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(54) **Electric vacuum cleaner**

(57) In a suctioning state, even if the amount of dust trapped in a dust collecting unit (9) in a main air passage is increased, air suctioned from a hose connection port is branched into a first half passage and reduction in the suction air amount can be suppressed. When the suctioning state is switched to a dust moving state by switch means, the dust trapped in a pleated filter (126) is moved to the dust collecting unit (9), increase in the air passage

resistance at the first half passage side caused by clogging of the pleated filter (126) can be suppressed, and reduction in suction power over time can be suppressed. Since an upper air passage (282) and lower air passage (283) are provided in the lid body (3), the dust collecting unit (9) is exposed with the lid body (3) opened, whereby maintenance performance of the dust collecting unit (9) is improved.

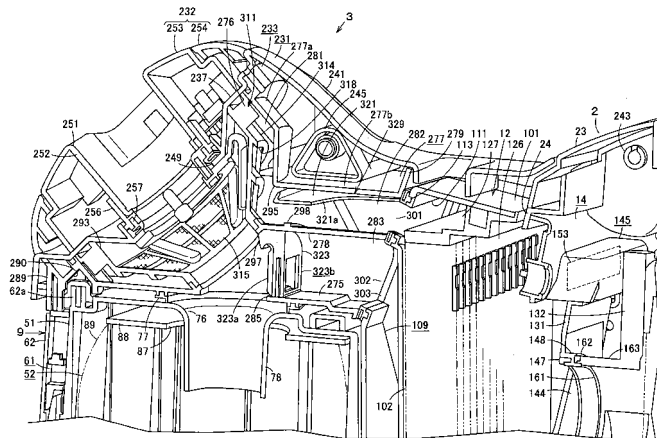


FIG. 2

EP 1 974 642 A2

Description

FIELD OF THE INVENTION

[0001] The present invention relates to an electric vacuum cleaner including a dust separator for separating dust from air.

BACKGROUND OF THE INVENTION

[0002] Conventionally, such kinds of electric vacuum cleaners have a constitution disclosed in Japanese Laid-Open Patent Publication No. 2005-211285, for example. That is, a conventional electric vacuum cleaner has a vacuum cleaner main body with an electric blower housed therein. A dust collecting cup, which is a dust collecting unit for collecting dust suctioned by driving the electric blower, is detachably provided in the vacuum cleaner main body. In the dust collecting cup, a dust separator is provided which communicates with a suction port and separates dust from air, rough dust, which is a part of dust separated by the dust separator, is collected in a dust collecting chamber into which the dust collecting cup is partitioned, and fine dust, which is the remaining dust contained in air separated by the dust separator, is trapped in a filter provided on the downstream side of the dust collecting cap. The downstream side of the dust collecting chamber communicates with the upstream side of the filter, the air flowing into the dust collecting chamber joins with the air separated by the dust separator on the upstream side of the filter, and the joined air is suctioned into the electric blower after passing through the filter.

[0003] However, in the above electric vacuum cleaner, although air suctioned by driving the electric blower is branched by the dust separator, the branched air finally passes through a common filter to be suctioned into the electric blower. Accordingly, the above electric vacuum cleaner has a problem that, in the case where the filter is clogged over time, suction power is gradually reduced in accordance with the degree of the clogging.

[0004] Additionally, even if a mechanism is additionally provided that prevents the filter from being clogged, there arises a problem that maintenance becomes difficult.

[0005] The present invention has been made in consideration of the above problem, and aims at providing an electric vacuum cleaner in which maintenance performance of the dust collecting unit is improved while reduction in suction power over time is suppressed.

SUMMARY OF THE INVENTION

[0006] The present invention includes: a vacuum cleaner main body provided with a lid body openable and closable to a main body case with an electric blower housed therein; a suction port provided in the lid body; a dust separator which is provided in the lid body on the downstream side of the suction port to separate dust from air; a main air passage which makes communication be-

tween the dust separator and a suction side of the electric blower, and through which dust separated by the dust separator passes; a dust collecting unit which is provided in the main air passage and held by the main body case with the lid body closed, and collects the dust separated at the main air passage side by the dust separator; a first air passage which makes communication between the dust separator and the suction side of the electric blower separately from the main air passage, and has at least a part provided in the lid body and a downstream side joined with the main air passage; a filter which has at least a part provided in the first air passage and collects fine dust contained in the air; a second air passage which makes communication between an introduction hole, through which outside air can be introduced separately from the suction port, and the suction side of the electric blower via the dust collecting unit, and has at least a part provided in the lid body; and switch means which makes switching between a suctioning state where dust suctioned from the suction port by driving the electric blower via the main air passage and the first air passage to be collectable in the dust collecting unit and the filter with the second air passage and the introduction hole closed, and a dust moving state where outside air is introduced into the second air passage via the introduction hole by driving the electric blower, and fine dust trapped in the filter is moved to the dust collecting unit via the second air passage.

[0007] In the suctioning state, even if the amount of dust trapped in the dust collecting unit of the main air passage is increased, air suctioned from the suction port is branched into the first air passage, and reduction in a suction amount is suppressed. When the suctioning state is switched to the dust moving state, the dust trapped in the filter is moved to the dust collecting unit, increase in the air passage resistance of the first air passage side caused by clogging of the filter is suppressed, and thus reduction in suction power over time can be suppressed, and the dust collecting unit is exposed, with the lid body opened, by providing at least a part of each of the first and second air passages in the lid body, whereby maintenance performance of the dust collecting unit is improved.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008]

Fig. 1 is a perspective view showing an electric vacuum cleaner with an opened lid body of a first embodiment of the present invention.

Fig. 2 is a perspective cross sectional view of an enlarged part of the electric vacuum cleaner.

Fig. 3 is a perspective cross sectional view of the electric vacuum cleaner in a suctioning state.

Fig. 4 is a perspective cross sectional view of the electric vacuum cleaner in a dust moving state.

Fig. 5 is a perspective view of a main body case of

the electric vacuum body.

Fig. 6 is a perspective view of the lower side of the lid body.

Fig. 7 is a perspective view of the vicinity of a filter of the electric vacuum cleaner.

Fig. 8 is a perspective view of the front side of a part of switch means of the electric vacuum cleaner.

Fig. 9 is a perspective view of the rear side of a part of the switch means.

Fig. 10 is a perspective view of the electric vacuum cleaner.

Fig. 11 is a perspective view of a part of an electric vacuum cleaner in the dust moving state of a second embodiment of the present invention.

Fig. 12 is a perspective view of a main case body of the electric vacuum cleaner.

Fig. 13 is a perspective view of the front side of a part of switch means of the electric vacuum cleaner.

Fig. 14 is a perspective view of the rear side of a part of the switch means.

Fig. 15 is a perspective view of the front side of switch means of an electric vacuum cleaner of a third embodiment of the present invention.

Fig. 16 is a perspective view of the rear side of the switch means shown.

Fig. 17 is a perspective cross sectional view of the electric vacuum cleaner.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0009] A first embodiment of the present invention will be described below with reference to Fig.1 to Fig. 10.

[0010] In Fig. 1, Fig. 3, Fig. 4 and Fig. 10, the reference numeral 1 denotes a vacuum cleaner main body, and the vacuum cleaner main body is a so-called canister type electric vacuum cleaner. The vacuum cleaner main body 1 has a main body case 2 and an openable/closable lid body 3 provided on the main body case 2.

[0011] The main body case 2 includes a lower case 5 formed in a long shape in a front and rear direction, and an upper case 6 provided to the upper side of the lower case 5. An electric blower chamber 8 with an electric blower 7 housed therein is formed at the rear portion of the main case body 2, and a recessed mount part 10 is formed at the front portion thereof, the recessed mount part 10 being a dust collecting unit attachment part on which a dust collecting unit 9 as a dust collecting unit being a main dust collecting unit is detachably mounted. A space 13, with which a filter 12 is engaged, is formed between the electric blower chamber 8 and the mount part 10, the filter 12 being an auxiliary dust collecting unit as a fine dust collecting unit. A partition wall 14 is arranged between the space 13 and the electric blower chamber 8.

[0012] Driven wheels 16 (only one shown) is pivotally and rotatably supported at both sides of the rear side of the lower case 5 respectively. Additionally, a turn wheel

17 is pivotally and turnably supported on a lower surface of the mount part 10 of the lower case 5. Thus, the driven wheels 16 and the turn wheel 17 allow the vacuum cleaner main body 1 to run on a floor as a surface to be cleaned.

[0013] The upper case 6 includes side face parts 21 (only one shown) which cover both sides of the rear portion of the lower case 5 and form into both sides of the electric blower chamber 8, a rear face part 22 for covering the rear portion of the lower case 5, and an upper face part 23 which covers the upper portion of the lower case 5 and forms into an upper portion of the electric vacuum cleaner 8. Additionally, in the upper case 6, a first slant part 24 is formed which is a rear slant part slanted forward and downward from the front portion of the upper face part 23 at the periphery of the partition wall 14 positioned at a substantial central region of the lower case 5 in the front and rear direction, a fine dust receiver 25 is formed which is a dust receiver as a horizontal part substantially horizontally in front of the first slant part 24, a second slant part 26 is formed which is a front slant part forward and downward slanting under the fine dust receiver 25 and behind the mount part 10 and extending to an upper surface of the lower case 5, an extended part 27 is formed which is substantially horizontally extended to the vicinity of the front end of the lower case 5 along the upper surface of the lower case 5, and the front end of the extended part 27 is latched to the lower case 5.

[0014] In each side face part 21, multiple exhaust holes 31 are provided which make communication between the electric blower chamber 8 and the outside of the vacuum cleaner main body 1.

[0015] In the rear face part 22, pullout port (not shown) is opened through which a power source cord can be pulled out, the cord being wound around a cord reel (not shown) housed in the side of the electric blower chamber 8.

[0016] A handle 35, with which the vacuum cleaner main body 1 is gripped, is rotatably attached to the upper face part 23 in the front and rear direction.

[0017] The first slant part 24 has a ventilation hole 37 which the upstream side of the partition wall 14 and the downstream side of the filter 12 face, and is formed in a frame shape so as to surround the partition wall 14.

[0018] The fine dust receiver 25 is formed so as to communicate with the lower portion of the filter 12 fitted in the space 13, and is spaced from the lower portion of the filter 12. Additionally, the fine dust receiver 25 is spaced upward with respect to the upper surface of the lower case 5, and a housing space 39 is provided between a lower surface of the fine dust receiver 25 and the upper surface of the lower case 5 so as to be laid between the second slant part 26 and the partition wall 14.

[0019] The second slant part 26 is positioned behind the turn wheel 17 of the lower case 5, and a rectangular hole-shaped lower communication opening 41 is opened in the second slant part 26.

[0020] The extended part 27 partitions a lower portion

of the mount part 10.

[0021] The electric blower 7, of which the front side is a suction side and the rear side is an exhaust side, is provided in the electric vacuum cleaner chamber 8 in the front and rear direction. Here, a flexible ring-shaped motor packing 43, which is a sealing member as a holding member, is engaged with the outer peripheral edge of the front side of the electric vacuum blower 7, and the electric vacuum blower 7 is engaged with the electric blower chamber 8 via the motor packing 43. Additionally, the upper side of the electric blower 7 is covered with a motor cover 44 which is a covering member. Further, control means (not shown) for controlling driving of the electric blower 7 and the like is housed above the motor cover 44 of the electric blower chamber 8.

[0022] The dust collecting unit 9 includes a cup member 51 as a dust collecting unit main body constituting an outline of the unit 9, and a dust collecting pack, that is, paper pack 52, which is a filtrating filter as a main filter attached to the cup member 51.

[0023] The cup member 51 includes a peripheral wall 55 extended from its front portion to its both sides, an upper wall 56 formed on the upper portion of the peripheral wall 55, and a lateral wall 57 formed continuously to the rear portion of the upper wall 56 between both sides of the peripheral wall 55. An attachment opening 58 is opened in the lower end of the cup member 51.

[0024] The peripheral wall 55 is formed so as to bend from its front side to its both sides along the shape of the mount part 10, is extended so that the rear ends of its both sides hold both sides of the filter 12 with the wall 55 attached to the mount part 10. Further, a housing recessed part 61 recessed backward is formed at the center of the front end of the peripheral wall 55 in a lateral direction so as to continue throughout the upper wall 56, and covered with a covering member 62 attached to the front portion of the peripheral wall 55.

[0025] A breakaway preventing mechanism 65 is housed in the housing recess part 61, the breakaway preventing mechanism 65 being actuated by the lid body 3 with the lid body 3 closed, and preventing the dust collecting unit 9 from breaking away from the mount part 10.

[0026] Here, the breakaway preventing mechanism 65 includes a latching body 68 at its lower end, the latching body 68 protruding, in a claw shape, forward from downward the coating member 62 by being pressed downward by the lid body 3.

[0027] The covering member 62 is bent from the upper wall 56 to the front portion of the peripheral wall 55, a protrusion 62a, which is fixed to the upper wall 56 by screw-engagement or the like, is formed at the upper portion of the covering member 62, and an exposing opening 62b, from which the upper end of the breakaway preventing mechanism 65 is exposed, is formed in front of the protrusion 62a. Additionally, the lower end of the covering member 62 is a notch into which the latching body 68 can be protruded.

[0028] Additionally, the upper wall 56 constitutes an

upper surface of the dust collecting unit 9, and a circular unit suction port 76, which is a dust collecting unit suction port as a dust suction port, is opened at the substantially central region of the upper wall 56 in the lateral direction. A flexible ring-shaped seal packing 77 as a dust collecting unit sealing member is attached to the circumferential edge of the unit suction port 76. Further, the inner circumferential edge of the unit suction port 76 continues, as an introduction cylinder 78 as a dust collecting unit rectifying part, toward the inside and lower side of the dust collecting unit 9. Additionally, protrusions to be engaged 79, 79 for being engaged with the lid body 3 are protruded upward at both sides in front of the unit suction port 76 of the upper wall 56.

[0029] The introduction cylinder 78 rectifies the flow of dust suctioned from the unit suction port 76, and is a cylinder to which the paper pack 52 is attached.

[0030] Additionally, the protrusions to be engaged 79, 79 protrude in a loop shape with respect to the upper wall 56, and a part of the lid body 3 can be latched between the protrusions 79, 79 and the upper wall 56.

[0031] Further, fitting protrusions 81, 81, which are a dust collecting unit latching part to be fitted with the lid body 3, are protruded upward on both sides of the unit suction port 76 of the upper wall 56. A unit handle 82, which is a dust collecting unit handle for gripping the dust collecting unit, is provided on a rear side from the lateral sides of the fitting protrusions 81, 81 of the upper wall 56.

[0032] A flexible holding member 84 protrudes on both sides outward from the upper portion of each fitting protrusion 81. The holding members 84 are slightly deformed in a state of being engaged with the closed lid body 3, and hold the lid body 3 so that the lid body 3 is laterally opened by recovery force of the deformation.

[0033] The lateral wall 57 is substantially vertically formed, faces the lower portion of the front side of the filter 12 in a state of being attached to the mount part 10, and regulates a position of the filter 12.

[0034] The attachment opening 58 is an opening for attaching/detaching the paper pack 52 to/from the cup member 51, and the inner edge of the opening 58 is fitted with the mount part 10 with the dust collecting unit 9 mounted on the mount part 10.

[0035] On the other hand, the paper pack 52 includes a mouth frame 88 in which a pack opening 87 is opened as a dust collecting pack opening into which the introduction cylinder 78 is inserted, and a pack body 89 attached to the mouth frame 88.

[0036] The mouth frame 88 is formed in a plate shape with thick paper such as corrugated paper, and latched to the inside of the cup member 51.

[0037] The pack body 89 is formed in a pack shape by laminating filtrating materials each having ventilation performance, and can be folded in an unused state.

[0038] As shown in Fig. 3 to Fig. 5, a frame body 91 is provided on the mount part 10, the frame body 91 being fitted to the attachment opening 58 of the dust collecting unit 9. The frame body 91 has a substantially horizontally

plate-shaped lattice part 93 in which lattice openings 92 are opened in a lattice shape, and a wall 94 erected upward from the peripheral edge of the lattice part 93.

[0039] In the lattice part 93, a lattice-shaped rib 95 is formed each between the lattice openings 92, and some ribs 95 in the front and rear direction come into contact with an upper surface of the extended part 27 of the upper case 6. Thus, a plate-shaped lower surface of the lattice part 93 is spaced from the upper case 6, and a part therebetween forms into a mount part air passage 96 continuous to the lower communication opening 41.

[0040] Additionally, supporting pieces 97 for supporting the lower side of the pack body 89 of the paper pack 52 are substantially horizontally protruded on the inner peripheral side of the wall 94. Further, a ring-shaped packing 98 is attached to the entire outer peripheral edge of the wall 94, the packing 98 being a mount part sealing member in airtight contact with the peripheral edge of the attachment opening 58 of the dust collecting unit 9.

[0041] As shown in Fig. 1, Fig. 3, Fig. 4 and Fig. 7, the filter 12 includes a filter container 101 as a filter main body constituting an outline of the filter, and a pleated filter body 102 which is detachably attached to the filter container 101.

[0042] The filter container 101 includes a laterally long front face part 104 and a frame face part 105 protruded backward from the entire peripheral edge of the front face part 104.

[0043] The front face part 104 has a slant face 107 positioned at its upper side, and backward and upward slanted, and an opposite face 108 continuous to the lower portion of the slant face 107. Additionally, a duct 109 for forming an air passage in the filter 12 is provided integrally with the rear portion of the front face part 104.

[0044] The slant face 107 is a face part facing forward and upward with the filter 12 attached to the space 13, and a laterally long rectangular filter opening 111 is opened in the slant face 107. The filter opening 111 is formed so that the duct 109 faces the front portion of the pleated filter body 102.

[0045] The opposite face 108 is a face part which is opposite to the lateral wall 57 of the cup member 51 of the dust collecting unit 9 with the dust collecting unit 9 and the filter 12 attached to the main body case 2.

[0046] Additionally, the duct 109 is formed in a reverse T-shape, in a front view, by a duct suctioning part 109a as a duct suctioning part laterally formed along an upper surface of the lower side frame face part 105, and a duct lifting part 109b as a dust moving part extended upward from the substantially central portion of the duct suctioning part 109a.

