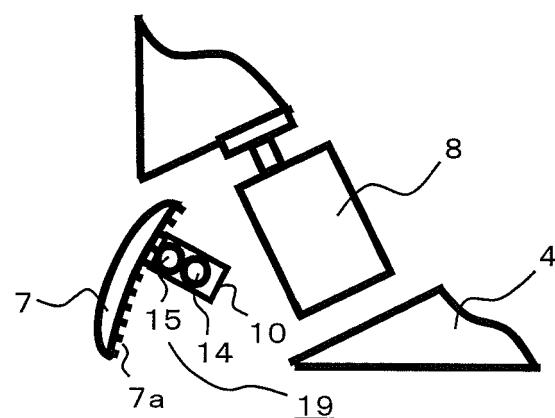


FIG.7B

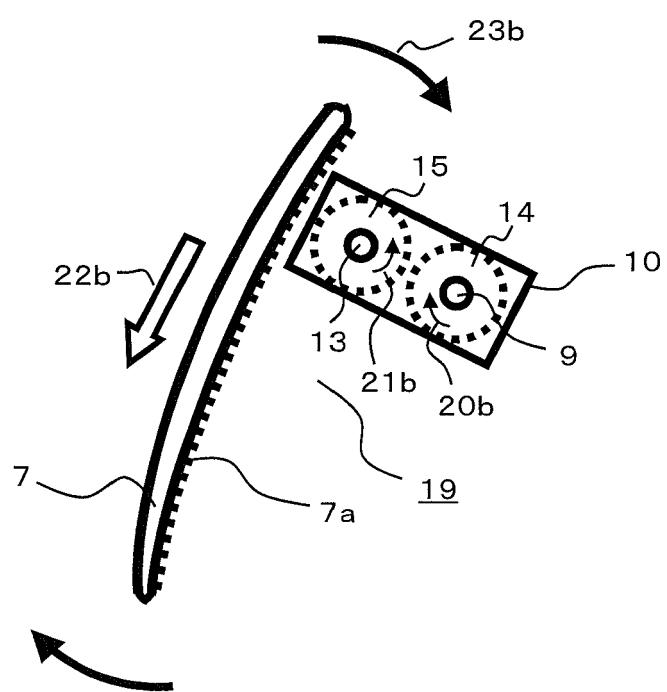


FIG.8

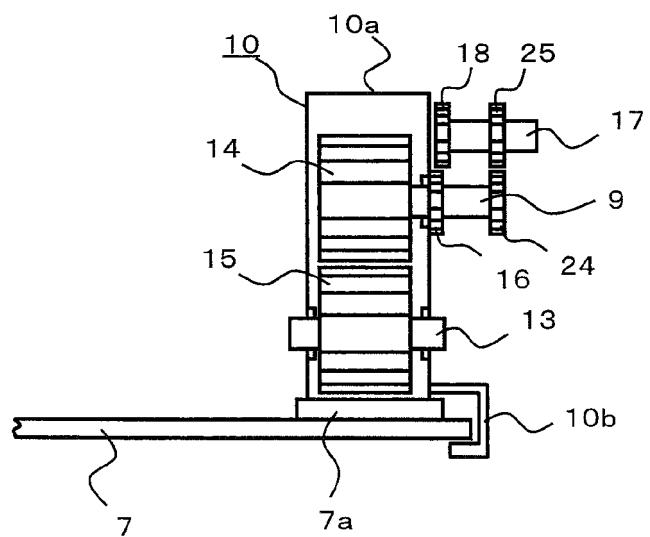


FIG.9

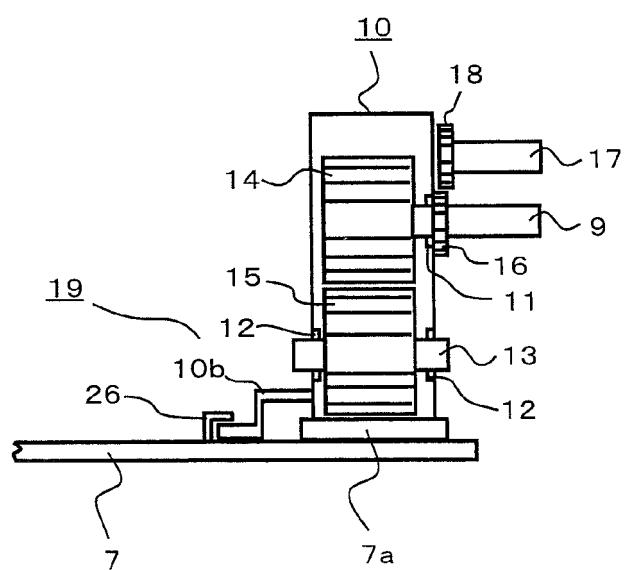


