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(54) **VACUUM CLEANER**

(57) A vacuum cleaner includes an electric blower, a dust separation section for separating dust from air, a dust collecting section, a rotatably provided filtering separation section, a driving unit for driving the filtering separation section, and a dust removing unit 2100 for removing fine dust adhering to the filtering separation section. In the vacuum cleaner, there are provided a communication air-passage opening/closing valve K3 for opening or closing a communication air-passage communicating the dust separation section and the filtering separation section with each other, an outside-air introduction port 84F provided on a downstream side of the communication air-passage opening/ closing valve K3 and for dis-

charging the removed fine dust to the outside by introducing outside air to an upstream side of the filtering separation section, and an outside-air opening/closing valve K6 for opening or closing the outside-air introduction port 84F, wherein, in a cleaning mode, the communication air-passage opening/ closing valve K3 is opened and the outside-air opening/closing valve K6 is closed, while in a dust removing mode, the communication air-passage opening/closing valve K3 is closed and the outside-air opening/ closing valve K6 is opened, and the communication air-passage opening/closing valve K3 and the outside-air opening/closing valve K6 are opened or closed by the rotation of the filtering separation section.

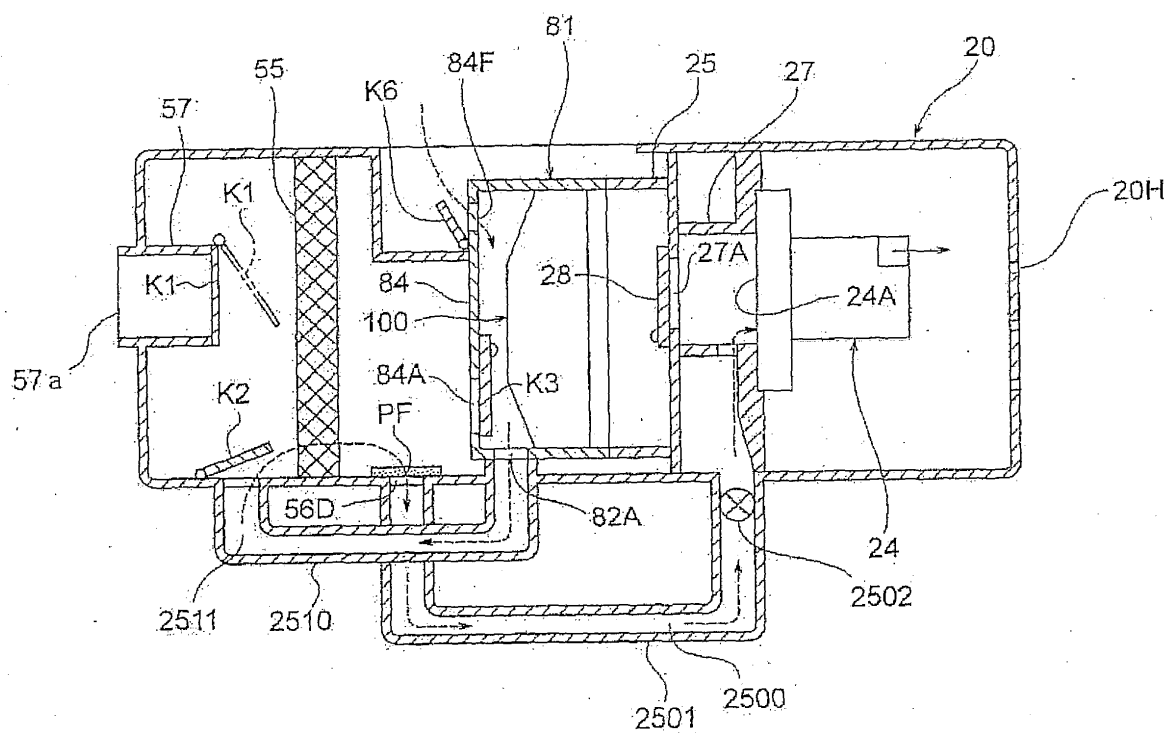


FIG. 22

Description

Technical Field

[0001] The present invention relates to a vacuum cleaner provided with a dust separation section for separating dust from air and a filtering separation section for separating dust having passed through the dust separation section from the air.

Background Art

[0002] Conventionally, there is known a vacuum cleaner provided with a dust collecting container detachably at a cleaner main body (See Patent Document 1).

[0003] Such a vacuum cleaner is provided with the dust collecting container, the cleaner main body having a mounting portion on which the dust collecting container is mounted, an electric blower provided on a downstream side of the dust collecting container chamber, a pleated filter body, which is a secondary filter detachably attached to a rear surface opening of the dust collecting container, dust removing unit for shaking off the dust adhering to the pleated filter body and the like.

[0004] The dust removing unit has a ring-shaped large-diameter gear rotatably arranged at a position opposite to the pleated filter, a projection brought into contact with the pleated filter is provided at the gear, the ring is rotated as an electric power cord is wound up by a cord reel, and the projection rides over a mountain section of a pleat of the pleated filter while moving as the ring is rotated, by means of which vibration is given to the pleated filter and the dust adhering to the pleated filter is shaken off.

[0005] Patent Document 1: Japanese Unexamined Patent Application Publication No. 2004-358135

Disclosure of the Invention

Problems to be solved by the Invention

[0006] However, such a vacuum cleaner has a problem that dust dropped off the pleated filter (filtering separation section) adheres to the pleated filter again when the electric blower is driven.

[0007] An object of the present invention is to provide a vacuum cleaner in which dust dropped off the filtering separation section does not adhere again to the filtering separation section.

Means for solving the Problems

[0008] A vacuum cleaner according to the present invention comprises:

a dust separation section for separating dust and air sucked through an electric blower;
a dust collecting section for collecting the dust separated from the air in the dust separation section;

a filtering separation section rotatably provided in a container case located on a downstream side of the dust separation section and separating fine dust passing through the dust separation section from the air;

a driving unit for rotating the filtering separation section;

an outside-air introduction hole formed to the container case for introducing outside air into the container case;

an outside-air introduction hole opening/ closing member for opening or closing the outside-air introduction hole;

a communication passage for communicating the dust separation section and the container case; and a communication air-passage opening/closing member for opening or closing the communication air-passage,

wherein there is provided an air-flow control unit for forming, for usual cleaning, a first flow passage extending through the dust separation section, the communication air-passage and the filtering separation section and being sucked by the electric blower and for air cleaning of the container case, and a second flow passage sucked by the electric blower without having the air introduced from the outside-air introducing hole pass through the filtering separation section, in air cleaning process; and there is provided an interlocking mechanism for interlocking the outside-air opening/closing member and the communication air-passage opening/closing member in accordance with rotation of the filtering separation section by the driving unit so that the first flow passage is formed by opening the communication air-passage opening/ closing member by rotating the filtering separation section in one direction and closing the outside-air opening/ closing member, and the second flow passage is formed by closing the communication air-passage opening/ closing member by rotating the filtering separation section in another direction and by opening the outside-air opening/ closing member.

Effects of the Invention

[0009] According to the present invention, dust dropped off from the filtering separation section by the dust removing unit is prevented from adhering again to the filtering separation section. Furthermore, since a connection opening/closing valve is closed by rotation of the filtering separation section, while an outside-air opening/ closing valve is opened, a motor for opening or closing the connection opening/ closing valve or the outside-air opening/closing valve is no longer needed.

Brief Description of Drawings

[0010]

[Fig. 1] Fig. 1 is a perspective view of an appearance of a vacuum cleaner according to the present invention.

[Fig. 2] Fig. 2 is a perspective view illustrating an appearance of a vacuum cleaner main body in Fig. 1 with a lid case being removed.

[Fig. 3] Fig. 3 is a plan view of the vacuum cleaner main body shown in Fig. 2.

[Fig. 4] Fig. 4 is a partially enlarged perspective view of the vacuum cleaner main body in Fig. 2 with a dust collecting container being removed.

[Fig. 5] Fig. 5 is an explanatory diagram illustrating a torsion coil spring 18 attached to a cylindrical axle of the vacuum cleaner main body.

[Fig. 6] Fig. 6 is an explanatory diagram illustrating an engagement relation between a locking claw of a clamp and an engagement member of a lid case.

[Fig. 7] Fig. 7 is an explanatory diagram illustrating a pop-up mechanism of the dust collecting container.

[Fig. 8] Fig. 8 is a plan view illustrating the clamp.

[Fig. 9] Fig. 9 is an explanatory diagram illustrating an unlocking state of the lid case and an unlocking state of a dust collecting case.

[Fig. 10] Fig. 10 is a perspective view illustrating an appearance of the dust collecting unit.

[Fig. 11] Fig. 11 is a perspective view illustrating an appearance of the dust collecting container.

[Fig. 12] Fig. 12 is a cross-sectional view illustrating a configuration of the dust collecting unit.

[Fig. 13] Fig. 13 is a perspective view illustrating an appearance of a dust separation section.

[Fig. 14] Fig. 14 is a cross-sectional view of the vacuum cleaner main body.

[Fig. 15] Fig. 15 is an explanatory diagram illustrating a state where the dust collecting container is popped up.

[Fig. 16] Fig. 15 is a side view of the vacuum cleaner main body for explaining an opening state of the lid case.

[Fig. 17] Fig. 17 is an explanatory diagram illustrating a state where the dust collecting container is popped up.

[Fig. 18] Fig. 18 is an explanatory diagram illustrating a front wall section of a dust removing unit and the container case.

[Fig. 19] Fig. 19 is a perspective view illustrating a configuration of an opening/closing mechanism.

[Fig. 20] Fig. 20 is a perspective view illustrating the opening/closing mechanism and the dust separation section.

[Fig. 21] Fig. 21 is a conceptual diagram illustrating an air passage in usual cleaning.

[Fig. 22] Fig. 22 is a conceptual diagram illustrating the air passage in air cleaning.

[Fig. 23] Fig. 23 is a horizontal sectional view illustrating a configuration of the dust separation section of this embodiment.

[Fig. 24] Fig. 24 is an explanatory diagram illustrating

the dust separation section and return air-passage pipe.

[Fig. 25] Fig. 25 is an explanatory diagram illustrating the dust separation section and the return air-passage pipe with the opening/closing valve opened.

[Fig. 26] Fig. 26 is a perspective view illustrating an appearance of the dust separation section and the return air-passage pipe in Fig. 23.

[Fig. 27] Fig. 27 is a longitudinal sectional view illustrating a configuration of the vacuum cleaner main body.

[Fig. 28] Fig. 28 is a perspective view illustrating the container case.

[Fig. 29] Fig. 29 is a rear view of the container case shown in Fig. 28.

[Fig. 30] Fig. 30 is a perspective view illustrating an appearance of the dust collecting unit.

[Fig. 31] Fig. 31 is an explanatory diagram illustrating an arm and a third opening/closing valve attached to the container case.

[Fig. 32] Fig. 32 is a perspective view illustrating the arm and the third opening/closing valve.

[Fig. 33] Fig. 33 is a perspective view illustrating an appearance of the dust collecting unit with a sixth opening/ closing valve opened.

[Fig. 34] Fig. 34 is an explanatory diagram illustrating the sixth opening/closing valve and an outside-air introduction port.

[Fig. 35] Fig. 35 is a cross-sectional view illustrating a configuration of the dust removing unit.

[Fig. 36] Fig. 36 is a longitudinal sectional view of the dust removing unit shown in Fig. 35.

[Fig. 37] Fig. 37 is a block diagram illustrating a configuration of a control system.

Reference Numerals

[0011]

24	electric blower
52	dust separation section
81	container case
84A	connection opening
84F	outside-air introduction port
100	pleated filter body (filtering separation section)
K3	third opening/closing valve (communication air-passage opening/ closing valve)
K6	sixth opening/closing valve (outside-air opening/ closing valve) Best Mode for carrying out the Invention

[0012] An example, which is an embodiment of an electric vacuum cleaner according to the present invention, will be described hereunder with reference to the accompanying drawings.

EXAMPLE

[0013] An electric vacuum cleaner 10 shown in Fig. 1 is provided with a cleaner main body 11, a dust collecting hose 12 having one end detachably connected to a connection port 11A of the cleaner main body 11 and a hand operation pipe 13 provided at the other end, an extension pipe 14 detachably connected to the hand operation pipe 13, and a suction port body 15 detachably connected to a distal end portion of the extension pipe 14. On the hand operation pipe 13, an operation section 13A is provided, and in the operation section 13A, a stop switch 13a for stopping driving of an electric blower 24 and a control switch 13b for setting power of the electric blower 24 and the like are provided.

[0014] In the suction port body 15, a suction chamber, not shown, is formed in which a suction opening (dust suction port), not shown, for sucking dust is formed in its bottom surface, and this suction chamber communicates with a suction connection port 57a of a dust collecting unit (See Fig. 10) provided in the cleaner main body 11 through the extension pipe 14, the dust collecting hose 12, and the connection port 11A.

[0015] The cleaner main body 11 is provided with a main body case 20, a dust collecting unit 50 (See Fig. 2) attached to the inside of the main body case 20, and the electric blower 24.

[0016] On the front side of the main body case 20, as shown in Figs. 2 to 4, a dust collecting unit chamber 22 having an upper opening 22A is formed, and a lid case 500 (See Fig. 1) is mounted on an upper portion of the main body case 20 capable of being opened or closed. By means of this lid case 500, the entire upper portion of the main body case 20 are covered together with the dust collecting unit chamber (containing chamber) 22. The main body case 20 is configured so as not to be sealed by the lid case 500.

[0017] Further, in the dust collecting unit chamber 22, a pop-up mechanism 1000 (See Fig. 7) for popping up a dust collecting container 410 (Fig. 11) as a dust collecting section, which will be described later, is provided.

[0018] As shown in Fig. 1, on a lower portion of both side portions of the lid case 500, a pair of leg portions 501 extending diagonally downward are formed, and lower portions 501A of the leg portions 501 are rotatably attached to a cylindrical axle 17 (See Fig. 5) provided in the main body case 20 and also cover rear wheels 16 mounted on the cylindrical axle 17. Furthermore, as shown in Fig. 5, a torsion coil spring 18 is attached inside the cylindrical axle 17, and one end of the torsion coil spring 18 is fixed to the cylindrical axle 17, while the other end 18A of the torsion coil spring 18 is fixed to the leg portion 501 (See Fig. 1), and the torsion coil spring 18 urges the lid case 500 around the cylindrical axle 17 counterclockwise in Fig. 1.

[0019] Actually, a rotating body 900 (See Fig. 2) is rotatably attached to the cylindrical axle 17, the other end 18A of the torsion coil spring 18 is locked by a projection

902 (See Fig. 14) of an arm portion 901 of the rotating body 900, while the arm portion 901 is locked in the leg portion 501 of the lid case 500 so that the lid case 500 is urged clockwise.

[0020] Furthermore, by rotating the lid case 500 clockwise around the cylindrical axle 17, the lid case 500 is opened as shown by a chain line in Fig. 16.

[0021] On the front side of the lid case 500, as shown in Figs. 6 and 7, a substantially inverted L-shaped engagement member 510 is provided.

[0022] Further, on the front side (left side in Fig. 1) of the electric blower 24 of the main body case 20, a cylindrical connection air-passage portion (connection air-passage) 25 (See Fig. 27) having a front surface opening 25B (See Fig. 14) is formed, and the connection air-passage portion 25 communicates with a suction opening 24A of the electric blower 24.

[0023] On the front surface opening 25B of the connection air-passage portion 25, a rotatable lattice member 600 is provided as shown in Fig. 14, and this lattice member 600 is rotated by a motor M1 (See Fig. 37).

[0024] In the connection air-passage portion 25, as shown in Fig. 27, a suction pipe 27 communicating with the suction opening 24A of the electric blower 24 is provided, and at a distal end portion of the suction pipe 27, a fourth opening/closing valve 28 for opening or closing an opening 27A is provided. An opening/closing operation of the fourth opening/closing valve 28 is carried out by a motor M2 (See Fig. 37).

[0025] On the lattice member 600, a plurality of projections 601 are formed as shown in Fig. 14, and each of the projections 601 is engaged with a valley portion (filter groove) of a pleated filter 104 (See Fig. 13), which will be described later, so as to rotate a pleated filter body 100, which will be described later. By rotating the pleated filter body 100, dust removing unit 2100 of a dust removing mechanism 2000 (See Fig. 31), which will be described later, removes dust adhering to the pleated filter 104.

[0026] On the connection port 11A of the main body case 20, a clamp 700 for locking the closed lid case 500 is provided.

[0027] The clamp 700 has, as shown in Figs. 7 and 8, an operation section 701 having an upper surface formed as a curved surface, and on both sides of a rear surface 701A of the operation section 701, support plate portions 702, 702 projecting rearward (right side in Figs. 7 and 8) are formed, and shaft portions 703, 703 are formed on outer surfaces of the support plate portions.

[0028] The shaft portions 703, 703 are, as shown in Fig. 3, rotatably held by bearing portions 27, 27 provided in the main body case 20. The clamp 700 is urged by a spring, not shown, clockwise around the shaft portion 703 in Fig. 7. The clamp 700 is regulated by a regulating member, not shown, so as not to be rotated clockwise from a position shown in Fig. 7.

[0029] Furthermore, the clamp 700 is rotated counterclockwise around the shaft portions 703, 703 from the

position shown in Fig. 7 against an urging force of a spring, not shown, when the operation section 701 is pushed downward from an upper side.

[0030] At a front end of the operation section 701, a front wall section 704 extending downward is formed, and at a lower portion of the front wall section 704, a pressing portion 705 extending rearward is formed. A support portion 706 extending upward is formed at a rear portion of the pressing portion 705, and a lock claw 707 is formed at an upper part of the support portion 706.

[0031] This lock claw 707 is, as shown in Figs. 6 and 7, engaged with a distal end portion 511 of the engagement member 510 of the lid case 500 so as to lock the lid case 500 by the main body case 20.

[0032] When the clamp 700 is rotated clockwise, as shown in Fig. 9, the lock claw 707 of the clamp 700 is removed from the distal end portion 511 of the engagement member 510 of the lid case 500, and the lid case 500 is unlocked.

[0033] The dust collecting unit 50 is, as shown in Fig. 10, provided with a dust separation unit 400 and a dust collecting container 410 detachably attached to the dust separation unit 400.

[0034] The dust separation unit 400 is provided with a dust separation section 52 and a filter section 80 integrated with the dust separation section 52.

[0035] The dust separation section 52 is provided with, as shown in Figs. 10 and 12, a separation chamber portion (upstream air passage) 54 formed cylindrically by an outer circumferential wall 53, a dust separating unit 55 having a substantially conical shape provided along the axis of the separation chamber portion 54 in the separation chamber portion 54, a suction air-passage portion (guide air passage) 56 provided outside of a right side wall 54A of the separation chamber portion 54, and a guide air-passage body 57 for guiding air from the suction connection port (dust suction port) 57a to the separation chamber portion 54. When the dust separation unit 400 is attached to the dust collecting unit chamber 22 of the cleaner main body 11, the suction connection port 57a is made to communicate with the connection port 11A of the cleaner main body 11. The suction air-passage portion 56 is provided below the guide air-passage body 57.

[0036] In an upper portion of the outer circumferential wall 53 of the separation chamber portion 54, as shown in Fig. 12, an introduction opening 53A for introducing dust separated from air into the dust collecting container 410 is formed. Furthermore, as also shown in Fig. 23, on a lower portion side of the outer circumferential wall 53 forming an arc surface, a return opening 53D is formed. In the return opening 53D, a second opening/ closing valve K2 is provided capable of being opened or closed. To the return opening 53D, as shown in Figs. 24 and 25, one end of a return air-passage pipe 2510 is connected. The return air-passage pipe 2510 constitutes a return air passage 2511 (See Figs. 21 and 22).

[0037] At one end of the second opening/ closing valve K2, a shaft portion KJ1 is formed, and as shown in Fig.

24, the shaft portion KJ1 is pivotally supported on an upstream side of the separation chamber portion 54, while the other end of the second opening/ closing valve K2 is located on a downstream side of the separation chamber portion 54. The second opening/ closing valve K2 is, as shown in Fig. 25, opened by being rotated counterclockwise around the shaft portion KJ 1.

[0038] The second opening/ closing valve K2 is closed by air introduced through a connection opening 54Aa, which will be described later, into the separation chamber portion 54 and opened by the air returned from the return air-passage pipe 2510 into the separation chamber portion 54.

[0039] Furthermore, the second opening/ closing valve K2 is formed with the same curvature as an inner circumferential wall surface of the separation chamber portion 54 as shown in Fig. 24 and is provided so as to be flush with the inner circumferential wall surface.

[0040] In the guide air-passage body 57, the connection opening 54Aa communicating with the separation chamber portion 54 as shown in Fig. 23 is formed, and at the connection opening 54Aa, a first opening/ closing valve K1 is provided so as to be opened or closed. When the first opening/ closing valve K1 is switched to a position indicated by a solid line, the connection opening 54Aa is closed, and on the other hand, when being switched to a position indicated by a chain line, the connection opening 54Aa is opened. The air introduced from the guide air-passage body 57 through the connection opening 54Aa into the separation chamber portion 54 is rotated counterclockwise in Fig. 10.

[0041] Further, in the right side wall 54A of the separation chamber portion 54A, a circular opening 154A (See Fig. 10) and a fan-shaped opening 154B (See Figs. 12 and 24) are formed, the dust separating unit 55 is mounted on the opening 154A, and in the opening 154B, a net filter NF2 (See Fig. 24) is mounted.

[0042] The dust separating unit 55 is constituted by a plurality of frames 55a and a net filter NF1 affixed on the periphery of the frames 55a. The suction air-passage portion 56 communicates with the inside of the separation chamber portion 54 through the opening 154A (See Fig. 10) of the right side wall 54A and the net filter NF1 (See Fig. 12) and also communicates with the inside of the separation chamber portion 54 through the net filter NF2 of the opening 154B in the right side wall 54A.