[0047] The duct suctioning part 109a is a part for suctioning dust trapped in the pleated filter body 102 by action of negative pressure of the electric blower 7, and formed so as to have a relatively small air passage cross section in a direction crossing the lateral direction that is an air passing direction. That is, the duct suctioning part 109a is slightly spaced from the upper surface of the low-

er side frame part 105.

[0048] Additionally, the duct lifting part 109b is a part for further lifting dust suctioned by the duct suctioning part 109a, and formed so as to have a relatively small air passage cross section in a direction crossing the vertical direction that is an air passing direction. Further, the upper end of the duct lifting part 109b faces forward from the filter opening 111 of the front face part 104. Accordingly, the upper end of the duct lifting part 109b is aslant opened so as to level with the slant of the front face part 104, and a seal packing member 113 is attached to the peripheral edge of the opening, the seal packing member 113 being a filter sealing member continuous to the peripheral edge of the filter opening 111.

[0049] The rear portion of the frame face part 105 faces the ventilation hole 37 of the upper case 6, and the frame face part 105 is formed so that a lower surface thereof is fitted to a support rib 114 provided at a lower portion in front of the ventilation hole 37. Additionally, a suction opening 115 is opened at the lower end of the opposite surface 108 positioned at the front portion of the lower side frame face part 105, the suction opening 115 facing the lower end of the duct suctioning part 109a of the duct 109. Further, positioning protrusions 116, 116 for positioning and fixing in arranging the filter 12 in the space 13 are protruded downward at the vicinity of both sides of a lower surface of the lower side frame face part 105. Further, latching pieces 117, 117 are protruded backward at the vicinity of both sides of the upper surface of the upper side frame face part 105, the latching pieces 117, 117 being used for positioning in arranging the filter 12 in the space 13, and for latching the filter 12 to the main body case 2.

[0050] A latching hole (not shown) is provided in each latching piece 117, and latching protrusions 124, 124 are inserted into the latching holes, the protrusions 124, 124 being protruded upward at the vicinity of both sides of the upper portion of the first slant part 24 of the upper case 6, in front of both sides of the handle 35.

[0051] On the other hand, the pleated filter body 102 has a fine dust filter (auxiliary filter), pleated filter 126, which is a filtrating filter, and a filter frame 127 surrounding the periphery of the pleated filter 126.

[0052] The pleated filter 126 is a surface dust collecting filter made of ethylene tetrafluoride (PTFE) or the like, and can collect, for example, fine dust capable of penetrating through the paper pack 52 of the dust collecting unit 9 on its surface, its upstream side face. Additionally, the pleated filter 126 is formed in a wave shape, the wave shape alternately having, in the lateral direction, a plurality of crest portions and valley portions vertically formed.

[0053] A filter frame 127 is formed in a frame shape so as to be fitted, from behind, to the edge of the frame face part 105 of the filter container 101, and a packing (not shown) is engaged with the entire outer periphery of the filter frame 127, the packing being a sealing member for holding airtightness between the filter frame 127

and the inside of the frame face part 105. Additionally, a slant face part 129, which faces the lower portion of the pleated filter 126 and slanted forward and downward, is formed in the filter frame 127.

[0054] As shown in Fig. 3, Fig. 4, Fig. 8 and Fig. 9, the partition wall 14 includes: a partition wall body 131 as a front side partition wall positioned at its front side, space 13 side; a partition wall main body 133 having a duct body 132 which is an air passage forming body as a rear side partition wall positioned at its rear side, electric blower chamber 8 side; a filter plate 134 as a partition wall plate engaged so as to cover the ventilation hole 37 in front of the partition wall main body 133; a dust shaking-off part 135 which is a dust removing mechanism for removing dust trapped in the pleated filter 126 positioned in front of the partition wall 14; and a driving mechanism 136 for driving the dust shaking-off part 135 and the like.

[0055] The partition wall body 131 is engaged so as to cover the entire rear portion of the ventilation hole 37, partitions the upper portion of the housing space 39, and includes a partition wall body main body 141 which is a substantially flat main body, and a partition wall body frame 142 which is a frame protruded forward throughout the entire peripheral edge of the partition wall body main body 141.

[0056] A round hole-shaped suction opening 144 is provided at the substantially central portion of the partition wall body main body 141. Additionally, an outside air communication part 145 is protruded backward above the suction opening 144 at one side of the partition wall body main body 141.

[0057] The suction opening 144 can make communication between the space 13 and the suction side of the electric blower 7. Additionally, an opening packing 147 as an opening sealing member is attached to the peripheral edge of the front portion of the suction opening 144. Further, a joint cylinder 148 as a first joint part, of which the rear end is joined with the duct body 132, is protruded on the peripheral edge of the rear portion of the suction opening 144.

[0058] The outside air connection part 145 can make communication between the space 13 and outside air, and includes: a protruded horizontal plate 151 substantially horizontally protruded backward from the rear portion of the partition wall body main body 141; and a duct-shaped air passage partition part 154 for providing an airtight air passage making communication between a rectangular hole-shaped introduction communication port 152 provided in the protruded horizontal plate 151 and a rectangular hole-shaped introduction hole 153 provided in the partition wall body main body 141.

[0059] Moreover, herein, outside air is air located outside of the air passage, and is not always air located outside of the vacuum cleaner main body 1.

[0060] The front end of the partition wall body frame 142 is air tightly connected to the peripheral edge of the rear portion of the ventilation hole 37 of the upper case 6.

[0061] The duct body 132 has a duct body main body

157 as a substantially flat plate-shaped air passage forming main body with which a front surface of the motor packing 43 comes into close contact, and a duct forming part 158 is provided integrally with the front portion of the duct body main body 157.

[0062] A round hole-shaped suction communication opening 161 substantially equivalent to the suction opening 144 is provided at the substantially central portion of the duct body main body 157, and a cylindrical protrusion cylinder 163 as a second joint part is protruded on the peripheral edge of the rear portion of the suction communication opening 161, the front end of the protrusion cylinder 163 being air tightly joined with the joint cylinder 148 via a packing 162 as a sealing member.

[0063] The duct forming part 158 is positioned in front of the duct body main body 157, and protruded downward continuously to the lower portion of the protrusion cylinder 163. Accordingly, a communication air passage 165 communicating with the inside of the protrusion cylinder 163 is provided between the duct forming part 158 and the duct body main body 157. A step part 166 is formed, at a part that is positioned at the upper end of the communication air passage 165 and communicates with the protrusion cylinder 163, so that the width of the communication air passage 165 is narrowed in the front and rear direction. Additionally, an air passage communication hole 167 communicating with the communication air passage 165 is provided in the lower portion of the duct forming part 158, and an air passage partition body 169 is air tightly connected to the front portion of the air passage communication hole 167 so that an air ventilation passage 168 is, in the front and rear direction, formed between the lower communication opening 41 and the air passage communication port 167. That is, the air passage partition body 169 is housed in the housing space 39, and makes communication among the air ventilation passage 168, communication air passage 165 and mount part air passage 96.

[0064] As shown in Fig. 5, the filter plate 134 includes a filter plate main body 171 for covering the entire ventilation hole 37, a laterally long protrusion hole 172, through which a part of the dust shaking-off part 135 protrudes forward, is provided at the upper side of the filter plate main body 171, a plurality of ventilation openings 173 are provided in a lattice shape under the protrusion hole 172, and a mesh filter 174 as a filter member is provided in the ventilation opening 173.

[0065] As shown in Fig. 8, the dust shaking-off part 135 has a laterally long dust shaking-off part main body 176 as a dust removing mechanism main body, and parts to be guided 178, 178 are cylindrically provided on the left and right sides of the rear portion of the dust shaking-off part main body 176 respectively, the parts to be guided 178, 178 into which a pair of guide bodies 177, 177 as guide bodies arranged in substantially horizontally with each other in the lateral direction respectively is inserted. Additionally, a rack-shaped gear 179 meshed with the driving mechanism 136 is provided on the upper side of

the rear portion of the dust shaking-off part main body 176 so as to be continuous in the lateral direction.

[0066] Thus, the dust shaking-off part 135 is laterally slidably provided by the driving mechanism 136.

[0067] Further, spaces 180, 180 opened forward are internally provided at lateral both sides of the front portion of the dust shaking-off part main body 176 respectively, and dust shaking-out bodies 181 (only one shown) as a dust removing body are pivotally and rotatably supported in the spaces 180, 180, respectively in a substantially horizontal direction.

[0068] Each guide body 177 is made of, for example, a metal rod, and both ends of the bodies 177 are supported by both sides guide body receivers 183 provided on the partition wall body frame 142, respectively.

[0069] The front end of each shaking-out body 181 is protruded forward and inserted into the protrusion hole 172 of the filter plate 134 shown in Fig. 5, and is fitted to a valley part of the pleated filter 126 of the filter 12 attached to the space 13 of the main body case 2.

[0070] Here, each dust shaking-off part 181 is energized, in either of left or right direction, by energizing means (not shown) in a rotation direction, and the front end of the dust shaking-off part 181 is kept directed forward with no load applied thereto.

[0071] As shown in Fig. 8 and Fig. 9, the driving mechanism 136 includes a motor 185, which is a drive source, at the rear portion of the duct body 132, and gears 186, 187 are provided on a rotary shaft protruded forward from the motor 185, the gears being spaced from and coaxial with each other in the front and rear direction.

[0072] The gear 186 is positioned behind the gear 187, at the motor 185 side, between the partition wall body 131 and the duct body 132, and a cam 191 is provided so as to rotate integrally with the rear portion of the gear 186. Additionally, the gear 186 is meshed with a rotary gear 192 positioned upward.

[0073] The cam 191 switches on or off a switch 194 by coming into contact with a switch piece 194a of the switch 194, which is arranged aside of the gear 186, by an approximate one round of the gear 186, and the switching allows the motor 185 to be switched on or off.

[0074] The rotary gear 192 is formed in the shape of a fan having a center angle of 90°, and a rotary shaft 192a protruded at the center of the gear 192 in the front and rear direction is inserted into the communication air passage 165. The front end of the rotary shaft 192a is pivotally and rotatably supported on the partition wall body main body 141 of the partition wall body 131, and the rear end thereof is pivotally and rotatably supported on the duct body main body 157, and thus the rotary shaft 192a is rotatable. Additionally, a regulating plate 196 is attached to the front portion of the rotary gear 192 coaxially with the rotary gear 192, the regulating plate 196 being formed in the fan shape approximately the same as that of the rotary gear 192. Further, a rectangular plate-shaped valve body 197 as an air passage opening-closing valve is attached to the rotary shaft 192a of the rotary

gear 192, and rotated integrally with the rotary shaft 192a in the communication air passage 165. An end of an arm 198 is pivotally supported at the front end of the rotary shaft 192a of the rotary gear 192, the arm 198 being a joining member formed in a long shape in front of the partition wall body main body 141.

[0075] In the regulating plate 196, a guiding part 203 is provided in the vicinity of the upper end of the outer peripheral edge of the rotary gear 192.

[0076] The guiding part 203 is positioned at the rear portion of the rotary gear 192, and a groove 203a, which is fitted to an arc-shaped guide rib (not shown) provided behind the rotary gear 192, is formed at the rear portion of the guiding part 203. A coil spring (not shown) as gear energizing means is arranged along the inside of the groove 203a. The coil spring energizes the rotary gear 192 in a direction reverse to the rotary direction and in a circumferential direction via the regulating plate 196 by coming into contact with the protrusions, which are protruded forward at both ends of the guide rib, by rotation of the rotary gear 192.

[0077] Additionally, an interlock body 205 comes into contact with the upper portion of the guiding part 203, and an introduction hole opening-closing valve 206 is joined with the upper portion of the interlock body 205, the valve 206 indirectly opening-closing the introduction hole 153 by opening-closing the introduction communication port 152.

[0078] A long guide hole 205a is vertically provided in the interlock body 205. A guide protrusion (not shown) is inserted into the guide hole 205a, and the interlock body 205 is vertically movable along the guide protrusion. Additionally, a flat contact face part 205b is laterally formed at the lower end of the interlock body 205. The lower side of the contact face part 205b is supported by the guiding part 203, and the interlock body 205 vertically moves in accordance with vertical movement of the guiding part 203 with rotation of the rotary gear 192.

[0079] The introduction hole opening-closing valve 206 is positioned above the joint cylinder 148 (protrusion cylinder 163) between the partition wall body main body 141 of the partition wall body 131 and the duct body main body 157 of the duct body 132, a cylindrical rotary shaft 206a pivotally and rotatably supported on the partition wall body main body 141 in the introduction hole opening-closing valve 206 in the front and rear direction, and a part to be joined 206b and an opening-closing valve main body 206c are protruded on both sides of the rotary shaft 206a respectively, the part to be joined 206b being jointed with the upper end of the interlock body 205, and the opening-closing valve main body 206c opening-closing the introduction communication port 152.

[0080] The part to be joined 206b is aslant provided so that its top end is slanted downward.

[0081] The opening-closing valve main body 206c is larger than the introduction communication port 152 and formed in a rectangular shape, protruded oppositely from the part to be joined 206b with respect to the rotary shaft

206a, and aslant provided with its top end directed downward. Accordingly, the introduction hole opening-closing valve 206 is formed in an approximate inverted V-shape in the front view. The opening-closing valve main body 206c is positioned downward of the introduction communication port 152.

[0082] The introduction opening-closing valve 206 can open/close the introduction communication port 152 in a manner that the part to be joined 206b vertically moves in accordance with the vertical movement of the interlock body 205 with rotation of the rotary gear 192 and the opening-closing valve main body 206c positioned oppositely from the part to be joined 206b with respect to the rotary shaft 206a vertically moves, in reverse to the joint part 206b, in accordance with vertical movement of the joint part 206b.

[0083] The valve body 197 rotates with rotation of the rotary gear 192 while keeping a predetermined angle with respect to the rotary gear 192. Additionally, a rectangular air passage hole 208 is provided at the substantially central region of the valve body 197. Further, a seal packing 209, which is a frame-shaped opening-closing valve sealing member, is attached to a surface of the side, which is opposite from the motor 185, of the valve body 197 throughout the entire peripheral edge of the valve body 197.

[0084] In the embodiment, the valve body 197 opens the communication air passage 165 along the vertical direction when the rotary gear 192 rotates upward, and the seal packing 209 is brought into press-contact with the step part 166 along the lateral direction when the rotary gear 192 rotates downward.

[0085] On the other hand, the arm 198 is positioned in front of the partition wall body main body 141 of the partition wall body 131, and rotates with rotation of the rotary gear 192 while keeping a predetermined angle with respect to the rotary gear 192. Additionally, a disc-shaped opening-closing valve body 211 as an open/close switching valve is rotatably joined with the top end of the arm 198.

[0086] The opening-closing valve body 211 is larger than the suction opening 144 and formed in a disc shape, and can open/close the suction opening 144 by rotating with rotation of the arm 198.

[0087] Additionally, the gear 187 is meshed with a crank gear 214 on the side opposite from the rotary gear 192. A crank gear shaft 214a is protruded at the center of the front portion of the crank gear 214, the front end of the crank gear shaft 214a being pivotally and rotatably supported on the partition wall body main body 141 of the partition wall body 131, and the rear portion in the vicinity of the circumferential edge of the crank gear 214 is jointed with a sliding member 216 via a linkage 215. A reciprocation slider crank mechanism for vertically reciprocating the sliding member 216 is constituted by the crank gear 214, linkage 215 and sliding member 216.

[0088] That is, the lower end of the linkage 215 is pivotally and rotatably supported on the crank gear 214, and

the upper end thereof is pivotally and rotatably supported on the lower end of the sliding member 216.

[0089] Additionally, guide cylinders 219, each into which a slide guide member (not shown) for vertically guiding the sliding member 216 is inserted, are protruded at the upper and lower both ends of the rear portion of the sliding member 216 respectively. Further, a rack-shaped slide gear 221 is formed at one side of the front portion of the sliding member 216, and a joint gear 222, which is positioned on one side above the sliding member 216, is meshed with the slide gear 221.

[0090] The joint gear 222 is positioned behind the partition wall body main body 141 of the partition wall body 131, a gear 223 having a large diameter is provided, on the front portion of the joint gear 222, coaxially and integrally with the gear 222, and the gear 222 is pivotally and rotatably supported on the partition wall body main body 141. Additionally, the gear 223 is meshed with a gear 224 positioned on one side thereof. The gear 224 is pivotally and rotatably supported on the partition wall body main body 141, and provided coaxially with a gear 225, which is positioned aside of the introduction hole 153, on the front portion of the partition wall body main body 141, and the gear 225 is meshed with the gear 179 of the dust shaking-off part 135.

[0091] On the other hand, as shown in Fig. 1, Fig. 2 and Fig. 6, the lid body 3 includes a lid body main body 231, a lid body joint part 232 joined with the upper side of the front end of the lid body main body 231, and an air passage partition part 233 engaged with the lower portion of the lid body main body 231.

[0092] The lid body main body 231 constitutes an outline of the lid body 3 and is formed so as to be forward and upward curved, parts to be pivotally supported 235, 235 are protruded at the rear end of the lid body main body 3, and a joint attachment part 237 aslant forward and downward is formed at the front end thereof. Additionally, holes 241 (only one shown) are provided at both sides of the lid body main body 231, and an open/close button (not shown) is provided in each hole 241.

[0093] Each part to be pivotally supported 235 is joined with the upper case 6 of the main body case 2 via a hinge 243 in front of the handle 35.

[0094] Additionally, the open/close button is operated in releasing latching of the lid body 3 onto the main body case 2, joined with a latching mechanism 245 arranged between the lid body main body 231 and the lid body joint part 232, and makes the latching mechanism 245 movable by being press-operated toward the center side in the lateral direction from both sides.

[0095] Here, as shown in Fig. 1 and Fig. 6, the latching mechanism 245 includes latching members 247, 247 which are inserted and latched, from the center to the outside in the lateral direction, into gaps between the protrusions to be engaged 79, 79 and upper wall 56 which are positioned on the upper portion of the cup member 51 of the dust collecting unit 9. The latching members 247, 247 are positioned under the air passage partition

part 233, and energized in a direction of being spaced from each other in the lateral direction by a coil spring (not shown) or the like as energizing means. When the latching members 247, 247 are moved so as to approach each other toward the center side in the lateral direction against energization according to press-operation of the open/close button, engagement of the latching members 247, 247 with the gaps between the protrusions to be engaged 79, 79 and the upper wall 56 is released.