FIG.10

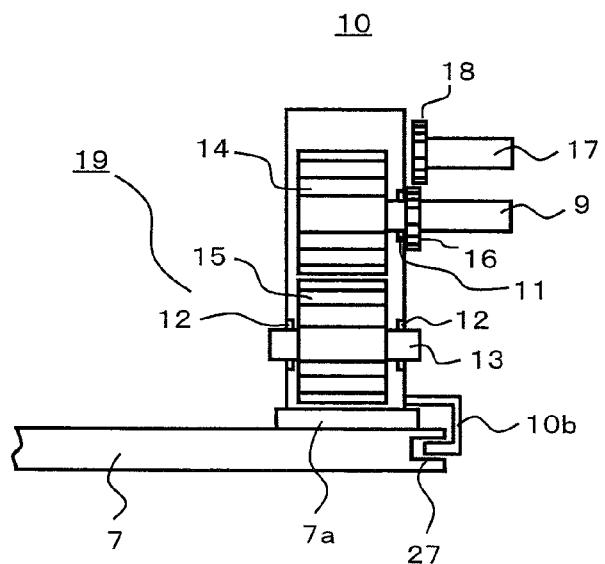


FIG.11

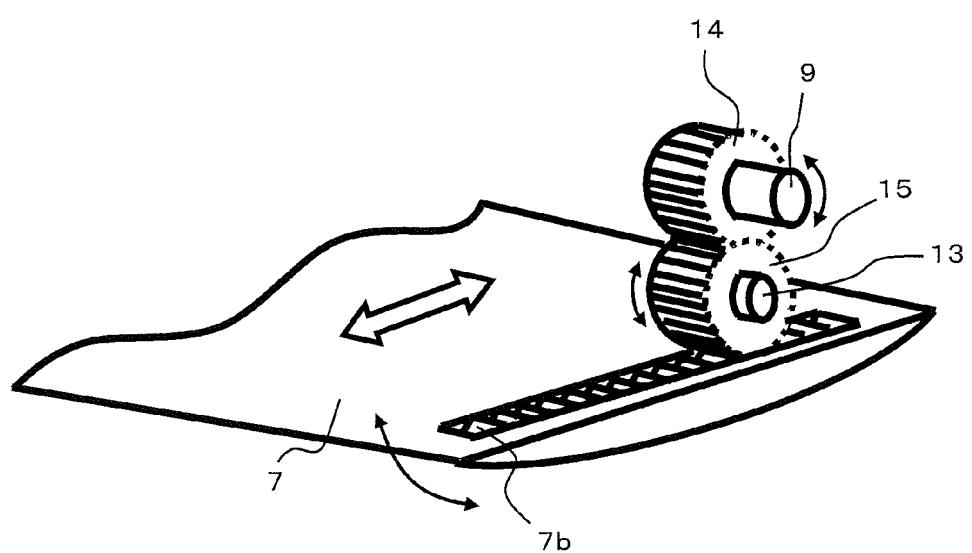


FIG.12

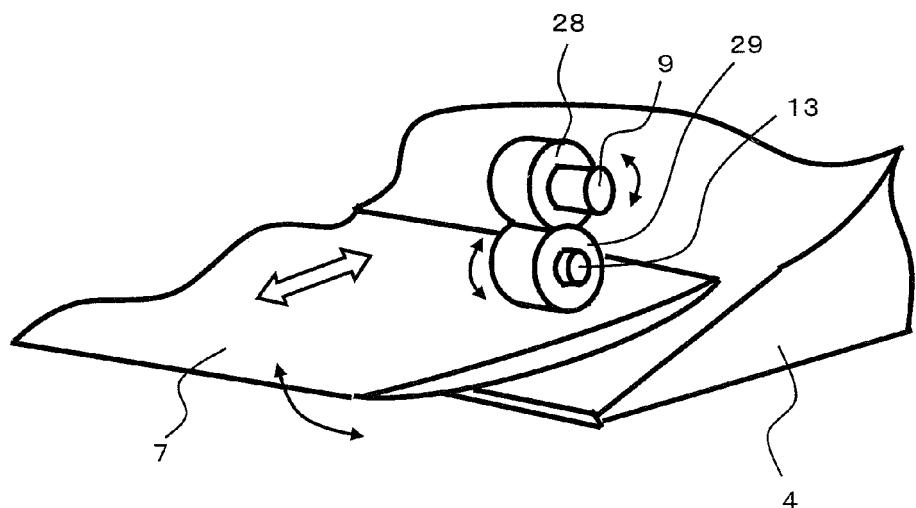