[0043] In a bottom portion of the suction air-passage portion 56, an opening 56D as shown in Fig. 12 is formed, and in the opening 56D, a filter (pleated filter) PF is mounted. One end of a bypass air-passage pipe 2501 forming a bypass air-passage 2500 (See Fig. 21) is connected to the opening 56D as shown in Fig. 26.

[0044] The other end of the bypass air-passage pipe 2501 is connected to the suction pipe 27 as shown in Fig. 27, and through the bypass air-passage pipe 2501, the suction air-passage portion 56 and the suction pipe 27 communicate with each other. In the bypass air-passage pipe 2501, a fifth opening/ closing valve (electromagnetic

valve) 2502 is provided.

[0045] The suction air-passage portion 56 communicates with the inside of a container case 81 of the filter portion 80, which will be described later, and also communicates with a dust collecting chamber 73 of a dust collecting case portion 74, which will be described later, through the connection opening 56A formed in the right side wall portion 156 (See Fig. 12).

[0046] The dust collecting container 410 has, as shown in Figs. 11 and 12, a communication case portion 72 having a communication path 71 extending in the horizontal direction formed in an upper portion and a dust collecting case portion 74 for collecting dust having the dust collecting chamber 73 extending downward from a right end portion of the communication case portion 72 (in Fig. 12).

[0047] In a lower surface of the communication case portion 72, an opening 72A communicating with the communication path 71 (See Fig. 12), a hook 72F, and a recess 76 are formed as shown in Fig. 11. In the recess 76, a rib 72R extending in the vertical direction is formed. The opening 72A is, as shown in Fig. 12, connected to the introduction opening 53A of the dust separation section 52.

[0048] Furthermore, a connection opening 75 is formed in a left side wall section 74A of the dust collecting case portion 74, and a net filter NF3 is mounted over this connection opening 75.

[0049] The dust collecting case portion 74 has a lid 74A capable of being opened or closed, and as shown in Fig. 11, a rib 74R extending downward is formed at a lower portion of the lid 74A. The lid 74A is disposed to be rotatable around the axis 74J so as to be opened or closed.

[0050] When the dust collecting container 410 is attached to the dust separation unit 400, as shown in Fig. 12, the introduction opening 53A of the dust separation section 52 is connected to the opening 72A of the dust collecting container 410, and the connection opening 75 of the dust collecting container 410 is connected to the connection opening 56A of the suction air-passage portion 56 of the dust separation unit 400.

[0051] The filter portion 80 has the cylindrical container case 81 having a rear surface opened as shown in Fig. 13 and a pleated filter body (secondary filter) 100 as a filtering separation section mounted rotatably in the container case 81. This pleated filter body 100 is constituted by a pleated filter 104 as a filter element, and a support frame, not shown, for holding the pleated filter 104. On a front surface of a front wall portion 84 of the container case 81, the dust separation section 52 (See Fig. 10) is integrally formed.

[0052] A connection opening 84A is formed in the front wall section 84 of the container case 81, as shown in Figs. 12 and 13, and the connection opening 84A is connected to the suction air-passage portion 56. The inside of the container case 81 and the suction air-passage portion 56 are communicated with each other through this connection opening 84A. The suction air-passage por-

tion 56 is a communication air passage through which the dust separation section 52 and the pleated filter body 100 are communicated with each other.

[0053] As shown in Fig. 29, an outside-air introduction port (outside-air introduction hole) 84F for introducing outside air into the container case 81 is formed in an upper portion of the front wall section 84, and as shown in Fig. 30, a sixth opening/closing valve (outside-air opening/closing member) K6 for opening or closing the outside-air introduction port 84F is provided in the front face of the front wall section 84. The sixth opening/ closing valve K6 is urged in a direction to close the outside-air introduction port 84F by an elastic member 86.

[0054] For the sixth opening/closing valve K6, a contact piece 87 shown in Fig. 29 is provided, so that the contact piece 87 projects into the container case 81 from the outside-air introduction port 84F. The contact piece 87 is provided with an inclined surface 87a which is increased in an amount projecting into the container case 81 as it extends to the right (in Fig. 29). By pressing the contact piece 87 against an urging force of the elastic member 86, the sixth opening/ closing valve K6 is opened so that the outside air is introduced from the outside-air introduction port 84F into the container case 81.

[0055] Furthermore, as shown in Fig. 28, in the bottom portion of a circumferential wall section 82 of the container case 81, a bottom-portion opening 82A is formed, and the other end portion of the return air-passage pipe 2510 is connected to the bottom-portion opening 82A. The inside of the container case 81 on the upstream side of the pleated filter body 100, which will be described later, and the inside of the separation chamber portion 54 of the dust separation section 52 are communicated with each other by means of this return air-passage pipe 2510 (See Fig. 21).

[0056] As shown in Fig. 21, an air passage from the suction connection port 57a to the suction opening 24A shown by solid-line arrows forms a first flow passage, and as also shown in Fig. 22, a second flow passage is formed by an air passage from the outside-air introduction port 84F to the suction opening 24A shown by chain-line arrows.

[0057] The first flow passage is not limited to the air passage shown in Fig. 21, and it is only necessary that the air passage passes through at least the dust separation section 52 and the filter body 100. The second flow passage is also not limited to the above air passage, and it is only necessary that the air passage passes through at least the container case 81.

[0058] The pleated filter body 100 has, as shown in Fig. 13, the pleated filter 104 in which pleats are formed radially from a shaft portion 101A provided at the center position of the container case 81. This shaft portion 101A is rotatably attached to a shaft 2001 (See Fig. 31), which will be described later.

[0059] When the dust collecting unit 50 is attached to the dust collecting unit chamber 22 of the main body case 20, a rear-surface opening 81B of the container case 81

is mated with the front-surface opening 25B (See Fig. 14) of the connection air-passage portion 25 in the main body case 20.

[0060] The pop-up mechanism 1000 is provided with, as shown in Fig. 7, a pair of pop-up unit 1100, 1100 (See Fig. 3) for popping up the dust collecting container 410 (lifting up the dust collecting container 410 by a spring), locking unit 1200 for fixing the dust collecting container 410 at an attachment position of the dust separation unit 400, and an unlocking unit 1300 for unlocking the locking unit 1200.

[0061] The pop-up unit 1100 has a cylindrical guide case 1101 with a rectangular section provided on an upper surface of the outer circumferential wall 53 of the dust separation section 52 in the dust separation unit 400 and extending upward, and a spring 1102 (not shown in Fig. 3) arranged in the guide case 1101. At the guide case 1101, a pair of slits 1103 (See Fig. 3) extending in the vertical direction is formed.

[0062] The pop-up unit 1110 has a cylindrical guide case 1111 (See Fig. 3) provided similarly at the dust collecting unit chamber 22 and a spring 1112 arranged in the guide case 1111. In the guide case 1111, a pair of slits 1113 (See Fig. 3) extending in the vertical direction is formed.

[0063] When the dust collecting container 410 is attached to the dust separation unit 400, the ribs 72R, 74R (See Fig. 11) of the dust collecting container 410 enter the slits 1103, 1113 of the guide cases 1101, 1111 and compress the springs 1102, 1112 (See Fig. 7) against the urging force. The dust collecting container 410 is urged upward by the urging force of the springs 1102, 1112.

[0064] The locking unit 1200 is provided with a slide member 1201 provided at an upper portion of the guide air-passage body 57 so as to be movable in the longitudinal direction (horizontal direction in Fig. 7) and extending in the longitudinal direction, a guide cover 1202 (See Fig. 4) for covering and guiding the slide member 1201 in the longitudinal direction, and a spring (not shown) for urging the slide member 1201 in the left direction (in Fig. 7).

[0065] On the rear portion side of the slide member 1201, a cylinder portion 1203 with a rectangular section protruding upward is formed and the cylinder portion 1203 protrudes from an opening 1202A (See Fig. 3) of the guide cover 1202. The cylinder portion 1203 has the longitudinal length set to be shorter than a width of the opening 1202A in the longitudinal direction so as not to obstruct the movement of the slide member 1201 in the longitudinal direction.

[0066] An opening 1203 is formed in an upper surface of the cylinder portion 1203, and when the dust collecting container 410 is attached to the dust separation unit 400, the hook 72F of the dust collecting container 410 enters the opening 1204 and is engaged with its edge portion (fixing unit) 1204a, and by this engagement, the dust collecting container 410 is locked at a position (attachment

position) shown in Fig. 7.

[0067] The unlocking unit 1300 is constituted by the slide member 1201 and the pressing portion 705 of the clamp 700 for moving the slide member 1201 to the right (in Fig. 7) and the like. When the operation section 701 is pressed from the upper side and rotated as shown in Fig. 9, the pressing portion 705 of the clamp 700 is brought into contact with a distal end portion 1201a of the slide member 1201 against the urging force of a spring, not shown, so as to move the slide member 1201 rightward. According to this movement, the hook 72F of the dust collecting container 410 is removed from the edge portion 1204a of the opening 1204 in the cylinder portion 1203 of the slide member 1201, and the lock of the dust collecting container 410 is released.

[0068] The dust removing mechanism 2000 is provided with, as shown in Figs. 31 and 32, the shaft 2001 rotatably provided at the central portion of the container case 81, an arm 2002 attached to the shaft 2001 and extending upward, and the dust removing unit 2100 provided at an upper portion (distal end portion) of the arm 2002. A third opening/closing valve (communication air-passage opening/closing member) K3 is integrally provided at the lower portion of the arm 2002, and the third opening/ closing valve K3 is integrally rotated with the arm 2002 and the shaft 2001. Then, when the third opening/closing valve K3 is rotated to a position shown in Fig. 31, it closes the connection opening 84A of the container case 81.

[0069] When the arm 2002 and the third opening/closing valve K3 are rotated counterclockwise to the position indicated by the chain line, the connection opening 84A of the container case 81 is opened.

[0070] When the arm 2002 is located at the position shown in Fig. 31, a shaft portion 2011 of the distal end portion of the arm 2002 is brought into contact with the inclined surface 87a of the contact piece 87 of the sixth opening/ closing valve K6 as shown in Fig. 34 so as to press the sixth opening/closing valve K6 against the urging force of the elastic member 86, and the sixth opening/ closing valve K6 is opened as shown in Fig. 33.

[0071] The dust removing unit 2100 includes, as shown in Figs. 32, 35, and 36, a shaft portion 2101 provided rotatably at a shaft center portion 2002A at the distal end of the arm 2002, a pair of support portions 2102 projecting outward from the shaft portion 2101, a roller 2103 provided rotatably at the distal end portion of the support portion 2102, and a projection (dust remover) 2104 projecting outward from the shaft portion 2101. The pair of support portions 2102 are arranged at a predetermined angle to each other, and the projection 2104 is arranged on a line bisecting the predetermined angle and on the side opposite the support portion 2102.

[0072] The roller 2103 is brought into contact with a bottom surface 84Ma of a groove 84M of the front wall section 84 of the container case 81 as shown in Fig. 18, and the projection 2104 is brought into contact with a mountain portion of the pleated filter 104. The groove

84M is formed in an arc shape as shown in Figs. 29 and 31, and both end portions of the groove 84M regulate the rotation of the arm 2002, and the arm 2002 becomes rotatable within a range of the groove 84M, that is, in the range of the position indicated by the solid line and the position indicated by the chain line shown in Fig. 31.

[0073] The projection 2104 is rotatable in the horizontal direction (in Fig. 35) around the shaft center 2002A together with the shaft portion 2101, and the projection 2104 is returned to an original position shown in Figs. 32 and 35 by the urging force of a spring BN (See Fig. 18).

[0074] When the pleated filter 104 is being rotated, the projection 2104, which is brought into contact with the mountain portion of the pleated filter 104, is rotated around the shaft center 2002A together with the shaft portion 2101. If the pleated filter 104 is rotated by a predetermined angle, the projection 2104 rides over the mountain portion of the pleated filter 104 and is returned to the original position by the urging force of the spring BN. Thereafter, the projection 2104 hits the mountain portion of the subsequent pleated filter 104, and the pleated filter 104 is thereby vibrated so as to shake off fine dust adhering to the pleated filter 104. An interlocking mechanism is composed of the arm 2002, the projection 2104 and the like.

[0075] The shaft 2001 provided in the container case 81 penetrates through the front wall section 84 and projects forward as shown in Fig. 18, and as shown in Fig. 19, a gear 2201 of an opening/closing mechanism 2200 for opening or closing the first opening/closing valve K1 is provided at the distal end portion of the shaft 2001.

[0076] The opening/closing mechanism 2200 is provided with, as shown in Figs. 19 and 20, a rack 2202 meshed with the gear 2201, a slide plate 2203 having the rack 2202 and being movable in the horizontal direction, a support portion 2204 extending forward from one end (left end in Fig. 19) of the slide plate 2203 and having a pin 2205 provided at a distal end, and an arm 2208 having a long hole 2206 with which the pin 2205 is engaged and extending from a shaft 2207 of the first opening/closing valve K1.

[0077] In the slide plate 2203, a long hole (slot) 2203A is formed, and into this long hole 2203A, the shaft 2001 is inserted, and since the shaft 2001 is relatively moved along the long hole 2203A, the movement of the slide plate 2203 in the horizontal direction is not obstructed.

[0078] Further, the pin 2205 engaged with the long hole 2206 of the arm 2208 is relatively movable along the long hole 2206. Thus, according to the movement of the slide plate 2203 in the horizontal direction, the arm 2208 is rotated with the shaft 2207, and by the rotation of the shaft 2207, the first opening/closing valve K1 is opened or closed.

[0079] For example, when the slide plate 2203 is positioned at a position shown in Figs. 19 and 20, the first opening/closing valve K1 closes the connection opening 54Aa of the guide air-passage body 57 as shown in Fig. 23. At this time, the sixth opening/closing valve K6 is

opened, and the third opening/closing valve K3 closes the connection opening 84A of the container case 81 as shown in Fig. 31.

[0080] Furthermore, when the slide plate 2203 is moved from the position shown in Figs. 19 and 20 to the right direction, the first opening/closing valve K1 is moved to the position indicated by the chain line shown in Fig. 23, the connection opening 54Aa is opened, the sixth opening/closing valve K6 is closed as shown in Fig. 30, and the third opening/closing valve K3 is moved to the position indicated by a chain line in Fig. 31 so as to open the connection opening 84A of the container case 81.

[0081] Fig. 37 is a block diagram illustrating a configuration of a control system of the vacuum cleaner. In Fig. 37, reference numeral 200 denotes a controller for controlling the motors M1, M2 and the electromagnetic valve 2502 on the basis of the operation of the operation section 13A. The opening/closing valves K1 to K3, K6, 28, 2502, the motors M1, M2, and the controller 200 constitute air-flow control unit.

[Operation]

[0082] Hereunder, an operation of the vacuum cleaner of the structure mentioned above will be described.

[0083] First, as shown in Fig. 2, the dust collecting unit 50 is mounted to the dust collecting unit chamber 22 of the cleaner main body 11, and as shown in Fig. 1, the dust collecting hose 12 is connected to the connection port 11A of the cleaner main body 11, and on the other hand, the suction port body 15 is connected to the hand operation pipe 13 through the extension pipe 14.

[0084] At this time, as shown in Fig. 21, the first opening/closing valve K1, the third opening/closing valve K3, and the fourth opening/closing valve 28 are opened, while the second opening/closing valve K2, the fifth opening/closing valve 2502, and the sixth opening/closing valve K6 are closed.

[0085] That is, the slide plate 2203 has been moved rightward from the position shown in Figs. 19 and 20, the first opening/closing valve K1 is moved to the position indicated by the chain line shown in Fig. 23, the connection opening 54Aa is opened, the sixth opening/closing valve K6 is closed as shown in Fig. 30, and the third opening/closing valve K3 is moved to the position shown by the chain line in Fig. 31 so as to open the connection opening 84A of the container case 81.

[0086] When the switch 13b of the operation section 13A in the hand operation pipe 13 is operated, the electric blower 24 is driven. By the driving of the electric blower 24, the air is then sucked from the suction opening 24A of the electric blower 24, a negative pressure is caused into the container case 81 of the dust collecting unit 50 through a connection air-passage portion, not shown, and it is further caused into the dust collecting case portion 74 and the separation chamber portion 54 of the dust separation section 52 through the suction air-passage portion 56. This negative pressure acts on the dust col-

lecting hose 12, the extension pipe 14, and the suction port body 15 through the guide air-passage body 57, and the dust is sucked with air from the suction port body 15.

[0087] The sucked dust and air are sucked into the suction connection port 57a of the dust collecting unit 50 through the extension pipe 14 and the dust collecting hose 12. The dust and air sucked into the suction connection port 57a are introduced into the separation chamber portion 54 of the dust separation section 52 through the guide air-passage body 57 and rotated in the separation chamber portion 54 counterclockwise in Fig. 10. According to this air flow, the second opening/closing valve K2 is forced to be closed even if it is opened.

[0088] The second opening/closing valve K2 is formed with the same curvature as that of the inner circumferential surface of the separation chamber portion 54 and provided so as to be flush with the inner circumferential surface, and hence, the valve is prevented to become a flow-passage resistance against air flowing through the separation chamber portion 54.

[0089] According to the rotation mentioned above, the dust and air are separated by inertia, and the air passes through the net filter NF1 (See Fig. 12) of the dust separation unit 55 and the net filter NF2 (See Fig. 24) of the opening 154B, then further passes through the suction air-passage portion 56 and is sucked into the container case 81 of the filter portion 80.

[0090] On the other hand, the separated dust are introduced from the introduction opening 53A of the separation chamber portion 54 by inertia into the communication case portion 72 of the dust collecting container 410 with a part of air. The introduced dust and air are sucked into the dust collecting chamber 73 through the communication path 71 of the communication case portion 72, while the dust being collected in the dust collecting chamber 73.

[0091] The air sucked into the dust collecting chamber 73 is sucked into the suction air-passage portion 56 through the net filter NF3 and further, sucked into the container case 81 of the filter portion 80.

[0092] The air sucked into the container case 81 passes through the pleated filter 104 of the pleated filter body 100, is sucked into the suction pipe 27 (See Fig. 21) in the connection air-passage portion 25 of the cleaner main body 11, and is then, sucked into the suction opening 24A of the electric air blower 24.

[0093] The air sucked into the suction opening 24A of the electric blower 24 is discharged through the electric blower 24 from a discharge port 20H (See Fig. 21) of the cleaner main body 11 shown in Fig. 2.

[0094] After the cleaning is finished, if the dust collected in the dust collecting container 410 is to be disposed of, the operation section 701 of the clamp 700 is pressed from the upper side. According to such pressing, the clamp 700 is rotated counterclockwise around the shaft portion 703 from the position shown in Fig. 7 against the urging force of a spring, not shown.

[0095] When the clamp 700 is rotated counterclock-

wise, as shown in Fig. 9, the lock claw 707 of the clamp 700 is removed from the distal end portion 511 of the engagement member 510 in the lid case 500 and the lid case 500 is unlocked. When the lid case is unlocked, the lid case 500 is opened by the torsion coil spring 18 (See Fig. 5) as shown by the chain line in Fig. 16.

[0096] On the other hand, if the clamp 700 is rotated as shown in Fig. 9, the pressing portion 705 of the clamp 700 moves the slide member 1201 rightward, and according to this movement, the hook 72F of the dust collecting container 410 is removed from the edge portion 1204a of the opening 1204 in the slide member 1201 and the dust collecting container 410 is unlocked. Further, the ribs 72R, 74R of the dust collecting container 410 are, as shown by Fig. 15, pushed upward by the urging force of the springs 1102, 1112 of the guide cases 1101, 1111. That is, the dust collecting container 410 is popped up by the urging force of the springs 1102, 1112 as shown in Fig. 17.

[0097] Due to a gap between the pressing portion 705 of the clamp 700 and the distal end portion 1201a of the slide member 1201, when the operation section 701 of the clamp 700 is pressed, the lid case 500 is opened, and then, the dust collecting container 410 is popped up.

[0098] In this way, since the lid case 500 is opened and the dust collecting container 410 is popped up only by pressing the operation section 701 of the clamp 700, the dust collecting container 410 from the cleaner main body 11 can be easily removed.

[0099] When the stop switch 13a of the operation section 13A of the hand operation pipe 13 is operated, as shown in Fig. 22, the fourth opening/closing valve 28 is closed, and the fifth opening/closing valve 2502 is opened, whereby the lattice member 600 is rotated by the motor M1 (See Fig. 37).

[0100] By the rotation of the lattice member 600, the pleated filter body 100 is rotated, and when the projection 2104 of the arm 2002 of the dust removing mechanism 2000 abuts against the mountain portion of the pleated filter 104, the arm 2002 and the shaft 2001 are rotated clockwise from the position indicated by the chain line in Fig. 31 together with the pleated filter body 100.

[0101] When the arm 2002 is rotated to the position shown in Fig. 31, the arm is regulated by the end portion of the groove 84M, the rotation of the arm 2002 and the shaft 2001 is stopped, and only the pleated filter body 100 is rotated.

[0102] When the arm 2002 is rotated to the position shown in Fig. 31, the third opening/closing valve K3 closes the connection opening 84A of the container case 81, and the shaft portion 2011 of the arm 2002 presses the contact piece 87 of the sixth opening/closing valve K6 and opens the sixth opening/closing valve K6. That is, the outside-air introduction port 84F of the container case 81 is opened as shown in Fig. 33.

[0103] On the other hand, when the shaft 2001 is rotated together with the arm 2002, the gear 2201 of the opening/closing mechanism 2200 is rotated, and the ro-

tation of the gear 2201 moves the slide plate 2203 leftward to the position shown in Figs. 19 and 20. By the movement of the slide plate 2203, as shown in Fig. 23, the first opening/closing valve K1 is moved to the position indicated by the solid line from the position indicated by the chain line and closes the connection opening 54Aa of the guide air-passage body 57.

[0104] In this way, as shown in Fig. 22, the first and third opening/ closing valves K1, K3 are closed, while the sixth opening/closing valve K6 is opened as shown in Figs. 19 and 20.

[0105] Furthermore, the electric blower 24 is driven by a predetermined power, and since the sixth opening/closing valve K6 is opened and the lid case 500 is not sealed or closed in the main body case 20, the outside air is introduced from the outside-air introduction portion 84F of the container case 81 as shown in Fig. 22.