[0096] Additionally, as shown in Fig. 1, Fig. 2 and Fig. 5, a round attachment hole 249 is opened in the central portion of the joint attachment part 237.

[0097] The lid body joint part 232 has a substantially cylindrical joint part main body 253 rotatable in a circumferential direction, the joint part main body 253 having a cylindrical connection cylinder 252, in which a round hose connection port 251 as a suction port is opened, at its center, and the peripheral edge of the joint main body 253 is attached to the joint attachment part 237 by a substantially cylindrical joint attachment part 254.

[0098] The hose connection port 251 is opened upward at the front side of the vacuum cleaner main body 1, and an opening direction of the hose connection port 251, that is, an axis direction of the connection cylinder 252, is slanted to approximately 45° with respect to the horizontal direction (vertical direction).

[0099] Additionally, the connection cylinder 252 has the hose connection port 251 at its front end, the rear end thereof is inserted into an eccentric flat linear cylindrical body 256, and the cylindrical body 256 as a sealing member is air tightly connected to an attachment hole 249 of the joint attachment part 237 via a packing 257. That is, the hose connection port 251 linearly communicates with the attachment hole 249 via the connection cylinder 252 and the cylindrical body 256.

[0100] Here, the cylindrical body 256 is provided so as to be rotatable integrally with the joint attachment part 254 in a circumferential direction.

[0101] As shown in Fig. 3, Fig. 4 and Fig. 10, in the hose connection port 251, a joint tube 262 of the base end of a hose body 261 is detachably inserted into the connection cylinder 252, a hand operation part 263 is provided at the top end of the hose body 261, a grip part 264 to be gripped by an operator is protruded on the hand operating part 263, a plurality of setting buttons 265 that the operator sets an operation mode and the like of the electric blower 7 to the control means are provided on the grip part 264, and a floor brush 267 as a suction port body is successively communicatively connected to the top end of the hand operating part 263 via an extension tube 266.

[0102] Accordingly, the joint tube 262 on the base end side of the hose body 261 is connected to the vacuum cleaner main body 1 (main body case 2) so as to be rotatable in the circumferential direction by the joint attachment part 254 and the cylindrical body 256 having the connection cylinder 252.

[0103] The air passage partition part 233 has: an air

passage lower plate 275 as a first air passage partition-plate positioned at its lowest part; an air passage front plate 276 as a second air passage partition plate continuously upward from the front end of the air passage lower plate 275; an air passage upper plate 277 as a third air passage partition plate continuously behind the air passage front plate 276 and above the air passage lower plate 275; an air passage middle plate 278 as a fourth air passage partition plate positioned between the air passage upper plate 277 and air passage lower plate 275; and an air passage rear plate 279 as a fifth air passage partition plate continuous to the air passage lower plate 275, air passage upper plate 277 and the rear end of the air passage middle plate 278. A separation space 281 is provided between the front end of the air passage lower plate 275, the air passage front plate 276 and the front end of the air passage upper plate 277, an upper air passage 282 as a first partial air passage is provided between the air passage upper plate 277 and air passage middle plate 278, and a lower air passage 283 as a second partial air passage is provided between the air passage middle plate 278 and air passage lower plate 275.

[0104] The air passage lower plate 275 forms into a lower surface of the lid body 3 and is formed so as to cover the entire lower portion of the lid body main body 231. Additionally, a communication port 285 communicating with the unit suction port 76 of the dust collecting unit 9 is provided at the substantially central portion of the air passage lower plate 275. As shown in Fig. 1 and Fig. 6, a circular ring-shaped seal packing 286 is attached to the outer periphery of the communication port 285, the ring-shaped seal packing 286 being a lid body lower portion sealing member air tightly connected to the seal packing 77. Further, in the air passage lower plate 275, fitting recesses 287, 287, into which the fitting protrusions 81, 81 of the dust collecting unit 9 fit, are provided on both sides of the communication port 285, and latch fitting recesses 288, 288, into which the latching members 247, 247 slidably fit, are provided at both sides in front of the communication port 285. An activation protrusion 289 is protruded on the central portion of the front end of the air passage lower plate 275 in the lateral direction, the activation protrusion 289 being inserted in the exposed opening 62b of the dust collecting unit 9 with the lid body 3 closed and activating the breakaway preventing mechanism 65. Further, protrusion fitting recess 290, into which the protrusion 62a of the dust collecting unit 9 fits, is formed behind the activation protrusion 289 of the air passage lower plate 275.

[0105] As shown in Fig. 1 to Fig. 4, the air passage front plate 276 is engaged with a lower surface of the joint attachment 237 of the lid body main body 231. Accordingly, the air passage front plate 276 is formed so as to be slanted forward and downward. A round air passage communication opening 293 communicating with the hose connection port 251 via the connection cylinder 252 is opened in the air passage front plate 276. The air passage communication opening 293 is formed so as to

have a diameter larger than that of the attachment hole 249, that is, connection cylinder 252, and the rear end, which is the end of the downstream side, of the connection cylinder 252 is fitted into the air passage communication opening 293 and protruded inward in an opening direction.

[0106] The air passage upper plate 277 has a front side partition part 277a which is positioned at its front end and partitions a separation space 281, and a rear side partition part 277b which is continuous to the rear end of the front side partition part 277a and forms the upper air passage 282, and both sides of the air passage upper plate 277 continue to the air passage lower plate 275 outside of the peripheral edge of the communication port 285.

[0107] The front side partition part 277a substantially perpendicularly protrudes from the rear end of the air passage front plate 276, and is provided so that the separation space 281 is diametrically contracted to the rear side partition part 277b.

[0108] The rear side partition part 277b is formed so as to be bent at a substantially right angle with respect to the rear end of the front side partition part 277a in a cross sectional view, along the front and rear direction.

[0109] A first air passage ventilation hole 295 making communication between the separation space 281 and the upper air passage 282 is formed between a continuation part of the front side partition part 277a and rear side partition part 277b, and a surface of the upper air passage 282 side of the air passage middle plate 278.

[0110] The air passage middle plate 278 is formed continuously to the air passage lower plate 275 along the peripheral edge of the communication port 285, and the front end thereof is positioned along the inside of the continuation part between the front side partition part 277a and rear side partition part 277b of the air passage upper plate 277. Additionally, a second air passage ventilation hole 297 making communication between the separation space 281 and the lower air passage 283 is opened at the front end of the air passage middle plate 278. Further, a latching rib 298 is protruded on the upper air passage 282 side of the air passage middle plate 278.

[0111] The second air passage ventilation hole 297 is formed in the shape of a round hole having a diameter approximately the same as that of the attachment hole 249, that is, the connection cylinder 252, and so as to have an opening direction along the axis direction of the connection cylinder 252.

[0112] The air passage rear plate 279 is formed in the shape of a slant face opposite to the slant face 107 of the filter container 101 of the filter 12, slanted backward and upward, with the lid body 3 closed. Additionally, as shown in Fig. 2 and Fig. 6, in the air passage rear plate 279, a first communication opening 301 and a second communication opening 302 are formed, the first communication opening 301 being a first partial air passage exhaust hole positioned at the downstream end of the upper air passage 282, and the second communication

opening 302 being a second partial air passage exhaust hole positioned at the downstream end of the lower air passage 283, and a seal packing 303 as a lid body rear portion sealing member is continuously attached to the peripheral edges of the first communication opening 301 and second communication opening 302.

[0113] The first communication opening 301 is formed in a shape approximately the same as that of the filter opening 111 provided in the slant face 107 of the filter 12.

[0114] The second communication opening 302 is formed in a shape substantially the same as that of an upper end opening of the duct lifting part 109b of the filter 12.

[0115] The seal packing 303 comes into contact with the seal packing 113 of the filter 12 with the lid body 3 closed, and connects the upper air passage 282 and lower air passage 283 air tightly to the upstream side of the filter opening 111 of the filter 12 and the upstream side of the upper end opening of the duct lifting part 109b respectively.

[0116] The separation space 281 is a space having an axis direction in the shape of a slant along a direction substantially the same as the opening direction of the hose connection port 251, that is, an axis direction of the connection cylinder 252, and houses a dust separator 311 therein, the dust separator 311 separating dust, which is suctioned together with air from the hose connection port 251, from the air.

[0117] The dust separator 311 has a separator main body 314 formed substantially cylindrically, and a mesh filter 315 as a filter attached to the separator main body 314.

[0118] The front end of the separator main body 314 is air tightly connected to the rear end of the air passage middle plate 276 around the air passage communication opening 293, the diameter thereof is contracted to the rear end thereof, and the rear end is latched to the front end of the air passage middle plate 278 so that the second air passage ventilation hole 297 is communicatively connected to the communication port 285. Accordingly, the separator main body 314 communicates with the communication port 285 to be slanted with respect to the communication port 285 by, for example, approximately 45°. Additionally, lattice-shaped communication holes 318 are provided in an outer peripheral surface of the separator main body 314, and the communication holes 318 are air tightly connected to the first air passage ventilation hole 295.

[0119] The mesh filter 315 is mounted so as to cover each of the communication holes 318 of the separator main body 314, and can collect dust contained air passing through the communication holes 318.

[0120] The dust separator 311 applies inertia to rough dust, which has a relatively large specific gravity, in dust suctioned together with air from the hose connection port 251 by driving the electric blower 7 and separates the rough dust aslant linearly from the upstream side to downstream side of the separator main body 314, and

separates the air aslant to the communication hole 318.

[0121] The upper air passage 282 is an air passage, through which air separated by the dust separator 311 passes to the filter 12, and substantially horizontally formed, and a first valve body 321 is provided therein.

[0122] The upper end of the first valve body 321 is pivotally and rotatably supported on the continuation part between the front side partition part 277a and rear side partition part 277b of the air passage upper plate 277 in the front and rear direction, and the rotation allows the upper air passage 282 to open and close. That is, the first valve body 321 is positioned in the vicinity of the first air passage ventilation hole 295. Additionally, a notch 321a is formed to be fitted along a surface of the upper air passage 282 side at the air passage middle plate 278 side of the first valve body 321, and the edge of the front side of the notch 321a is latched to the latching rib 298 of the air passage middle plate 278, and thus forward rotation is regulated. Accordingly, the first valve body 321 is opened against its own weight by the flow from the front side to the rear side of the air, and closed by its own weight when the flow of air is stopped, and the flow from the rear side to the front side of the air cannot open it.

[0123] On the other hand, the lower air passage 283 is an air passage, through which air from the filter 12 side passes to the dust collecting unit 9 side, substantially horizontally formed, and partitioned from the upper air passage 282 by only the air passage middle plate 278, and a second valve body 323 as a valve body is provided in the lower air passage 283.

[0124] The second valve 323 has a valve main body 323a and an attaching frame 323b for attaching the valve main body 323a to the inside of the lower air passage 283, and is provided on the rear side of the edge of the communication port 285 arranged in the vicinity of the second air passage ventilation hole 297.

[0125] The upper end of the valve main body 323a is pivotally and rotatably supported on the attaching frame 323b, and the rotation allows the lower air passage 283 to open and close.

[0126] The attaching frame 323b is positioned behind the valve main body 323a and formed in a frame shape along an inner surface between the air passage lower plate 275 and the air passage middle plate 278. Accordingly, in the second valve body 323, the valve main body 323a is opened against its own weight by the flow of air from the rear side to the front side, closed by its own weight when the flow is stopped, and is constituted so that it is not opened, since it is supported by the attaching frame 323b from behind, even if receiving the flow of air from the front side to the rear side.

[0127] As shown in Fig. 3 and Fig. 4, according to the above constitution, a main air passage 325 is formed which communicates with the suction side of the electric blower 7 from the hose connection port 251, via the connection cylinder 252, the dust separator 311, the communication port 285, the dust collecting unit 9, the mount part air passage 96, the air ventilation passage 168, the

communication air passage 165, the communication hole 208 and the joint cylinder 148. Additionally, an auxiliary air passage 328 is formed which has: a first half passage 326 as a first air passage communicating with the suction side of the electric blower 7 from the hose connection port 251, via the connection cylinder 252, the dust separator 311, the upper air passage 282 (the first valve body 321), the filter 12 and the joint cylinder 148; and a second half passage 327 as a second air passage communicating with the suction side of the electric blower 7 via the introduction communication port 152, the introduction hole 153, the filter 12, the duct 109, the lower air passage 283 (the second valve body 323), the dust collecting unit 9, the mount part air passage 96, the air ventilation passage 168, the communication air passage 165 and the joint cylinder 148.

[0128] Accordingly, the auxiliary air passage 328 is joined with the main air passage 325 in the communication air passage 165 at the downstream side, the upper air passage 282 and the lower air passage 283, which constitute a part of the auxiliary air passage 328, are provided in the lid body 3, and the space 13, in which the filter 12 is arranged, is a cross position between the first half passage 326 and second half passage 327.

[0129] The second half passage 327 and the introduction hole 153 are blocked by the driving mechanism 136, the first valve body 321, the second valve body 323 and the like, and a switch means 329 is provided that makes switching between a suctioning state (cleaning state) where dust can be trapped in the duct collecting unit 9 and the pleated filter 126 of the filter 12, the dust being suctioned from the hose connection port 251 by driving the electric blower 7 via the main air passage 325 and the first half passage 326, and a dust moving state (air washing state) where outside air is introduced into the second half passage 327 by driving the electric blower 7 via the introduction hole 153 and the dust trapped in the pleated filter 126 is moved to the dust collecting unit 9 via the second half passage 327.

[0130] Next, operations of the first embodiment will be described.

[0131] First, in starting cleaning, the lid body 3 is opened, the dust collecting unit 9, to which the paper pack 52 is attached, is attached to the mount part 10, the positioning protrusions 116, 116 are brought into contact with the fine dust receiver 25, the latching protrusions 124, 124 of the upper case 6 are engaged with the latching holes of the latching pieces 117, 117, and the filter 12, to which the pleated filter 126 is attached, is fixed in the space 13.

[0132] Then, when the lid body 3 is closed, the latching members 247, 247 are engaged with the gaps between the protrusions to be engaged 79, 79 of the dust collecting unit 9 and upper wall 56 of the dust collecting unit 9, the fitting protrusions 81, 81 of the dust collecting unit 9 are fitted into the fitting recesses 287, 287, the protrusion 62a of the dust collecting unit 9 is fitted into the protrusion fitting recess 290, the activation protrusion 289 is inserted

into the exposed opening 62b, the breakaway preventing mechanism 65 is activated, the latching body 68 is latched to the upper end of the front portion of the mount part 10, and the dust collecting unit 9 and the filter 12 are held in the main body case 2 by the lid body 3.

[0133] In this state, the seal packing 286 is brought into press-contact with the seal packing 77 of the dust collecting unit 9, the seal packing 303 is brought into press-contact with the seal packing 113 of the filter 12, and the lid body 3 is air tightly connected to the dust collecting unit 9 and the filter 12.

[0134] Then, an operator inserts and connects the joint tube 262 on the base end side of the hose body 261 into the hose connection port 251 of the lid body 3, and successively communicatively connects the floor brush 267 to the top end side of the hose body 261 via the extension tube 266.

[0135] At this time, the joint tube 262 of the hose body 261 is linearly inserted into the connection cylinder 252 via the hose connection port 251, and rotatably connected to the main body case 2.

[0136] Then, when the operator sets the operation mode of the electric blower 7 with the set buttons 265 and starts operating the electric vacuum cleaner, the electric blower 7 is driven by the set operation mode.

[0137] Moreover, in the suctioning state, the opening-closing valve body 211 is positioned on the right side shown in Fig. 8 and the suction opening 144 is opened, the valve body 197 is positioned at the upper side, the seal packing 209 comes into contact with the step part 166, and the part to be joined 206b of the introduction hole opening-closing valve 206 is positioned at the lower side, that is, the opening-closing valve main body 206c is positioned at the upper side and blocks the introduction communication port 152. Thus, in the suctioning state, as shown in Fig. 3, the second half passage 327 and the introduction hole 153 are blocked.

[0138] Dust is suctioned together with air from the top end of the floor brush 267 with the action of negative pressure generated by driving the electric blower 7, the suctioned dust is suctioned together with the air into the hose connection port 251 via the extension tube 266 and the hose body 261.

[0139] Here, inertia is applied to rough dust in the suctioned dust by suction air, and the rough dust moves straight forward and then passes through the second air passage ventilation hole 297 in the dust separator 311, is rectified by the valve main body 323a of the second valve body 323 positioned in the vicinity of the second air passage ventilation hole 297, separated in the substantially vertical direction, that is, by, for example, 45° with respect to the axis direction of the connection cylinder 252 that is the opening direction of the hose connection port 251, and passes through the communication port 285, and then passes through the introduction cylinder 78 from the unit suction port 76 and is suctioned into the paper pack 52 in the dust collecting unit 9 from the pack opening 87.

[0140] Additionally, when the air suctioned together with the rough dust into the paper pack 52 passes through the pack body 89 of the paper pack 52, contained fine dust is collected, the air flows into the mount part air passage 96 via the lattice openings 92, and then passes from the lower communication opening 41 to the air ventilation passage 168, is further suctioned into the suction side of the electric blower 7 from the air passage communication port 167, via communication air passage 165, air passage hole 208 and the joint cylinder 148.

[0141] Further, the remaining air suctioned together with the dust and separated by the dust separator 311 is separated by the dust separator 311 toward the substantially horizontal direction with an angle equal to that of the rough dust with respect to the axial direction of the connecting tube 252 as the opening direction of the hose connecting port 251, for example, by 45°, with respect to the axial direction of the connecting tube 252 and passes through the communicating holes 318, and at the time of this passage, fine dust contained in the air is trapped in the mesh filter 315, and in passing through the upper air passage 282, the first valve body 321 is forcibly opened backward, and the dust flows into the filter portion 12 via the first communication opening 301 and filter opening 111, and in passing through the pleated filter 126, the micro dust that is not trapped in the mesh filter is further trapped in the pleated filter, and after passing through the pleated filter 126, the dust is trapped in the mesh filter 174 while passing through the ventilation opening 173 of the filter plate main body 171, and suctioned from the suction opening 144 via the joint cylinder 148 into the electric blower 7.

