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(54) ELECTRIC VACUUM CLEANER

ELEKTRISCHER STAUBSAUGER

ASPIRATEUR ÉLECTRIQUE

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Description

TECHNICAL FIELD

[0001] The present invention relates to an electric vacuum cleaner including a centrifugally separating part which turns air containing dust sucked by driving of an electric blower to centrifugally separate and trap the dust.

BACKGROUND ART

[0002] Conventionally, an electric vacuum cleaner includes a main body case housing an electric blower, and a dust collecting device for trapping dust sucked by driving of the electric blower. Air containing dust is sucked into the dust collecting device by driving of the electric blower, and the air, from which the dust has been trapped by the dust collecting device, is exhausted to the outside of a cleaner main body. Recently, in such a dust collecting device, a centrifugally separating part has been used which turns air containing dust inside to centrifugally separate the dust.

[0003] In the case where, for example, the electric vacuum cleaner is not driven for a long time, undesirably in terms of hygiene, germs propagate or an exhaust odor is generated in an air passage including the dust collecting device. Therefore, an electric vacuum cleaner is desired which suppresses propagation of germs.

CITATION LIST

Patent Literature

[0004]

Patent Document 1: Japanese Laid-Open Patent Publication No. 2006-231030
Patent Document 2: Japanese Patent Publication No. 1-7774
Patent Document 3: Japanese Patent No. 4263013

SUMMARY OF INVENTION

Technical Problem

[0005] In a vacuum cleaner disclosed in Patent Document 1, the inside of a centrifugally separating part is sterilized by irradiating the centrifugally separating part for centrifugally separating coarse dust and fine dust in air containing dust with ultraviolet rays. However, in the case where such a centrifugally separating part is irradiated with ultraviolet rays, the ultraviolet rays are obstructed or diffused by coarse dust, thereby hardly obtaining a sufficient sterilization effect.

[0006] In an electric vacuum cleaner disclosed in Patent Document 2, with use of heat of air exhausted from an electric blower, the exhaust air is circulated to a suction side to perform sterilization.

[0007] However, in such a constitution, undesirably in terms of saving-energy and silence, not only does sterilization take time but the electric blower is required to be continuously driven until sterilization is finished. Specifically, for example, it is required for extermination of mites to heat the mites at a temperature of 50°C or higher for about 20 minutes, and disadvantageously, the temperature becomes close to the heat-resistant temperature of synthetic resin such as ABS of which a cleaner main body is made.

[0008] An electric vacuum cleaner disclosed in Patent Document 3 irradiates a photocatalyst arranged on a cleaner main body with ultraviolet rays to generate oxidation and reduction effect of the photocatalyst for sterilization.

[0009] However, in such a constitution, disadvantageously, sterilization takes several hours.

[0010] JP-2004-113469A discloses a vacuum cleaner with an electric fan for sucking the dust, a dust collection chamber for collecting the sucked dust, and a deodorizing and disinfecting device having at least an ozone generating means and placed inside the dust collection chamber.

[0011] JP-2011-177268A discloses a vacuum cleaner allowing a user to visually recognize the dust stored inside a dust collection cup from outside only when necessary.

[0012] It is an object of the present invention to provide an electric vacuum cleaner capable of effectively eliminating germs by ultraviolet rays.

[0013] It is a further object of the present invention to provide an electric vacuum cleaner enabling sterilization at low noise and in a short time.

Solution to Problem

[0014] An electric vacuum cleaner according to an embodiment has: a cleaner main body housing an electric blower; an air passage communicating with a suction side of the electric blower; an ultraviolet ray irradiation part which irradiates the inside of the air passage with ultraviolet rays for sterilization; a control unit which is provided on the cleaner main body to control operations of the electric blower and the ultraviolet ray irradiation part; and a setting unit capable of setting on/off of driving of the electric blower by operation. The control unit operates the ultraviolet ray irradiation part for a first predetermined time from timing when off of the electric blower is set by the setting unit in operation of the electric blower. The control unit varies the first predetermined time in accordance with operation time of the electric blower.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015]

Fig. 1 is a vertical cross sectional view showing a cleaner main body of an electric vacuum cleaner ac-

cording to a first embodiment.

Fig. 2 is a perspective view partially showing the cleaner main body of the same electric vacuum cleaner.

Fig. 3 is a plan view showing a centrifugally separating part positioned at a downstream side of the same electric vacuum cleaner.

Fig. 4 is a perspective view showing a front side of the centrifugally separating part positioned at the same downstream side.

Fig. 5 is a vertical cross sectional side view of the centrifugally separating part positioned at the same downstream side.

Fig. 6 is a vertical cross sectional front view of the centrifugally separating part positioned at the same downstream side.

Fig. 7 is a perspective view showing a state where the centrifugally separating part positioned at the downstream side is detached from the same cleaner main body.

Fig. 8 is a perspective view showing a state where a centrifugally separating part positioned at an upstream side is detached from the same cleaner main body.

Fig. 9 is a perspective view showing the same electric vacuum cleaner.

Fig. 10 is a graph indicating an example of a relationship between the irradiation distance of an ultraviolet ray and time taken for inactivation of germs.

Fig. 11 is a block diagram illustrating the internal structure of an electric vacuum cleaner according to a second embodiment.

Fig. 12 is a flowchart partially indicating control of the same electric vacuum cleaner.

Fig. 13 is a flowchart partially indicating control of an electric vacuum cleaner according to a third embodiment.

EMBODIMENTS

[0016] Hereinafter, a constitution of a first embodiment will be described with reference to the drawings.

[0017] In Fig. 9, the reference numeral 11 denotes a so-called canister type electric vacuum cleaner. The electric vacuum cleaner 11 has a tube part 12 as a sucked air passage body (air passage forming body) and a cleaner main body 13 detachably connected to the tube part 12.

[0018] The tube part 12 includes: a connection tube part 15 to be connected to the cleaner main body 13; a flexible hose body 16 communicating with a tip end side of the connection tube part 15; a hand operation part 17 provided on a tip end side of the hose body 16; an extension tube 18 detachably connected to a tip end side of the hand operation part 17; and a floor brush 19 as a suction port body selectively detachable from a tip end side of the extension tube 18 or the tip end side of the hose body 16.

[0019] A loop-shaped grip part 21 is projected to the hose body 16 side from the hand operation part 17, and a plurality of set buttons 22 which are setting units as an operation part for operation are provided on an upper part of the grip part 21.

[0020] As shown in Figs. 1, 2 and 7 to 9, the cleaner main body 13 includes a main body case 25 having large diametrical traveling wheels 23 at its both sides and a small diametrical turning wheel 24 at its lower part. A dust collecting unit 28 can be attached/detached to/from the main body case 25, the unit 28 including a first dust separating collecting part 26 which is a (first) centrifugally separating part as a dust collecting part, and a second dust separating collecting part 27 which is a (second) centrifugally separating part as a dust collecting device. That is, the dust collecting unit 28 includes the first dust separating collecting part 26 at its front stage and the second dust separating collecting part 27 at its rear stage and employs multi-stage construction. Moreover, although the dust collecting unit 28 of the present embodiment is constructed at two stages, it may be constructed at two or more stages. The cleaner main body 13 can travel (move) along a floor surface to be cleaned at least along the back and forth direction by the traveling wheels 23 and the turning wheel 24. Moreover, hereinafter, a vertical direction, a horizontal direction, etc., will be defined with reference to a traveling direction of the cleaner main body 13 (main body case 25).

[0021] The main body case 25 is molded of, for example, synthetic resin and has a main body part 32 housing an electric blower 31, and a projecting part 33 as a mounting part projected on a front part of the main body part 32. In the main body case 25, there are disposed: an upstream side duct part 38 as a (first) duct part positioned from the inside of the projecting part 33 to a front part of the inside of the main body part 32; and a downstream side duct part 39 as a (second) duct part positioned in the main body part 32. Additionally, in the main body case 25, a power supply chamber 40 is partitioned, and a diffusing chamber 41 as a diffusing part is partitioned at a rear part.

[0022] The electric blower 31 is, for example, a fan motor which rotationally drives a centrifugal fan by an electric motor to generate negative pressure for sucking air, substantially cylindrically provided, positioned in the downstream side duct part 39 and arranged in the main body part 32. On/off of operation or the like of the electric blower 31 is controlled, in accordance with setting operation of the set buttons 22, by a control unit (not shown) such as a microcomputer housed in the main body part 32. By the electric blower 31, an air passage W is formed in which the tube part 12, the first dust separating collecting part 26, the second dust separating collecting part 27 and the downstream side duct part 39 successively communicate with each other. An exhaust port (not shown) for exhausting sucked air sideward is provided on an outer circumferential surface of the electric blower 31.

[0023] An attachment recess part 44, to/from which the second dust separating collecting part 27 of the dust collecting unit 28 is attached/detached, is provided, facing the projecting part 33, on a front part of the main body part 32. The traveling wheels 23 are axially supported rotatably on both sides of the main body part 32.

[0024] One and the other front surface parts 48 and 49 are provided at both sides of the attachment recess part 44. An upper part of the attachment recess part 44 is covered with a cover part 56. A communication port 63, which is an upstream end of the downstream side duct part 39, is opened on an upper rear part of the attachment recess part 44. The communication port 63 is, for example, provided longitudinally in a lateral width direction, in a laterally long shape, and a communication port seal member 64 such as a rubber packing is arranged along a peripheral edge of the communication port 63. The communication port 63 is airtightly connected to a downstream end of the second dust separating collecting part 27 via the communication port seal member 64.