FIG.13

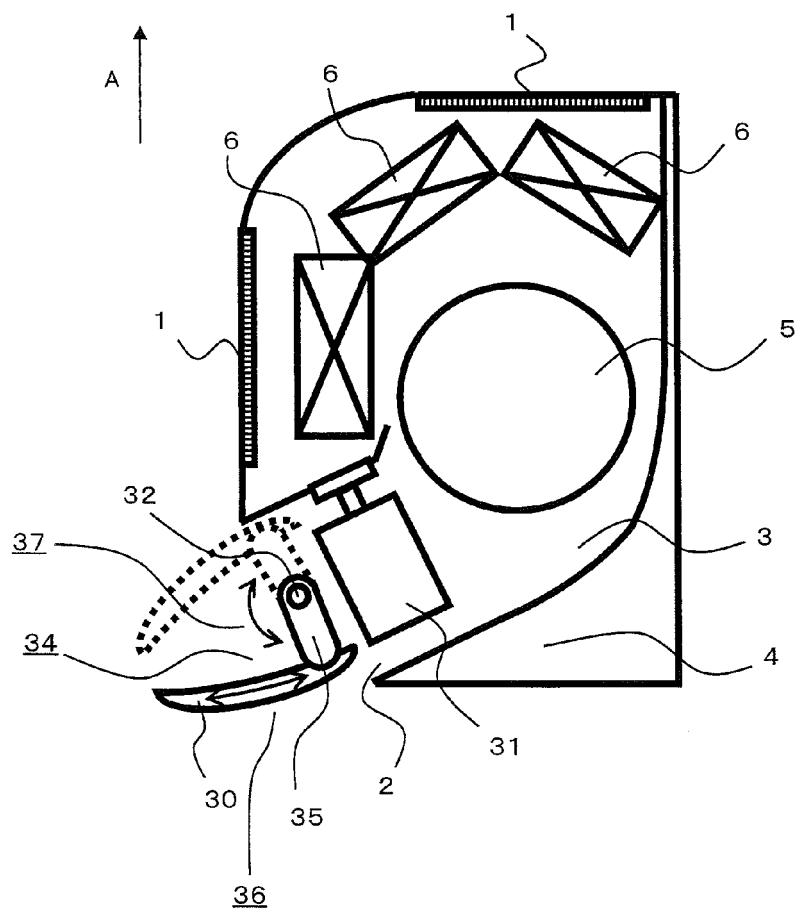


FIG.14

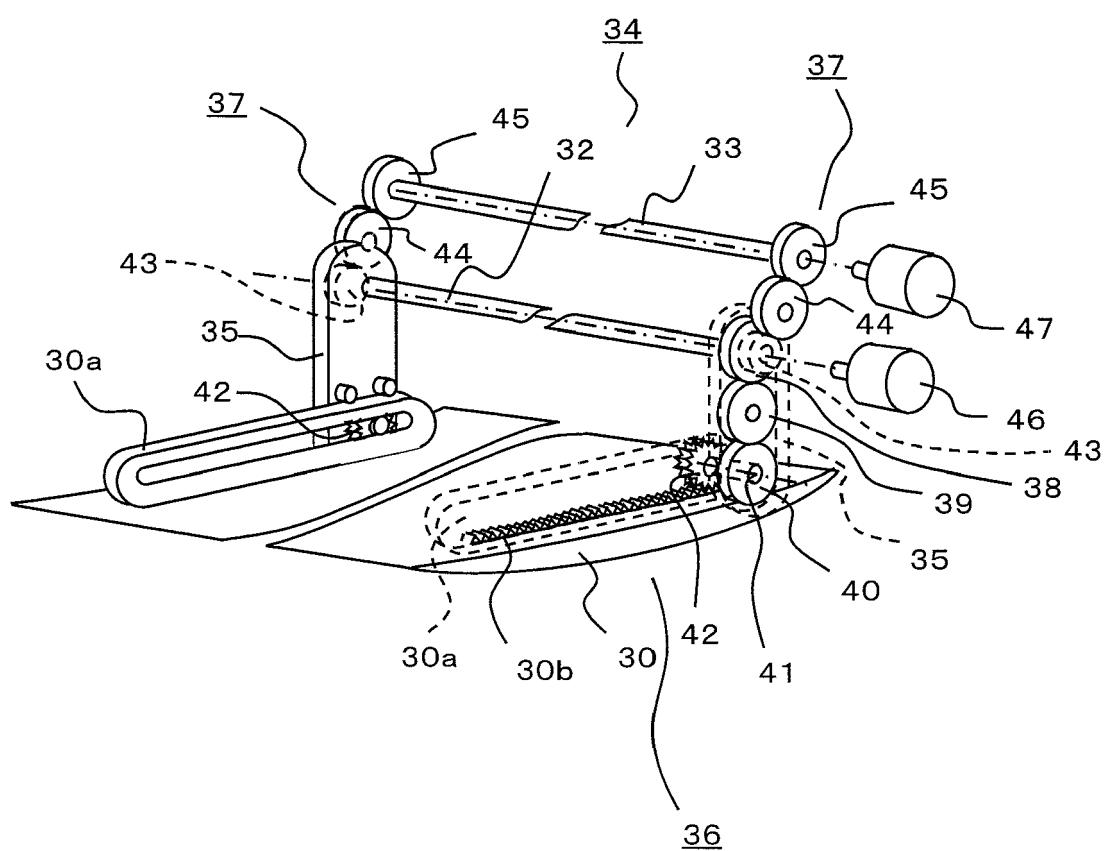


FIG.15A

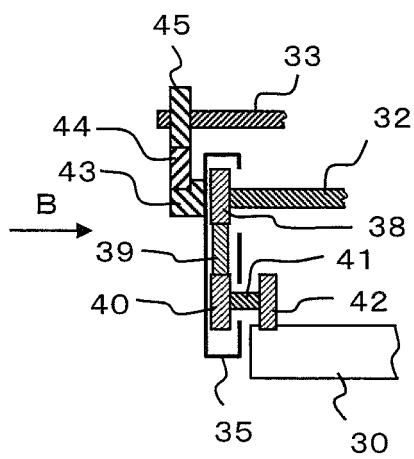


FIG.15B