[0142] The air suctioned into the electric blower 7 passes through the electric blower 7 to form into exhaust air, and is exhausted outside of the main body case 2 from the electric blower 7 via the exhaust hole 31.

[0143] To finish cleaning, when the operator sets the operation mode of the electric blower 7 to a stop mode by the set buttons 265, the control means operates the driving mechanism 136 via the motor 185.

[0144] Specifically, the motor 185 rotates clockwise as shown in Fig. 8, and thus the gears 186, 187 rotate in the same direction. At the gear 186 side, the rotary gear 192 meshed with the gear 186 rotates upward, the opening-closing valve body 211 rotates in a left direction in Fig. 8 via the arm 198 with rotation of the rotary gear 192 and the suction opening 144 is closed, and the valve body 197 rotates downward and the seal packing 209 is made to be spaced from the step part 166. Further, the part to be joined 206b of the introduction opening-closing valve 206 moves upward, and thus the opening-closing valve main body 206c rotates downward, the introduction communication port 152 is opened to communicate with the introduction hole 153.

[0145] Thus, as shown in Fig. 4, the main air passage 325 and the first half passage 326 of the auxiliary air passage 328 are blocked by the switch means 329, and makes switching to the dust moving state where only the

second half passage 327 of the auxiliary air passage 328 communicates with the suction side of the electric blower 7.

[0146] Additionally, at the gear 187 side, the crank gear 214 meshed with the gear 187 rotates, the sliding member 216 vertically reciprocates along the slide sliding member via the linkage 215, the joint gear 222 meshed with the slide gear 221 of the sliding member 216 reciprocally rotates clockwise and counterclockwise in Fig. 8, the gear 223 rotates integrally with the joint gear 222, the gear 224 meshed with the gear 223 rotates, the gear 225 rotates integrally with the gear 224, the dust shaking-off part main body 176, in which the gear 225 is meshed with the gear 179, laterally reciprocates along the guide bodies 177, 177, and thus the dust shaking-off part 181 successively gets over the crest parts of the pleated filter 126 to apply vibration to the pleated filter 126, dust adhered to the pleated filter 126 is removed, and the removed dust drops onto the fine dust receiver 25, etc., along the slant face part 129 of the filter frame 127.

[0147] When the gear 186 rotates substantially once around, the cam 191 pushes in the switch piece 194a of the switch 194, and thus the control means stops the motor 185 with a signal from the switch 194.

[0148] In the dust moving state, outside air introduced into the main body case 2 from the introduction hole 153 by driving the electric blower 7 passes through the pleated filter 126 from the downstream side to the upstream side, in a reverse-wash direction, and thus the micro dust trapped in the pleated filter 126 is removed, the outside air suctions up the micro dust dropped on the fine dust receiver 25, etc., via the suction opening 115 from the duct suctioning part 109a, and is suctioned into the lower air passage 283 via the second communication opening 302 from the duct lifting part 109b.

[0149] The outside air suctioned into the lower air passage 283 pushes and opens the second valve body 323 forward, passes through the communication port 285, and then is suctioned into the paper pack 52 of the dust collecting unit 9, and suctioned into the suction side of the electric blower 7 via the mount part air passage 96, the air ventilation passage 168 and the communication air passage 165.

[0150] In this time, the micro dust passing through the lower air passage 283 is rectified and collected into the dust collecting unit 9 by the valve main body 323a of the second valve body 323.

[0151] The control means then stops the electric blower 7 and rotates the motor 185 in a direction reverse to the above direction after elapse of a predetermined time, and thus each part operates reversely to the above operation to return to the position of the suctioning state, and then the control means stops the motor 185.

[0152] The switch means 329 thus makes switching between the suctioning state, where the second half passage 327 of the auxiliary air passage 328 and the introduction hole 153 are blocked and the dust suctioned from the hose connection port 251 by driving the electric blow-

er 7 via the main air passage 325 and the first half passage 326 of the auxiliary air passage 328 can be trapped in the dust collecting unit 9 and the pleated filter 126 of the filter 12, and the dust moving state where outside air is introduced into the second half passage 327 by driving the electric blower 7 via the introduction hole 153 and the dust trapped in the pleated filter 126 is moved to the dust collecting unit 9 via the second half passage 327. In the suctioning state, even if the amount of the dust trapped in the dust collecting unit 9 of the main air passage 325 is increased, the air suctioned from the hose connection port 251 is branched into the first half passage 326 of the auxiliary air passage 328 and reduction in the suctioned air amount is suppressed. When the suctioning state is switched to the dust moving state by the switch means 329, the dust trapped in the pleated filter 126 is moved to the dust collecting unit 9 and increase in the air passage resistance at the auxiliary air passage 328 side caused by clogging of the pleated filter 126 is suppressed, and thus reduction in suction power over time can be suppressed.

[0153] Additionally, in maintaining the electric blower, the latching members 247 of the latching mechanism 245 are activated by operating the open/close button of the lid body 3, the lid body 3 is rotated upward to be opened while engagement of the lid body 3 with the dust collecting unit 9 is released, and then, as shown in Fig. 1, the dust collecting unit 9 and the filter 12 are exposed from the main body case 2. Thus, the dust collecting unit 9 and the filter 12 are taken off from the main body case 2, the paper pack 52 is taken off from the cup member 51 to be scraped, a new paper pack 52 is mounted on the cup member 51, the pleated filter 126 is taken off from the filter container 101 and the dust is removed, the pleated filter 126 is mounted on the filter container 101 again, and the dust collecting unit 9 and the filter 12 are attached to the main body case 2.

[0154] That is, according to the first embodiment, since the upper air passage 282 and lower air passage 283 are provided which are a part of the first half passage 326 and second half passage 327 of the auxiliary air passage 328 respectively, the dust collecting unit 9 is exposed with the lid body 3 opened, and thus detachment performance and maintenance performance of the dust collecting unit 9 are improved.

[0155] Additionally, since the upper air passage 282 and the lower air passage 283 are provided in the lid body 3, the air passages 282, 283 are easily cleaned from the first communication opening 301 and the second communication opening 302 sides.

[0156] Further, since the pack opening 87 is positioned at the upper side of the paper pack 52 with the pack 52 attached to the dust collecting unit 9, no dust drops from the paper pack 52.

[0157] The upper air passage 282 is separated from the lower air passage 283 by only the air passage middle plate 278, and thus space-saving in the lid body 3 can be realized and the lid body 3 (electric vacuum cleaner)

can be reduced in weight.

[0158] Additionally, since the second valve body 323 is provided at the communication part between the downstream side of the dust separator 311 and the dust collecting unit 9, and at the communication part between the second half passage 327 of the auxiliary air passage 328 and the dust collecting unit 9, the rough dust passed through the dust separator 311 can be rectified to the dust collecting unit 9 by the valve main body 323a of the second valve body 323 in the suctioning state, and the micro dust passed through the second air passage 327 can be rectified to the dust collecting unit 9 by the valve main body 323a in the dust moving state.

[0159] Further, since the dust collecting unit 9 is arranged under the lid body 3 and the second half passage 327 is provided under the first half passage 326 in the auxiliary air passage 328, the micro dust removed from the pleated filter 126 in the dust moving state need not be unnecessarily lifted up, and is efficiently moved to the dust collecting unit 9.

[0160] Since the introduction hole 153 is provided downstream with respect to the pleated filter 126, that is, at the suction side of the electric blower 7, in the suctioning state, outside air introduced from the introduction hole 153 in the dust moving state passes from the downstream side of the pleated filter 126 and performs reverse-washing, and thus, in the reverse-washing, the outside air is made even and spreads all over the entire pleated filter 126 so as to substantially evenly wash the entire pleated filter 126, and the pleated filter 126 can be securely prevented from being clogged.

[0161] Additionally, since the introduction opening-closing valve 206 and the opening-closing valve body 211 are moved in conjunction with each other and opened/closed by the single motor 185, switching between the suctioning state and dust moving state is simply performed, space-saving and weight reduction can be realized and the electric vacuum cleaner can be downsized, compared with the case of opening-closing them with use of a plurality of motors.

[0162] Further, since the dust shaking-off part 135 is driven by the motor 185 for making the introduction opening-closing valve 206 and the opening-closing valve body 211 move in conjunction with each other and opening-closing them, the constitution thereof is simplified, the dust trapped in the pleated filter 126 can be further securely removed, and the pleated filter 126 can be prevented from being clogged.

[0163] Next, a second embodiment will be described with reference to Fig. 11 to Fig. 14. Moreover, the same reference symbol is attached to each part having the same operation-effect as that of the first embodiment, and description thereof will be omitted.

[0164] In the second embodiment, outside air is introduced to the upstream side of the pleated filter 126 from the introduction hole 153 in the dust moving state, and the dust trapped in the pleated filter 126 is removed in the first embodiment.

[0165] That is, as shown in Fig. 11 to Fig. 14, the duct forming part 158 is extended to a front of the partition wall body main body 141, and the outside air communication part 145 is protruded forward from an opening 331 provided above the protrusion hole 172 of the filter plate main body 171.

[0166] Additionally, a contact wall 333 is protruded, downward to the pleated filter body 102, on the frame face part 105 of the filter container 101 of the filter 12, a rectangular communication hole 334, with which the front end of the duct forming part 158 communicates, is provided in the contact wall 333, and a seal packing 335 as a sealing member for air tightly connecting the duct forming part 158 is attached to the edge of the communication hole 334.

[0167] Further, a duct air passage 337 is extended forward on the front portion of the communication hole 334, the top end of the duct air passage 337 is bent from upward to downward directed to a front surface, which is an upstream side surface of the pleated filter 126, behind the filter opening 111, and the top end opening of the duct air passage 337 forms into the introduction hole 153.

[0168] In the suctioning state, cleaning is performed in the same operation as that of the first embodiment. However, when the suctioning state is switched to the dust moving state, the introduction communication port 152 is opened, and thus outside air passes through the inside of the duct forming part 158, is blown from upward to downward over the upstream side surface, that is, front surface, of the pleated filter 126 from the introduction hole 153 via the duct air passage 337, and removes the dust trapped in the pleated filter 126.

[0169] The removed dust is suctioned up to the lower air passage 283 via the duct 109 by air passing through the second half passage 327 by driving the electric blower 7, and moved and collected into the paper pack 52 in the dust collecting unit 9 similar to the first embodiment.

[0170] Thus, an operation-effect similar to that of the first embodiment can be obtained. Additionally, since the pleated filter 126 has a pleated shape along the vertical direction, the dust collected on the upstream surface of the pleated filter 126 can be securely removed by blowing outside air along the pleated shape of the pleated filter 126 from above via the introduction hole 153.

[0171] Specifically, since the pleated filter 126 is a surface dust collecting filter, the dust hardly enters the inside of the filter and is adhered to the upstream side surface to be collected, and thus the dust can be securely removed by blowing air over the filter from the introduction hole 153.

[0172] Moreover, in each embodiment, by providing a notch in the first valve body 321 of the second air passage 327 of the auxiliary air passage 328, outside air introduced from the introduction hole 153 in the dust moving state may be made to pass through from the downstream side of the mesh filter 315 of the dust separator 311 so as to be introduced to the dust collecting unit 9. In this case, the mesh filter 315 can be also subjected to the

reverse-washing in the dust moving state, and the auxiliary air passage 328 side thereof can be securely prevented from being clogged.

[0173] Further, instead of providing the ventilation hole 208 in the valve body 197, the constitution can be made without providing the valve body 197. In this case, the constitution of interlocking the valve body 197 can be omitted.

[0174] Next, a third embodiment will be described with reference to Fig. 15 to Fig. 17. Moreover, the same reference symbol is attached to each part having the same constitution and operation as those of the above embodiments, and so that description thereof is omitted.

[0175] In the third embodiment, in place of the filter 12, as shown in Fig. 17, the pleated filter 126 is provided in the lid body 3.

[0176] In the lid body 3, the air passage upper plate 277 is formed aslant upward from its front end to its rear end, the rear ends of the air passage lower plate 275 and air passage middle plate 278 are formed aslant downward, and a space 341 housing the pleated filter 126 therein is provided behind the air passage upper plate 277, the air passage lower plate 275 and the air passage middle plate 278. The rear portion of the space 341 communicates with the outside of the lid body 3 via a communication opening 342.

[0177] In the space 341, the upper side of the pleated filter 126 is arranged so as to be slanted forward and downward, has a lower end arranged at the upper portion of the rear end of the air passage lower plate 275 and faces the rear ends of the upper air passage 282 and lower air passage 283. A rear side surface of the pleated filter 126 is exposed to the outside of the lid body 3 from the communication opening 342, and faces the front side of the upper portion of the partition wall 14 with the lid body 3 closed.

[0178] Additionally, in the dust separator 311, the separator main body 314 is provided integrally with the air passage lower plate 275 and formed in the shape of an approximate cylinder diametrically contracted from the upper side to lower side, upstream side to downstream side, and a communication hole 344 is opened in the peripheral surface of the rear side of the separator main body 314, the communication hole 344 facing the front ends of the upper air passage 282 and lower air passage 283. A mesh filter 345 is provided, behind the downstream side of the communication hole 344, so as to be positioned in front of the upper air passage 282 and the lower air passage 283. The lower end of the separator main body 314 is air tightly connected to the communication port 285, which is a base end of the introduction cylinder 78 of the dust collecting unit 9, with the lid body 3 closed.

[0179] Further, as shown in Fig. 15 and Fig. 16, in the partition wall 131, the partition wall main body 141 is vertically formed in a plate shape, an upper protrusion plate 351 as a partition plate is forward protruded at a position slightly higher than the middle part of the partition wall

main body 141 in the vertical direction, a lower protrusion plate 352 is forward protruded at the lower end of the partition wall main body 141, side continuation plates 353 continue to both sides of the partition wall main body 141, the upper protrusion plate 351 and the lower protrusion plate 352, an upper space 355 is provided which is surrounded by the partition wall main body 141, the upper protrusion plate 351 and side continuation plates 353, and a lower space 356 is provided which is surrounded by the partition wall main body 141, the upper protrusion plate 351, the side continuation plates 353 and the lower protrusion plate 352.

[0180] The suction opening 144 is provided so as to make communication between the lower space 356 and the electric blower chamber 8 under the upper protrusion plate 351, a joint cylinder 361 is protruded at the rear portion of the entire peripheral edge of the suction opening 144, and the rear end of the joint cylinder 361 is communicatively connected to the suction side of the electric blower 7.

[0181] Additionally, the introduction hole 153 communicates with the upper space 355 and the electric blower chamber 8 above the upper protrusion plate 351 of the partition wall main body 141, a duct 363 is protruded into the upper space 355 on the front portion of the edge of the introduction hole 153. The introduction hole 153 can be opened and closed by an introduction opening-closing valve 365.

[0182] The introduction opening-closing valve 365 is formed larger than the introduction hole 153, and a pivot 367 is protruded on the rear side of the lower portion of the valve 365. The pivot 367 is connected to the driving mechanism 136, and the driving mechanism 136 allows the introduction opening-closing valve 365 to be opened and closed.

[0183] The front end of the upper protrusion plate 351 faces the upper edge of the rear portion of the dust collecting unit 9. Additionally, a space communication opening 371 as a passage opening for making communication between the upper space 355 and the lower space 356 is vertically provided in the upper protrusion plate 351, and can be opened and closed by a plate-shaped opening opening-closing valve 372 attached to the upper portion of the upper protrusion plate 351.

[0184] The rear end of the opening opening-closing valve 372 is pivotally and rotatably supported at the front portion of the upper protrusion plate 351 so that the valve 372 is vertically rotatable in the upper space 355. Additionally, a joint protrusion 374 is protruded on the lower portion of the opening opening-closing valve 372, inserted into the space communication opening 371, and jointed with the driving mechanism 136. Thus, the opening opening-closing valve 372 is opened and closed by the driving mechanism 136.

[0185] The lower protrusion plate 352 faces the lower edge of the dust collecting unit 9.

[0186] A seal packing 376 as a sealing member is attached along the entire front ends of the partition wall

main body 141, the upper protrusion plate 351 and the side continuation plates 353 which surround the upper space 355. Additionally, a partitioning wall 377 is laterally extended at the upper side of the upper space 355, and partitions the upper space 355 into the upper space 378 and the lower space 379. An upper side lattice frame 381 is fitted into the upper space 378, and a lower side lattice frame 382 is fitted into the lower space 379.

[0187] The upper space 378 is a space which makes communication between the introduction hole 15 and the upstream side surface of the pleated filter 126 via the upper portion of the pleated filter 126 with the lid body closed and serves as a part of the second half passage 327. The front end of the duct 363 is connected to the rear portion of the upper side lattice frame 381.

[0188] The lower space 379 is a space which faces the rear side surface of the pleated filter 126 with the lid body 3 closed and serves as a part of the first half passage 326, and the dust shaking-off part 135 is positioned therein.

[0189] In the lower side lattice frame 382, a long hole-shaped exposure opening 384 is laterally extended into which the front end of the dust shaking-out body 181 of the dust shaking-off part 135 fits and protrudes forward.

[0190] Additionally, the lower space 356 is a space which communicates with the downstream side of the dust collecting unit 9 and serves as a part of the first half passage 326. A seal packing 386 as a sealing member is attached to the entire front edges of the partition wall main body 141, the upper protrusion plate 351, the side continuation plates 353 and the lower protrusion plate 352 which surround the lower space 356. Additionally, a lower lattice frame 387 is fitted into the lower space 356, and a front lattice frame 388 is movably provided in front of the lower lattice frame 387 so that the lower lattice frame 387 can be exposed.

[0191] Further, for example, a plurality of communication holes 389 are provided in the first valve body 321.