[0025] An upper side of the cover part 56 is convex and a cross section thereof is provided in an arc shape. An arrangement part 66 elongated along the back and forth direction is provided at, for example, the center of the cover part 56 in the lateral width direction. An ultraviolet lamp (ultraviolet ray emitting tube) 67 as an ultraviolet ray irradiation part which irradiates the second dust separating collecting part 27 with ultraviolet rays for sterilization at a predetermined timing is housed in the arrangement part 66. An ultraviolet ray radiated from the ultraviolet lamp 67 is sterilization light having a sterilization effect of destroying the DNA of germs, and, for example, a lighting state including lights-out is controlled by a control unit. A plurality of openings 68 are provided on a part, which faces a lower part, of the arrangement part 66 in the back and forth direction, and ultraviolet rays are radiated from the ultraviolet lamp 67 to an upper part of the seconddust separating collecting part 27 via the openings 68.

[0026] A communication opening 103 which is a downstream end of the upstream side duct part 38 is opened on an upper side of the other front surface part 49. A communication opening seal member 104 such as a rubber packing is arranged along a peripheral edge of the communication opening 103. The communication opening 103 is airtightly connected to an upstream end of the first dust separating collecting part 26 via the communication opening seal member 104.

[0027] The projecting part 33 is a part supporting the first dust separating collecting part 26 from a lower side. A main body suction port 107, which is an upstream end of the upstream side duct part 38 and to which the connection tube part 15 of the tube part 12 is connected, is opened on a front part of the projecting part 33. The turning wheel 24 is turnably pivotally supported on a lower part of the projecting part 33.

[0028] A handle 108 for lifting up the cleaner main body 13 is attached to an upper part of the main body case 25 behind the cover part 56. A plurality of exhaust holes 109, which communicate with the diffusing chamber 41 to exhaust air from the electric blower 31 to the outside of the main body case 25, are opened on substantially the entire surface of the rear part of the main body case 25.

[0029] The downstream side duct part 39 includes: a communication air passage part 115 which vertically extends in front of the diffusing chamber 41 and behind the second dust separating collecting part 27 (attachment recess part 44), in the vicinity of the rear part of the main body case 25, and of which an upper end as an upstream end is the communication port 63; an electric blower chamber part (not shown) which communicates with a front part of one side of the communication air passage part 115 and houses the electric blower 31 therein; and a connection air passage part 117 as an air passage part which extends, in the lateral width direction, from a side surface of a front part of the electric blower chamber part to the power supply chamber 40 arranged on a side, which is opposite from the electric blower chamber part, of the cleaner main body 13 (main body case 25). A communication air passage, in which a rear upper side, a lower front part and the front other side (power supply chamber 40) communicate with each other, is partitioned in the downstream side duct part 39. A filter 119 is housed in the connection air passage part 117.

[0030] A power supply part 121 for supplying power to the electric blower 31 is housed in the power supply chamber 40. In the present embodiment, the power supply part 121 is, for example, a cord reel device, a tip end side thereof is led out to the outside of the main body case 25, a plug part 121a provided at the tip end part can be connected to a commercial AC power supply (not shown), and the power supply part 121 can be wound in the main body case 25 by operation of a winding button (not shown) provided on an upper part of the main body part 32 of the main body case 25.

[0031] On the other hand, the first dust separating collecting part 26 constituting part (upstream side) of the dust collecting unit 28 is a dust collecting cup which turns air containing dust sucked by driving of the electric blower 31 to centrifugally separate (cyclone-separating) and trap relatively large coarse dust such as fiber dust, and is positioned at the most upstream of the dust collecting unit 28. The first dust separating collecting part 26 has a case body 125, which is a cup part having a shape of a cylinder with a bottom, and a cylindrical turning part 126 housed in the case body 125, and is formed in a unit form. The first dust separating collecting part 26 can be attached/detached to/from the main body case 25 by being turned around its front lower part (fulcrum) in a state of being mounted on the projecting part 33, is supported in a state where the part 26 is attached to the main body case 25 and an upper part of the part 26 is tilted rearward, and covers a front part of the attachment recess part 44. Moreover, the first dust separating collecting part 26 is detachably locked to the main body case 25 by a first attaching/detaching mechanism (not shown).

[0032] The case body 125 includes: a cylindrical case main body 131 as a dust collecting part main body; a lid body 132 turnably pivotally supported on the case main body 131; and an upper lid part 133 attached to an upper part of the case main body 131. An inlet port 135 which is airtightly connected to the communication opening 103 is opened on one side of a rear part of the case main body 131, and air containing dust flows into the case body 125 along a tangential direction via the inlet port 135.

[0033] The case main body 131 is a part which turns air flowing in from the inlet port 135 and accumulates dust (coarse dust) separated by the turning therein, and is formed of material such as, for example, synthetic resin having transmittance so that the inside (dust) can be visually recognized. Additionally, a lower end of the case main body 131 serves as a discard opening 137 for discarding dust accumulated in the case main body 131 outward.

[0034] The lid body 132 is opened/closed by turning the discard opening 137 of the case main body 131, and integrally has a disk-shaped lid body main body 141 having a diametrical size slightly larger than that of the case main body 131 and a seal member 142 arranged on an upper side of the lid body main body 141, the case main body 131 side.

[0035] The seal member 142 is arranged circularly on the lid body main body 141 so as to be brought into pressure contact with a lower end of the discard opening 137 with the lid body 132 closed.

[0036] The upper lid part 133 covers an upper part of the case body 125 (case main body 131), integrally includes a knob part 152 as a grip part for dust collecting parts, and is airtightly attached to the case main body 131.

[0037] A connection air passage 153 for making the case main body 131 communicate with the second dust separating collecting part 27 is partitioned in the upper lid part 133. An exhaust port 154 constituting a downstream end of the communication air passage 153 is provided on a rear part of the upper lid part 133 so as to be positioned at a rear upper side of the case body 125. The exhaust port 154 exhausts air, which has passed through the case body 125 of the first dust separating collecting part 26, to the second dust separating collecting part 27 side, that is, a downstream side, and an exhaust port seal member 155 such as a rubber packing is attached along a peripheral edge of the exhaust port 154.

[0038] The turning part 126 is arranged in the case body 125 (case main body 131) concentrically (coaxially) with the case body 125 (case main body 131). The turning part 126 includes a cylindrical turning part main body 161 and a cylindrical compression part 162 as an enlarged part provided integrally with a lower end side, which is one end side, of the turning part main body 161.

[0039] An upper part of the turning part main body 161 communicates with the connection air passage 153. A plurality of ventilation opening parts 166 communicating with the inside are opened on a circumferential surface of the turning part main body 161, and a mesh-shaped dust collecting filter 167 is attached to the turning part main body 161 so as to cover the ventilation opening parts 166. In the turning part main body 161, air, from which dust (coarse dust) having a relatively large mass has been separated by centrifugal force, passes through the ventilation opening parts 166 (dust collecting filter 167) from the outside to the inside to flow to the communication air passage 153.

[0040] A lower part, which faces the lid body 132, of the compression part 162 is opened, has a diametrical size larger than that of the turning part main body 161 and continues to the turning part main body 161 in a stepped shape. At the center of the compression part 162, a communication opening part 168 communicating with a lower end of the turning part main body 161 is provided, and a mesh-shaped compression filter 169 covering the communication opening part 168 is attached. In the compression part 162, part of air turning on an outer circumference of the turning part main body 161 passes through the communication opening part 168 into the turning part main body 161 from the lower side so that trapped dust (coarse dust) is pushed and compressed against the compression filter 169.

[0041] As shown in Figs. 1 to 9, the second dust separating collecting part 27 constituting the other part (downstream side) of the dust collecting unit 28 centrifugally separates dust which is, in air containing dust sucked by driving of the electric blower 31, a relatively small dust (fine dust or minute dust) such as a powder dust which could not be separated by the first dust separating collecting part 26, that is, dust finer than coarse dust separated by the first dust separating collecting part 26, and is positioned at the most downstream of the dust collecting unit 28 in the present embodiment. The second dust separating collecting part 27 is molded of, for example, synthetic resin such as ABS, includes a dust separating collecting part main body 171 which is a second centrifugally separating part main body as a dust collecting device main body and a dust collecting case 172 which is a fine dust accumulating part as a dust accumulating part not integral with the dust separating collecting part main body 171 and positioned at a lower side of the dust separating collecting part main body 171, the dust separating collecting part main body 171 and the dust collecting case 172 are integrally locked in a unit form by clamps 173 and 173 as a holding member, and the second dust separating collecting part 27 can be attached/detached to/from the attachment recess part 44 of the main body case 25. The second dust separating collecting part 27 is detachably locked to the main body case 25 by a second attaching/detaching mechanism (not shown). Accordingly, the second dust separating collecting part 27 is movable in relation to the ultraviolet lamp 67.