[0106] On the other hand, when the rotation of the arm 2002 stops, the projection 2104 of the arm 2002 rides over the mountain portion 2104 of the pleated filter 104 in accordance with the rotation of the pleated filter 104, and at every time of riding over the mountain portion, the projection 2104 of the arm 2002 hits the mountain portion of the pleated filter 104 and shakes off the fine dust adhering to the pleated filter 104.

[0107] The fine dust shaken off from the pleated filter 104 is returned by the outside air introduced through the outside-air introduction port 84F to the separation chamber 54 of the dust separation section 52 through the return air passage 2511. That is, the fine dust removed from the pleated filter 104 is discharged from the inside of the container case 81 into the separation chamber 54.

[0108] Since the outside air introduced from the outside-air introduction port 84F hits the pleated filter 104, the pleated filter 104 is cleaned.

[0109] Since the second opening/ closing valve K2 is opened by the outside air flowing through the return air passage 2511 as shown in Fig. 25, the fine dust shaken off from the pleated filter 104 can be surely returned to the separation chamber 54 of the dust separation section 52.

[0110] The outside air and the fine dust introduced into the separation chamber 54 are rotated counterclockwise in Fig. 10, and by this rotation, the fine dust and the air are separated by the inertia force, and the separated fine dust are collected by the inertia force from the introduction opening 53A of the separation chamber 54 through the communication case portion 72 of the dust collecting container 410 to the dust collecting chamber 73.

[0111] Furthermore, the air separated from the fine dust passes through the net filter NF1 (See Fig. 12) of the dust separating unit 55 and the net filter NF2 (See Fig. 25) of the opening 154B and is further sucked into the suction air-passage portion 56. The outside air sucked into the suction air-passage portion 56 is sucked into the suction pipe 27 through the bypass air-passage 2500, and then, sucked into the suction opening 24A of the electric blower 24 and discharged from the discharge

port 20H of the cleaner main body 11.

[0112] In this way, since the fine dust shaken off from the pleated filter 104 are returned to the separation chamber 54 of the dust separation section 52, the dust is prevented from re-adhering to the pleated filter 104.

[0113] Furthermore, since the arm 2002 is rotated by the rotation of the pleated filter 104 to thereby close the third opening/closing valve K3 and to open the sixth opening/closing valve K6, an exclusive motor for opening the third opening/closing valve K3 and the sixth opening/closing valve K6 and the like are no longer needed.

[0114] When a predetermined time has elapsed, the driving of the electric blower 24 is stopped, the lattice member 60 is backwardly rotated only for a predetermined angle, and as shown in Fig. 21, the first opening/closing valve K1, the third opening/closing valve K3, and the fourth opening/closing valve 28 are opened, while the second opening/closing valve K2, the fifth opening/closing valve 2502, and the sixth opening/closing valve K6 are closed.

[0115] According to this embodiment, since the second opening/ closing valve K2 is opened or closed by the air flow, the entire structure can be simplified.

[0116] Although, in the described embodiment, the outside air introduced from the outside-air introduction port 84F is directly blown against the pleated filter 104, the present invention is not limited thereto. That is, an embodiment of air cleaning may include, other than that mentioned hereinabove, such structure that air is not directly blown against the pleated filter 104, and the fine dust floating in a space on the front side of the pleated filter 104 in the container case 81 and the fine dust collected on the bottom portion of the container case 81 are discharged by air flowing into the outside-air introduction port 84F to the outside of the container case 81 from the bottom-portion opening 82A.

[0117] Furthermore, in the described embodiment, after the dust remover 2104 has rid over the mountain portion of the pleated filter 104, the dust remover 2104 removes the dust by the hitting to mountain portion, but the present invention is not limited thereto. For example, it may be so configured that when the dust remover 2104 hits the holding frame of the pleated filter body 100, its vibration is transmitted to the pleated filter 104, and the dust of the pleated filter 104 is removed by this vibration.

[0118] Still furthermore, this embodiment is configured such that when the dust remover 2104 is brought into contact with the mountain portion of the pleated filter 104, the rotation operation of the pleated filter body 100 is transmitted to the arm 2002 on which the dust remover 2104 is provided. The present invention is not, however, limited to this embodiment, and for example, it may possible that the rotation of the pleated filter body 100 is transmitted to the arm 2002 by bringing the dust remover 2104 into contact with the holding frame of the pleated filter body 100.

[0119] Still furthermore, although this embodiment is configured such that the pleated filter 104 includes the

pleats formed radially, the present invention is not limited thereto. As long as the rotation of the pleated filter body 100 can be transmitted to the arm 2002 and the third opening/ closing valve K3, the direction of the pleats may exclude a structure other than radial direction, such as one direction or multi directions, for example. However, considering transmission of the rotation operation to the arm 2002 and efficient dust removal by the dust remover 2104, the radial direction of the pleats as in this embodiment may be preferred.

[0120] In the above description, the present invention has been described from the viewpoint of an exemplified embodiment, but the present invention is not limited thereto. Those skilled in the art can easily understand that various improvements or changes may be made to the configuration of the present invention without departing from the scope or gist of the present invention. From the viewpoint of the above description, the present invention is intended to include the improvements and changes of the present invention, and the improvements or changes are included in a scope of the appended claims and their equivalents.

[0121] The present invention claims priority on the basis of Japanese Patent Application No. 2006-229886 filed on August 25, 2006 and application contents including the description, drawings, and claims of the application are all incorporated herein by reference.

Claims

1. A vacuum cleaner comprising:

a dust separation section for separating dust and air sucked through an electric blower;
 a dust collecting section for collecting the dust separated from the air in the dust separation section;
 a filtering separation section rotatably provided in a container case located on a downstream side of the dust separation section and separating fine dust passing through the dust separation section from the air;
 a driving unit for rotating the filtering separation section;
 an outside-air introduction hole formed to the container case for introducing outside air into the container case;
 an outside-air introduction hole opening/closing member for opening or closing the outside-air introduction hole;
 a communication passage for communicating the dust separation section and the container case; and
 a communication air-passage opening/closing member for opening or closing the communication air-passage,

wherein there is provided an air-flow control unit for forming, for usual cleaning, a first flow passage extending through the dust separation section, the communication air-passage and the filtering separation section and being sucked by the electric blower and for air cleaning of the container case, and a second flow passage sucked by the electric blower without having the air introduced from the outside-air introducing hole pass through the filtering separation section, in air cleaning process; and there is provided an interlocking mechanism for interlocking the outside-air opening/closing member and the communication air-passage opening/closing member in accordance with rotation of the filtering separation section by the driving unit so that the first flow passage is formed by opening the communication air-passage opening/closing member by rotating the filtering separation section in one direction and closing the outside-air opening/closing member, and the second flow passage is formed by closing the communication air-passage opening/closing member by rotating the filtering separation section in another direction and by opening the outside-air opening/ closing member.

2. The vacuum cleaner according to claim 1, wherein the filtering separation section is provided with a pleated filter having a number of filter grooves disposed radially, the interlocking mechanism is provided with dust removing unit having a dust remover engaged with the pleated filter, and the communication air-passage opening/closing member and the outside-air opening/closing member are opened or closed in accordance with the rotation of the filtering separation section through the dust removing unit at the rotation of the filtering separation section.
3. The vacuum cleaner according to claim 2, wherein the dust removing unit starts dust removal of the filter after the opening or closing operation of the communication air-passage opening/closing member and the outside-air opening/ closing member is completed.
4. The vacuum cleaner according to claim 3, wherein the dust removing unit is provided with an arm having a rear end pivotally supported at a rotation center of the pleated filter and the dust remover provided at the arm and brought into contact with a mountain portion of the pleated filter, and the dust remover is disposed to be rotatable around an axis of the arm and is urged around the axis.