[0192] According to the above constitution, the main air passage 325 runs from the hose connection port 251, via the connection cylinder 252, the dust separator 311, the communication port 285, the dust collecting unit 9, the lower space 356 and the suction opening 144, to the suction side of the electric blower 7, the first half passage 326 runs, with the first valve body 321 opened and the second valve body 323 closed, from the hose connection port 251, via the connection cylinder 252, the dust separator 311, the communication hole 344, the mesh filter 345, the upper air passage 282 (the first valve body 321), the space 341, the pleated filter 126, the lower space 379, the space communication opening 371 and the suction port 144, to the suction side of the electric blower 7, and the second half passage 327 runs, with the first valve body 321 closed and the second valve body 323 opened, from the introduction hole 153, via the duct 363, the space 341, the lower air passage 283 (the second valve body 323), the communication hole 344, the communication port 285, the dust collecting unit 9, the lower space 356

and the suction port 144, to the suction side of the electric blower 7.

[0193] Further, as shown in Fig. 15 and Fig. 16, the motor 185 is attached to the rear portion of the partition wall main body 141, and a gear 391 is provided on a rotary shaft protruding forward from the motor 185.

[0194] The gear 391 meshes with a rotary gear 393 at one end of its front side, and meshes with a circular crank gear 394 at the upper portion of one side of its rear side.

[0195] The rotary gear 393 is formed in the shape of a fan having, for example, a center angle of 180°, in a half circle shape, and an arc part of the gear 393 meshes with the gear 391. Additionally, in the rotary gear 393, the front end of the rotary shaft 393a is pivotally and rotatably supported at the rear portion of the partition wall main body 141, and connected to a front rotary gear (not shown) positioned on the front portion of the partition wall main body 141. Additionally, an insertion shaft 393b is protruded at the rear portion of the rotary gear 393 eccentrically to a direction protruding from the rotary gear 393 with respect to the rotary shaft 393a, and inserted into an opening-closing valve driving body 397 for driving the introduction hole opening-closing valve 365.

[0196] The front rotary gear is positioned in the lower space 356, and can be rotated integrally with the rotary gear 393 while keeping a predetermined angle with respect to the rotary gear 393. Additionally, the front rotary gear is meshed with a front crank gear 401 positioned upward.

[0197] The front crank gear 401 is a circular gear, positioned in the lower space 356, and pivotally and rotatably supported on the partition wall main body 141. A crank protrusion 401a is protruded forward in the vicinity of the outer peripheral edge of the front crank gear 401, and inserted into a rotating joining member 403 for rotating the introduction hole opening-closing valve 365.

[0198] The rotating joining 403 is formed in a vertically long shape, vertically long guide holes 403a, 403a are provided in the upper side and lower side of the member 403 respectively, and a crank hole 403b, into which the crank protrusion 401a is inserted, is provided at the substantially central region of the member 403 in the vertical direction so as to be long in the lateral direction that is a direction of crossing of the hole 403b and the guide holes 403a, 403a. Additionally, a joint protrusion 403d is provided at the upper end of the rotating joining member 403, the protrusion 403d including a long joint hole 403c, into which the joint protrusion 374 of the opening opening-closing valve 372 is inserted, in the front and rear direction. Guide protrusions (not shown) protruded from the partition wall main body 141 are inserted into the guide holes 403a, 403a, and the rotating joining member 403 is vertically guided with rotation of the front crank gear 401.

[0199] The opening-closing valve driving body 397 includes: a lower driving body horizontal part 397b having a joint guide hole 397a into which the insertion shaft 393b of the rotary gear 393 is inserted; a driving body vertical

part 397c extended upward from the top end of the lower driving body horizontal part 397b; an upper driving body horizontal part 397d protruded substantially horizontally and in parallel with the lower driving body horizontal part 397b from the upper end of the driving body vertical part 397c; and a joint protrusion 397e which is protruded substantially vertically upward from the tip end of the upper driving body horizontal part 397d and pivotally and rotatably supported by the pivot 367. Long guide holes 397f are vertically provided in the driving body vertical part 397c and the upper driving body horizontal part 397d respectively.

[0200] The joint guide hole 397a is formed in an approximately laterally long arc shape, and bent in an inverted V-shape, in the front view, with respect to the lower driving body horizontal part 397b.

[0201] Each guide protrusion 406 protruded from the partition wall main body 141 is inserted into each guide hole 397f, and the opening-closing valve driving body 397 is vertically guided with rotation of the rotary gear 393.

[0202] On the other hand, a cam 408 is provided integrally with a cam portion 408 across the rear half periphery of the crank gear 394, and the cam 408 comes into contact with a switch piece of a switch (not shown) arranged aside of the gear 391 so that the switch is can be turned on/off. Further, a lower end of a linkage 411, which is long in the vicinity of the outer peripheral edge, is rotatably joined with the rear portion of the crank gear 394, and the upper end of the linkage 411 is rotatably joined with the lower end of a vertically long rack gear 412. The rack gear 412 is vertically slidably held by a guide member 413 attached to the rear portion of the partition wall main body 141.

[0203] Accordingly, the rack gear 412 can be vertically reciprocated by rotation of the crank gear 394 via the linkage 411.

[0204] Further, a gear (not shown) pivotally and rotatably supported on the guide member 413 is meshed with the rack gear 412, and a gear 417 is coaxially provided with and rotatable integrally with the gear, the gear 417 being positioned in front of the guide member 413 and having a large diameter. Further, the gear 417 is meshed with an upper gear 418 positioned upward, and the upper gear 418 is provided coaxially with and rotatable integrally with a front gear 419 which is positioned in front of the partition wall main body 141 and in the upper space 355, and meshes with the gear 179 of the dust shaking-off part 135.

[0205] Additionally, the switch means 329 can make switching between the suctioning state (cleaning state) where dust suctioned from the hose connection port 251 by driving the electric blower 7 via the main air passage 325 and the first half passage 326 can be trapped in the dust collecting unit 9 and the pleated filter 126 with the introduction hole 153 closed by the driving mechanism 136, the introduction hole opening-closing valve 365, the opening opening-closing valve 372 and the like, and the

dust moving state (air cleaning state) where outside air is introduced into the auxiliary air passage 328 from the downstream side of the pleated filter 126 in the suctioning state, by driving the electric blower 7 via the introduction hole 153, and the dust trapped in the pleated filter 126 is moved to the dust collecting unit 9 via the first half passage 326.

[0206] Next, operations of a third embodiment will be described.

[0207] In the suctioning state, the front end of the opening opening-closing valve 372 is positioned at the upper side and the space communication opening 371 is opened, the opening-closing valve driving body 397 is positioned at the upper side, and thus the introduction hole opening-closing valve 365 is positioned at the upper side and the introduction hole opening-closing valve 365 closes the introduction hole 153. That is, in the suctioning state, the second half passage 327 and the introduction hole 153 are blocked.

[0208] Then, dust is suctioned together with air from the top end of the floor brush 267 by the action of negative pressure generated by driving the electric blower 7. The suctioned dust is suctioned into hose connection port 251 together with the air via the extension tube 266 and the hose body 261.

[0209] Here, inertia is applied to rough dust, which is almost all suctioned dust, by the air, and the rough dust moves straight forward through the connection cylinder 252 and the separator main body 314 to be suctioned into the dust collecting unit 9.

[0210] Additionally, the air suctioned in the dust collecting unit 9 together with the rough dust flows into the lower space 356 from the rear portion of the dust collecting unit 9, and then is suctioned into the suction side of the electric blower 7 via the suction opening 144.

[0211] Further, the remaining air suctioned together with dust and separated by the separator main body 314 of the dust separator 311 is separated to the communication hole 311, and at the same time, micro dust contained therein is trapped in the mesh filter 345, when the air passes through the first half passage 326, micro dust not trapped in the mesh filter 345 is further trapped in the pleated filter 126, after passing through the pleated filter 126, the air flows into the upper space 355 and flows into the lower space 356 from the space communication opening 371 and while the air joined with the main air passage 325, the air is suctioned to the electric blower 7 via the suction opening 144.

[0212] The air suctioned in the electric blower 7 forms into exhaust air through the electric blower 7, and is exhausted outside of the main body case 2 via the exhaust hole of the electric blower 7.

[0213] To finish cleaning, when the operator sets the operation mode of the electric blower 7 to a stop mode by the set buttons 265, the control means operates the driving mechanism 136 via the motor 185.

[0214] Specifically, the gear 391 rotates clockwise in Fig. 16 with rotation of the motor 185, the rotary gear 393

meshed with the gear 391 rotates upward at a maximum of about 180°, the front rotary gear rotates upward with rotation of the rotary gear 393, the rotating joining member 403 moves downward with rotation of the crank gear 401 meshed with the front rotary gear, the front end of the opening opening-closing valve 372 joined with the upper end of the rotating joining member 403 rotates downward, and the space communication opening 371 is closed.

[0215] Simultaneously, the insertion shaft 393b of the rotary gear 393 moves from the left end to right end in the joint guide hole 397a with rotation of the rotary gear 393 and comes into slidable contact with the inside of the joint guide hole 397a while moving, and thus pushes the opening-closing valve driving body 397 downward and pushes the introduction hole opening-closing valve 365 downward via the pivot 367 of the introduction opening-closing valve 365, and the introduction hole opening-closing valve 365 opens the introduction hole 153.

[0216] Additionally, the crank gear 394 meshed with the gear 391 rotates, and thus the rack gear 412 vertically reciprocates via the linkage 411, the gear meshed with the rack gear 412 rotates, the gear 417 rotates coaxially with the gear, the upper gear 418 meshed with the gear 417 rotates, the front gear 419 rotates integrally with the upper gear 418, and thus the gear 179, which is meshed with the front gear 419, of the dust shaking-off part 135 laterally reciprocates together with the dust shaking-out body 181, the dust shaking-out body 181 successively flicks the downstream side of the pleated filter 126 to apply vibration to the pleated filter 126, and the dust adhered to the pleated filter 126 is removed.

[0217] The removed dust drops on the air passage lower plate 275 in the space 341.

[0218] When the gear 391 rotates to the maximum point, the switch piece of the switch pushed in by the cam 408 returns and thus the control means stops the motor 185.

[0219] In the dust moving state, outside air introduced into the main body case 2 from the introduction hole 153 by driving the electric blower 7 passes through from upward to downward at the upstream side of the pleated filter 126, and thus removes micro dust trapped in the pleated filter 126, and, in passing through the lower air passage 283, allows the air, from which the micro dust is removed, to be suctioned into the suction side of the electric blower 7 via the lower space 356 and the suction opening 144 after the micro dust dropped on the air passage lower plate 275 passes through the communication hole 344 to be suctioned into the dust collecting unit 9.

[0220] Additionally, a part of the outside air flows into the separator main body 314 from the front of the pleated filter 126 through the communication hole 389 of the first valve body 321 to subject the mesh filter 345 to the reverse-washing, and moves the dust adhered to the mesh filter 345 into the dust collecting unit 9 via the separator main body 314.

[0221] The control means then stops the electric blow-

er 7 and rotates the motor 185 in a direction reverse to the above direction after elapse of a predetermined time, and thus each part operates reversely to the above operation to return to the position of the suctioning state, and then the control means stops the motor 185.

[0222] Thus, an operation-effect similar to the above embodiment can be obtained.

[0223] Additionally, since the pleated filter 126 is provided above the dust collecting unit 9, the micro dust trapped in and removed from the pleated filter 126 is supported by its own weight (gravity applied thereto) when being moved to the dust collecting unit 9 with negative pressure of the electric blower 7. Accordingly, the micro dust trapped in and removed from the pleated filter 126 is securely moved to the dust collecting unit 9 so that the pleated filter 126 can be prevented from being clogged, suction air passing through the first half passage 326 is quantitatively secured in switching the dust moving state to the suctioning state, and reduction in suction power over time can be suppressed.

[0224] Moreover, in each above embodiment, the switch means 329 may be activated at an arbitrary timing, for example, after elapse of a predetermined time from the start of driving of the electric blower 7, other than the start or end of driving of the electric blower 7.

[0225] The introduction hole 153 may be made to communicate with air outside of the vacuum cleaner main body 1 via the exhaust hole 31.

[0226] Additionally, a constitution of the switch means 329 is not limited to the above constitutions.

[0227] Further, the dust shaking-off part 135 may not be provided.

[0228] A constitution of the electric vacuum cleaner is not limited to the above constitutions. So long as an electric vacuum cleaner has a constitution that the dust collecting unit 9 is held by the lid body 3 from above, not only a canister type but an autonomous running type (robot type), a handy type and the like are applicable as the types of the electric vacuum cleaner, and the constitution of the electric vacuum cleaner of the present invention is applicable to each constitution of those types electric vacuum cleaners.

45 Claims

1. An electric vacuum cleaner comprising:

a vacuum cleaner main body including a main body case with an electric blower housed therein, and a lid body openable and closable to the main body case;
 a suction port provided in the lid body;
 a dust separator which is provided in the lid body on the downstream side of the suction port and separates dust from air;
 a main air passage which makes communication between the dust separator and a suction

side of the electric blower, and through which the dust separated by the dust separator passes;

a dust collecting unit which is provided in the main air passage and held by the main body case with the lid body closed, and collects the dust separated at the main air passage side by the dust separator;

a first air passage which makes communication between the dust separator and the suction side of the electric blower separately from the main air passage, and has at least a part provided in the lid body and a downstream side joined with the main air passage;

a filter which has at least a part provided in the first air passage and collects fine dust contained in air;

a second air passage which makes communication between an introduction hole, from which outside air can be introduced separately from the suction port, and the suction side of the electric blower passing through the dust collecting unit, and has at least a part provided in the lid body; and

switch means which makes switching between a suctioning state where dust can be trapped in the dust collecting unit and the filter with the second air passage and introduction hole closed, the dust being suctioned from the suction port by driving the electric blower via the main air passage and the first air passage, and a dust moving state where outside air is introduced into the second air passage by driving the electric blower via the introduction hole, and fine dust trapped in the filter is moved to the dust collecting unit via the second air passage.

2. The electric vacuum cleaner according to claim 1, wherein the switch means includes a valve body which closes the second air passage in the suctioning state to rectify dust separated into the main air passage to the dust collecting unit, and opens the second air passage in the dust moving state to rectify fine dust trapped in the filter to the dust collecting unit.
3. The electric vacuum cleaner according to claim 1, wherein the dust collecting unit is positioned under the lid body and the second air passage is positioned under the first air passage.
4. The electric vacuum cleaner according to claim 1, wherein the introduction hole is provided at the downstream side with respect to the filter.
5. The electric vacuum cleaner according to claim 1, wherein the introduction hole is provided so as to face an upper surface of the filter.