[0042] The dust separating collecting part main body 171 is a part housed in an upper side of the attachment

recess part 44 with the second dust separating collecting part 27 attached to (the attachment recess part 44 of) the main body case 25, and includes a separating part 175 and a lid part 176 for opening/closing an upper side, opposite from the dust collecting case 172, of the separating part 175. An inlet air passage part 177, into which air containing dust which has passed through the first dust separating collecting part 26 and the communication air passage 153 flows from a front end side as one end side, is partitioned between the separating part 175 and the lid part 176, and an outlet air passage part 178, through which air exhausted from the separating part 175 flows out from a rear end side as the other end side to the communication port 63 (a suction side of the electric blower 31), is partitioned in the lid part 176.

[0043] The separating part 175 turns air containing dust, which is sucked to the inside through the first dust separating collecting part 26 by driving of the electric blower 31, to centrifugally separate the dust, and integrally has: a plurality of separating chambers 181; a projected outer frame part 182 surrounding an upper side, which is one direction side, of the separating chambers 181; and a connection part 183 positioned at a lower side, which is the other direction side, of the separating chambers 181.

[0044] The separating chamber 181 is provided in the shape of a long cylinder gradually reduced in diameter from its upper side to its lower side, that is, from its upstream side to its downstream side, and a plurality of separating chamber lines L, each of which has, for example, four separating chambers, are arranged on an extension line in a direction that air containing dust flows into the inlet air passage part 177, that is, along the back and forth direction. In the present embodiment, for example, a center line L1 positioned at the center, and a left line L2 and a right line L3 positioned at both left and right sides of the center line L1, are set in the separating chamber line L. That is, in the present embodiment, the center line L1 is a separating chamber line positioned at the center side, and the left line L2 and right line L3 are separating chamber lines positioned at both the sides. Accordingly, the separating chambers 181 are arranged in the shape of a quadrilateral (matrix) in a plan view. Each separating chamber 181 of the left line L2 and the right line L3 is tilted so that the lower side of the separating chamber 181 approaches the separating chamber 181 of the center line L1.

[0045] Each separating chamber 181 includes an attachable/detachable rectifying part 185 on its upper part, and turns flowing-in air containing dust along its inner circumferential surface via the rectifying part 185. Additionally, the maximum diameter size of the inner circumferential surface of each separating chamber 181 is at least smaller than that of the case body 125 (case main body 131) of the first dust separating collecting part 26, and is set to, for example, not more than half of the diameter size of the inner circumferential surface of the case body 125 (case main body 131).

[0046] Each rectifying part 185 integrally includes: a spiral rectification passage part 188 communicating with the inlet air passage part 177 via an introduction opening (not shown) ; and a ventilation cylinder part 189 which is an exhaust tube part as a ventilating part positioned along a central axis of the rectification passage part 188.

[0047] Each rectification passage part 188 is provided along a periphery of the ventilation cylinder part 189 and makes air containing dust flow from the introduction opening into the separating chamber 181 along a tangential direction of the separating chamber 181.

[0048] Each ventilation cylinder part 189 exhausts, flows out, air, form which dust (fine dust or minute dust) is eliminated by the separating chamber 181, to the outlet air passage part 178, and is cylindrically provided and arranged coaxially with an upper end side of the separating chamber 181. A lower end, which is an upstream end, of the ventilation cylinder part 189 communicates with the inside of the separating chamber 181, and an upper end, which is a downstream end, thereof is airtightly connected to the outlet air passage part 178.

[0049] The outer frame part 182 is formed in the shape of a quadrilateral in a plan view, and in the shape of a box surrounding, in a manner of framing, the outside of the separating chambers 181 as a whole. That is, the outer frame part 182 includes: a bottom part 182a which continues to an outer circumferential surface of the separating chamber 181 and to which the rectifying part 185 is attached; a front surface 182b which is an upstream side surface erected from the bottom part 182a; both side surfaces 182c on which the clamps 173 are turnably pivotally supported; and a rear surface 182d which is a downstream side surface, and an upper side of the outer frame part 182 is opened, and closed by the lid part 176. An inlet opening part 182e, which is an upstream end of the inlet air passage part 177 and airtightly connected to the downstream end of the connection air passage 153 of the first dust separating collecting part 26, is opened on the front face 182b. Thus, the inlet air passage part 177 surrounds the outside of the upper sides of all of the separating chambers 181 as a whole and is provided longitudinally along the back and forth direction.

[0050] The connection part 183 is a part serving as a lid of the dust collecting case 172, communicates with lower ends of all of the separating chambers 181 and is provided longitudinally in the back and forth direction.

[0051] The lid part 176 is detachably locked to the separating part 175 by an upper side of each clamp 173, and opens/closes the upper side of the separating part 175 by being detached/attached from/to the separating part 175. The lid part 176 includes a covered part 192 partitioning an upper side of the inlet air passage part 177 and a lid part main body 193 covering an upper side (outside) of the covered part 192. The covered part 192 and the lid part main body 193 are vertically airtightly connected to each other so that the outlet air passage part 178 is partitioned between the covered part 192 and the lid part main body 193. An outlet opening part 194, which

is a downstream end of the outlet air passage part 178, is opened between rear parts of the covered part 192 and the lid part main body 193. A window part 195 as a permeable part, through which ultraviolet rays radiated from the ultraviolet lamp 67 penetrate to be guided downward, that is, to the outlet air passage part 178, each separating chamber 181, dust collecting case 172, etc. , is opened longitudinally along the back and forth direction at the center of a lateral width direction of the lid part main body 193. The window part 195 is covered with and airtightly closed by a permeable member 195a such as fluorine resin or quartz glass through which an ultraviolet ray is permeable.

[0052] A plurality of circular connection openings 192a, which is airtightly connected to an upper end side of the ventilation cylinder part 189 of each rectifying part 185 positioned at the downstream side of the separating part 175, the downstream side of each separating chamber 181, and makes each separating chamber 181 and the outlet air passage part 178 communicate with each other, is opened on the covered part 192. Accordingly, the downstream sides of all of the separating chambers 181 communicate, in parallel with each other, with the outlet air passage part 178. The connection openings 192a are provided in accordance with the number of separating chambers 181. That is, in the present embodiment, 4 connection openings 192a are arranged in the back and forth direction on each of 3 lines in the lateral width direction, and a total of 12 openings 192a are provided.

[0053] The window part 195 is positioned at an uppermost part of the second dust separating collecting part 27, faces each ventilation cylinder part 189 (connection opening 192a) of the center line L1, and faces a lower side of the arrangement part 66, that is, a lower side of the ultraviolet lamp 67, with the second dust separating collecting part 27 attached to (the attachment recess part 44 of) the main body case 25. Accordingly, each ventilation cylinder part 189 (connection opening 192a) of the center line L1 faces the ultraviolet lamp 67 with the second dust separating collecting part 27 attached to (the attachment recess part 44 of) the main body case 25, and ultraviolet rays radiated from the ultraviolet lamp 67 are linearly guided to the dust collecting case 172, which is positioned directly under the center line L1, via the window part 195, each ventilation cylinder part 189 (connection opening 192a) of the center line L1 and the separating chambers 181 of the center line L1.

[0054] The outlet air passage part 178 is provided longitudinally in the back and forth direction along the upper side of the inlet air passage part 177. Accordingly, the outlet air passage part 178 and the inlet air passage part 117 are provided at two (upper and lower) layers. The outlet air passage part 178 is airtightly connected to the communication port 63, with the second dust separating collecting part 27 attached to (the attachment recess part 44 of) the main body case 25, and thus communicates with the suction side of the electric blower 31.

[0055] On the other hand, the dust collecting case 172 houses dust (fine dust) separated by the dust separating collecting part main body 171, and integrally includes a dust collecting case main body 201 as a dust accumulating part main body provided longitudinally along the back and forth direction, and a fitting part 202 continuing to an upper side of the dust collecting case main body 201. A receiving part 203 projecting in a stepped shape is provided at a connection part of the dust collecting case main body 201 and the fitting part 202.

[0056] The dust collecting case main body 201 is housed in a lower side of the attachment recess part 44 with the second dust separating collecting part 27 attached to (the attachment recess part 44 of) the main body case 25, has an opened upper side and is openably covered with the connection part 183 of the dust separating collecting part main body 171. A plurality of plate-shaped partitioning parts 201a, each extending along the lateral width direction, are provided in the dust collecting case main body 201 in the back and forth direction to partition the inside of the dust collecting case main body 201 into a plurality of accumulating parts 201b in the back and forth direction. The partitioning parts 201a are airtightly connected to a lower end of the connection part 183 so that each accumulating part 201b communicates with the separating chambers 181 adjacent in the lateral width direction. The accumulating part 201b is positioned at the lower end side of the separating chamber 181 of the center line L1, in other words, a side, which is opposite from the rectifying part 185 (introduction opening), of the separating chamber 181, and, in the present embodiment, directly under the separating chamber 181 of the center line L1, that is, on an extension line of a central axis of the ventilation cylinder part 189 of the separating chamber 181 of the center line L1. Accordingly, the dust collecting case main body 201 is positioned at a side opposite from the window part 195 (ultraviolet lamp 67) via the separating chambers 181.

[0057] The lower end of the connection part 183 is supported by and airtightly connected to the receiving part 203.

[0058] Next, operations of the first embodiment will be described.

[0059] In the case of cleaning, the first dust separating collecting part 26 and the second dust separating collecting part 27 are attached to the main body case 25 of the cleaner main body 13 in advance.