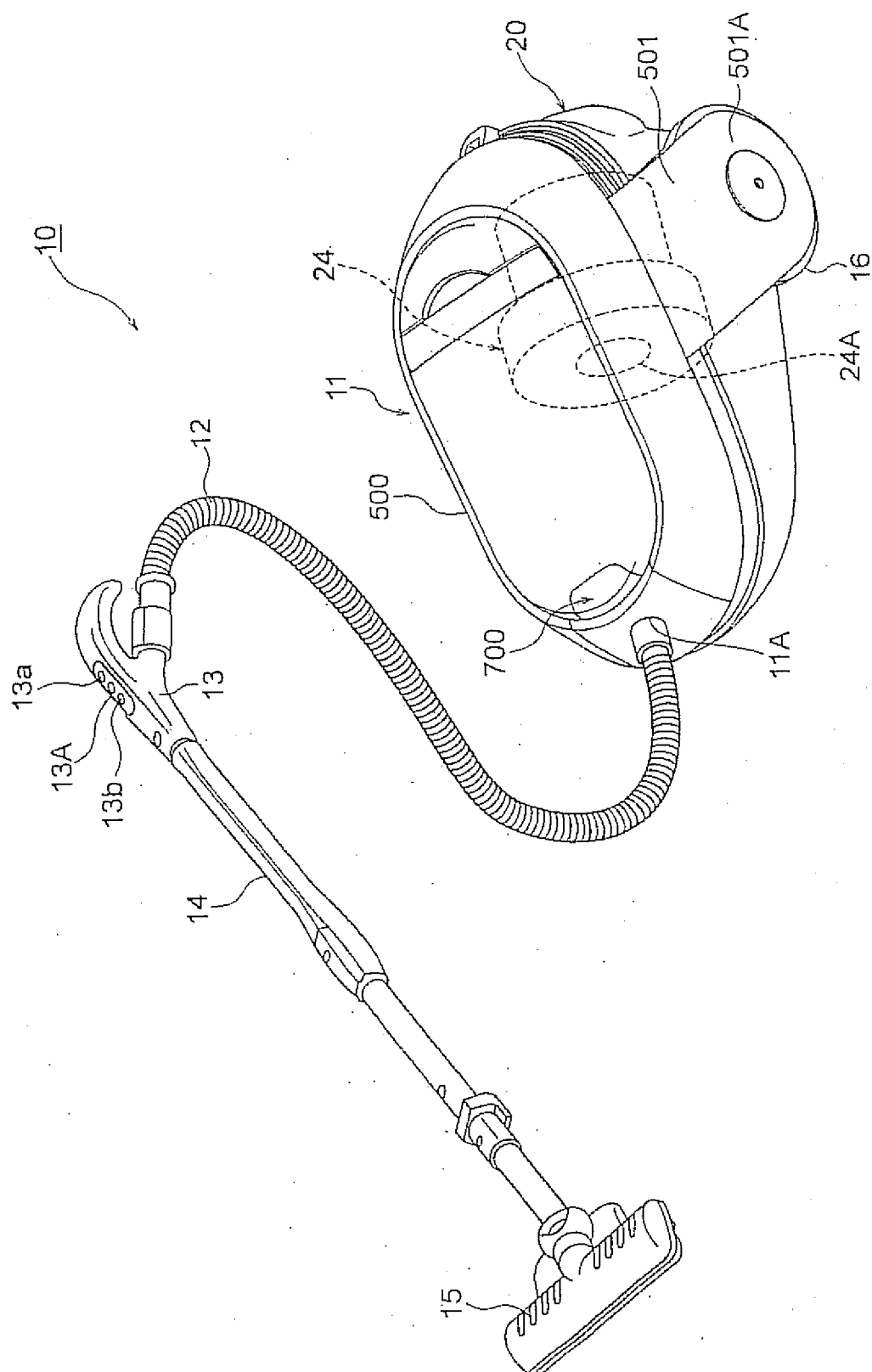


FIG. 1

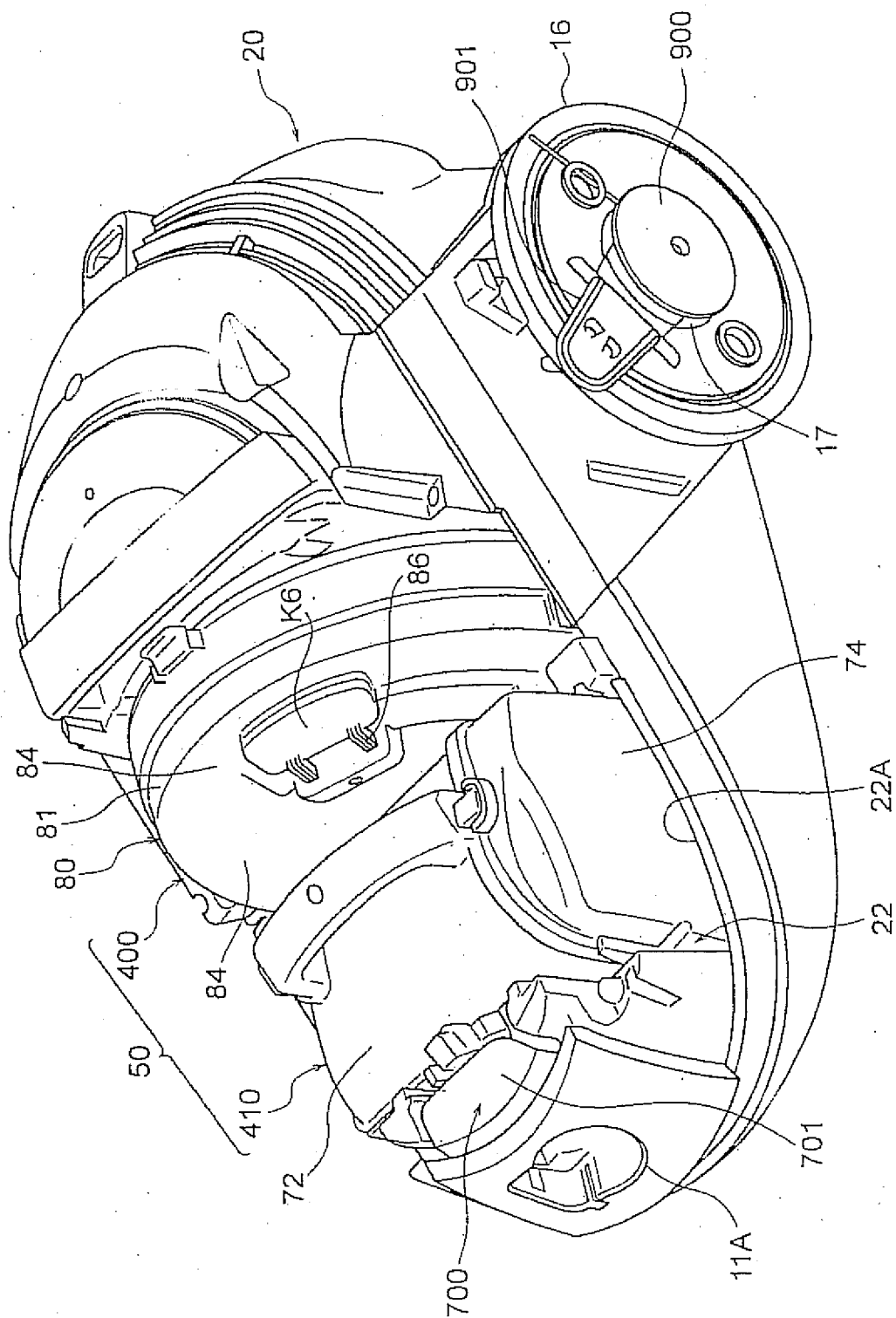


Fig. 2

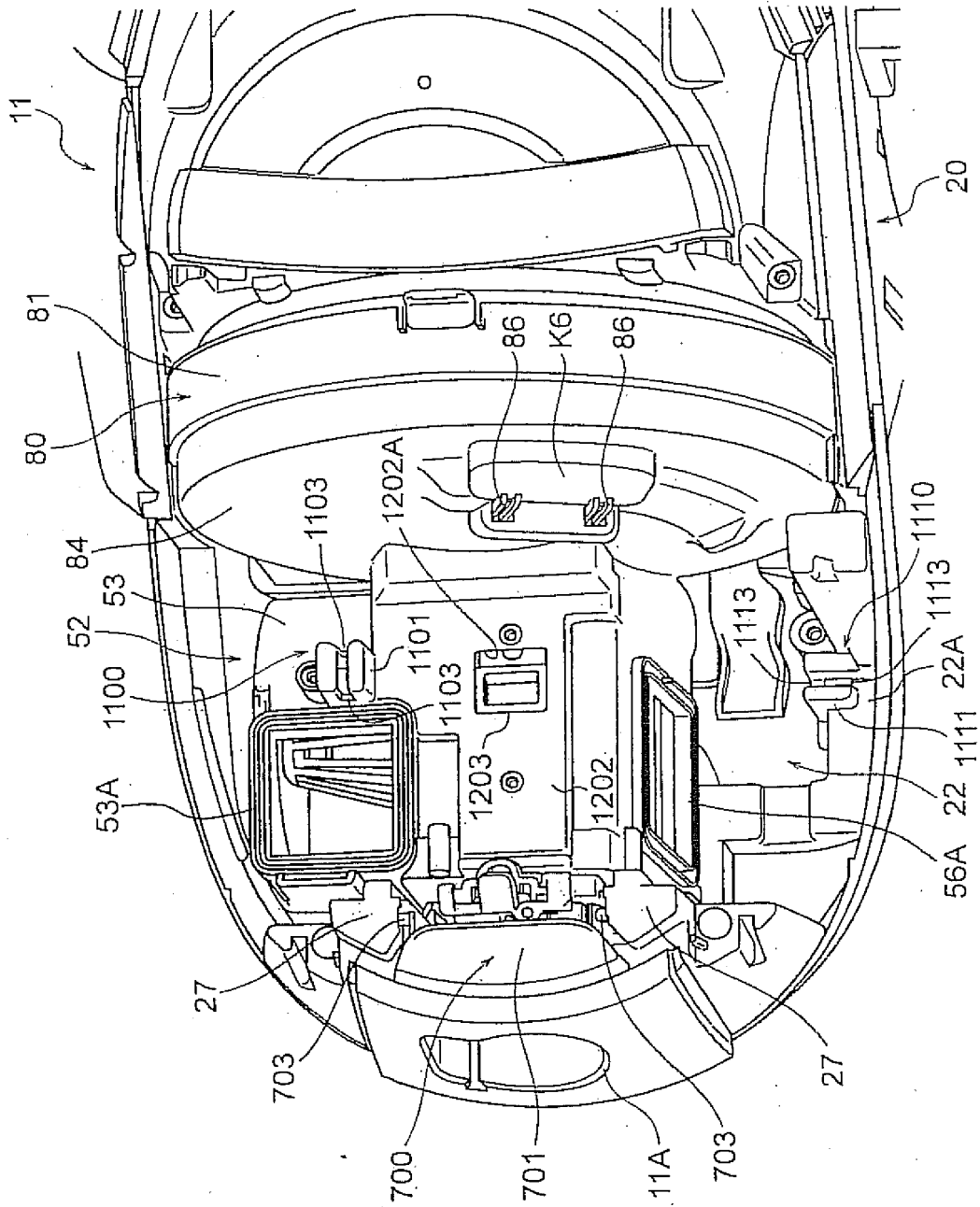


FIG. 3

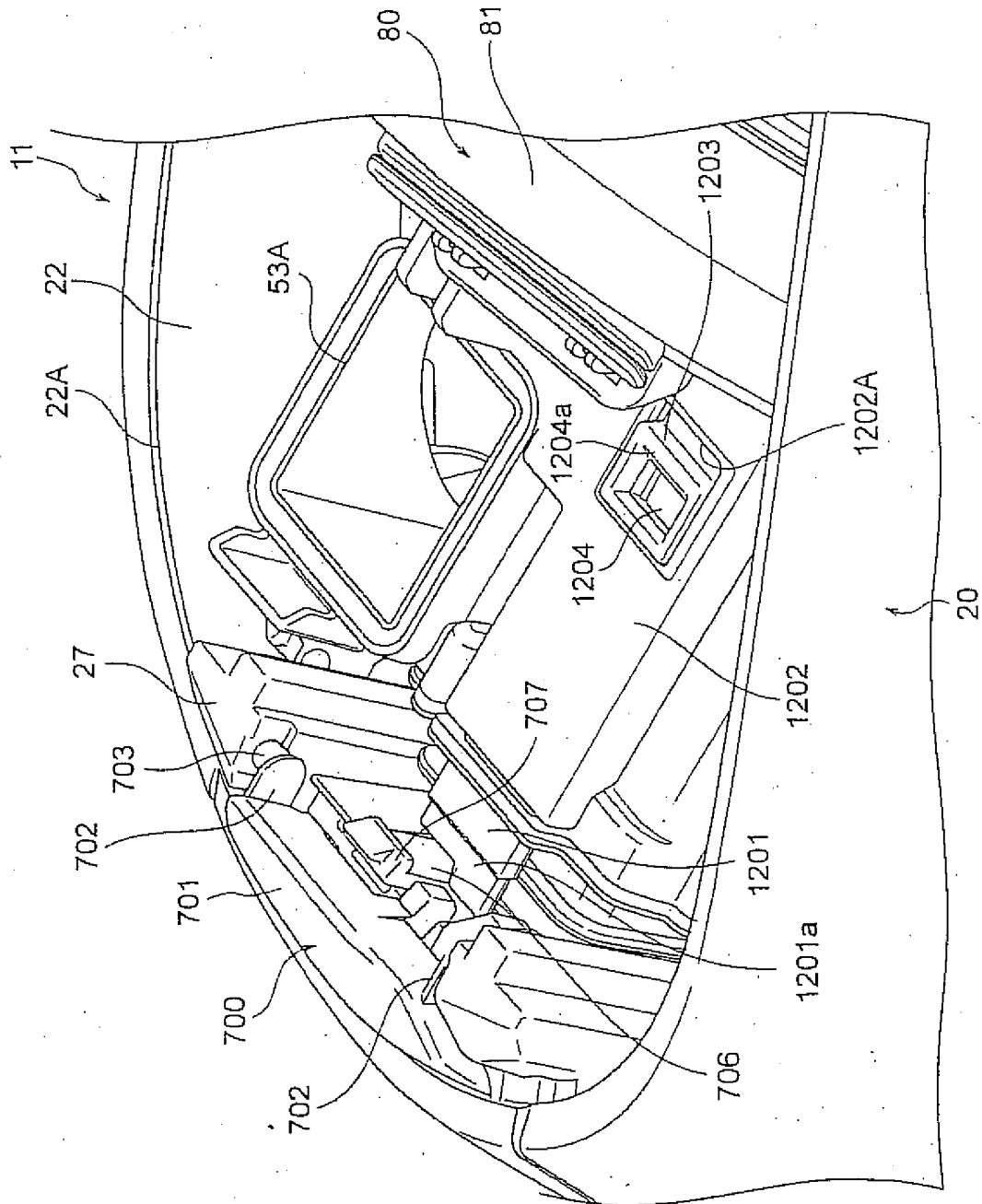


FIG. 4

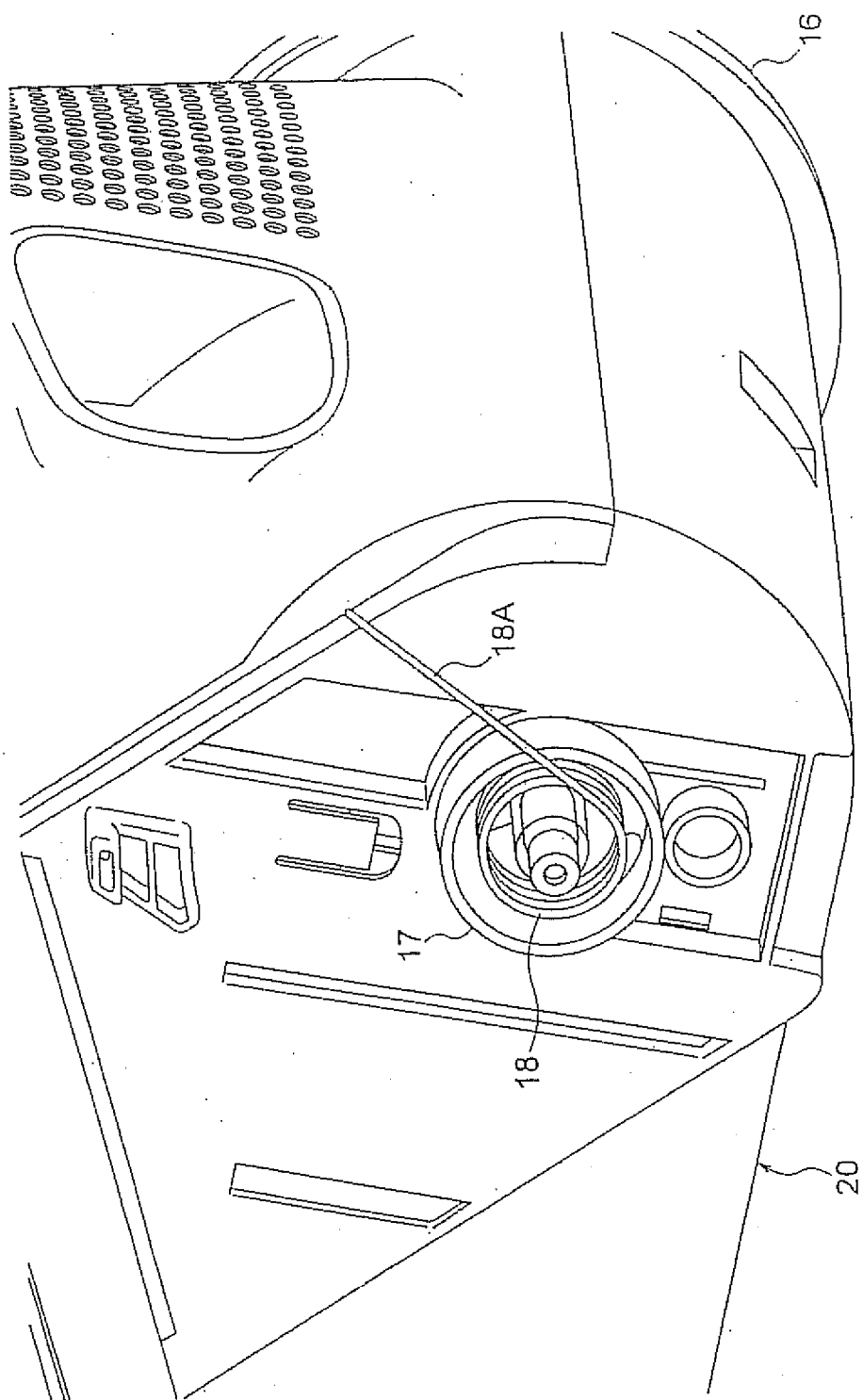


FIG. 5

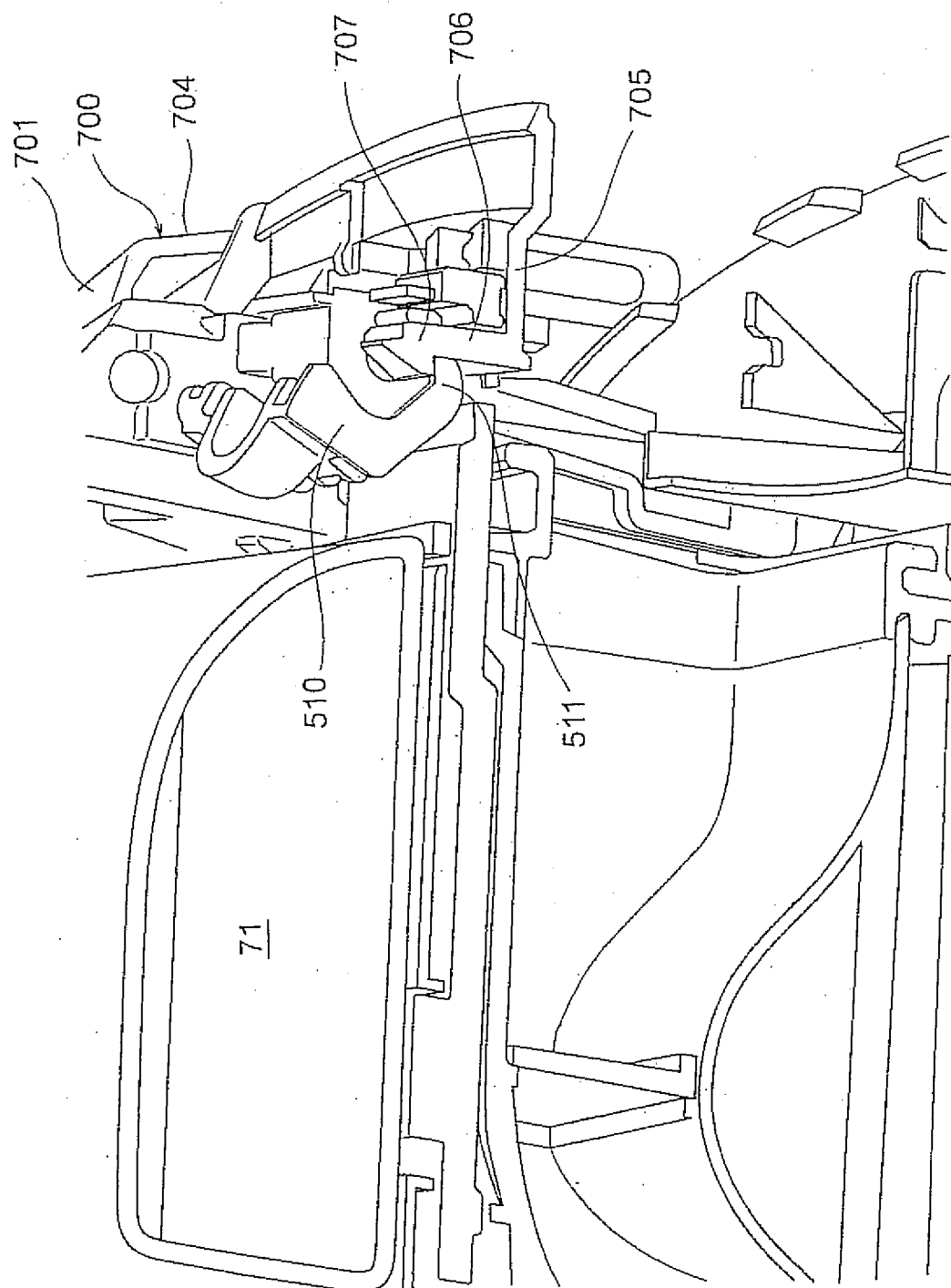
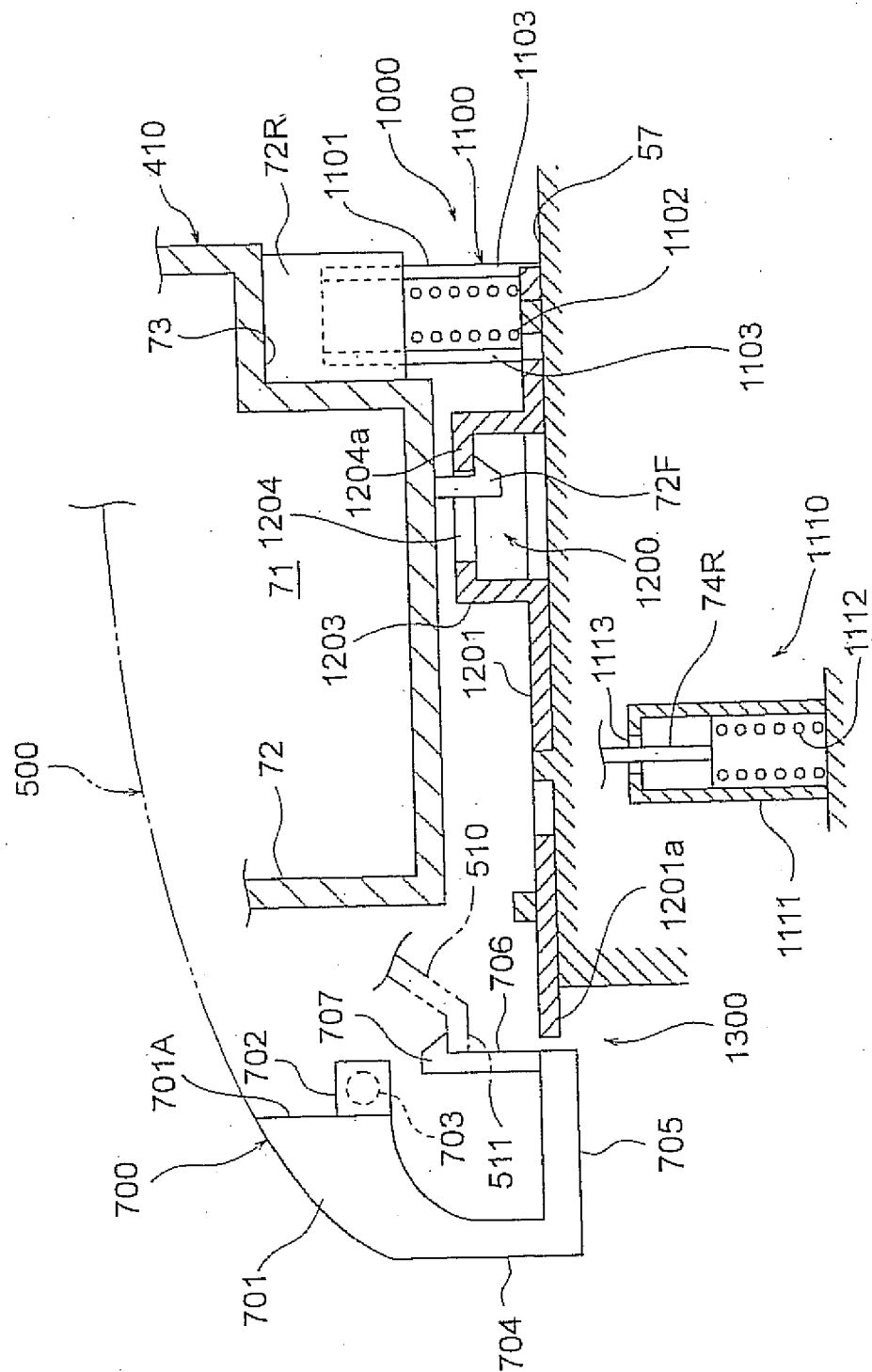


FIG. 6



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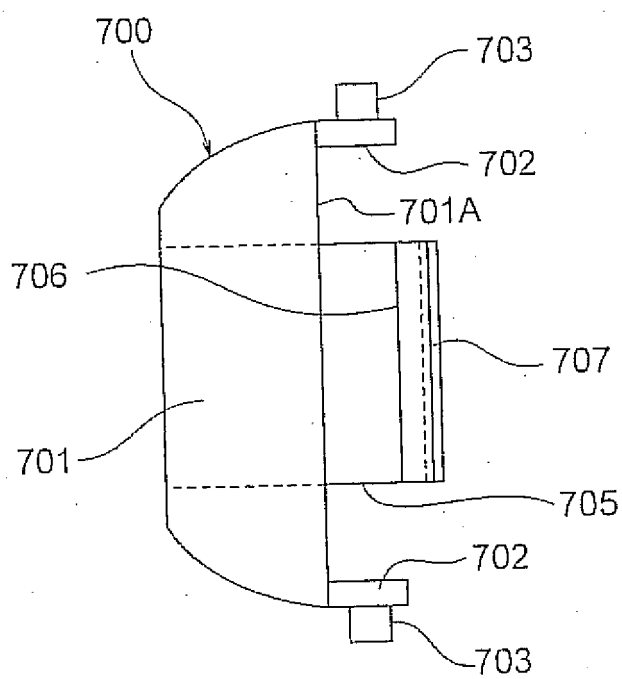
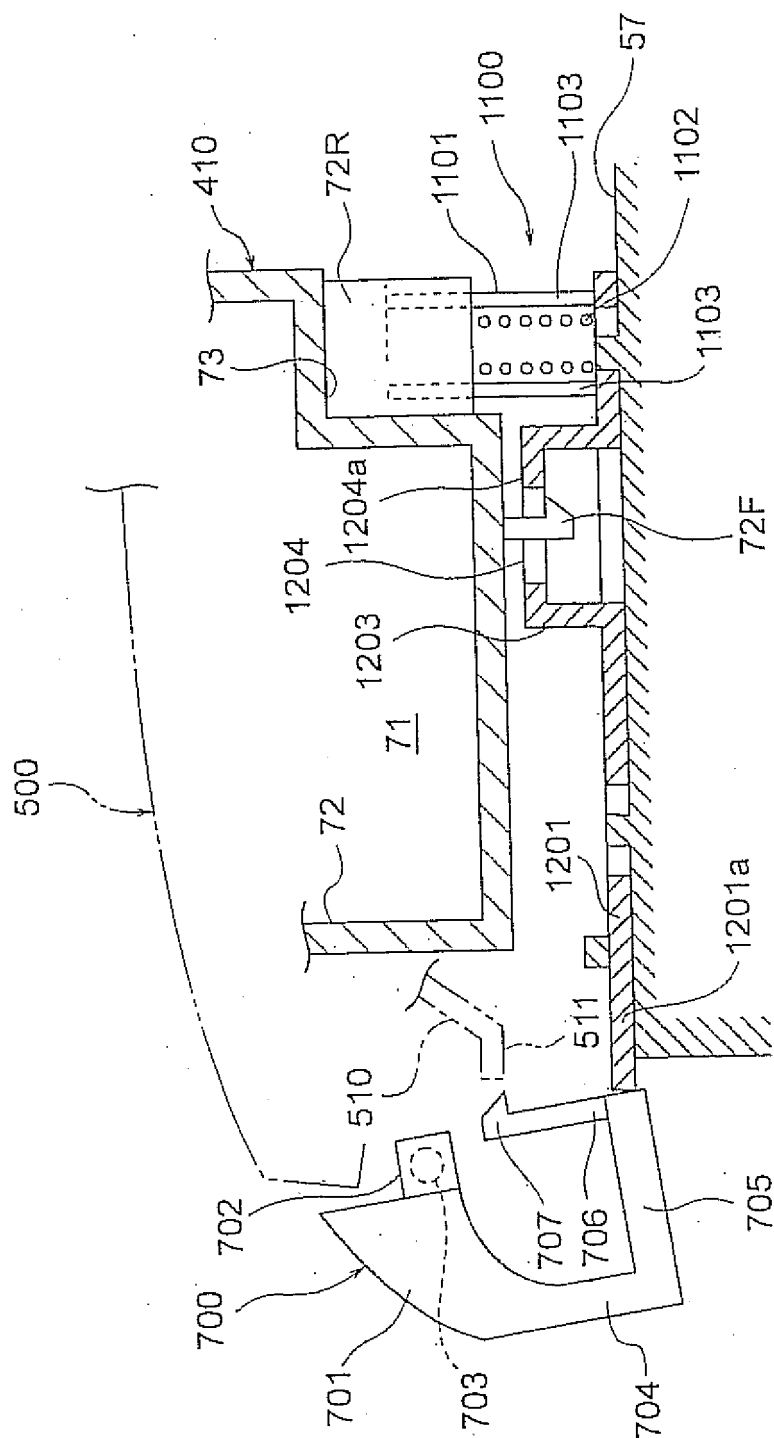


FIG. 8

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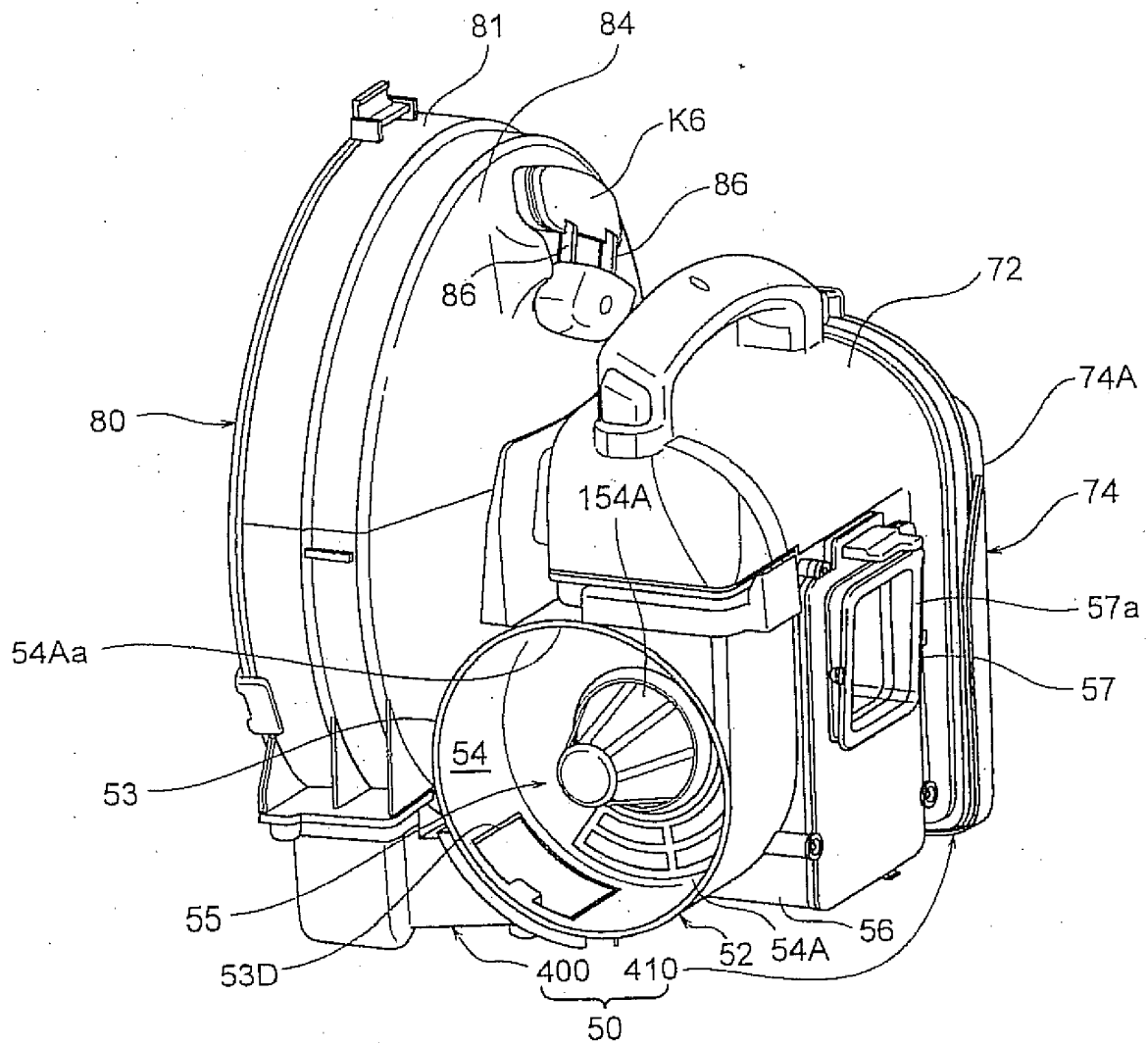