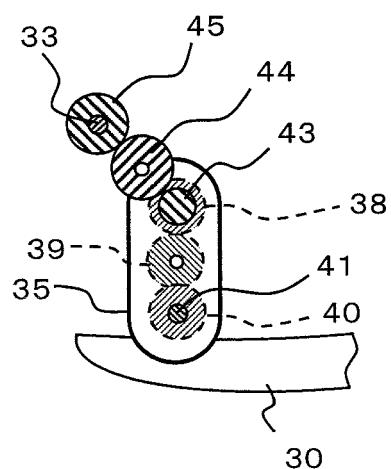


FIG.15C

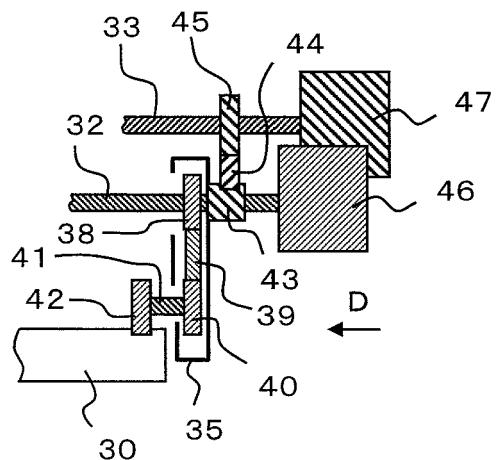


FIG.15D

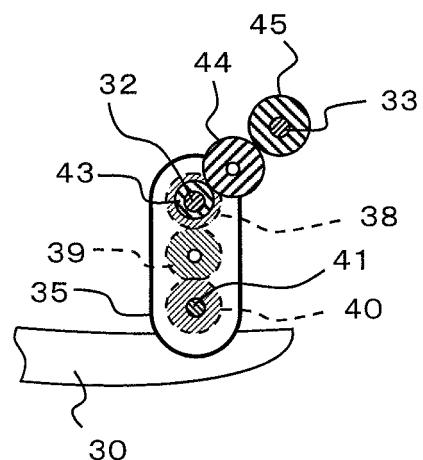


FIG.16

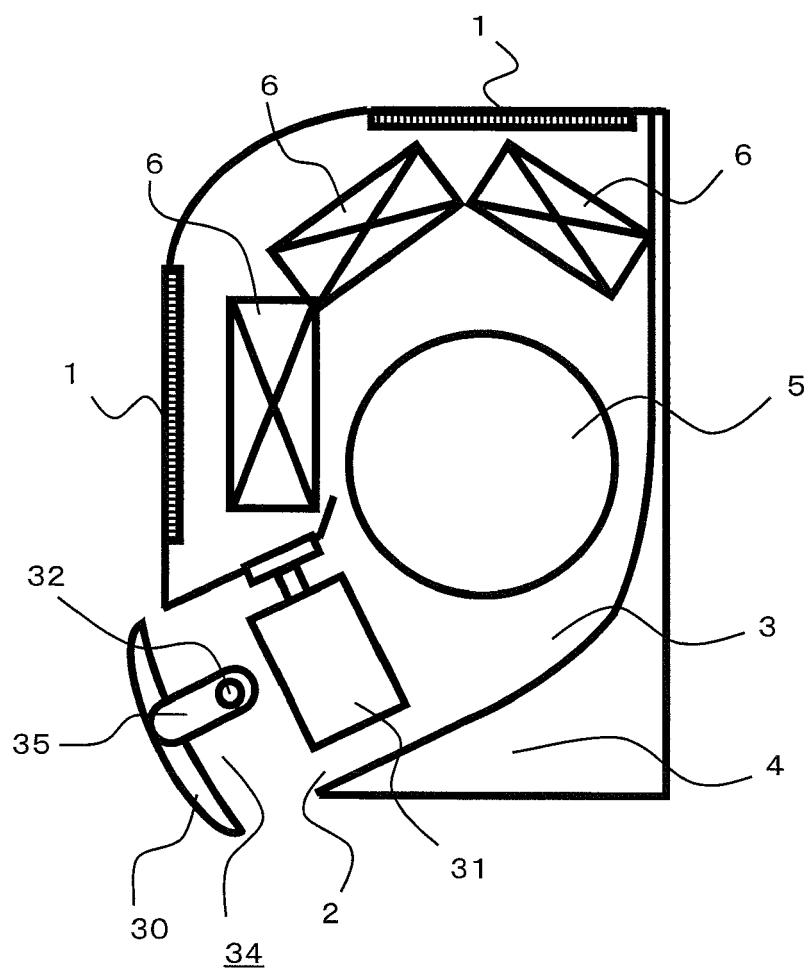