[0060] In the case of attaching the second dust separating collecting part 27, the second dust separating collecting part 27 is inserted and pushed into the attachment recess part 44 from a front surface of the main body part 32 and fixed to the main body case 25 by the second attaching/detaching mechanism. In this state, an edge, which is the downstream end of the outlet air passage part 178, of the outlet opening part 194, is brought into pressure contact with the communication port seal member 64 and airtightly connected to the communication port 63, and the window part 195 (permeable member 195a) approaches and faces the ultraviolet lamp 67 via a slight

gap.

[0061] In the case of attaching the first dust separating collecting part 26, a front lower part of the lid body 132 is mounted on the projecting part 33 with the knob part 152 gripped, and the part 26 is turned rearward around the front lower part. Then, the first dust separating collecting part 26 is fixed to the main body case 25 by the first attaching/detaching mechanism while being positioned in the lateral width direction with respect to the main body case 25. In this state, an edge of the inlet port 135 of the first dust separating collecting part 26 is brought into pressure contact with the communication opening seal member 104 and airtightly connected to the communication opening 103, the exhaust port seal member 155 of the exhaust port 154 is brought into pressure contact with an edge of the inlet opening part 182e of the second dust separating collecting part 27, and the exhaust port 154 and the inlet opening part 182e are airtightly connected to each other. Additionally, a rear end side of the knob part 152 of the first dust separating collecting part 26 is connected to a front end side of the arrangement part 66 of the main body case 25.

[0062] Accordingly, the tube part 12 and the suction side of the electric blower 31 are airtightly connected to each other, via the first dust separating collecting part 26 and the second dust separating collecting part 27, to form the air passage W.

[0063] A user, in a state where power can be supplied by the power supply part 121, grips the grip part 21 to operate a desired set button 22, and thus, the control unit phase-angle controls the electric blower 31 to drive the electric blower 31 in an operation mode set by the operation of the set button 22.

[0064] Negative pressure generated by driving of the electric blower 31 acts on the tube part 12 via the communication air passage part 115 of the downstream side duct part 39, the communication port 63, the second dust separating collecting part 27, the first dust separating collecting part 26, the communication opening 103, the upstream side duct part 38 and the main body suction port 107. In the tube part 12, negative pressure acts on the hose body 16, the extension tube 18 and the floor brush 19, and dust is sucked, together with air, from a tip end of the floor brush 19 or the like mounted on a surface to be cleaned.

[0065] Air containing dust flows into the case body 125 of the first dust separating collecting part 26 via the floor brush 19, the extension tube 18, the hose body 16, the main body suction port 107, the communication opening 103 of the upstream side duct part 38 and the inlet port 135. Air containing dust flowing in through the inlet port 135 circumferentially turns between the case body 125 (case main body 131) and the turning part main body 161 of the turning part 126, and coarse dust is centrifugally separated and gravitationally drops downward to be trapped at a lower part of the case body 125 (case main body 131) of the first dust separating collecting part 26.

[0066] Air containing dust turning in the first dust separating collecting part 26 flows from the ventilation opening part 166 into the turning part main body 161 via the dust collecting filter 167. When the air containing dust passes through the dust collecting filter 167, dust finer than coarse dust in the air is trapped by the dust collecting filter 167. Additionally, part of air containing dust turning in the first dust separating collecting part 26 flows to the compression part 162 side and flows from the communication opening part 168 into the turning part main body 161 via the compression filter 169. When the air containing dust passes through the compression filter 169, dust finer than coarse dust in the air is trapped by the compression filter 169, and dust trapped in the case body 125 (case main body 131) is pressed and compressed against the compression filter 169.

[0067] Air containing dust (fine dust), which has passed through the turning part main body 161, passes through the connection air passage 153, is exhausted from the exhaust port 154, flows from the inlet opening part 182e into the inlet air passage part 177, branches and flows into the rectification passage part 188 of each rectifying part 185 of the second dust separating collecting part 27 from the inlet opening, and flows into each separating chamber 181 while being rectified by the rectification passage part 188.

[0068] Air containing dust flowing in the separating chamber 181 circumferentially turns, along the inner circumferential surface of the separating chamber 181, at a flow rate faster than that of turning in the case body 125 of the first dust separating collecting part 26. Fine dust (minute dust) is centrifugally separated, gravitationally drops from the lower end of each separating chamber 181 to the dust collecting case 172 via the connection part 183, and trapped in each accumulating part 201b of the dust colleting case main body 201 of the dust collecting case 172. Pure air obtained by removing fine dust (minute dust) is extracted into the outlet air passage part 178 through the ventilation cylinder parts 189 of the rectifying parts 185, and flows of the pure air join together.

[0069] Air, of which flows join together in the outlet air passage part 178, is sucked into the electric blower 31 in the electric blower chamber part via the outlet opening part 194, the communication port 63 and the communication air passage part 115 of the downstream side duct part 39, passes through and cools the electric blower 31, and then is exhausted as exhaust air sideward from the exhaust port positioned at a front side of the electric blower 31. The exhaust air flows into the connection air passage part 117 of the downstream side duct part 39 while passing through the filter 119, then flows into the power supply chamber 40 from the connection air passage part 117 and cools the power supply part 121 in the power supply chamber 40. Exhaust air passing rearward through the power supply chamber 40 is diffused when flowing into the diffusing chamber 41, and dispersedly exhausted from each exhaust hole 109 to the outside of the main body case 25 of the cleaner main body 13.

[0070] When cleaning is finished, a user operates the

set button 22, and thus the control unit operates the ultraviolet lamp 67 first so that ultraviolet rays are radiated therefrom for a predetermined time, and then stops the electric blower 31 and the ultraviolet lamp 67. Moreover, since the ultraviolet lamp 67 is closed to the second dust separating collecting part 27 via a slight gap, a sufficient sterilization effect can be obtained even if irradiation time of ultraviolet rays is extremely short, for example, several seconds to several tens of seconds (Fig. 10). Ultraviolet rays radiated from the ultraviolet lamp 67 pass through the window part 195 via the openings 68 of a lower part of the arrangement part 66 and the permeable member 195a, advance to the outlet air passage part 178 in the second dust separating collecting part 27 to sterilize the inside of the outlet air passage part 178, and further advance into each separating chamber 181 via each connection opening 192a to sterilize the inside of each separating chamber 181. Some of the ultraviolet rays, which advance into the separating chambers 18 positioned at the center line L1, axially pass through the separating chambers 181, and advance into the dust collecting case main body 201 of the dust collecting case 172 to sterilize the inside of the dust collecting case main body 201 and fine dust (minute dust) accumulated in the accumulating parts 201b of the dust collecting case main body 201.

[0071] When dust not less than a predetermined amount accumulates in the first dust separating collecting part 26 and the dust collecting case 172 of the second dust separating collecting part 27, a user can discard the dust by detaching the first dust separating collecting part 26 and the second dust separating collecting part 27 from the main body case 25.

[0072] According to the first embodiment, since the first dust separating collecting part 26 and the second dust separating collecting part 27, which turn air containing dust sucked by driving of the electric blower 31 to centrifugally separate and trap the dust, are connected at multiple stages and the ultraviolet lamp 67 irradiates the second dust separating collecting part 27 positioned at the downstream side with ultraviolet rays, germs can be effectively eliminated by the ultraviolet rays.

[0073] That is, since coarse dust in air containing dust flowing into the second dust separating collecting part 27 is centrifugally separated by the first dust separating collecting part 26, the coarse dust does not accumulate in the second dust separating collecting part 27. Therefore, when the ultraviolet lamp 67 irradiates the second dust separating collecting part 27 with ultraviolet rays, the ultraviolet rays are neither obstructed nor diffused by coarse dust and thus can effectively eliminate germs.

[0074] Coarse dust is mainly trapped in the first dust separating collecting part 26, and a user frequently performs maintenance, for example, detaches the first dust separating collecting part 26 from the main body case 25 to discard the dust in the part 26. Therefore, dust hardly accumulates in the first dust separating collecting part 26 for a long time, propagation of germs or the like is comparatively suppressed. On the other hand, dust (fine dust) hardly accumulates in the second dust separating collecting part 27 positioned at the rear stage of the first dust separating collecting part 26 which has eliminated almost all of the dust, and a user does not frequently perform maintenance such as discarding dust. Therefore, germs or the like easily propagate in the second dust separating collecting part 27, compared with in the first dust separating collecting part 26. That is, in the dust collecting unit 28, the amount of dust trapped at the rear stage (downstream side) is less than that at the front stage, frequent maintenance is not required for the rear stage, and dust tends to accumulate at the rear stage for a long time. Therefore, by irradiating and sterilizing the second dust separating collecting part 27 positioned at the downstream side with ultraviolet rays, germs in the entire dust collecting unit 28 can be made to hardly propagate.

[0075] Since the ultraviolet lamp 67 irradiates the separating chambers 181 of the second dust separating collecting part 27 and the outlet air passage part 178, through which air from which dust has been separated by the separating chambers 181 passes, with ultraviolet rays, both air containing dust before the dust is centrifugally separated by the separating chambers 181 and air remaining after the dust is centrifugally separated by the separating chambers 181 can be sterilized and germs can be effectively eliminated. Particularly, since air passing through the outlet air passage part 178 is sucked into and then exhausted from the electric blower 31 without passing through a place, where germs easily propagate, at the downstream side, sterilization of air passing through the outlet air passage part 178 can further reliably prevent, for example, an odor from generating in air exhausted from the electric blower 31.