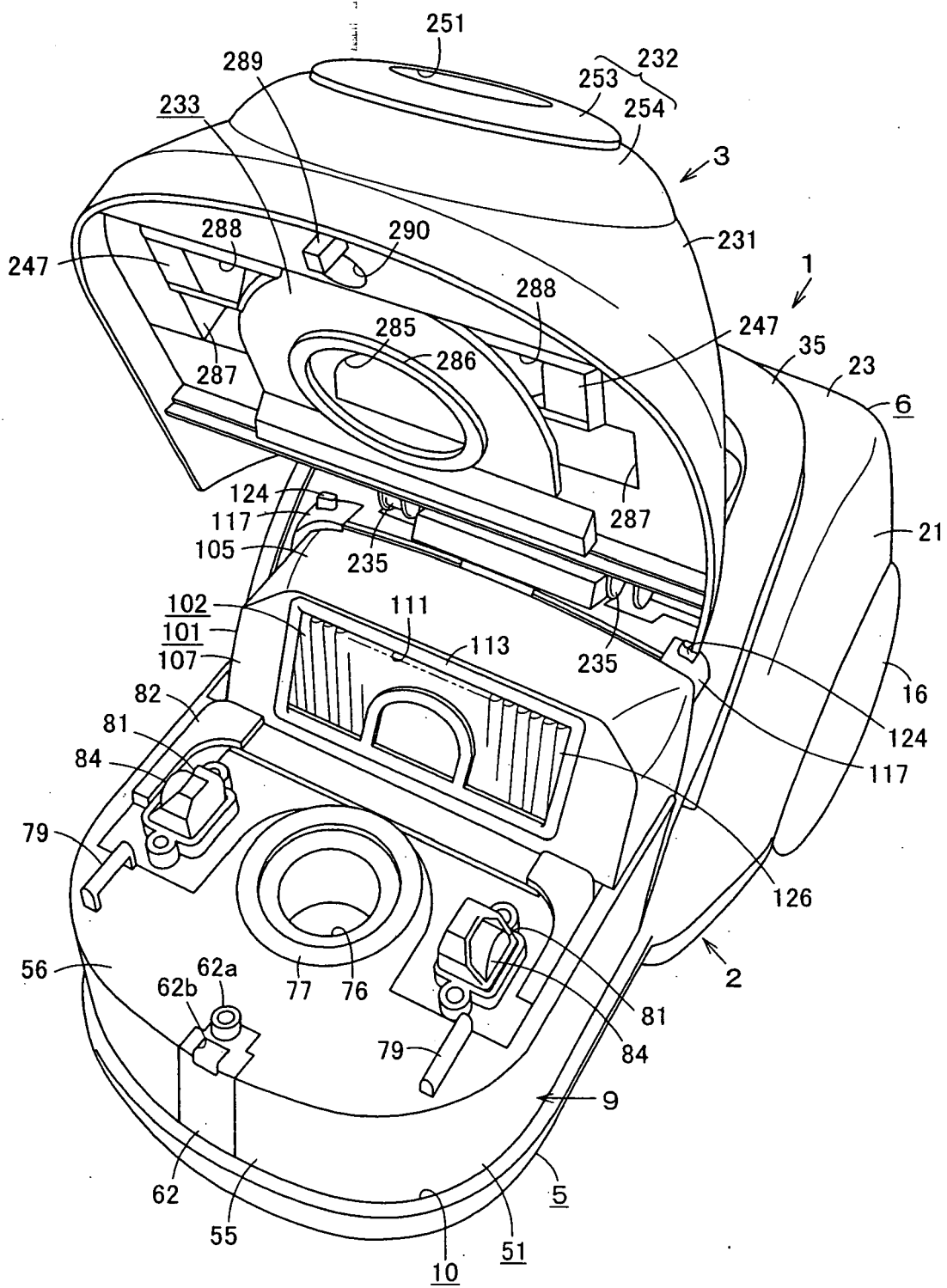


FIG. 1

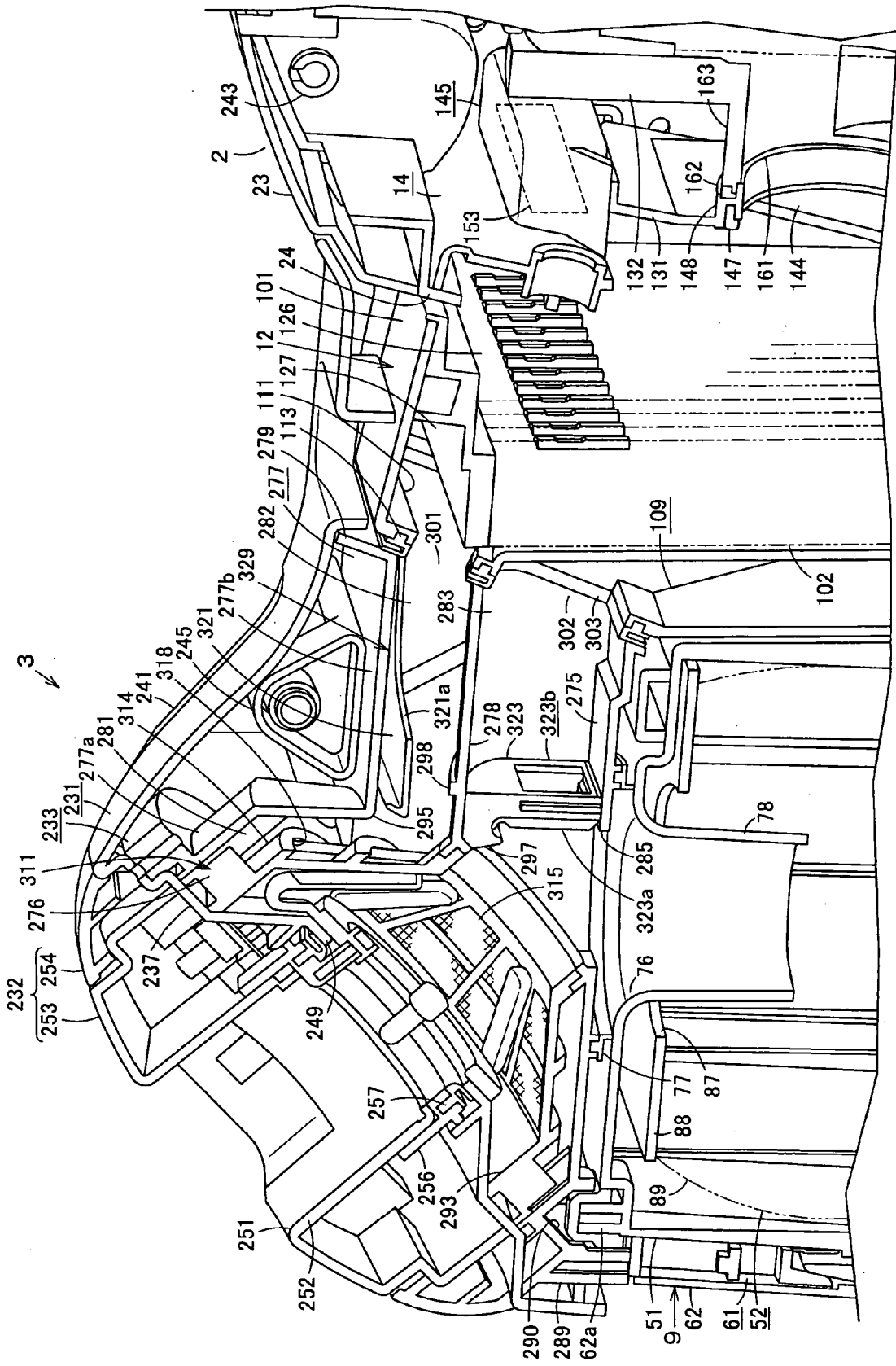


FIG. 2

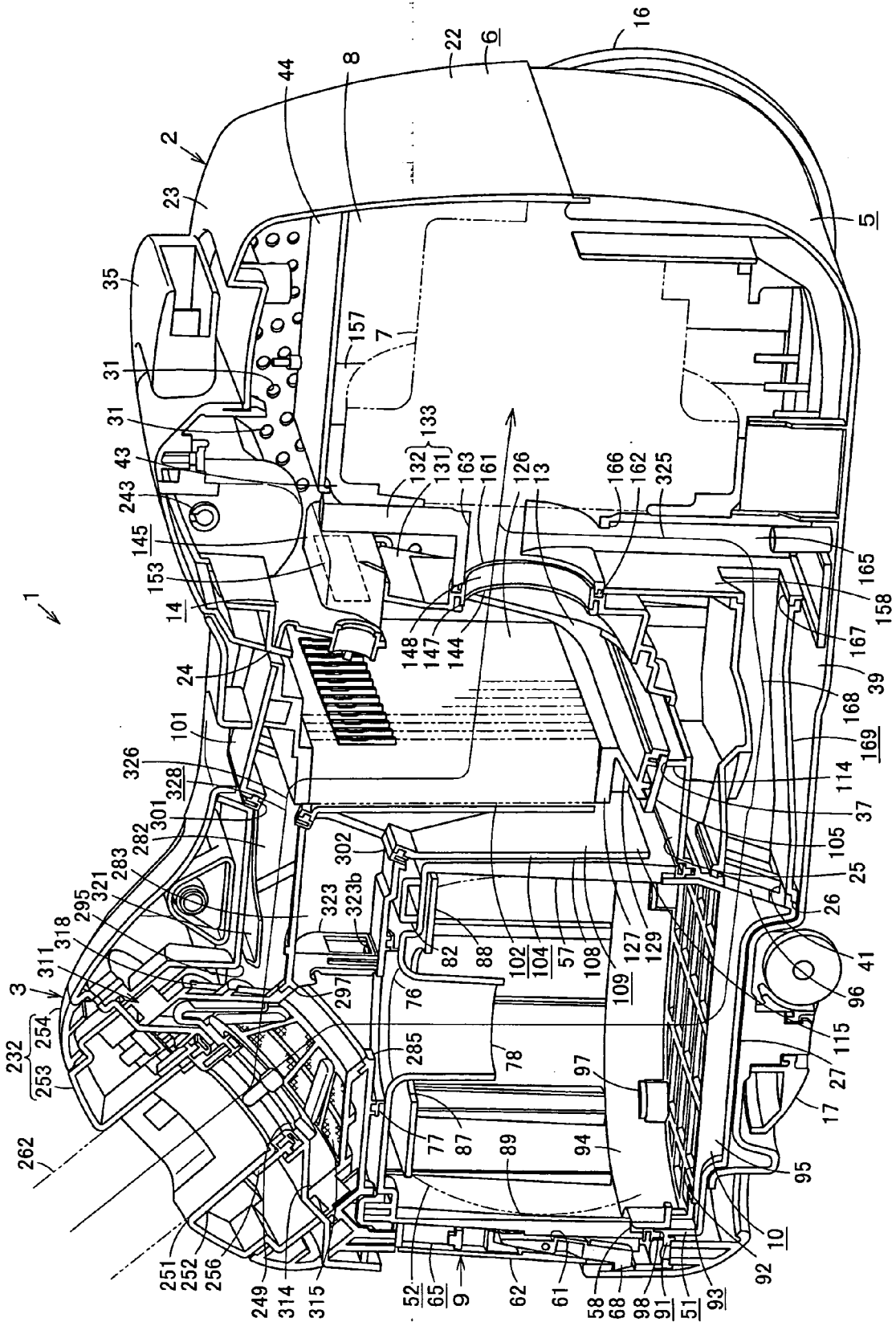


FIG. 3

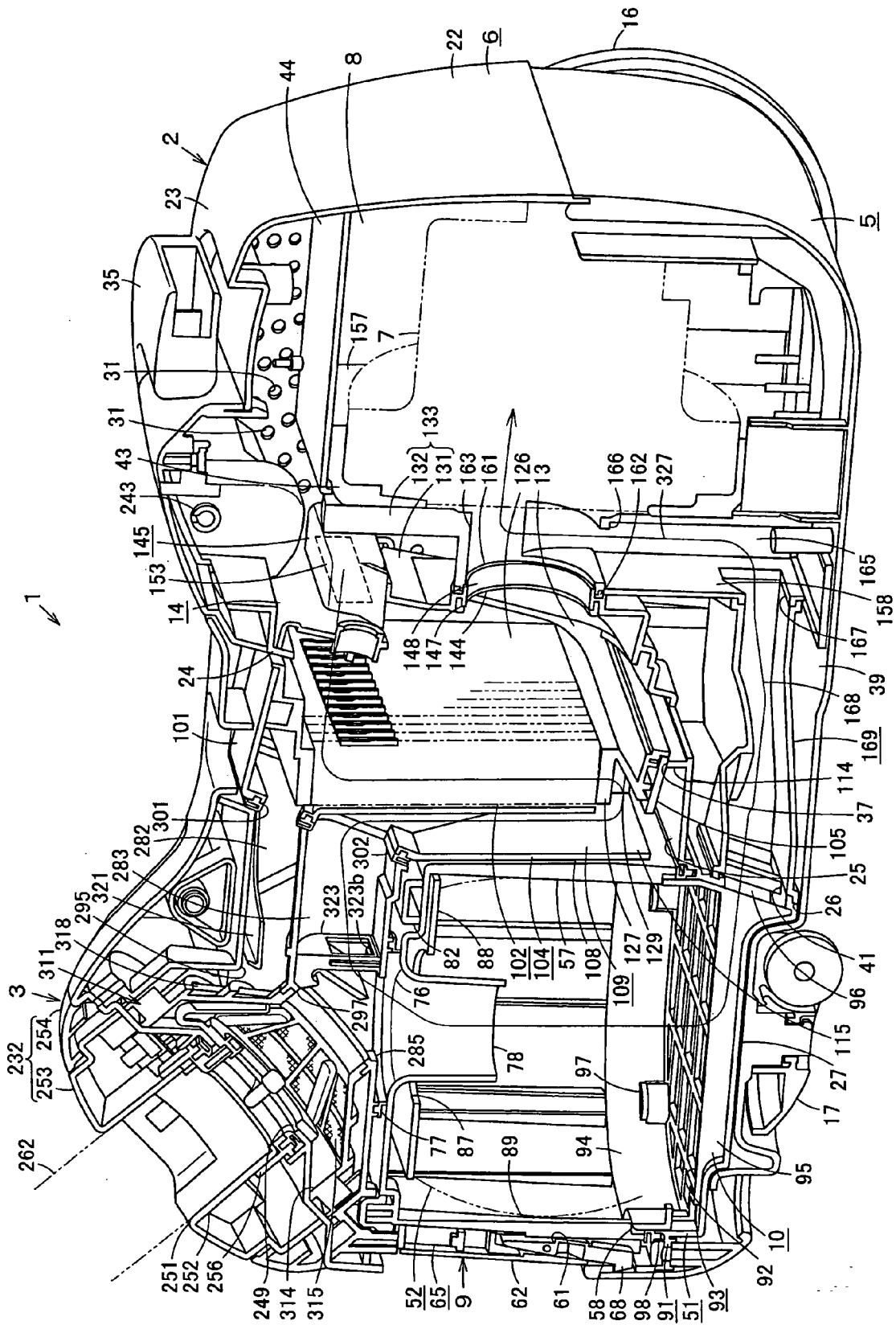


FIG. 4

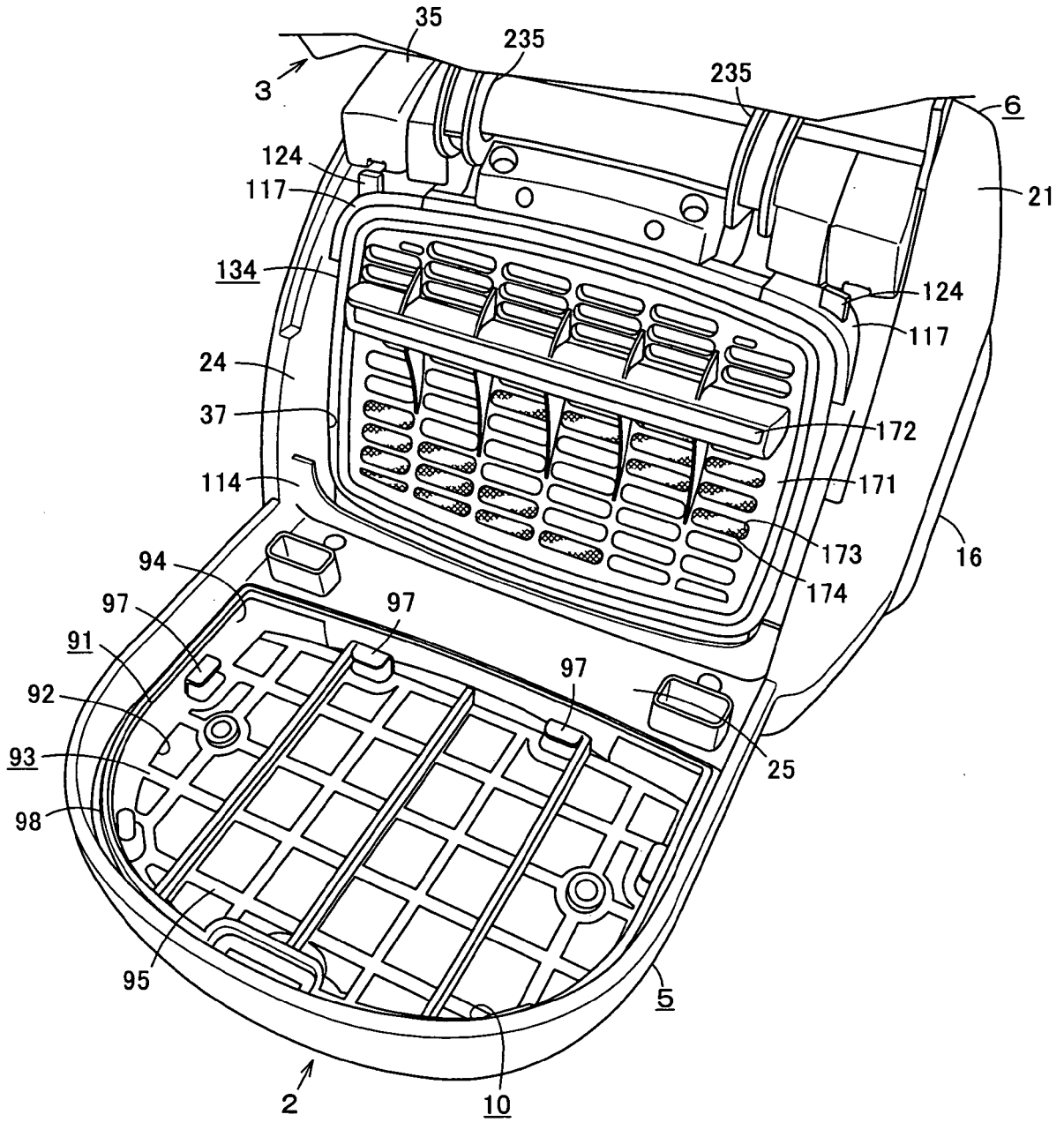


FIG. 5

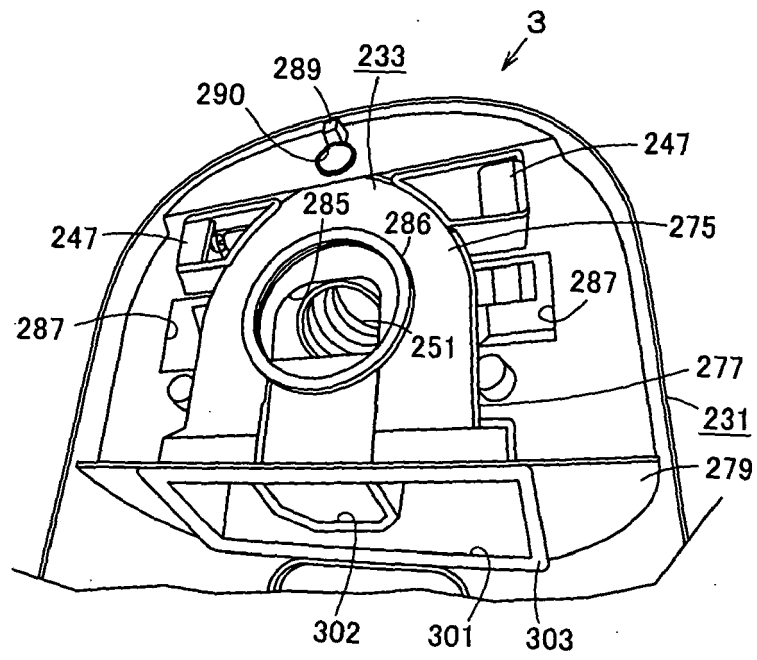


FIG. 6