FIG.17

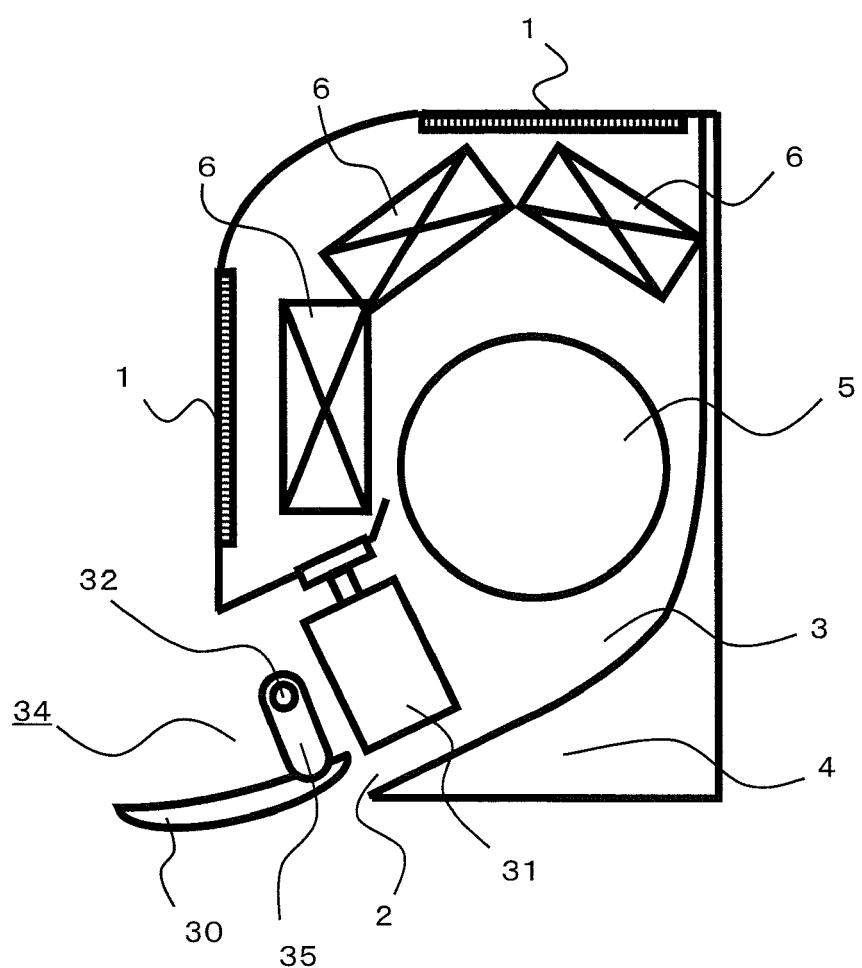


FIG.18

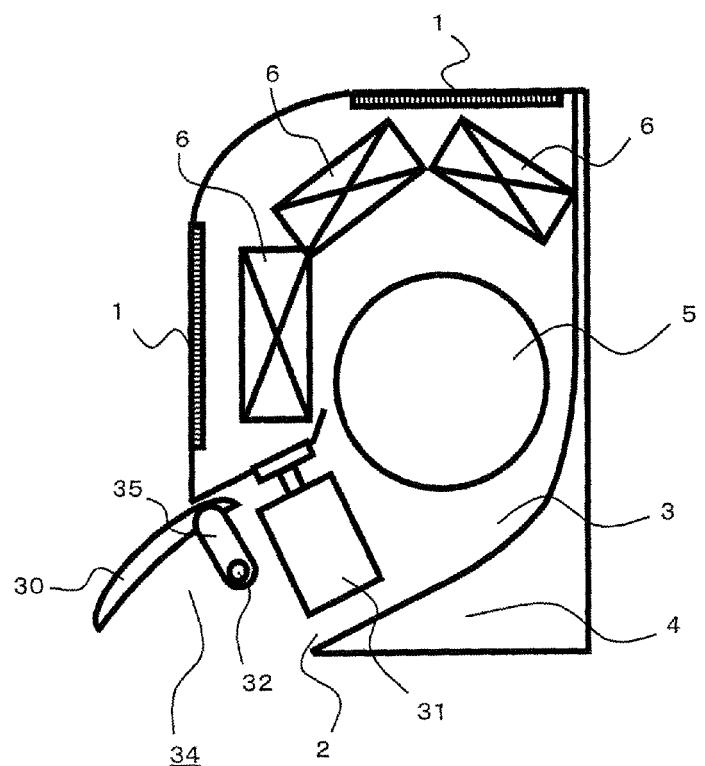


FIG. 19

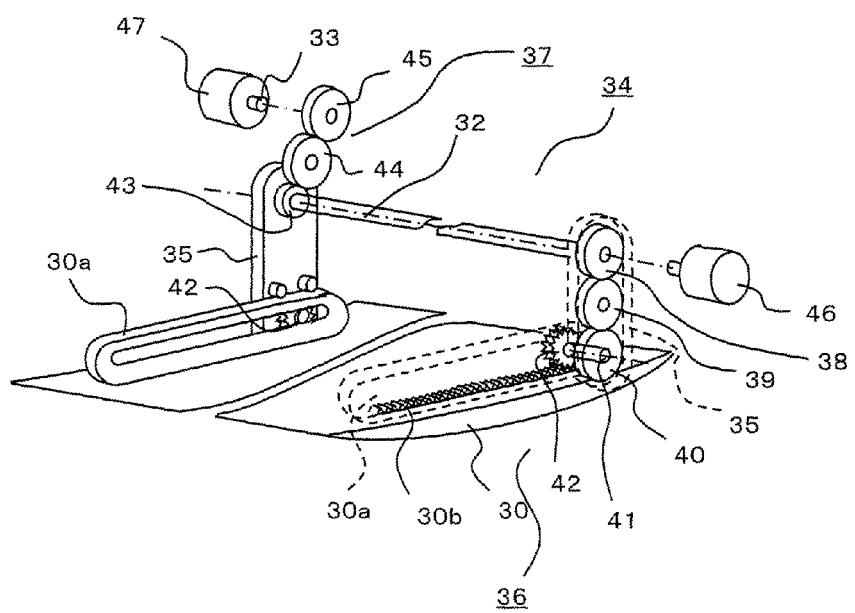