[0076] Moreover, in the first embodiment, timing of lighting the ultraviolet lamp 67 can be optionally set.

[0077] The dust collecting unit 28 may include centrifugally separating parts of multiple stages, three or more stages. In this case, if the ultraviolet lamp 67 irradiates at least any of the centrifugally separating parts except the centrifugally separating part positioned at the most upstream, that is, any of the centrifugally separating parts positioned at the downstream side, with ultraviolet rays, the same effect as that of the first embodiment can be obtained.

[0078] Next, a second embodiment will be described with reference to Fig. 11 and Fig. 12. Moreover, the same symbols are attached to the same configurations and operations as those of the above-described first embodiment, and description thereof will be omitted.

[0079] According to the second embodiment, in the first embodiment, on/off operation or the like of the electric blower 31 is controlled by a control unit 211 such as a microcomputer housed in the main body part 32 in accordance with setting operation of the set buttons 22.

[0080] The ultraviolet lamp 67 irradiates and sterilizes part of the air passage W, the second dust separating collecting part 27 in the present embodiment, with ultra-

violet rays, for example, a lighting state including lights-out of the lamp 67 is controlled by the control unit 211.

[0081] Next, the internal structure of the second embodiment will be described.

[0082] An operation signal is input from the set button 22 to the control unit 211. The control unit 211 can operate by receiving power from the power supply part 121 of which the plug part 121a at its tip end is connected to a commercial AC power supply e as a power supply, and sets input to the electric blower 31, in accordance with an operation signal transmitted from the set button 22, via a control element Tr such as a triac.

[0083] The control unit 211 is electrically connected to a timer T as a clocking unit and the ultraviolet lamp 67, and can control operation of the ultraviolet lamp 67. In the present embodiment, timing when the control unit 211 operates the ultraviolet lamp 67 is just before the set button 22 is operated in operation of the electric blower 31 and the control unit 211 stops the electric blower 31, and the ultraviolet lamp 67 is operated for a first predetermined time T1 obtained by clocking via the timer T. Preferably, the first predetermined time T1 is variably set in accordance with, for example, operation time of the electric blower 31, that is, the length of time from starting-up to stopping of the electric blower 31 at this time. The first predetermined time T1 may be set in a manner of: comparing operation time of the electric blower 31 with preset single or a plurality of threshold(s) and then referring to a preset table or the like in accordance with a magnitude relationship between the operation time and the threshold (s) ; calculating the first predetermined time T1 by, for example, a predetermined numerical expression that the operation time of the electric blower 31 is set as a variable; or the like. In any case, since it is conceivable that as the operation time of the electric blower 31 is longer, more dust accumulates in the dust collecting case 172 of the second dust separating collecting part 27, the first predetermined time T1 is preferably set longer as the operation time of the electric blower 31 is longer.

[0084] Next, operations of the second embodiment will be described.

[0085] In the case of cleaning, a user, in a state where the plug part 121a is connected to the commercial AC power supply e and power can be supplied by the power supply part 121, grips the grip part 21 to operate a desirable set button 22, and thus the control unit 211, to which power is supplied from the power supply part 121, phase-angle controls the electric blower 31 via the control element Tr, the electric blower 31 is driven in an operation mode set by the operation of the set button 22, and dust is sucked, by negative pressure generated by the driving of the electric blower 31, together with air from the tip end of the floor brush 19 or the like mounted on a surface to be cleaned. Since the step of separating and trapping each kind of dust from air containing dust is the same as that of the first embodiment, description thereof will be omitted.

[0086] When cleaning is finished, a user operates the set button 22, and thus the control unit 211 operates the ultraviolet lamp 67 first so that ultraviolet rays are radiated therefrom, and then stops electric blower 31 and the ultraviolet lamp 67. That is, the control unit 211 determines whether, in operation of the electric blower 31, stopping operation has been performed by set button 22, that is, off of the electric blower 31 has been set (Step 1). The control unit 211 repeats Step 1 when determining, in Step 1, that off has not been set, but starts up the timer T and lights (starts up) the ultraviolet lamp 67 when determining, in Step 1, that off has been set (Step 2). Then, the control unit 211 determines whether the first predetermined time T1 has passed from timing when off of the electric blower 31 has been set, that is, from lighting of the ultraviolet lamp 67 (Step 3). The control unit 211 repeats Step 3 when determining that the first predetermined time T1 has not passed, but stops the timer T and the ultraviolet lamp 67 when determining that the first predetermined time T1 has passed (Step 4). Moreover, the timer T may be reset simultaneously with stopping, or may be reset just before being started up in Step 2. Timing of stopping the electric blower 31 can be optionally set, for example, just before starting-up of the ultraviolet lamp 67 and the timer T (just after it is determined, in Step 1, that off has been set), simultaneously with starting-up of the ultraviolet lamp 67 and the timer T, in operation of the ultraviolet lamp 67 and the timer T, simultaneously with stopping of the ultraviolet lamp 67 and the timer T, or after stopping of the ultraviolet lamp 67 and the timer T.

[0087] Ultraviolet rays radiated from the ultraviolet lamp 67 pass through the window part 195 via the opening 68 of the lower part of the arrangement part 66 and the permeable member 195a, advance to the outlet air passage part 178 in the second dust separating collecting part 27 to sterilize the inside of the outlet air passage part 178, and further advance into each separating chamber 181 via each connection opening 192a to sterilize the inside of each separating chamber 181. Some of the ultraviolet rays, which advance into the separating chambers 181, axially pass through the separating chambers 181, and advance to the dust collecting case 172 to sterilize the inside of the dust collecting case 172 and fine dust (minute dust) accumulated in the dust collecting case 172.

[0088] When dust not less than a predetermined amount accumulates in the first dust separating collecting part 26 and the second dust separating collecting part 27, a user can discard the dust by detaching the first dust separating collecting part 26 and the second dust separating collecting part 27 from the main body case 25.

[0089] According to the second embodiment, since the control unit 211 operates the ultraviolet lamp 67 and makes it irradiate the inside of the air passage W, the second dust separating collecting part 27 in the present embodiment, with ultraviolet rays for sterilization, for the first predetermined time T1 from timing when off of the electric blower 31 is set by the set button 22 in operation

of the electric blower 31, noise can be reduced compared with that in the case where, for example, sterilization is performed by heat of exhaust air circulated from an electric blower. Further, since an ultraviolet ray radiated from the ultraviolet lamp 67 is stronger than light for generating oxidation-reduction reaction of a photocatalyst and is sterilization light having a sterilization effect by destroying the DNA of germs or the like, sterilization can be performed in a short time. Accordingly, saving-energy of the electric vacuum cleaner 11 can be realized.

[0090] It is conceivable that the amount of dust trapped by the second dust separating collecting part 27 and the number of germs in the air passage W (second dust separating collecting part 27) increase with an increase in operation time of the electric blower 31. Therefore, by varying the first predetermined time T1 of operating the ultraviolet lamp 67 in accordance with the preceding operation time of the electric blower 31, specifically, setting the first predetermined time T1 longer as the operation time of the electric blower 31 is longer, the air passage W (second dust separating collecting part 27) can be more effectively sterilized.

[0091] Next, a third embodiment will be described with reference to Fig. 13. Moreover, the same symbols are attached to the same configurations and operations as those of the above-described second embodiment, and description thereof will be omitted.

[0092] In the third embodiment, in place of control of the second embodiment, the control unit 211 operates the ultraviolet lamp 67 for a predetermined time T2 from timing when power can be supplied from the commercial AC power supply e to the electric blower 31, in other words, timing (plug-in) when the plug part 121a is connected to the commercial AC power supply e.

[0093] Moreover, in the case where on of the electric blower 31 has been set by the set button 22 before the predetermined time T2 passes from the timing when the plug part 121a is connected to the commercial AC power supply e, the control unit 211 continuously operates the ultraviolet lamp 67 even in operation of the electric blower 31. That is, the control unit 211, regardless of presence/absence of operation for starting up the electric blower 31, continuously operates the ultraviolet lamp 67 until the predetermined time T2 passes from the timing when the plug part 121a is connected to the commercial AC power supply e.

[0094] As indicated by the flowchart in Fig. 13, the control unit 211 determines whether the plug part 121a has been connected to (plugged in) the commercial AC power supply e (Step 11). The control unit 211 repeats Step 11 when determining, in Step 11, that the plug part 121a has not been connected to (plugged in) the commercial AC power supply e. Alternatively, the control unit 211 starts up the timer T and lights (starts up) the ultraviolet lamp 67 when determining, in Step 11, that the plug part 121a has been connected to (plugged in) the commercial AC power supply e in (Step 12).

[0095] Then, the control unit 211 determines whether the predetermined time T2 has passed from timing when the plug part 121a has been connected to the commercial AC power supply e, that is, from lighting of the ultraviolet lamp 67 (Step 13). The control unit 211, when determining, in Step 13, that the predetermined time T2 has passed, stops the timer T and the ultraviolet lamp 67 (Step 14), and determines whether starting-up operation has been performed by the set button 22, that is, whether on of the electric blower 31 has been set (Step 15). The control unit 211 repeats Step 15 when determining, in Step 15, that on has not been set, but starts up the electric blower 31 in an operation mode set by the set button 22 when determining, in Step 15, that on has been set (Step 16).