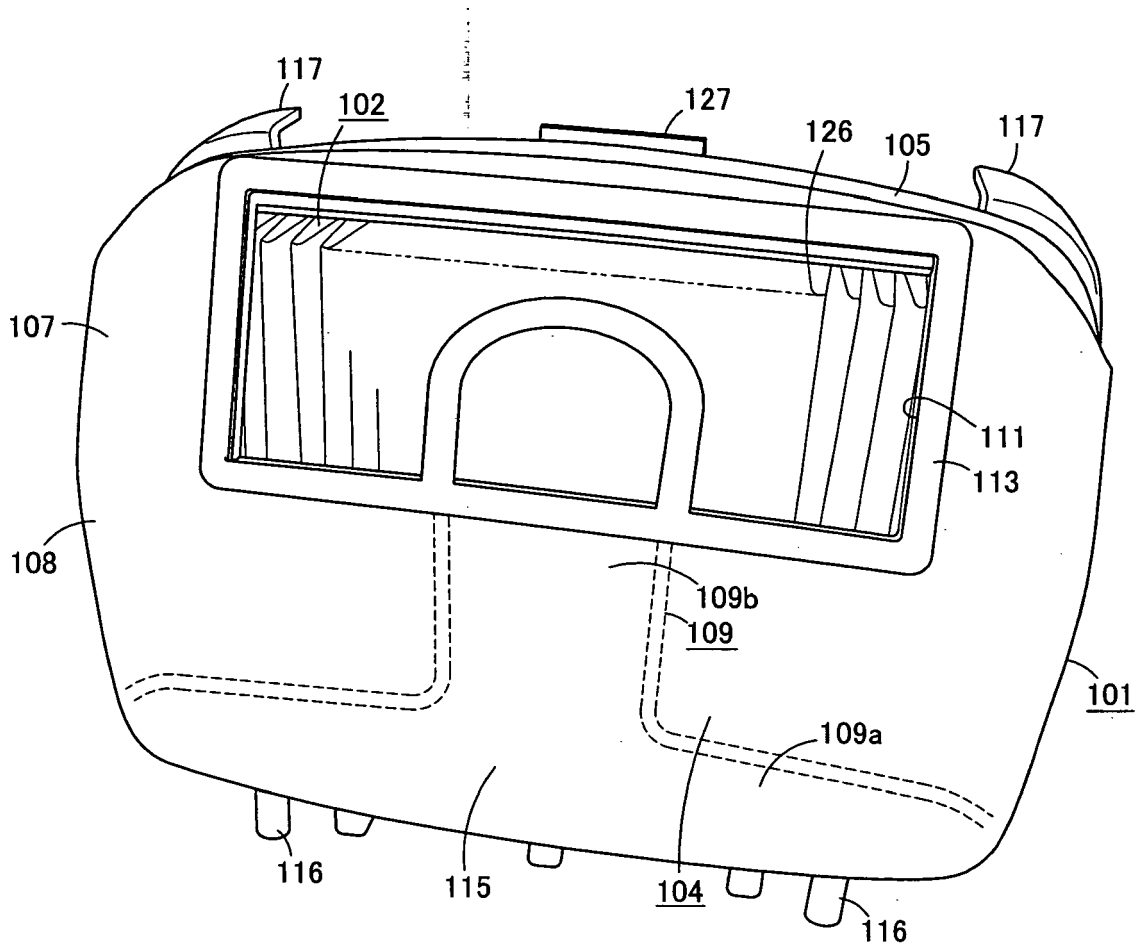


FIG. 7

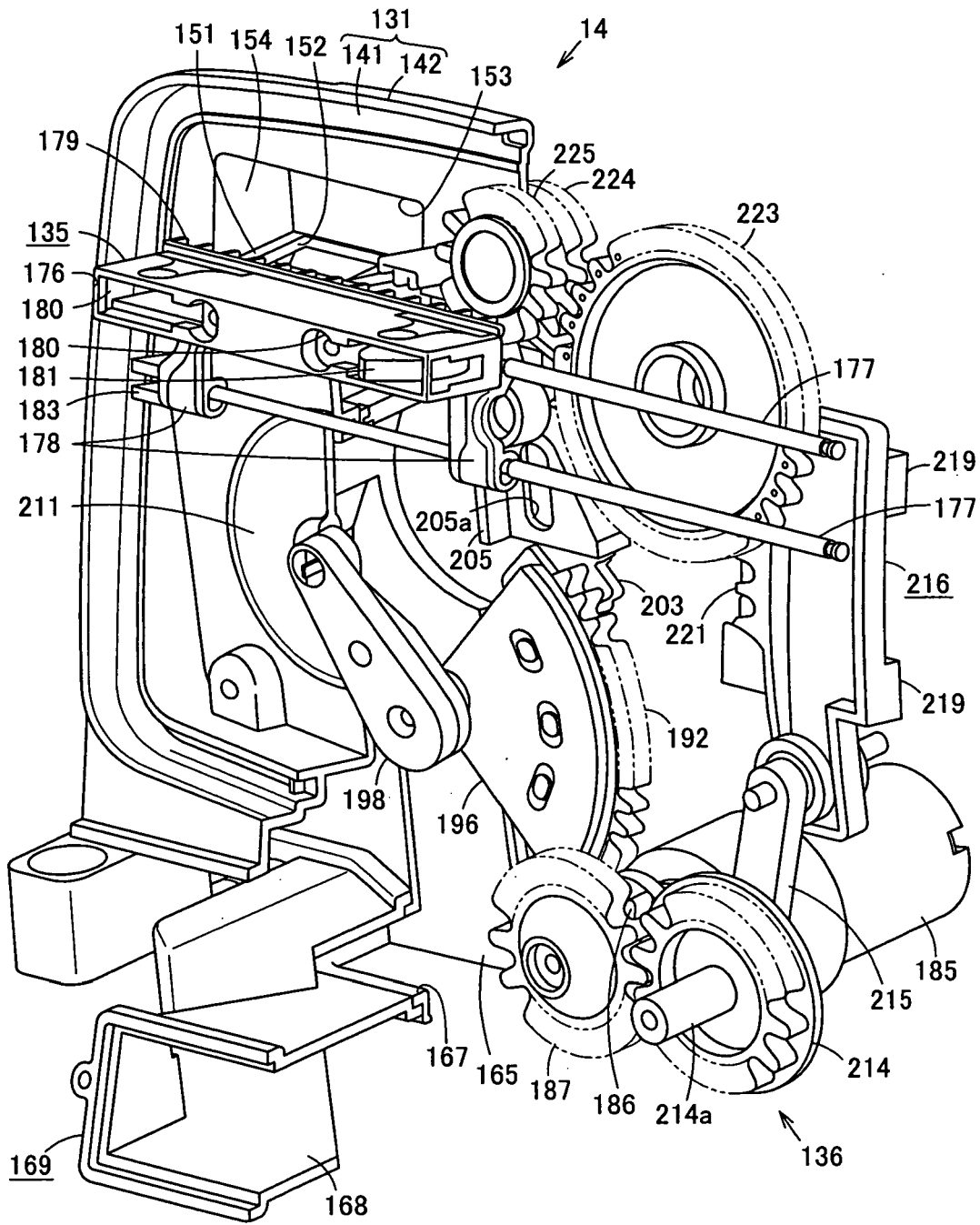


FIG. 8

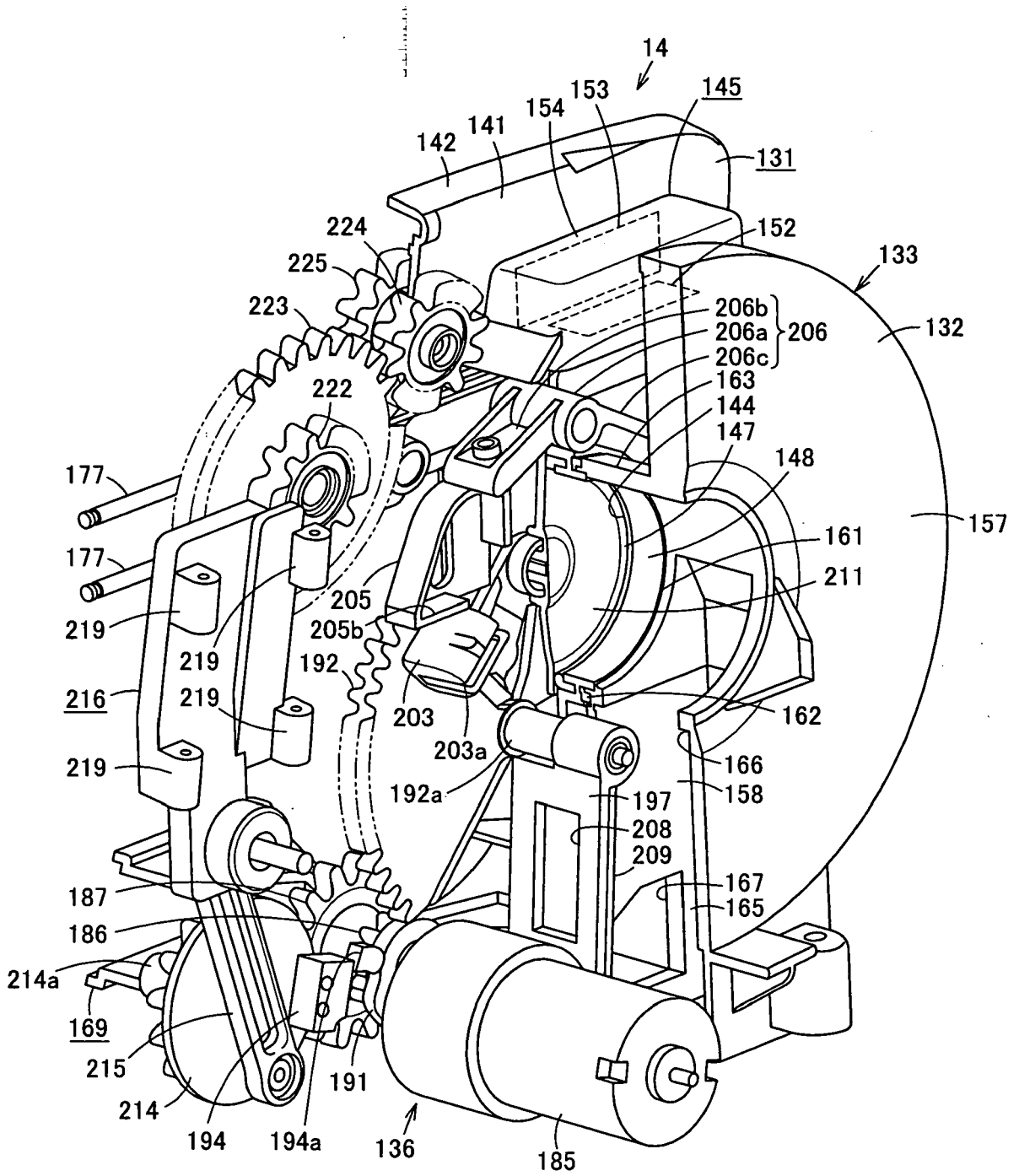


FIG. 9

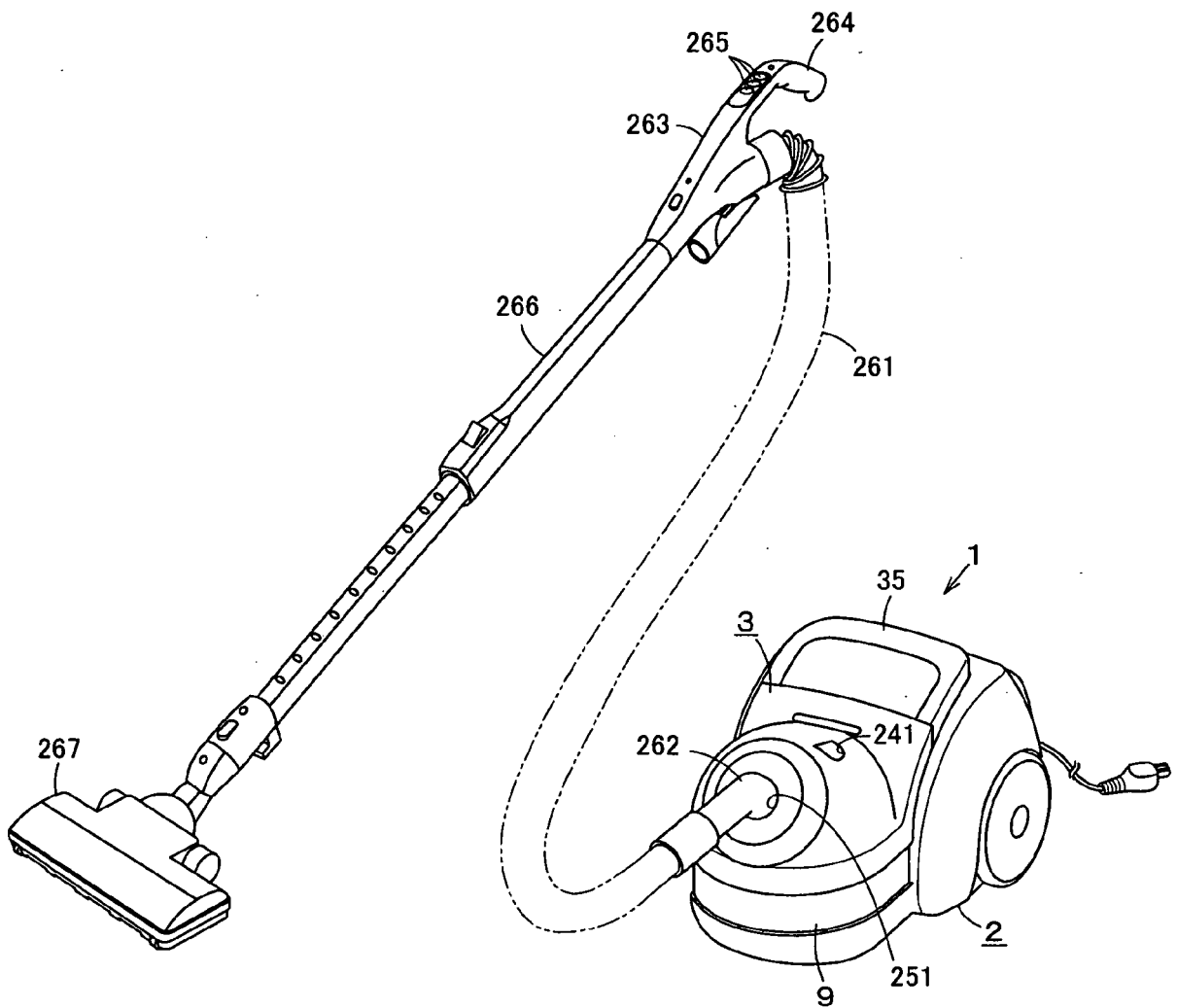


FIG. 10

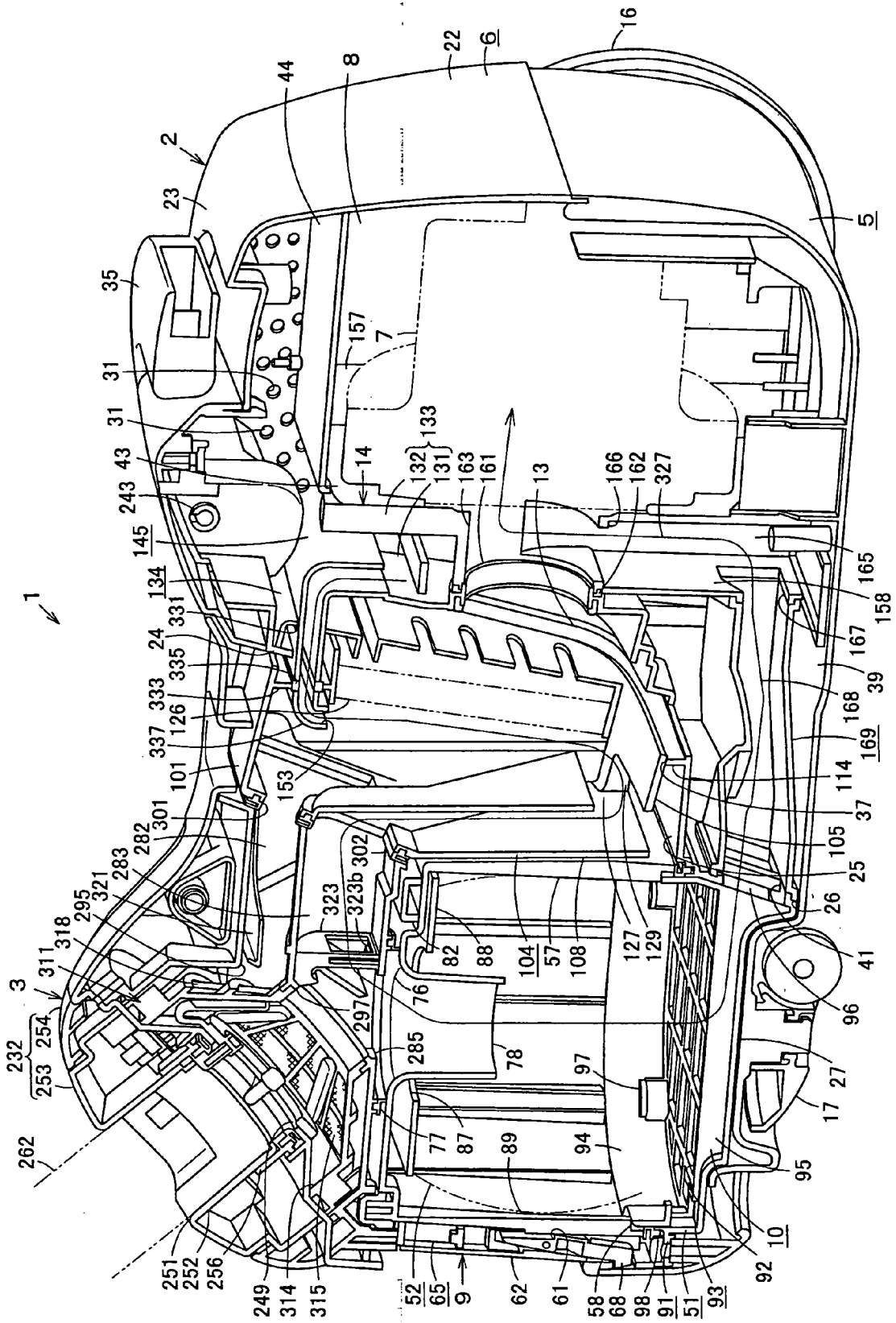


FIG. 11

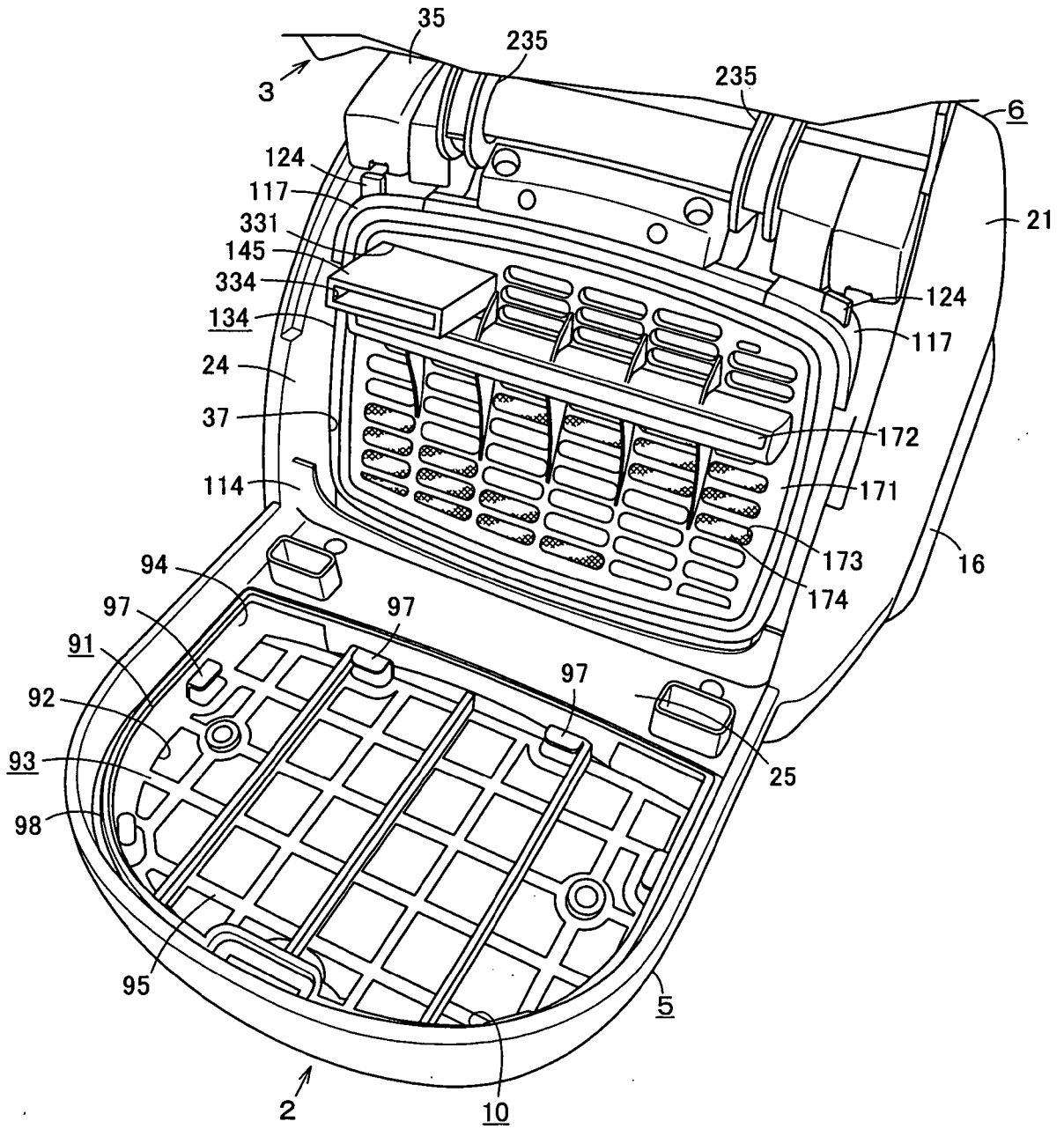


FIG. 12