FIG.20A

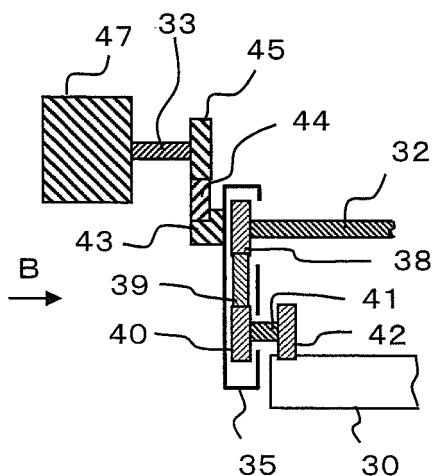


FIG.20B

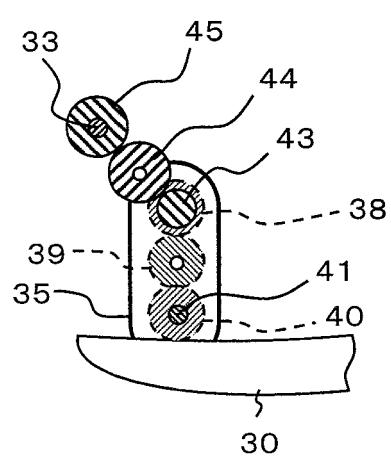


FIG.20C

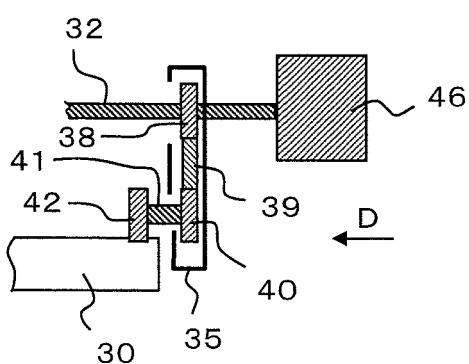


FIG.20D