[0096] On the other hand, the control unit 211, when determining, in Step 13, that the predetermined time T2 has not passed, determines whether starting-up operation has been performed by the set button 22, that is, whether on of the electric blower 31 has been set (Step 17). The control unit 211 makes return to Step 13 when determining, in Step 17, that on has not been set, but starts up the electric blower 31 in an operation mode set by the set button 22 when determining, in Step 17, that on has been set (Step 18).

[0097] After Step 18, the control unit 211 determines whether the predetermined time T2 has passed from the timing when the plug part 121a has been connected to the commercial AC power supply e, that is, lighting of the ultraviolet lamp 67 (Step 19). The control unit 211 repeats Step 19 when determining that the predetermined time T2 has not passed, but stops the timer T and the ultraviolet lamp 67 when determining that the predetermined time T2 has passed (Step 20). In the case where off of the electric blower 31 has been set by the set button 22 before the predetermined time T2 passes in Step 19, the control unit 211, for example, may immediately stop the ultraviolet lamp 67 and the electric blower 31, stop the ultraviolet lamp 67 and the electric blower 31 after the predetermined time T2 has passed from the timing when the plug part 121a has been connected to the commercial AC power supply e, or continuously light the ultraviolet lamp 67 until the predetermined time T2 passes from the timing when the plug part 121a is connected to the commercial AC power supply e after stopping the electric blower 31. Additionally, the timer T may be reset simultaneously with stopping in Step 14 or Step 20, or reset just before being started up in Step 12.

[0098] According to the above-described third embodiment, since the control unit 211 operates the ultraviolet lamp 67 and makes it irradiate the inside of the air passage W, the second dust separating collecting part 27 in the present embodiment, with ultraviolet rays for sterilization, for the predetermined time T2 from the timing when power can be supplied from the commercial AC power supply e to the electric blower 31, that is, timing when the plug part 121a is connected to the commercial AC power supply e, noise can be reduced compared with that in the case where, for example, sterilization is per-

formed by heat of exhaust air circulated from an electric blower. Further, since an ultraviolet ray radiated from the ultraviolet lamp 67 is stronger than light for generating oxidation-reduction reaction of a photocatalyst and is sterilization light having a sterilization effect by destroying the DNA of germs or the like, sterilization can be performed in a short time. Accordingly, saving-energy of the electric vacuum cleaner 11 can be realized.

[0099] Since it is conceivable that germs propagate in the air passage W (second dust separating collecting part 27) in the case where, for example, any length of time has passed from the preceding cleaning to the present cleaning, sterilization by the ultraviolet lamp 67 before cleaning, that is, starting-up of the electric blower 31, can reliably prevent an odor from generating in exhaust air at the time of starting-up of the electric blower 31.

[0100] In the case where on of the electric blower 31 has been set by the set button 22 before the predetermined time T2 passes from the timing when the plug part 121a is connected to the commercial AC power supply e, the ultraviolet lamp 67 is continuously operated even in operation of the electric blower 31. Thus, regardless of operation of the set button 22, there occurs no trouble such as non-starting-up of the electric blower 31 and the air passage W (second dust separating collecting part 27) can be reliably sterilized.

[0101] Moreover, the second and third embodiments maybe combined with each other. That is, control of the third embodiment may be performed before starting-up of the electric vacuum cleaner 11, or control of the second embodiment may be performed in the case of stopping the electric vacuum cleaner 11 in operation. At this time, in the case where, for example, in Step 19 of the third embodiment, off of the electric blower 31 has been set by the set button 22 before the second predetermined time T2 as a predetermined time passes, the control unit 211 may, for example, reset the timer T and may perform Step 2 of the second embodiment.

[0102] According to at least either of the second and third embodiments, since the first dust separating collecting part 26 and the second dust separating collecting part 27, which turn air containing dust sucked by driving of the electric blower 31 to centrifugally separate and trap the dust, are connected at multiple stages and the ultraviolet lamp 67 irradiates the second dust separating collecting part 27 positioned at the downstream side with ultraviolet rays, germs can be effectively eliminated by the ultraviolet rays.

[0103] That is, since coarse dust in air containing dust flowing into the second dust separating collecting part 27 is centrifugally separated by the first dust separating collecting part 26, the coarse dust does not accumulate in the second dust separating collecting part 27. Therefore, when the ultraviolet lamp 67 irradiates the second dust separating collecting part 27 with ultraviolet rays, the ultraviolet rays are neither obstructed nor diffused by coarse dust and thus can effectively eliminate germs.

[0104] Coarse dust is mainly trapped in the first dust separating collecting part 26, and a user frequently performs maintenance, for example, detaches the first dust separating collecting part 26 from the main body case 25 to discard the dust in the part 26. Therefore, dust hardly accumulates in the first dust separating collecting part 26 for a long time, propagation of germs or the like is comparatively suppressed. On the other hand, dust (fine dust) hardly accumulates in the second dust separating collecting part 27 positioned at the rear stage of the first dust separating collecting part 26 which has eliminated almost all of the dust, and a user does not frequently perform maintenance such as discarding dust. Therefore, germs or the like easily propagate in the second dust separating collecting part 27, compared with in the first dust separating collecting part 26. That is, in the dust collecting unit 28, the amount of dust trapped at the rear stage (downstream side) is less than that in the front stage, frequent maintenance is not required for the rear stage, and dust tends to accumulate in the rear stage for a long time. Therefore, by irradiating and sterilizing the second dust separating collecting part 27 positioned at the downstream side with ultraviolet rays, germs in the entire dust collecting unit 28 can be made to hardly propagate.

[0105] Since the ultraviolet lamp 67 irradiates the separating chambers 181 of the second dust separating collecting part 27 and the outlet air passage part 178, through which air from which dust has been separated by the separating chambers 181 passes, with ultraviolet rays, both air containing dust before the dust is centrifugally separated by the separating chambers 181 and air remaining after the dust is centrifugally separated by the separating chambers 181 can be sterilized and germs can be effectively eliminated. Particularly, since air passing through the outlet air passage part 178 is sucked into and then exhausted from the electric blower 31 without passing through a place, where germs easily propagate, at the downstream side, sterilization of air passing through the outlet air passage part 178 can further reliably prevent an odor from generating in air exhausted from the electric blower 31.

[0106] Moreover, in the second and third embodiments, the first dust separating collecting part 26 and the second dust separating collecting part 27 can be optionally constituted as long as they can trap dust from air containing dust.

[0107] The ultraviolet lamp 67 may irradiate any place in the air passage W with ultraviolet rays.

[0108] In each of the above-described embodiments, in the case where the second dust separating collecting part 27 is molded of synthetic resin, a part, which receives ultraviolet rays, of the part 27 may be, for example, plated, so that ultraviolet rays radiated from the ultraviolet lamp 67 are prevented from deteriorating the part 27. As long as ultraviolet rays are prevented from deteriorating the second dust separating collecting part 27, any material other than synthetic resin may be used for the part 27.

[0109] Not limited to a canister type electric vacuum

cleaner 11, there can also be used: an upright type cleaner in which the floor brush 19 is connected to a lower part of a vertically long cleaner main body 13; a handy type cleaner that a user performs cleaning while carrying the cleaner main body 13 to which the floor brush 19, etc., are directly connected; a robot type cleaner in which the cleaner main body 13 self-travels or autonomously travels by driving wheels (traveling wheels); and the like.

[0110] While certain embodiments have been described, these embodiments have been presented by way of example only, and are not intended to limit the scope of the invention. Indeed, the novel embodiments described herein may be embodied in a variety of other forms; furthermore, various omissions, substitutions, and changes in the form of the embodiments described herein may be made. The accompanying claims and their equivalents are intended to cover such forms or modifications as would fall within the scope of the invention.

Claims

1. An electric vacuum cleaner (11) comprising:

   a cleaner main body (13) housing an electric blower (31);
   an air passage (W) communicating with a suction side of the electric blower (31);
   an ultraviolet ray irradiation part (67) which irradiates the inside of the air passage (W) with ultraviolet rays for sterilization;
   a control unit (211) which is provided in the cleaner main body (13) and controls operations of the electric blower (31) and the ultraviolet ray irradiation part (67); and
   a setting unit (22) capable of setting on/off of driving of the electric blower (31) by operation,
   wherein the control unit (211) operates the ultraviolet ray irradiation part (67) for a first predetermined time (T1) from timing when driving of the electric blower (31) is set to be off by the setting unit (22) in operation of the electric blower, **characterized in that**
   the control unit (211) varies the first predetermined time (T1) in accordance with operation time of the electric blower (31).

2. The electric vacuum cleaner (11) according to claim 1, wherein the control unit (211) operates the ultraviolet ray irradiation part (67) for a second predetermined time (T2) from timing when power can be supplied from a power supply (e) to the electric blower (31), and, in the case where driving of the electric blower (31) is set to be on by the setting unit (22) before the second predetermined time (T2) passes from the timing, continuously operates the ultraviolet ray irradiation part (67) even in operation of the electric blower (31).