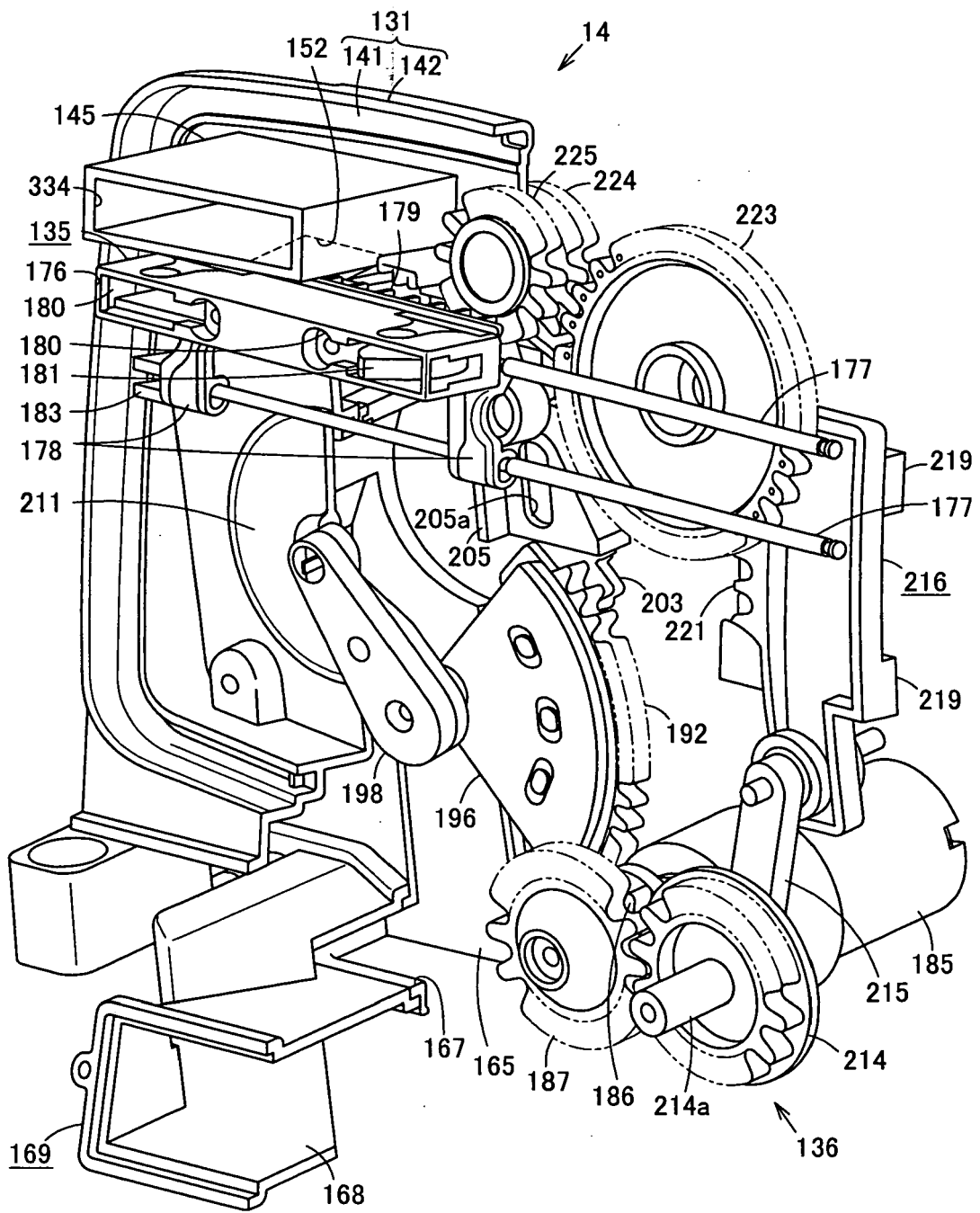


FIG. 13

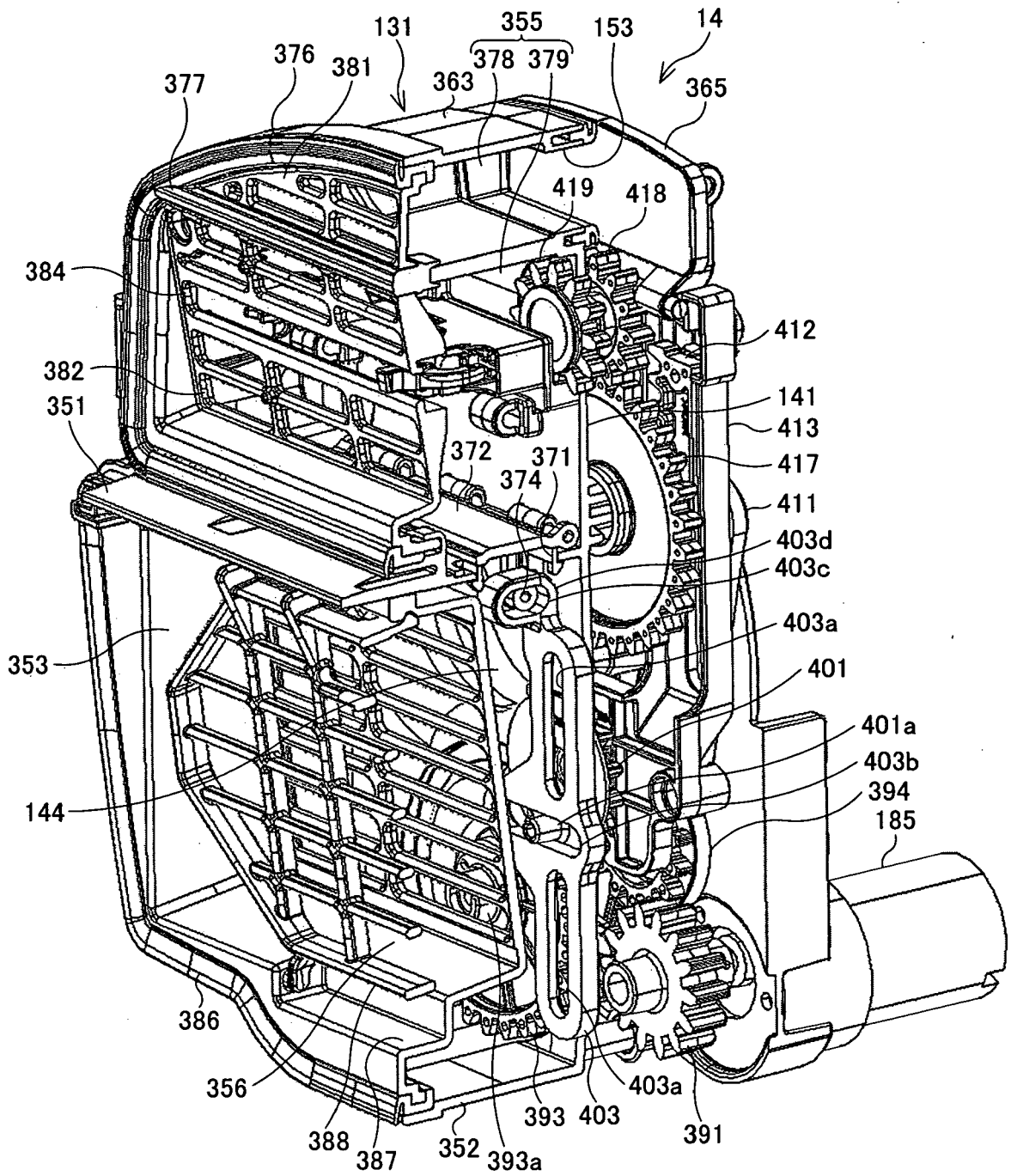


FIG. 15

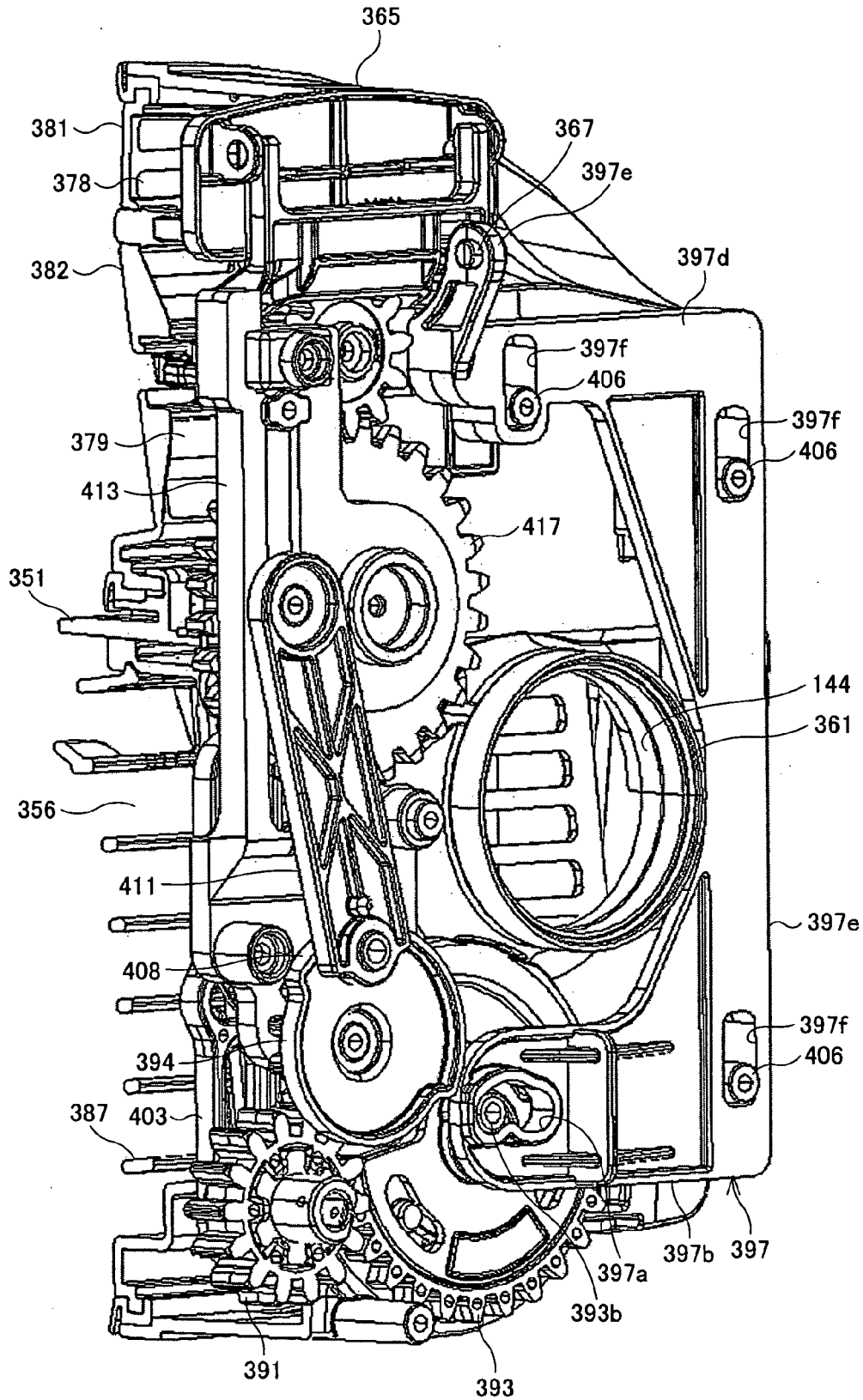


FIG. 16

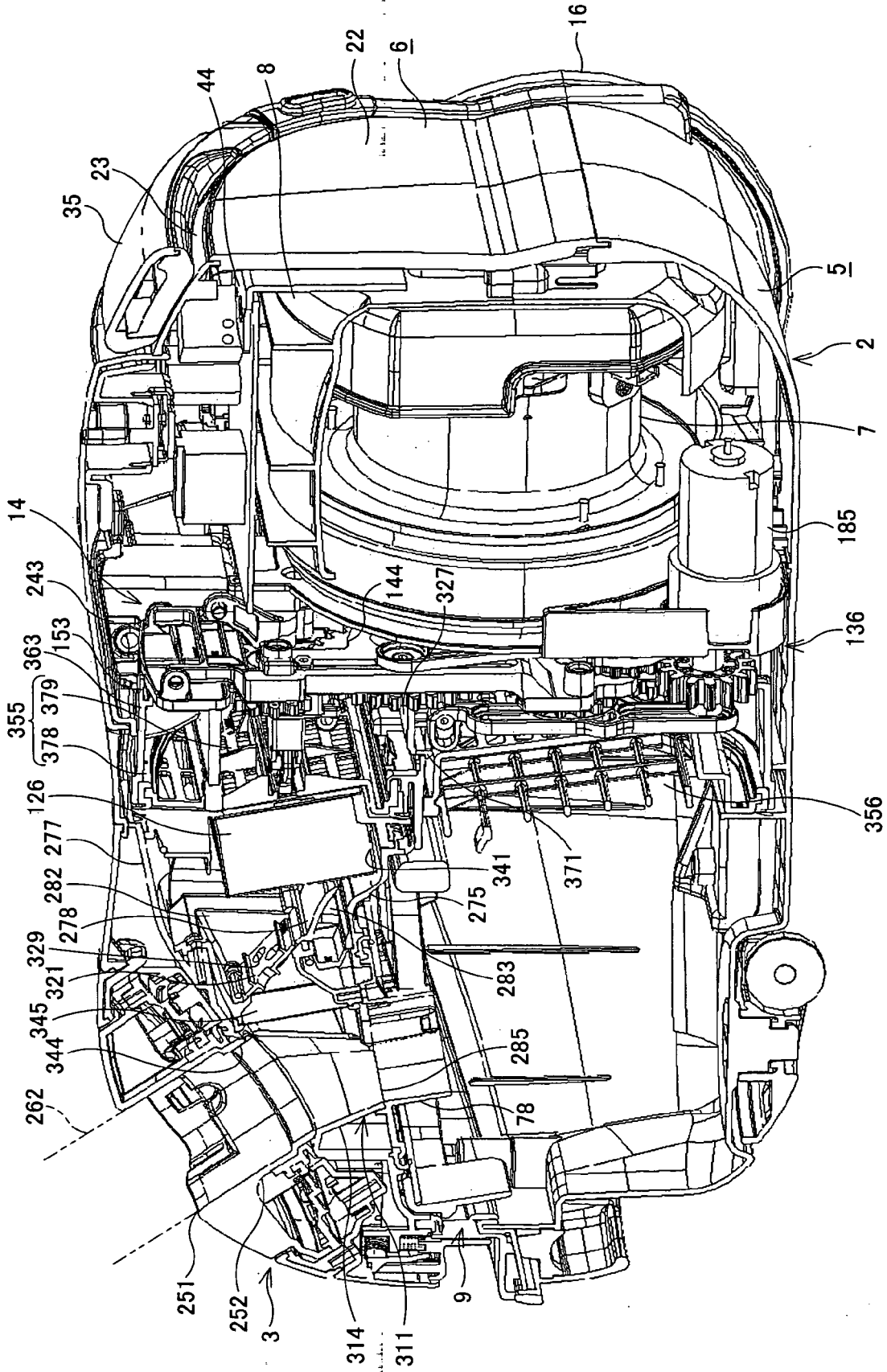


FIG. 17

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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