FIG. 10

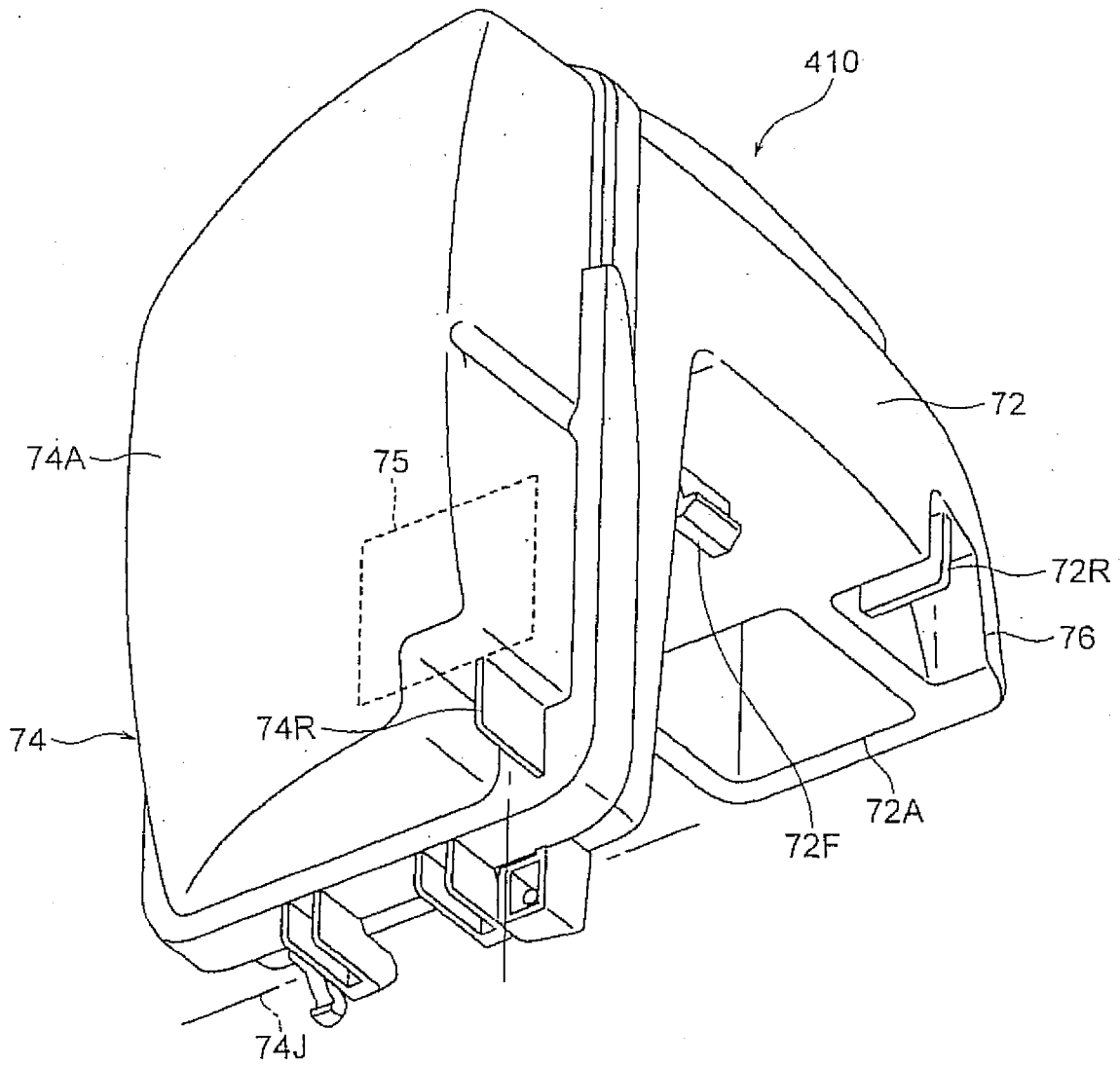


FIG. 11

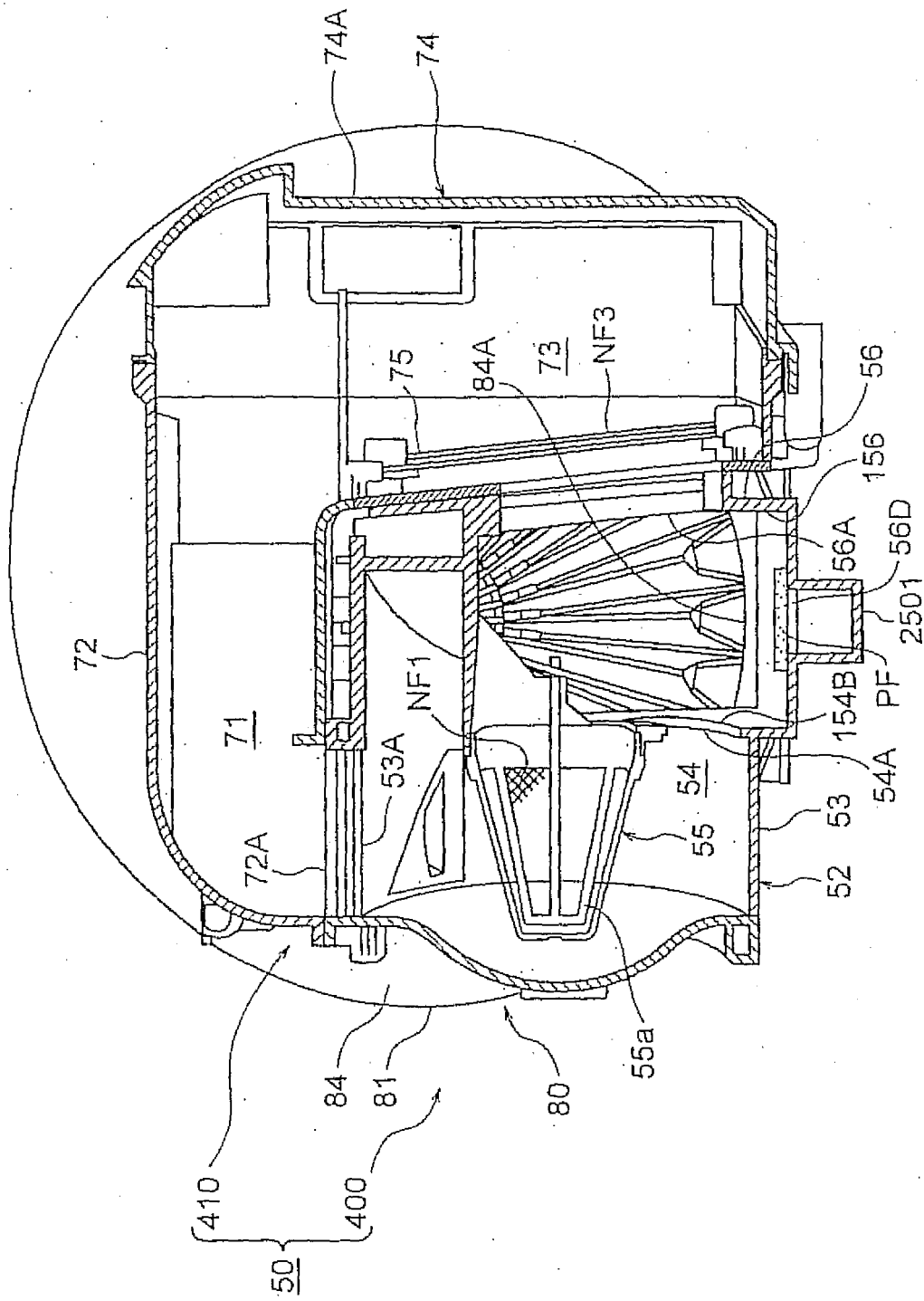


FIG. 12

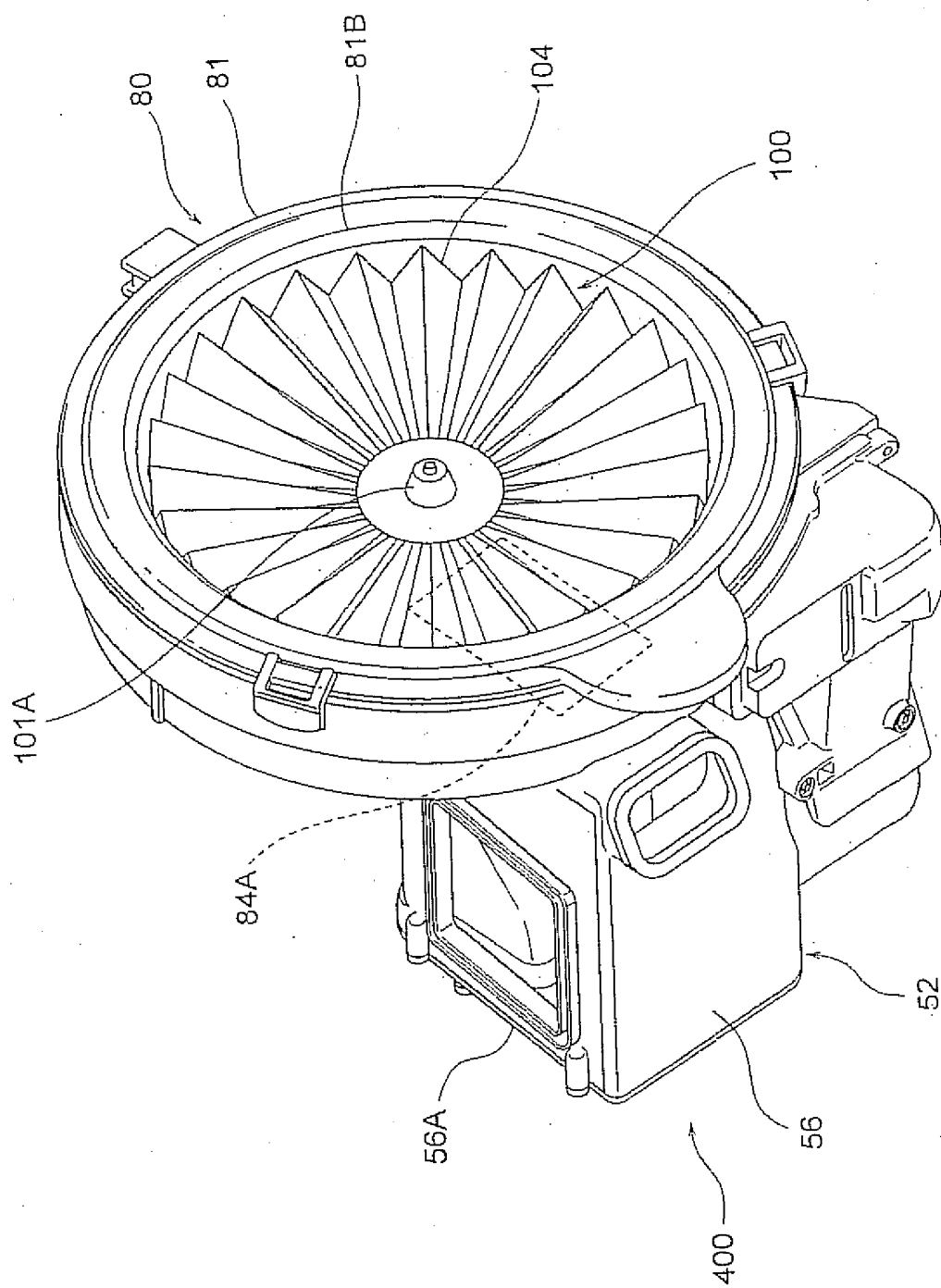


FIG. 13

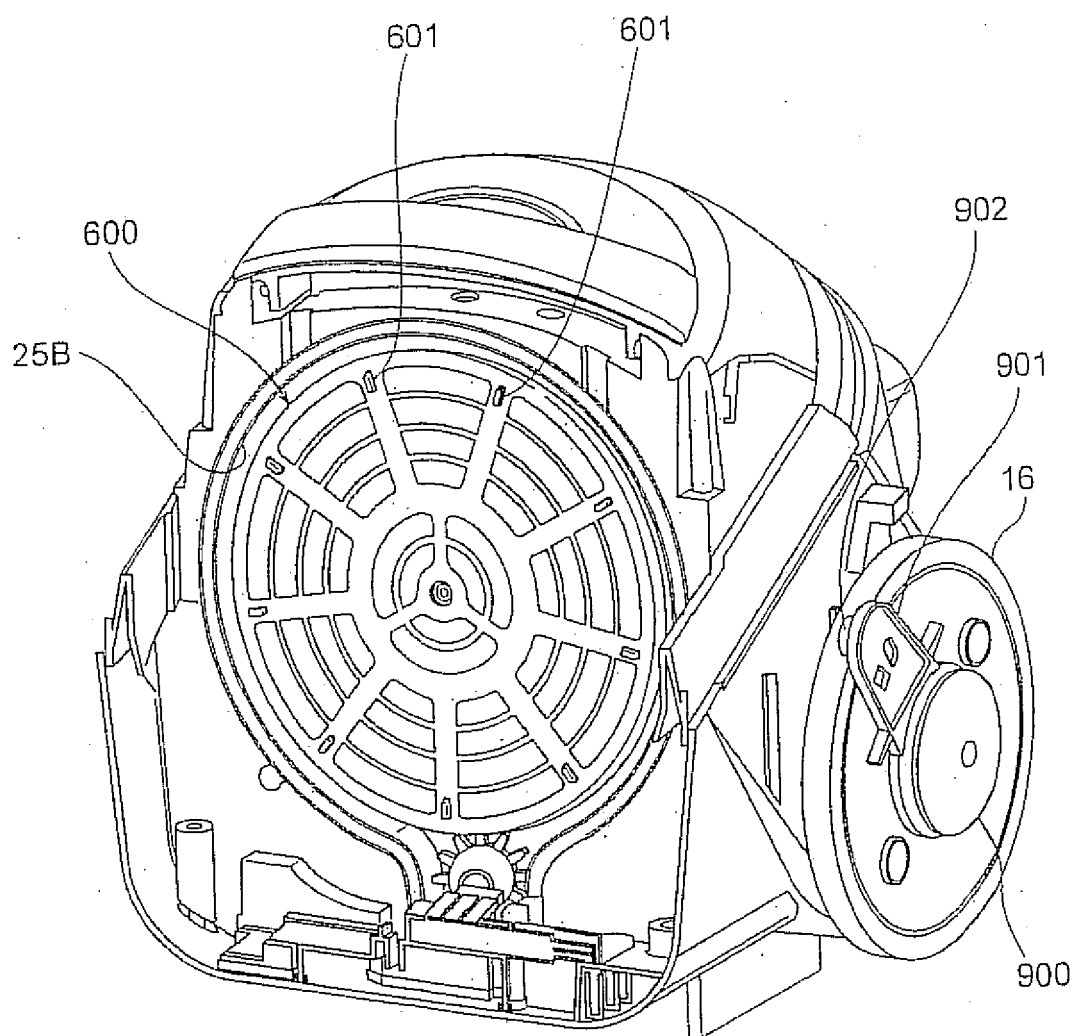
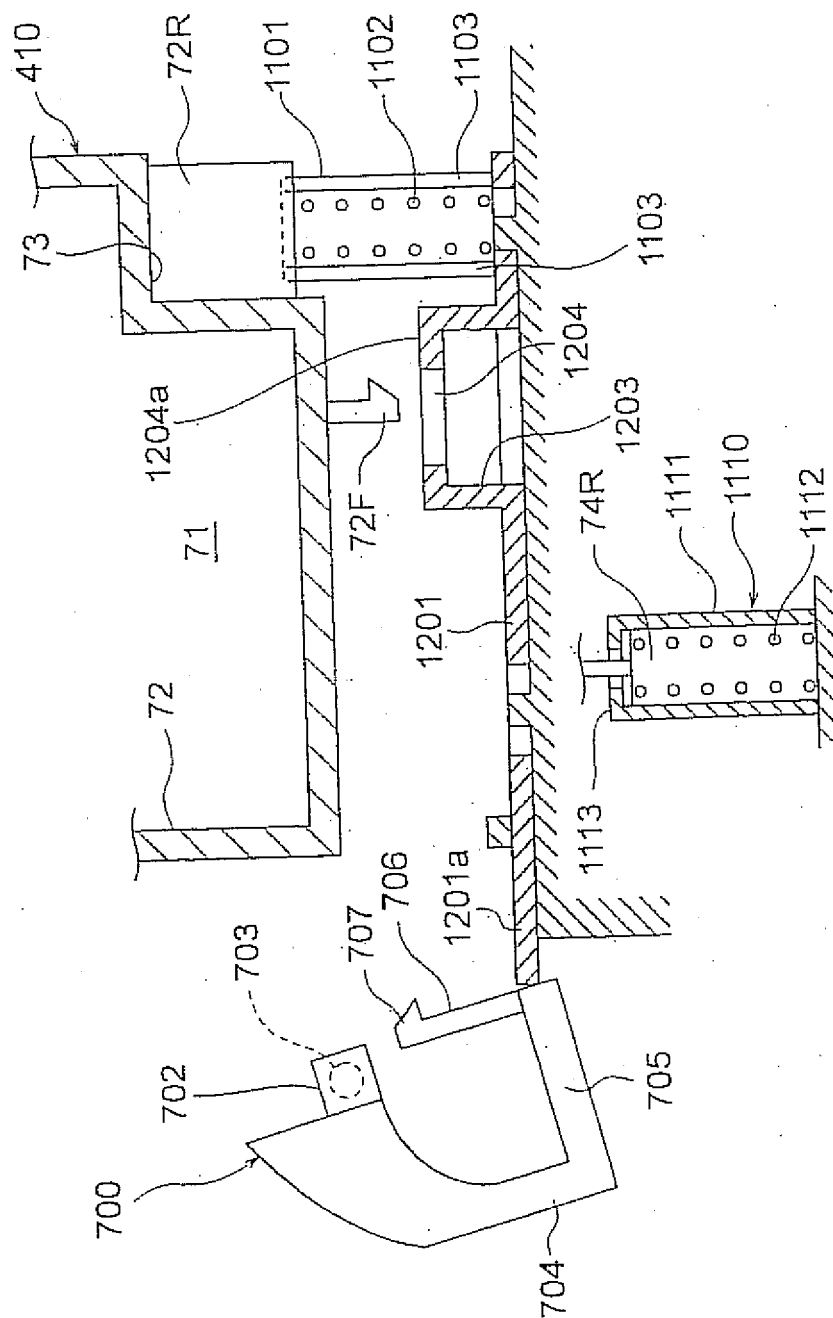


FIG. 14



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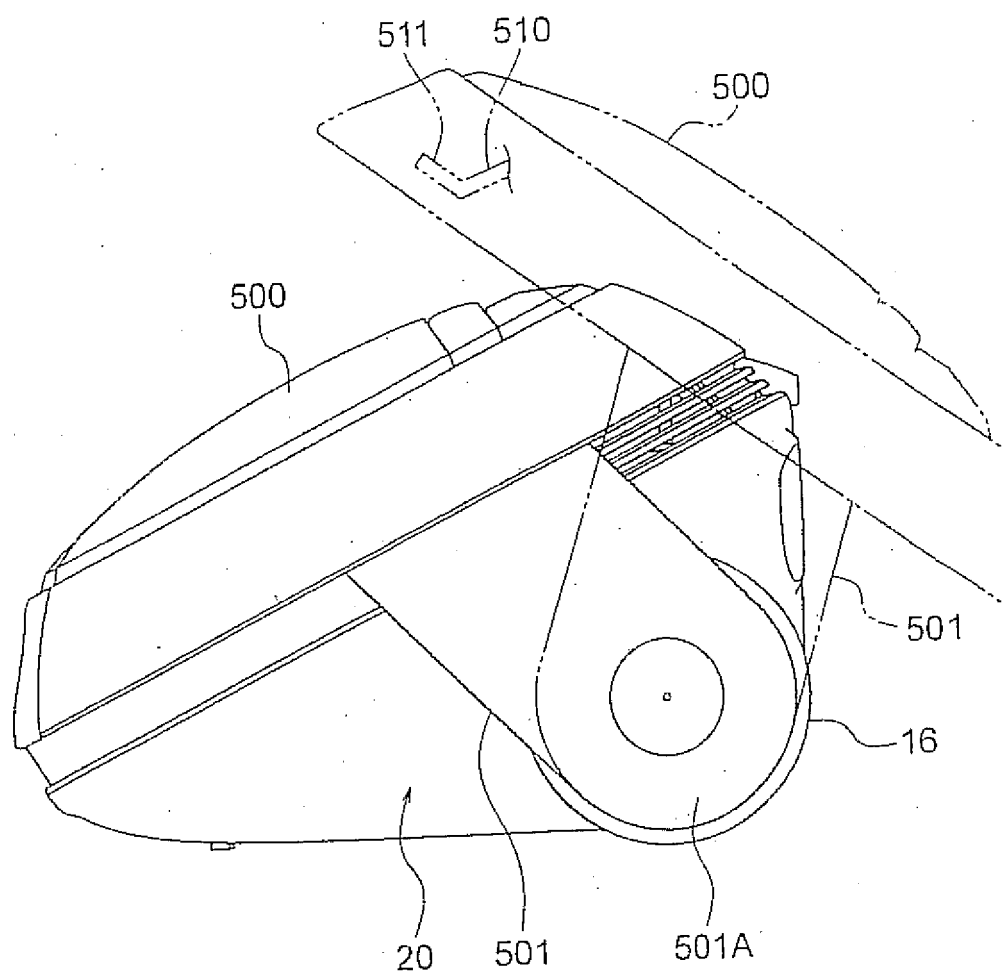