Patentansprüche

1. Ein elektrischer Staubsauger (11) umfassend :

   ein Reinigungshauptgehäuse (13), das ein elektrisches Gebläse (31) enthält;
   einen Luftdurchlass (W), der mit einer Ansaugseite des elektrischen Gebläses (31) kommuniziert;
   ein ultraviolettes Bestrahlungsteil (67), das die Innenseite des Luftdurchlasses (W) mit ultravioletten Strahlen zwecks Sterilisation bestrahlt;
   eine Kontrolleinheit (211), die in dem Reinigungshauptgehäuse (13) bereitgestellt wird und den Betrieb des elektrischen Gebläses (31) und des ultravioletten
   Bestrahlungsteils (67) kontrolliert; und
   eine Einstelleinheit (22), die imstande ist, den Betrieb des elektrischen Gebläses (31) ein- bzw. auszuschalten,
   worin die Kontrolleinheit (211) das ultraviolette Bestrahlungsteil (67) für einen ersten vorgegebenen Zeitraum (T1) betätigt, ab der Zeit, wenn der Betrieb des elektrischen Gebläses (31) durch die Einstelleinheit (22) ausgeschaltet ist, und
   dadurch gekennzeichnet, dass die Kontrolleinheit (211) den ersten vorgegebenen Zeitraum (T1) in Übereinstimmung mit der Betriebsdauer des elektrischen Gebläses (31) variiert.

2. Der elektrische Staubsauger (11) gemäß Anspruch 1, worin die Kontrolleinheit (211) das ultraviolette Bestrahlungsteil (67) für eine zweite vorgegebene Zeitperiode (T2) betätigt, ab der Zeit, wenn Strom von einer Elektrizitätsquelle (e) an das elektrische Gebläse (31) bereitgestellt werden kann, und, im Fall, dass der Betrieb des elektrischen Gebläses (31) von der Einstelleinheit (22) eingeschaltet ist, bevor die zweite vorgegebenen Zeitdauer (T2) die Zeitverlässt, kontinuierlich das ultraviolette Bestrahlungsteil (67) auch dann betätigt, wenn das elektrische Gebläse (31) in Betrieb ist.

Revendications

1. Un aspirateur électrique (11) comprenant :

   un corps principal de nettoyeur (13) logeant une soufflante électrique (31) ;
   un passage d'air (W) communiquant avec un côté d'aspiration de la soufflante électrique (31) ;
   une partie d'irradiation de rayons ultraviolets (67) qui irradie l'intérieur du passage d'air (W) avec des rayons ultraviolets pour la stérilisation ;

une unité de commande (211) qui est prévue dans le corps principal de nettoyeur (13) et qui commande les opérations de la soufflante électrique (31) et de la partie d'irradiation des rayons ultraviolets (67) ; et une unité de réglage (22) capable d'activer / désactiver l'entraînement de la soufflante électrique (31) par fonctionnement, dans lequel l'unité de commande (211) actionne la partie d'irradiation aux rayons ultraviolets (67) pendant un premier temps prédéterminé (T1) à partir du moment où l'entraînement de la soufflante électrique (31) est réglé pour être éteint par l'unité de réglage (22) en fonctionnement de la soufflante électrique,
caractérisée en ce que l'unité de commande (211) fait varier le premier temps prédéterminé (T1) en fonction du temps de fonctionnement de la soufflante électrique (31).

2. L'aspirateur électrique (11) selon la revendication 1, dans lequel l'unité de commande (211) actionne la partie d'irradiation de rayons ultraviolets (67) pendant un deuxième temps prédéterminé (T2) à partir d'une alimentation électrique (e) à la soufflante électrique (31), et, dans le cas où l'entraînement de la soufflante électrique (31) est réglé pour être activé par l'unité de réglage (22) avant que le second temps prédéterminé (T2) ne passe par le minutage, opère en continu la partie d'irradiation de rayons ultraviolets (67) même en fonctionnement de la soufflante électrique (31).

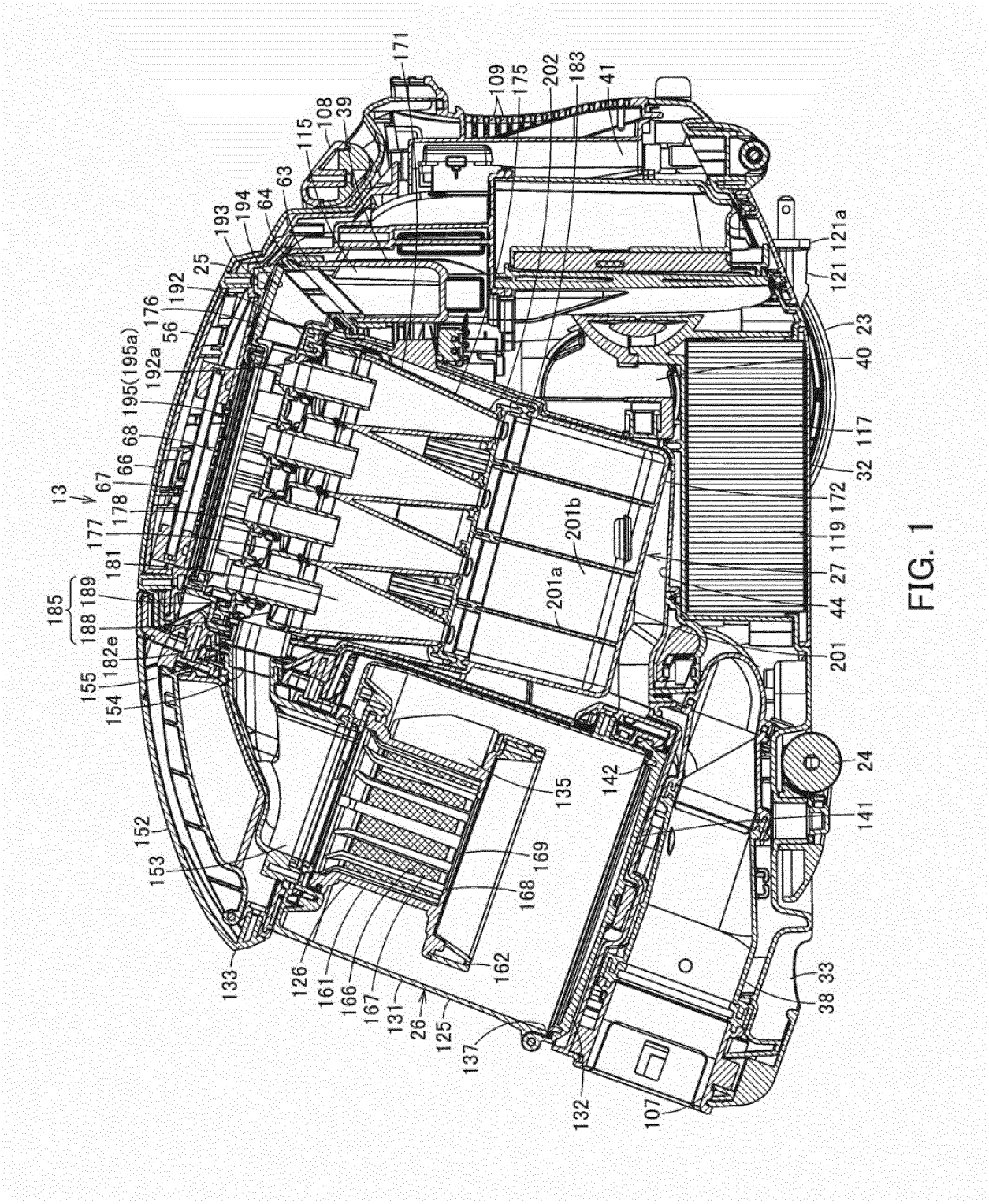

171
109
175
202
183
41
115
108
39
63
64
194
193
25
192
176
56
192a
195(195a)
68
66
67
178
177
181
185
189
188
182e
155
154
152
153
133
126
161
166
167
131
26
125
137
132
107
135
142
169
168
162
201a
201b
13
121a
121
23
40
117
32
172
119
27
44
201
24
141
33
38