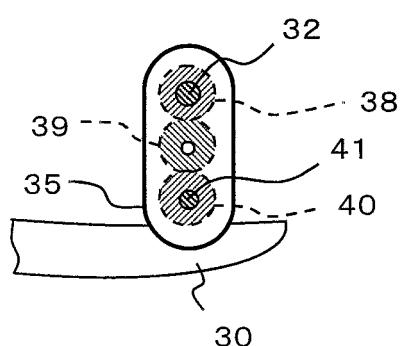


FIG.21

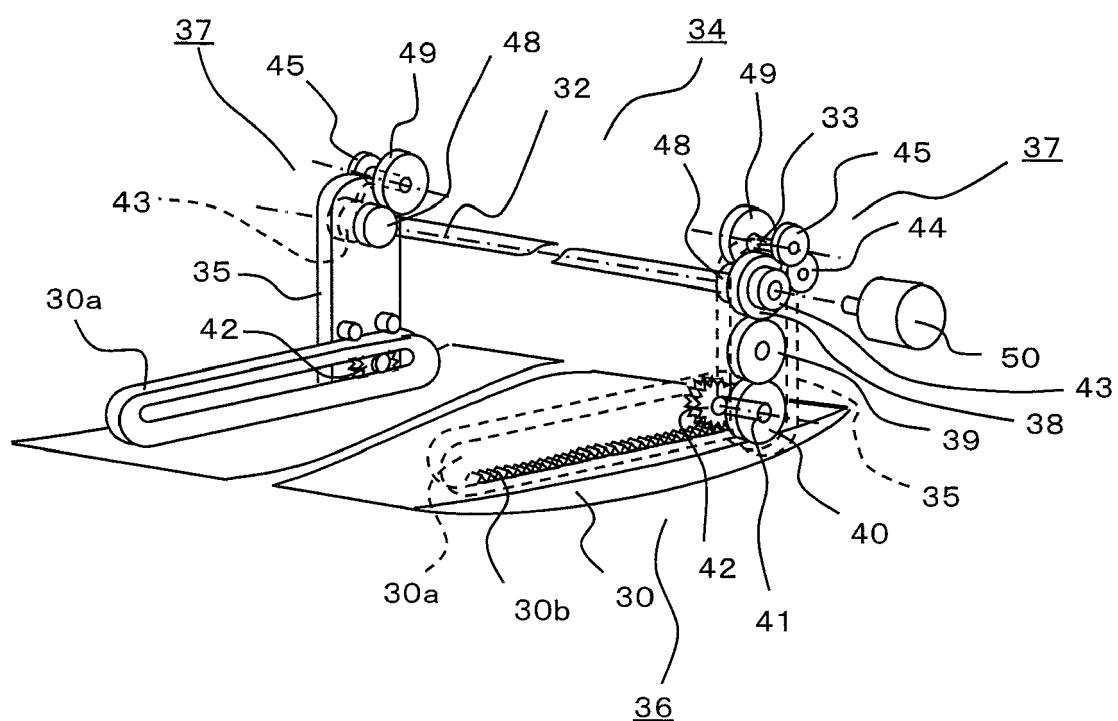


FIG.22A

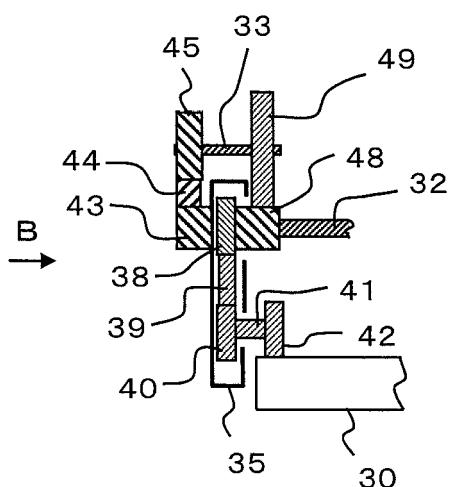


FIG.22B

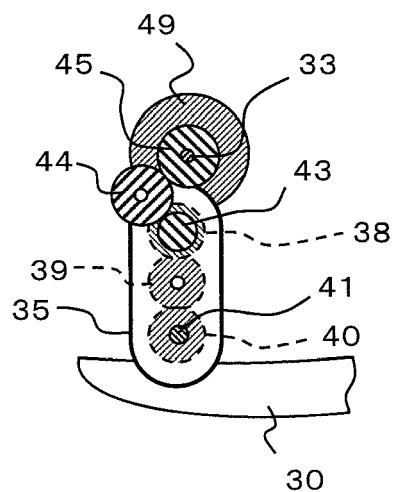