FIG. 16

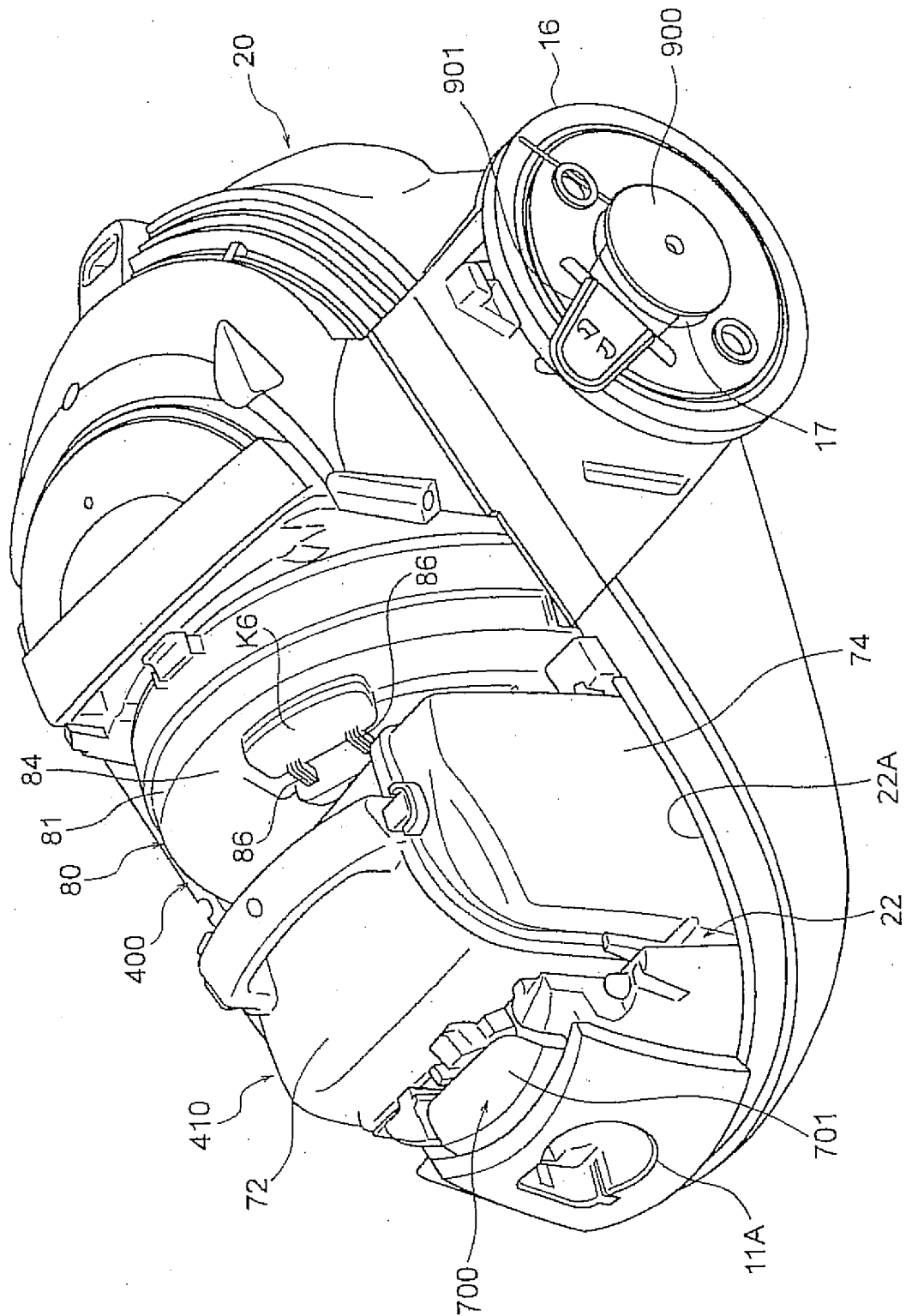


FIG. 17

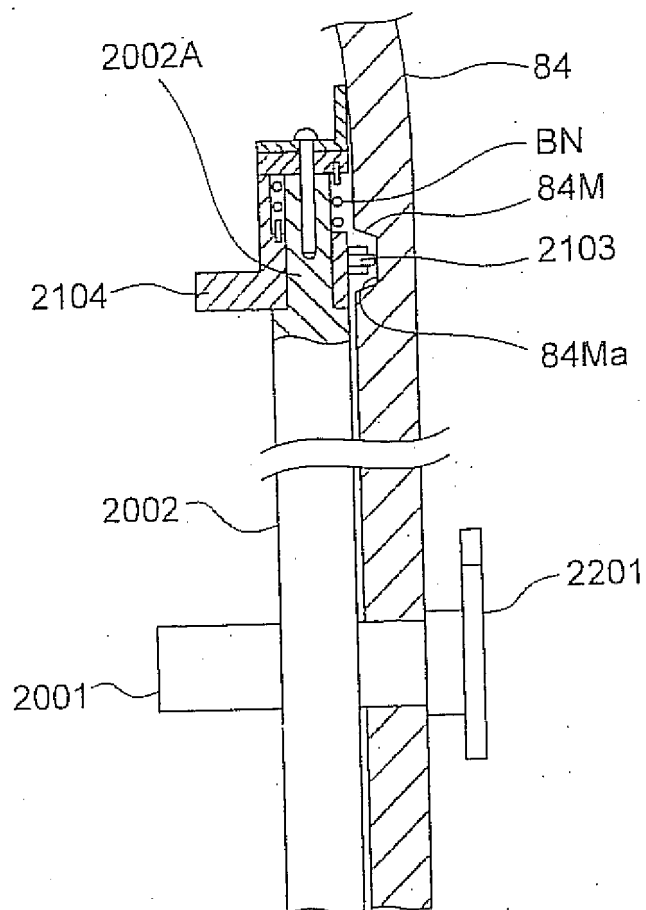
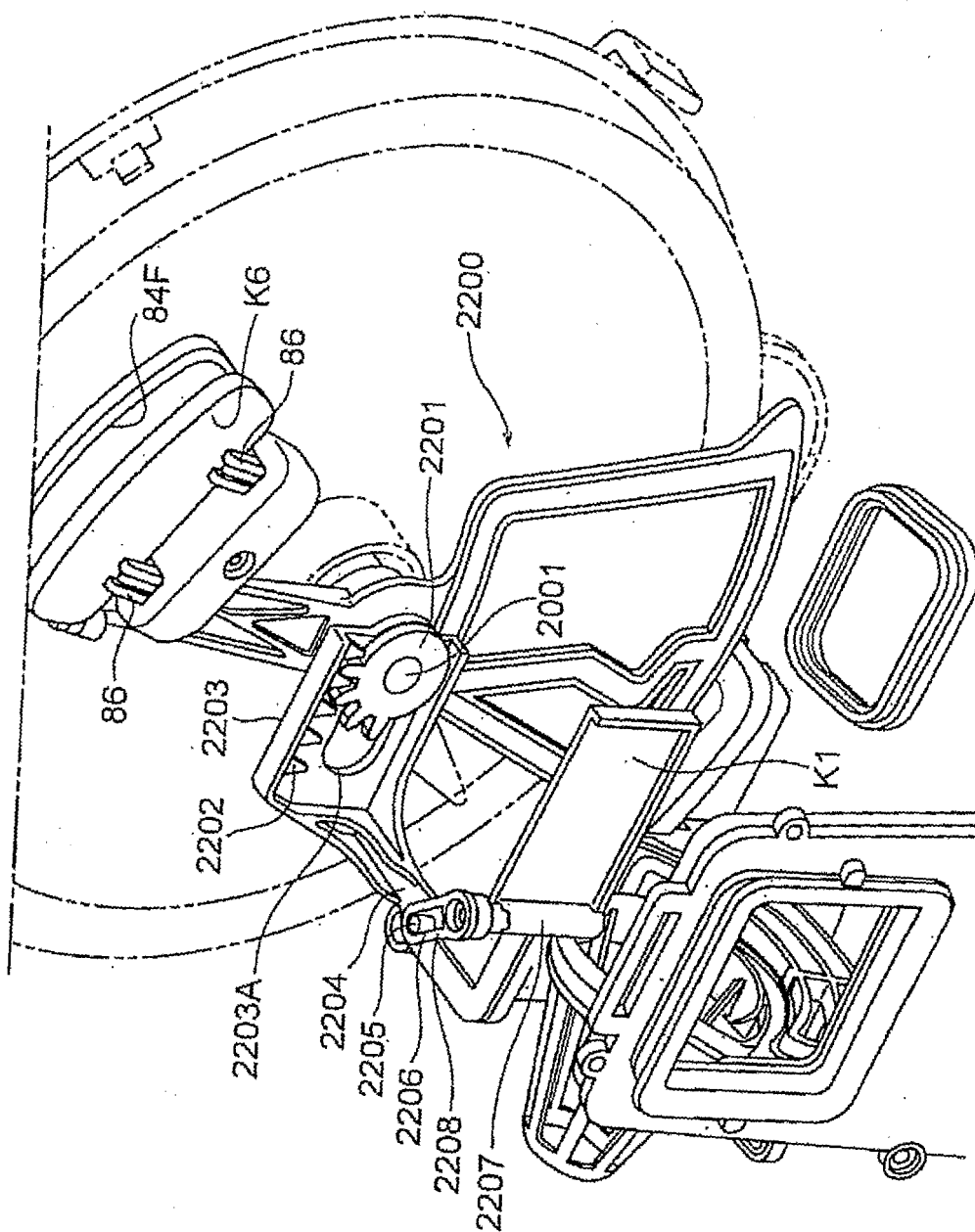


FIG. 18



619

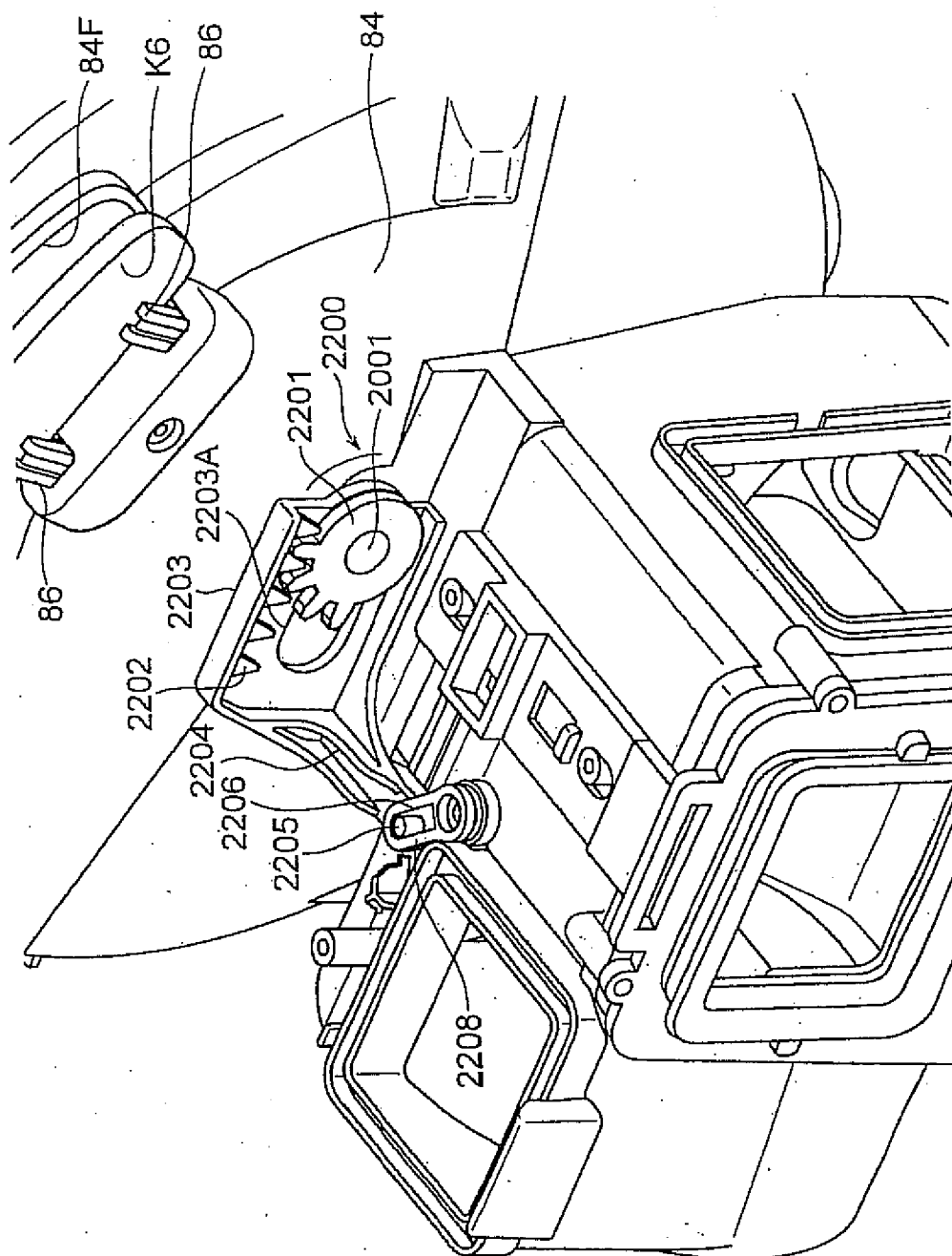


FIG. 20

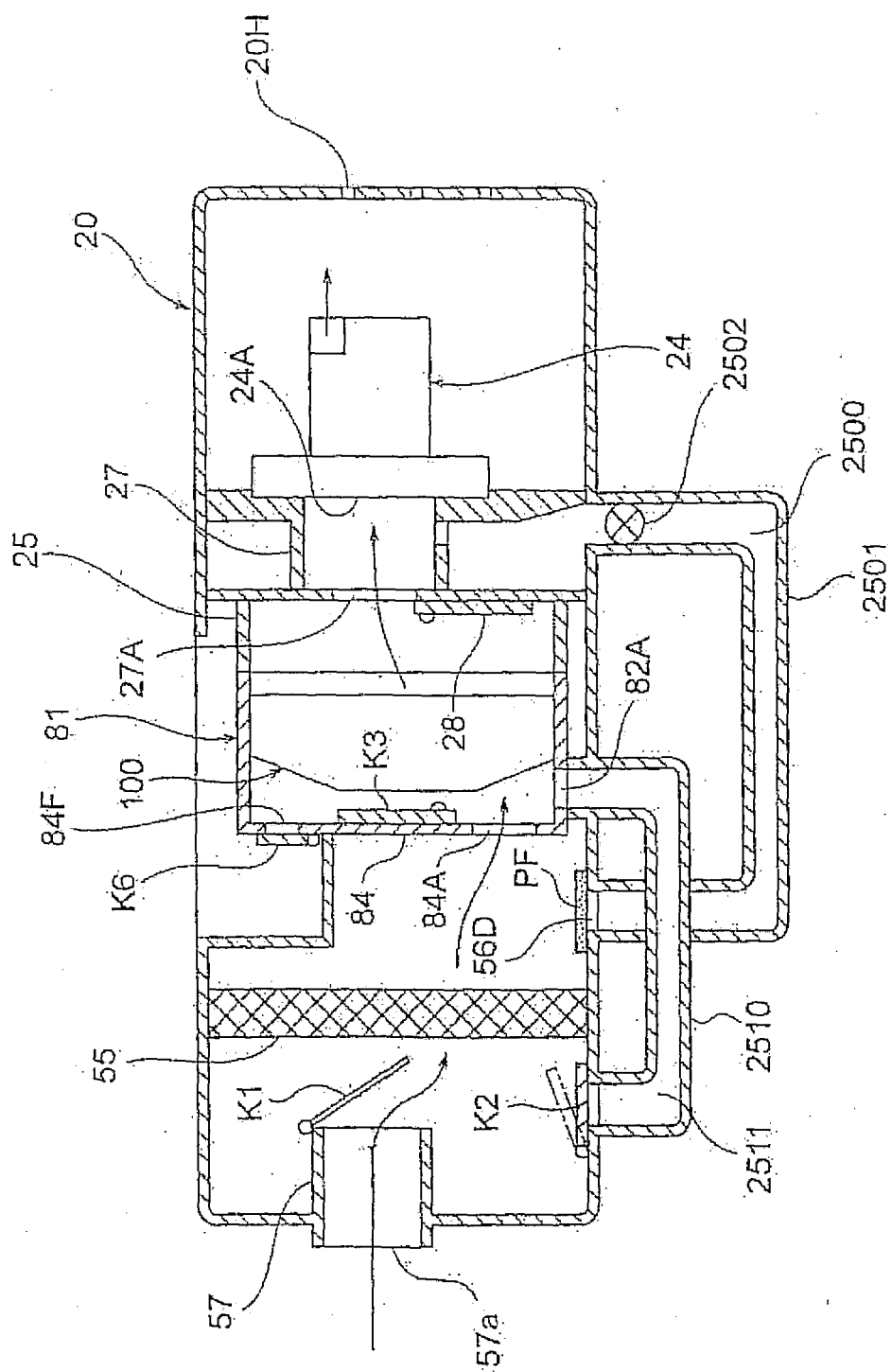


FIG. 21

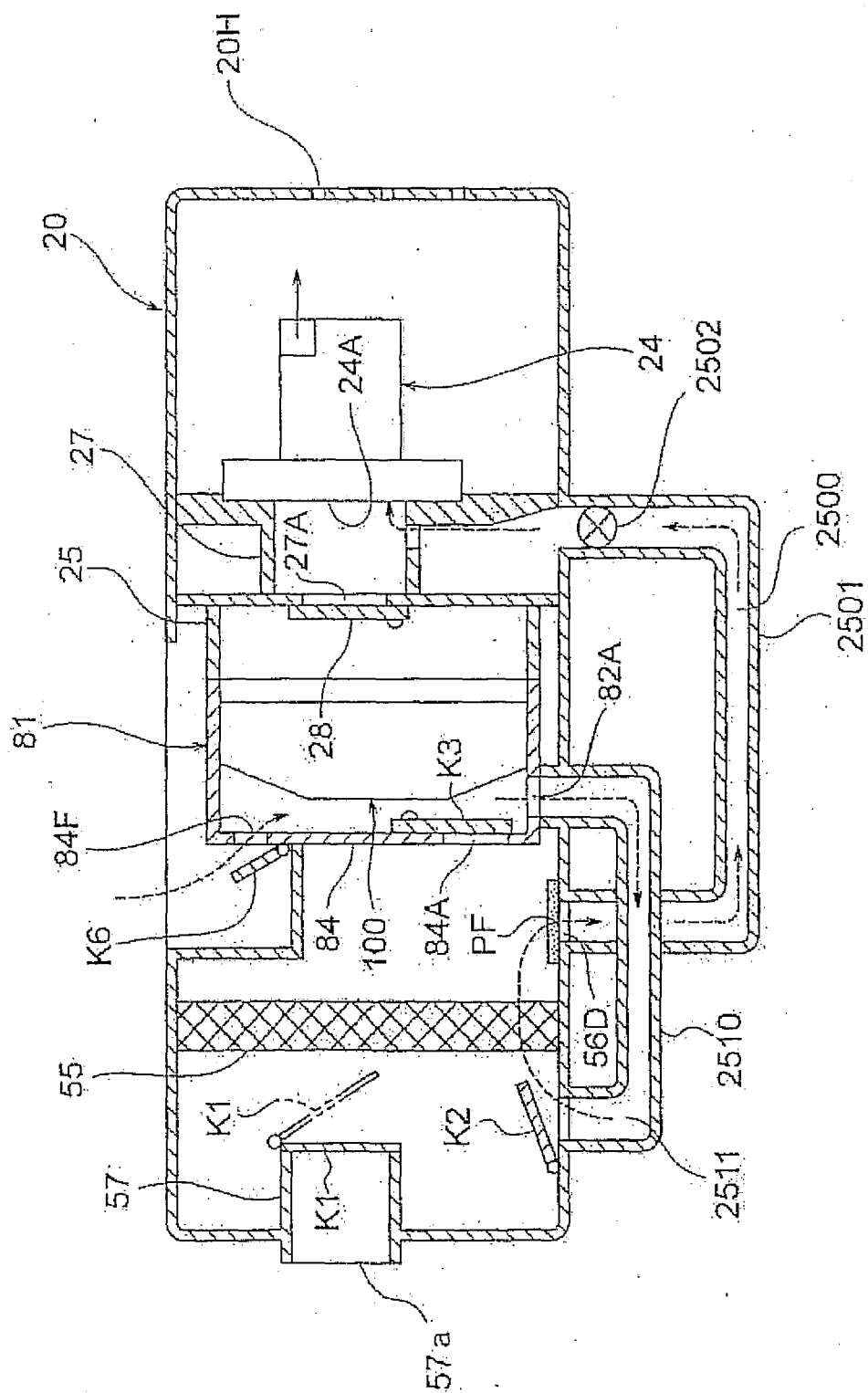


FIG. 22

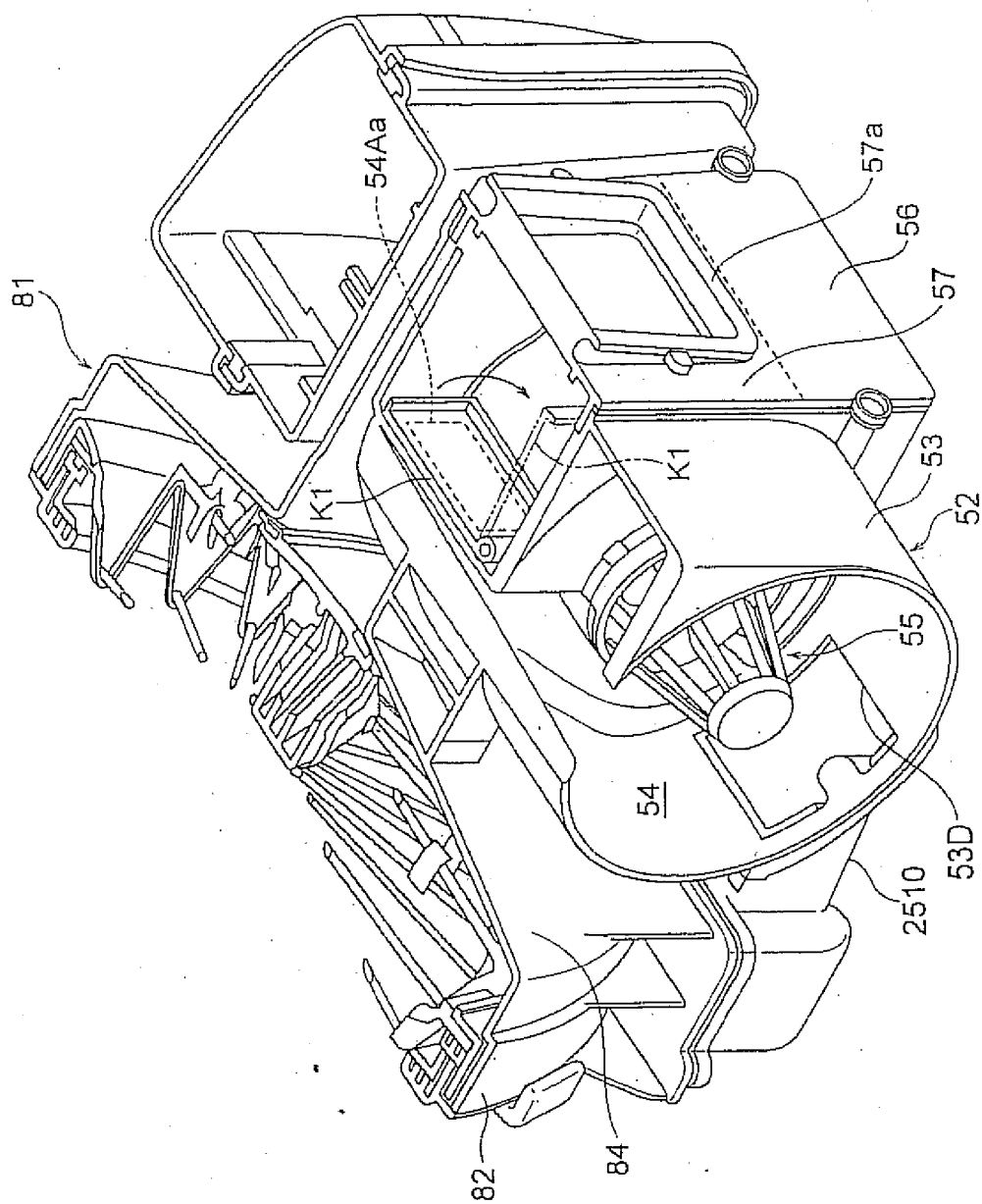


FIG. 23

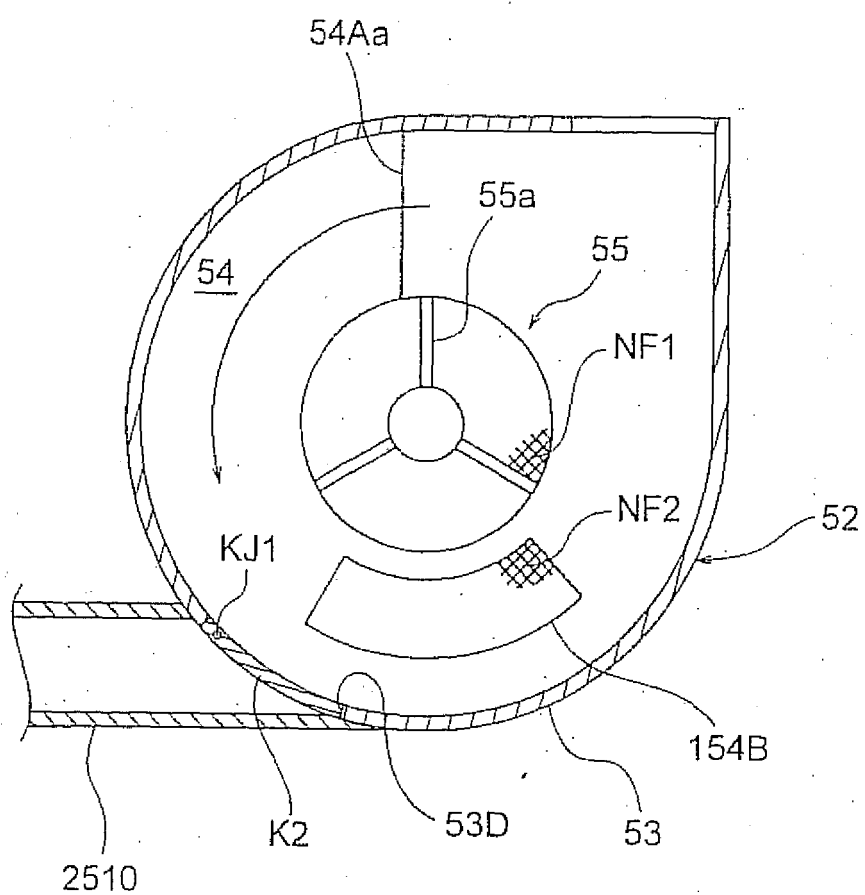


FIG. 24

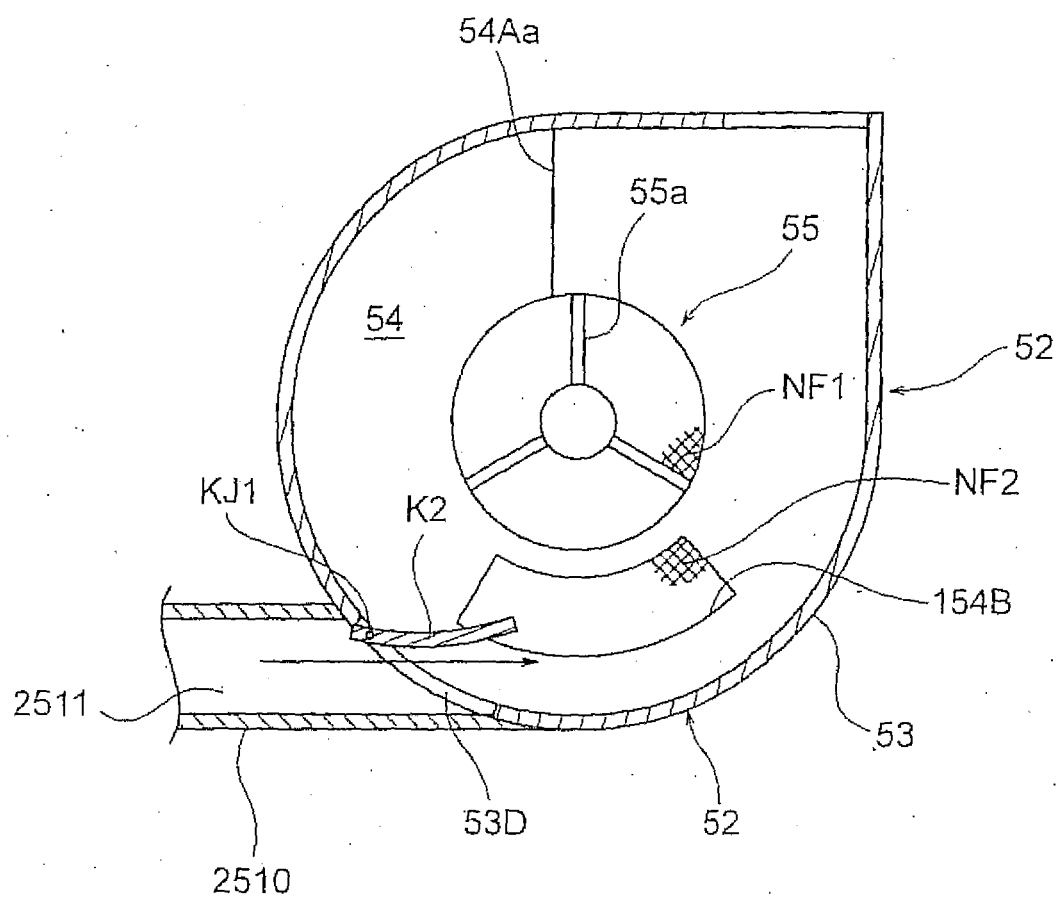


FIG. 25

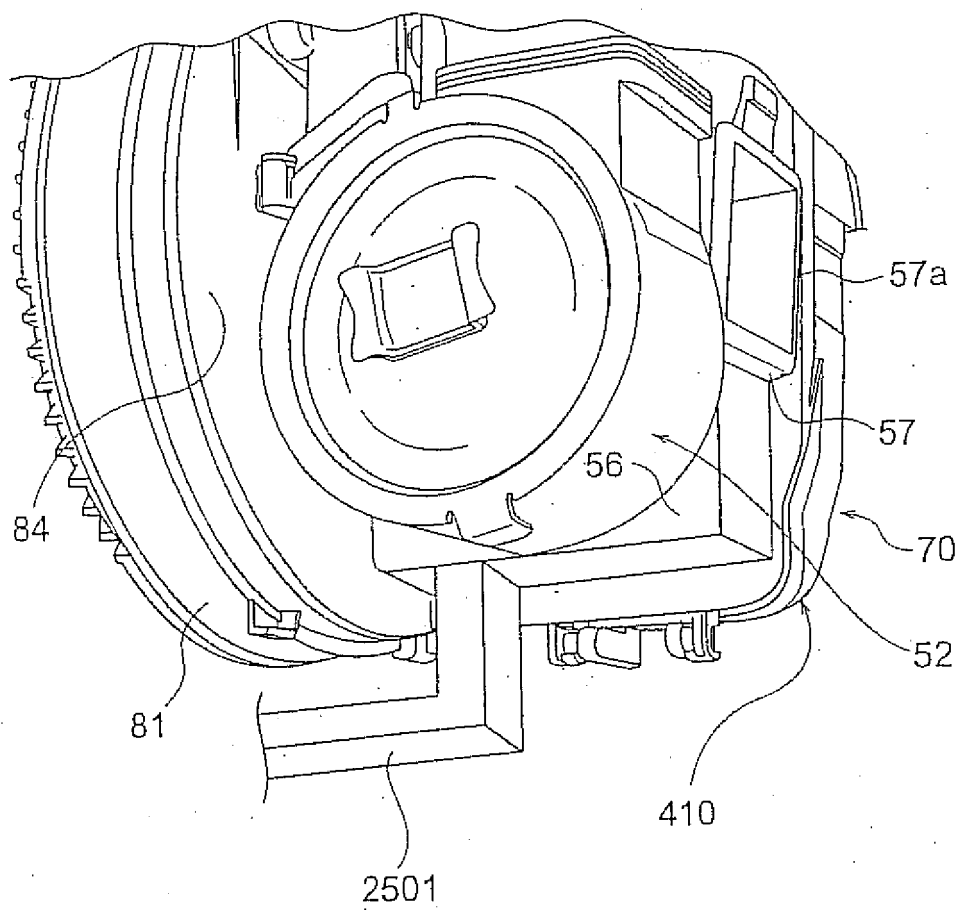


FIG. 26

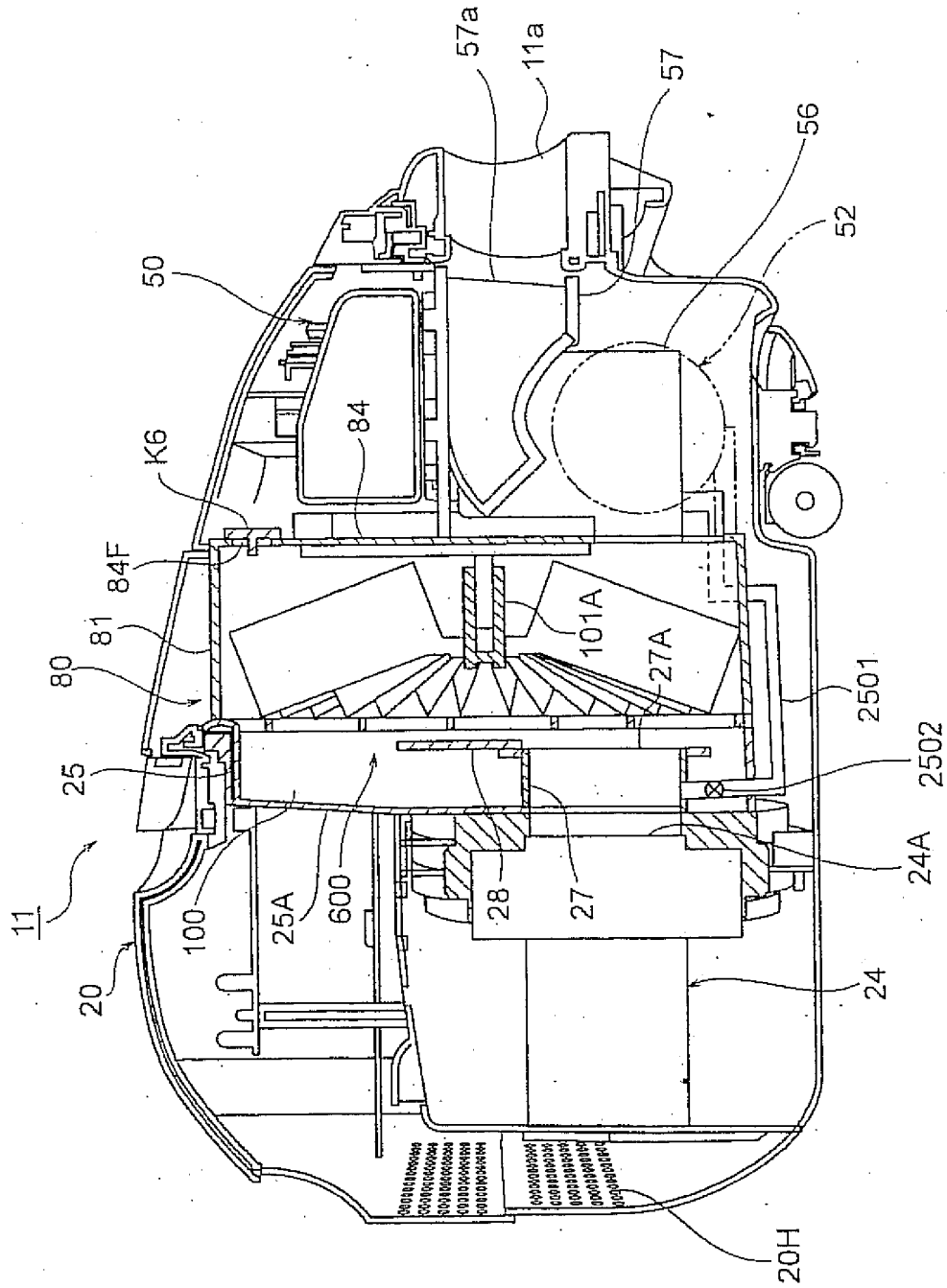
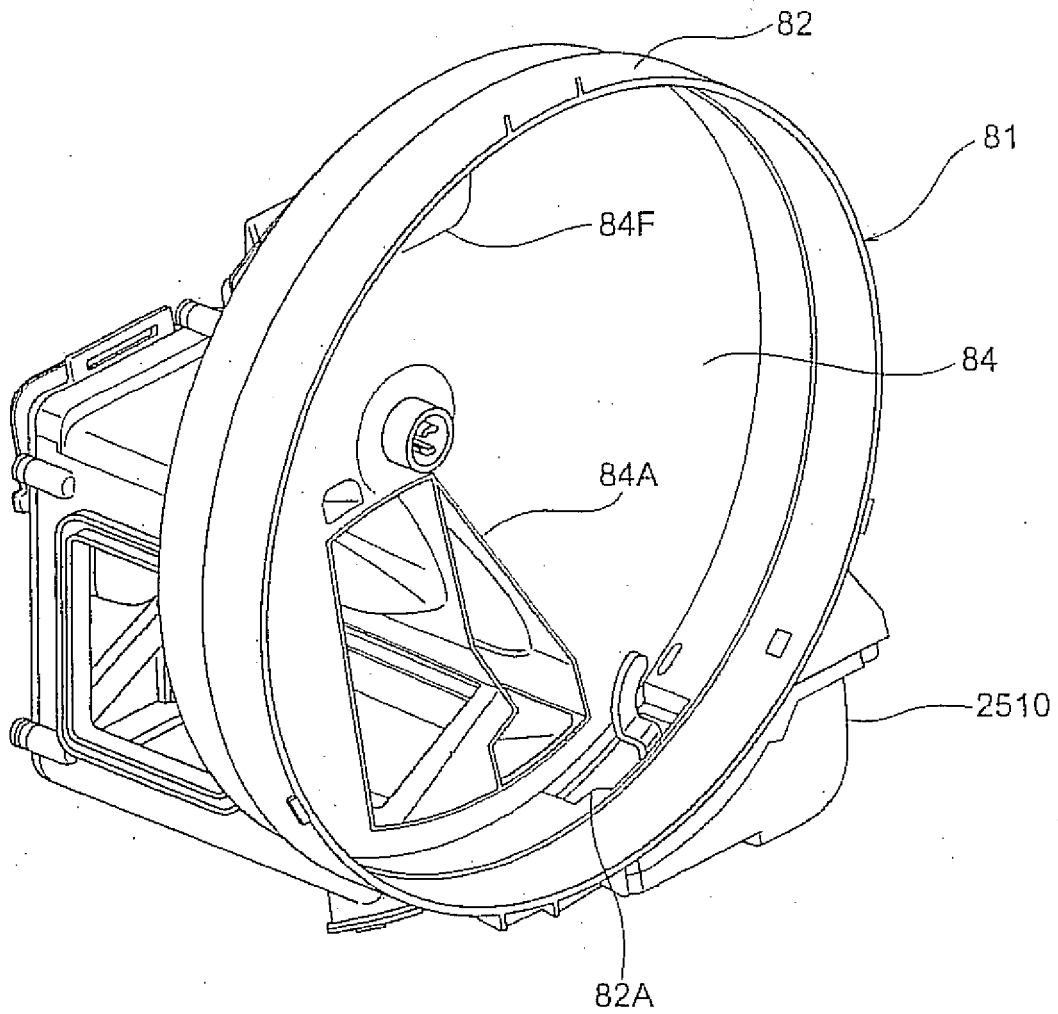