FIG.22C

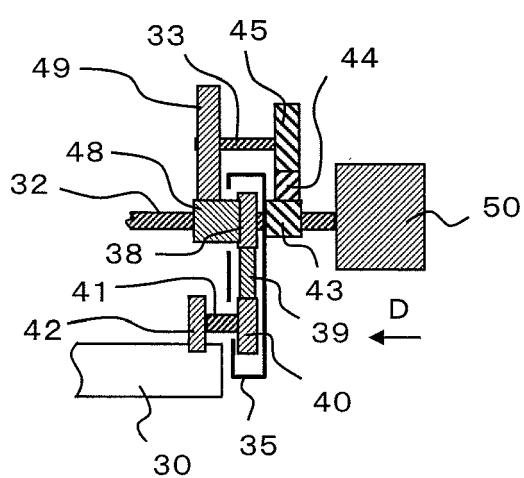
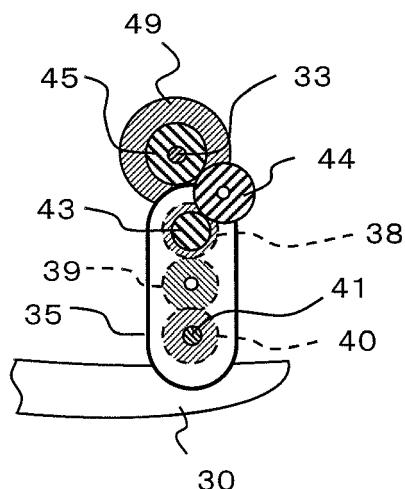


FIG.22D





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