FIG. 27



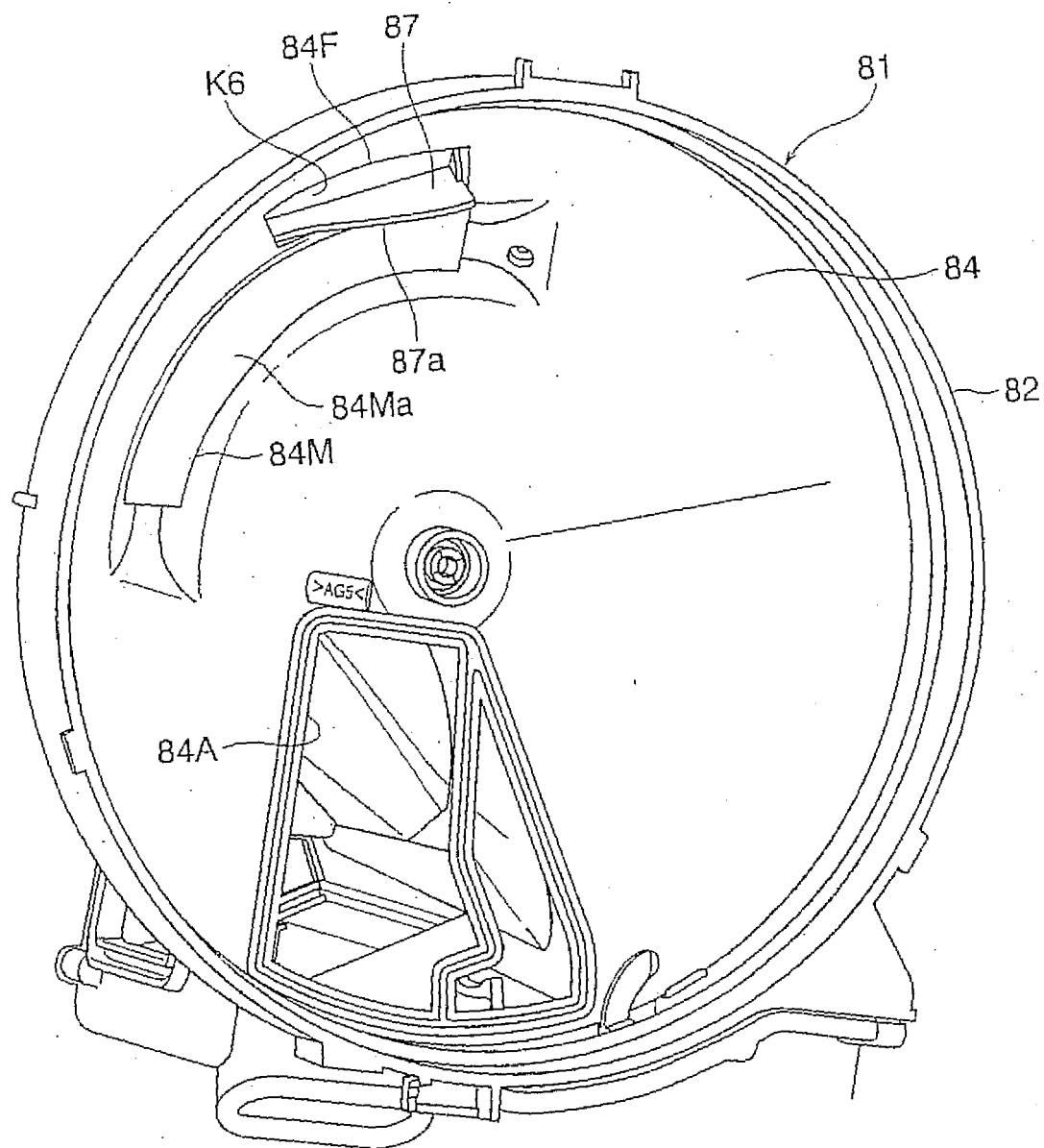


FIG. 29

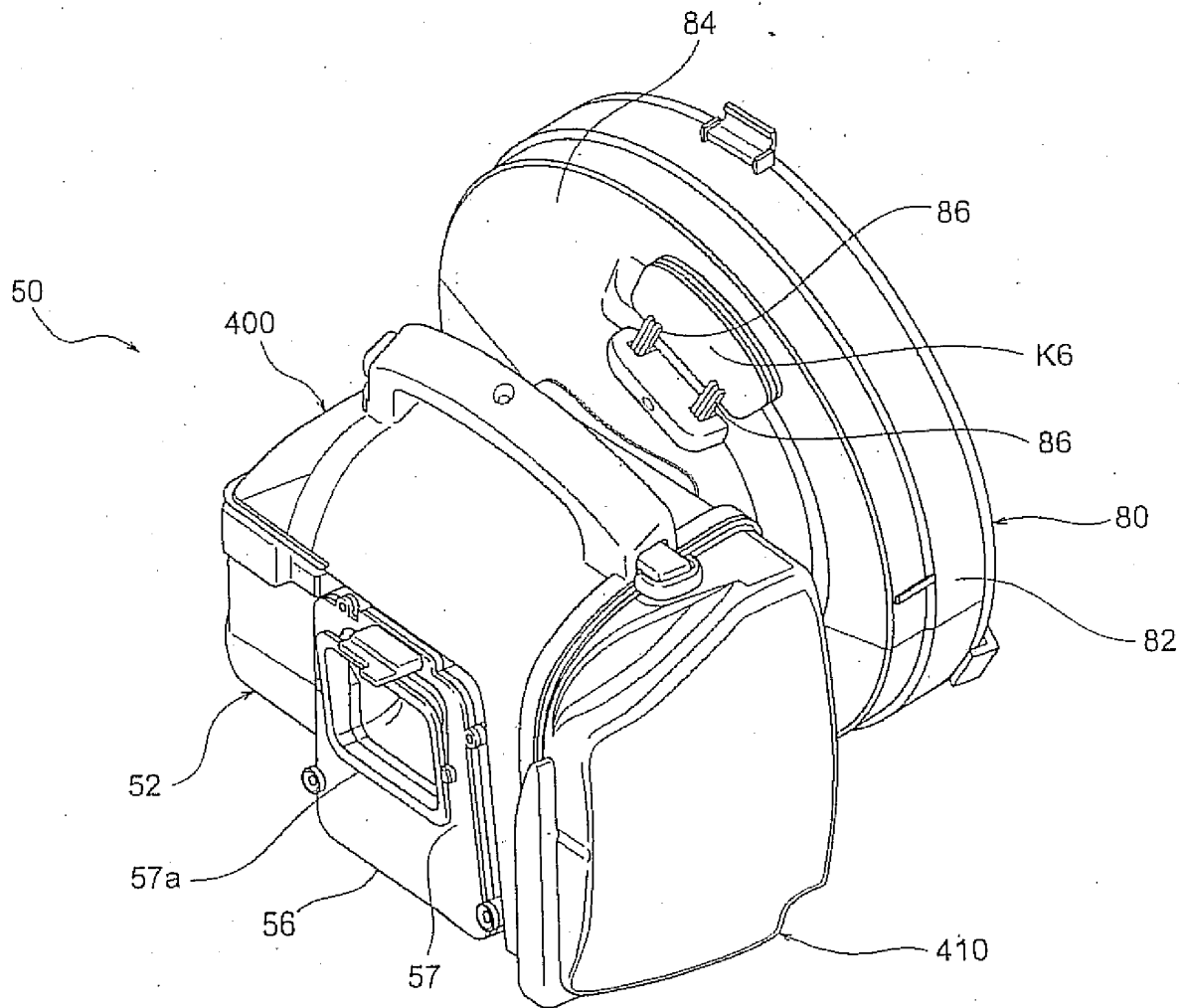


FIG. 30

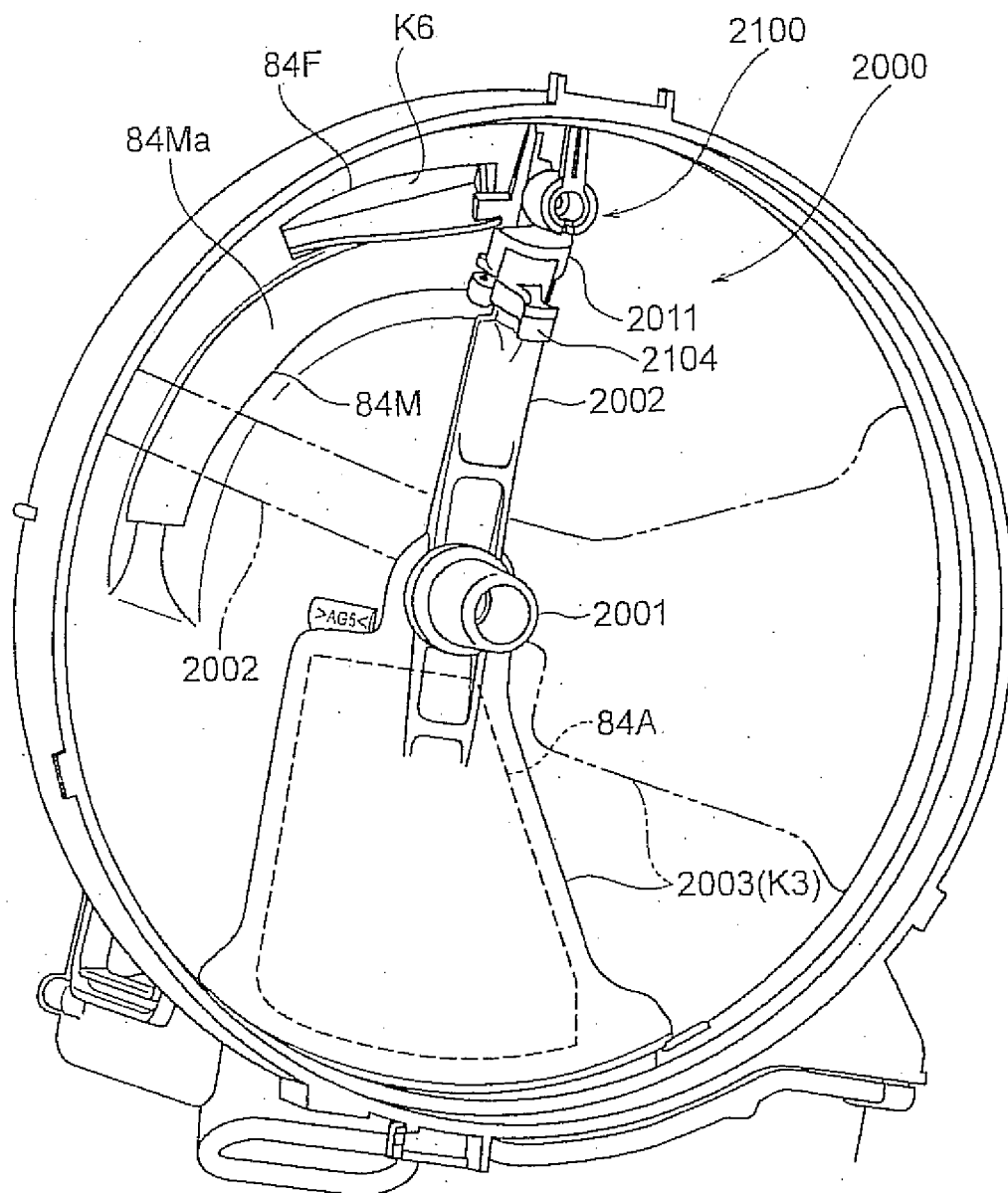


FIG. 31

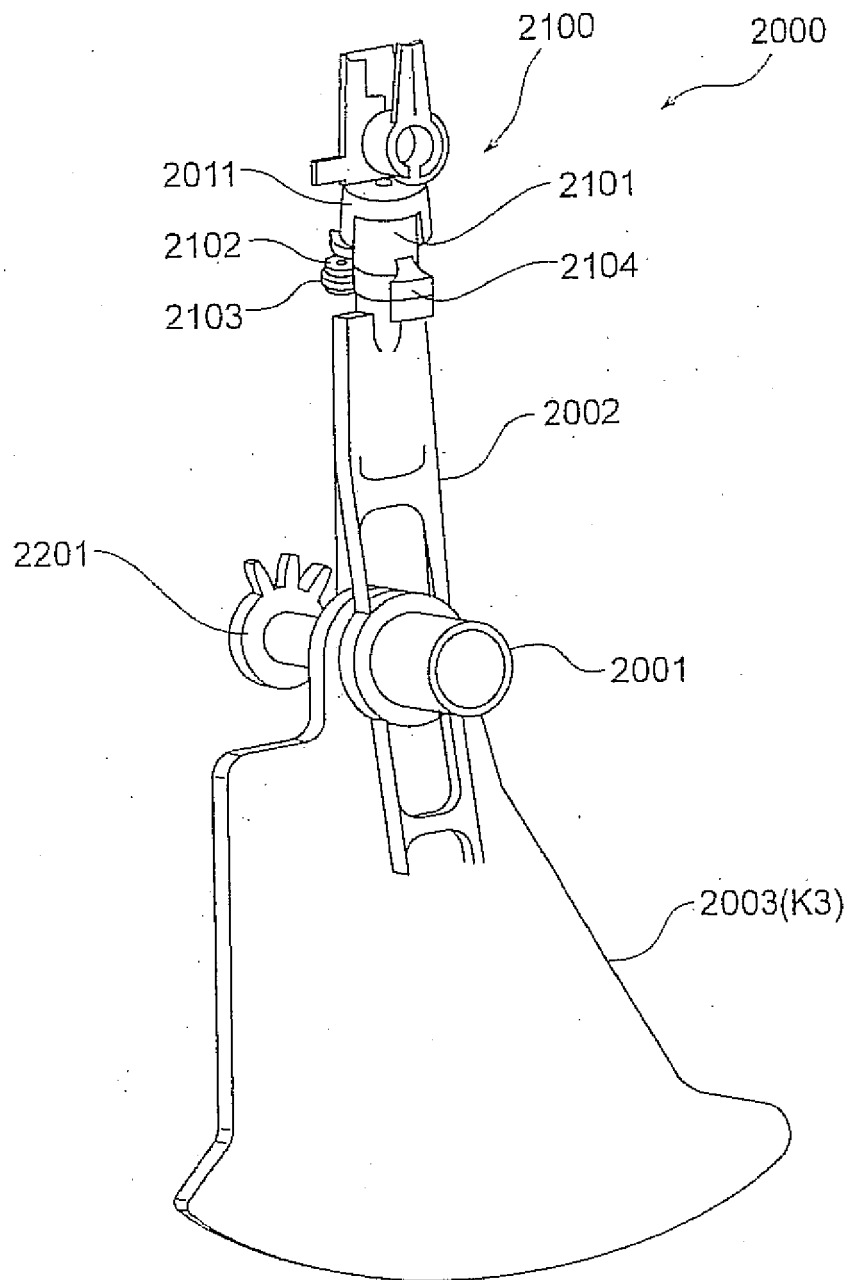


FIG. 32

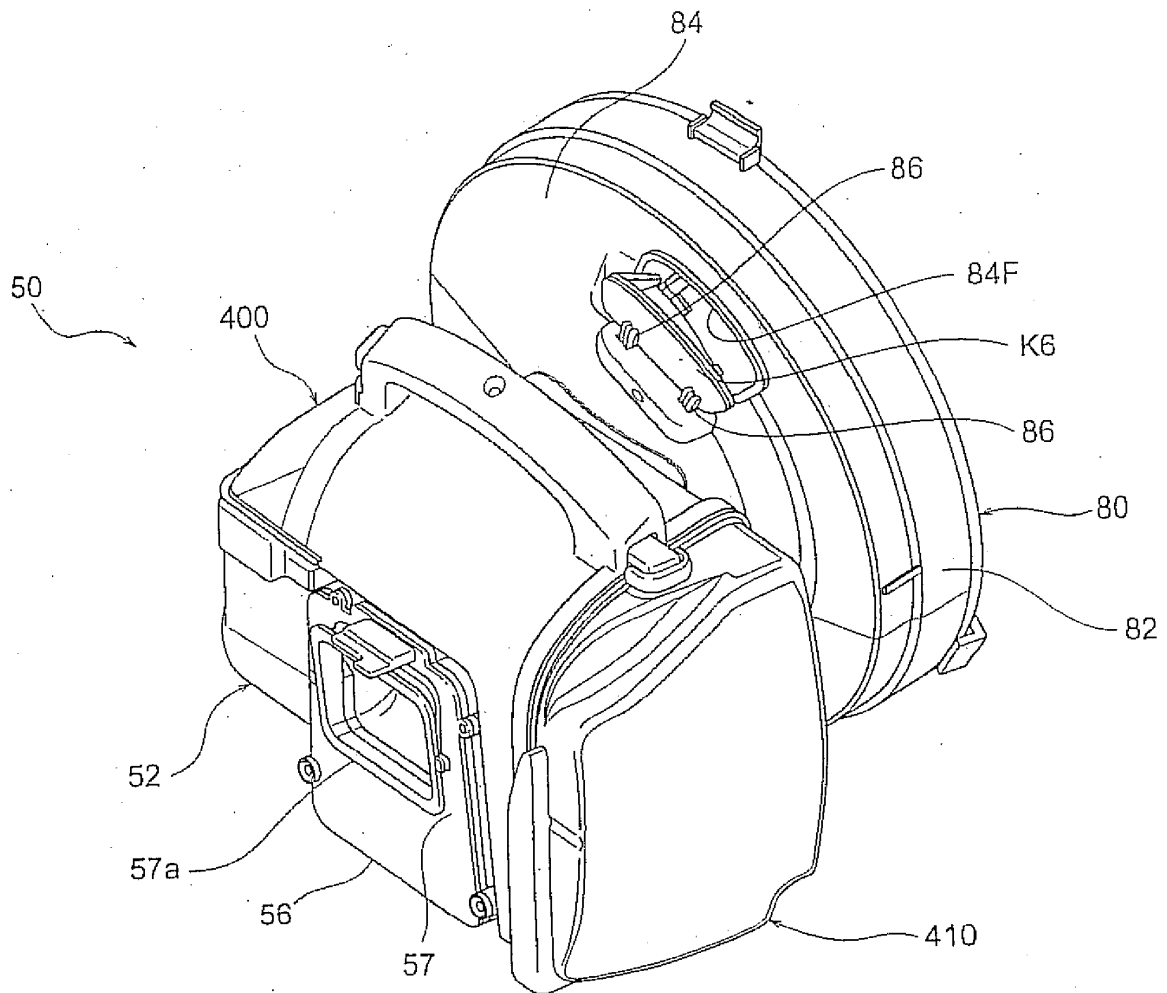


FIG. 33

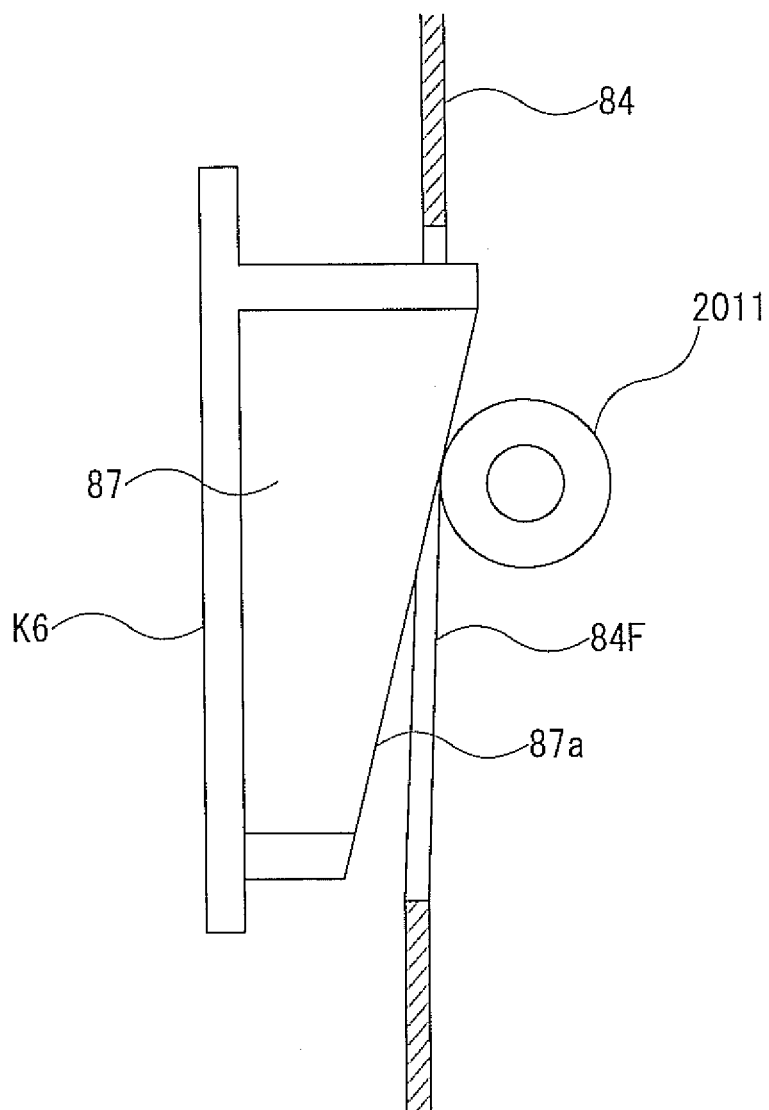


FIG. 34

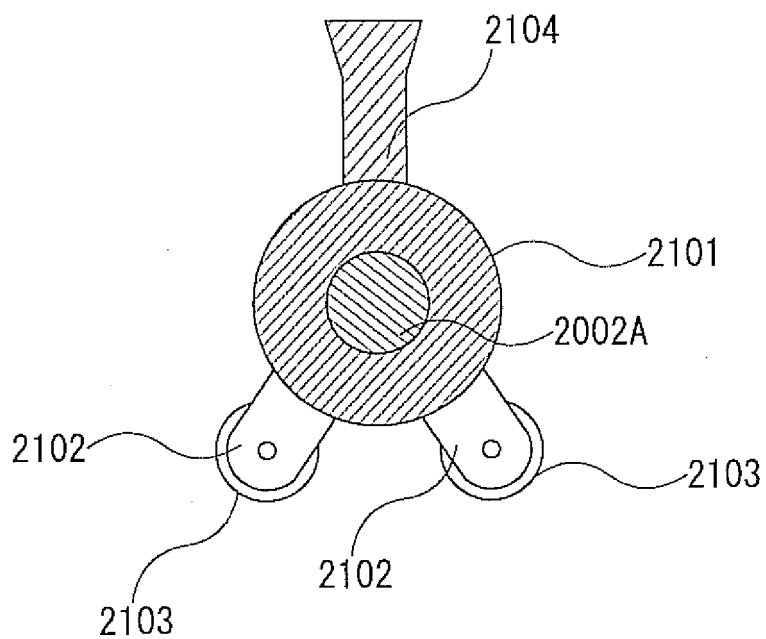


FIG. 35

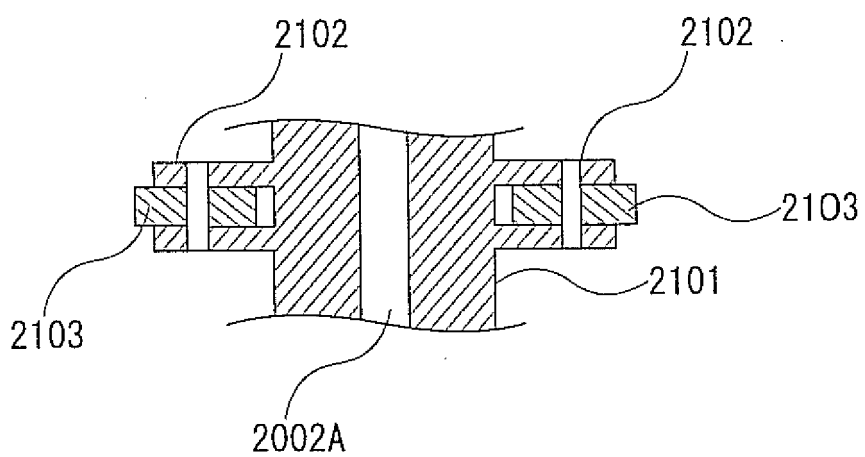


FIG. 36

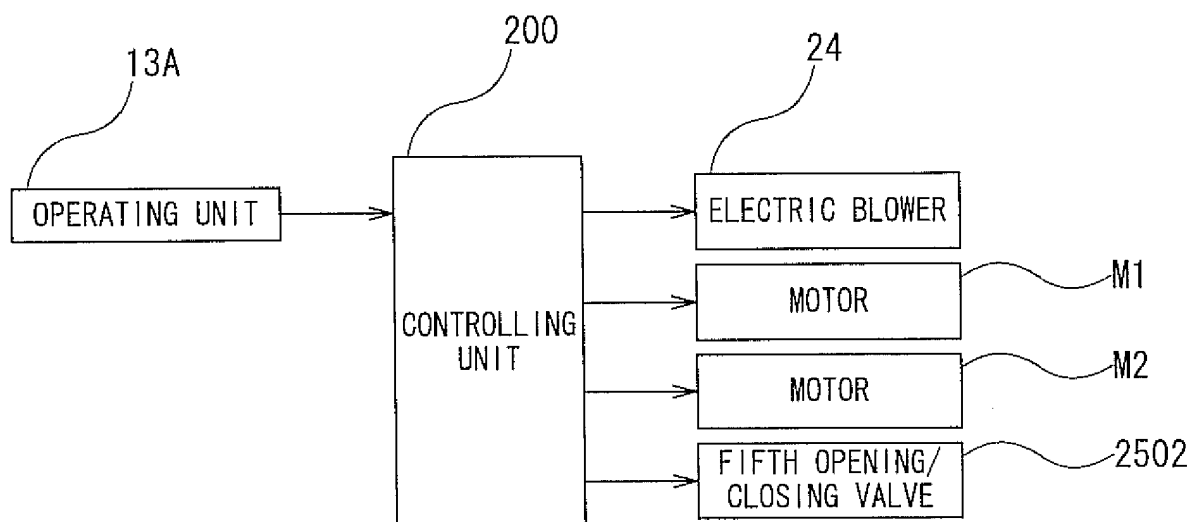


FIG. 37

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2007/057209

A. CLASSIFICATION OF SUBJECT MATTER

A47L9/10(2006.01) i, A47L9/12(2006.01) i, A47L9/20(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)

A47L9/10, A47L9/12, A47L9/20

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 1996-2007

Kokai Jitsuyo Shinan Koho 1971-2007 Toroku Jitsuyo Shinan Koho 1994-2007

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.
A	JP 2004-358031 A (Matsushita Electric Industrial Co., Ltd.), 24 December, 2004 (24.12.04), Full text; all drawings (Family: none)	1-4
A	JP 08-294470 A (Mitsubishi Electric Corp.), 12 November, 1996 (12.11.96), Full text; all drawings (Family: none)	1-4



Further documents are listed in the continuation of Box C.



See patent family annex.

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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Date of the actual completion of the international search
25 June, 2007 (25.06.07)Date of mailing of the international search report
03 July, 2007 (03.07.07)Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

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Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2007/057209

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 93861/1971 (Laid-open No. 51172/1973) (Fuji Denki Seizo Kabushiki Kaisha), 04 July, 1973 (04.07.73), Full text; all drawings (Family: none)	1-4

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2004358135 A [0005]
- JP 2006229886 A [0121]