FIG. 1

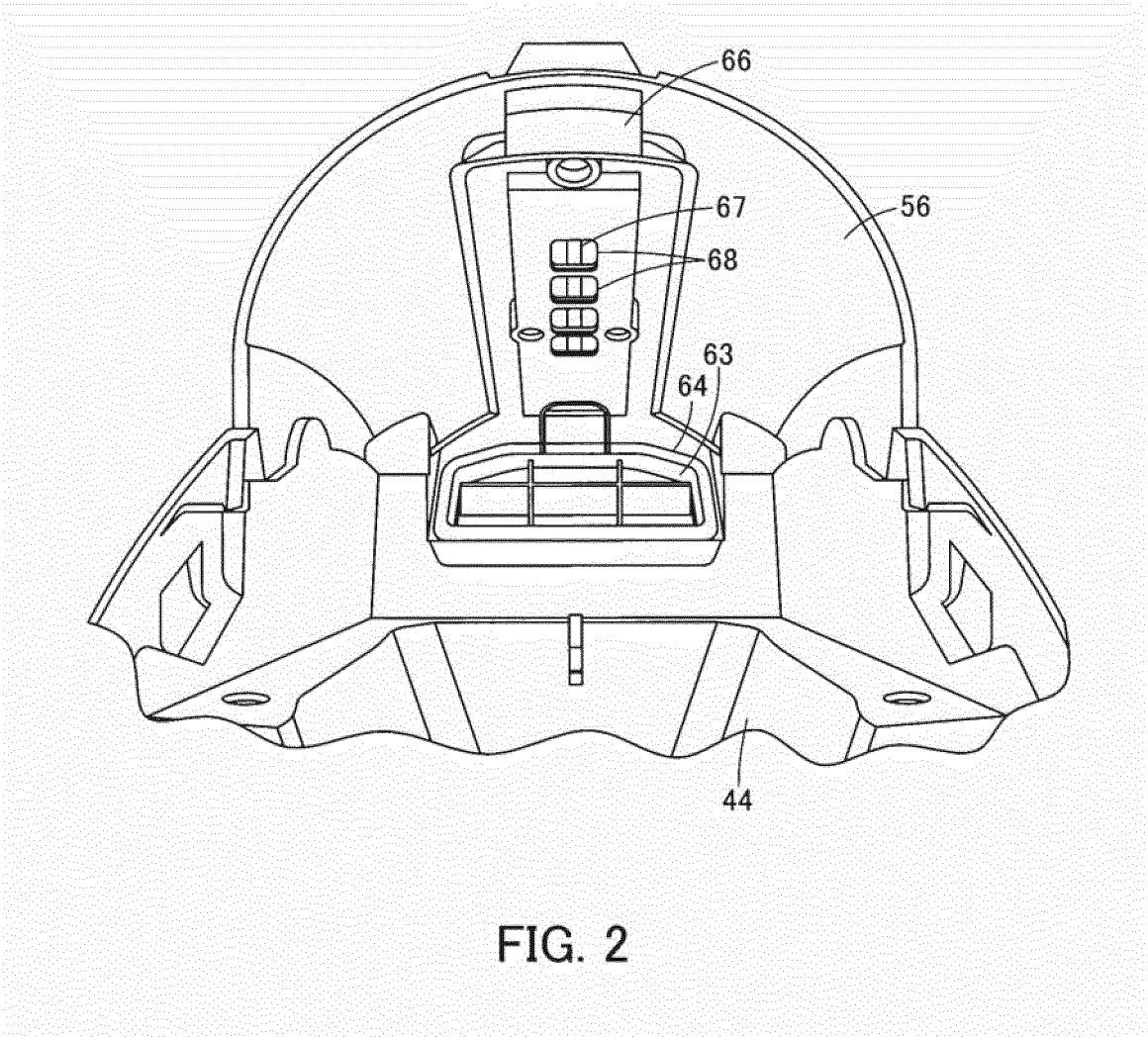


FIG. 2

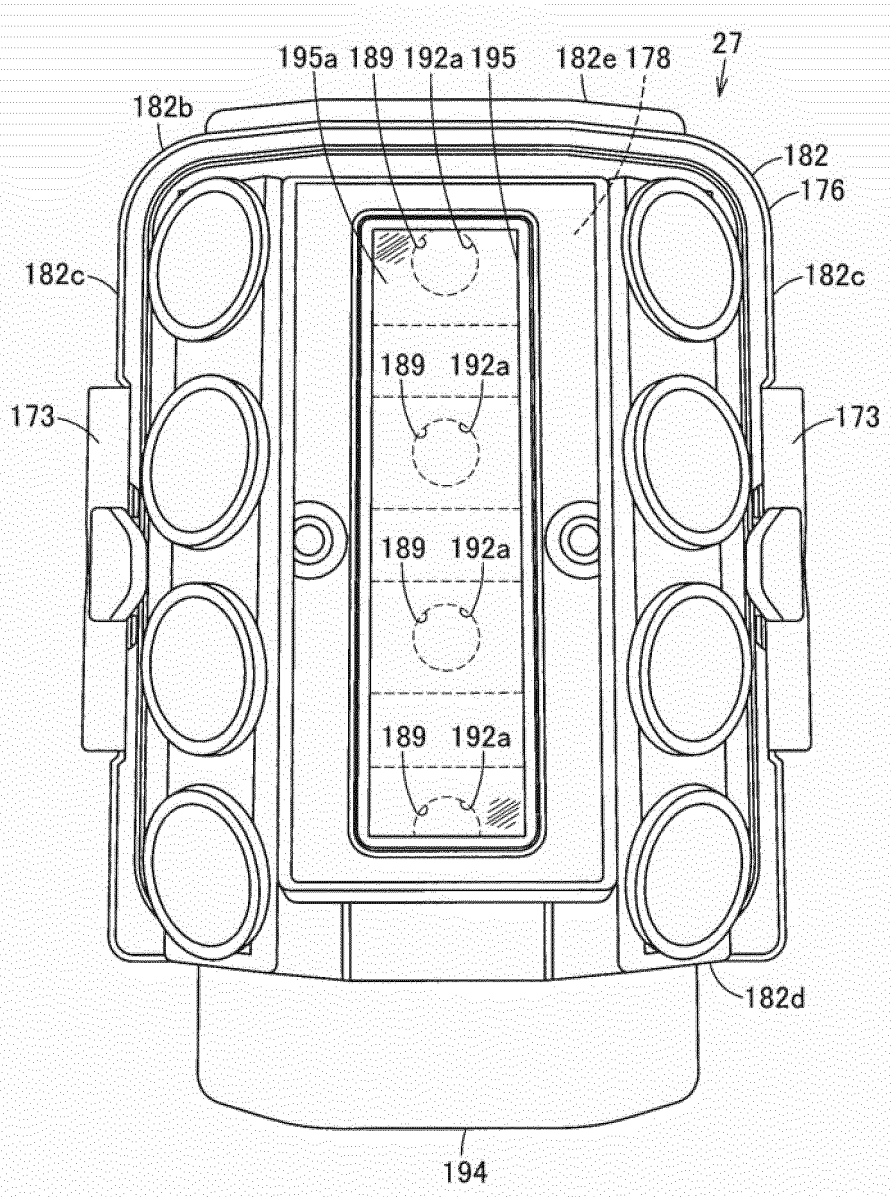

195a
189
192a
195
182e
178
27
182b
182
176
182c
182c
189
192a
173
173
189
192a
189
192a
182d
194

FIG. 3

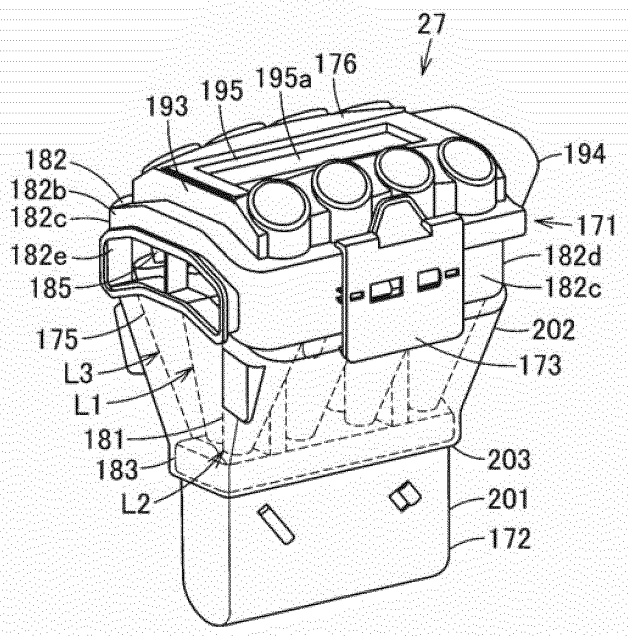

27
193
195
195a
176
182
182b
182c
182e
185
175
L3
L1
181
183
L2
194
171
182d
182c
202
173
203
201
172

FIG. 4

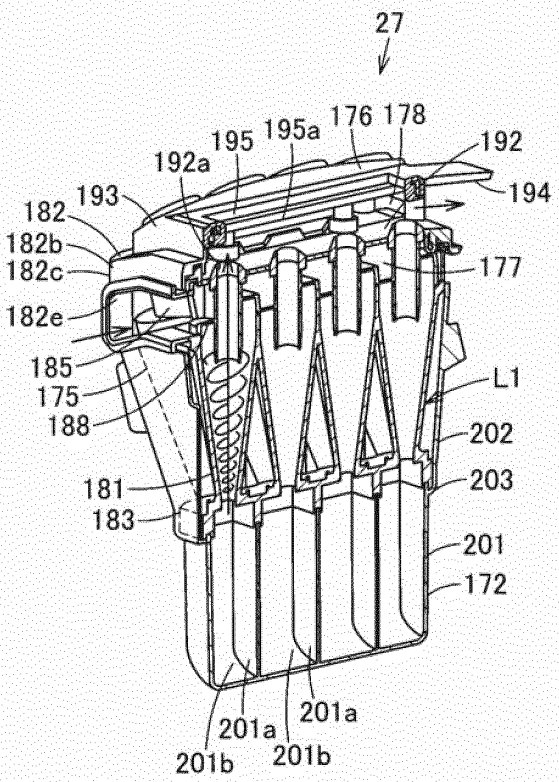

27
195
195a
176
178
192
192a
193
194
182
182b
182c
182e
185
175
188
177
L1
202
203
181
183
201
172
201a
201b
201a
201b

FIG. 5

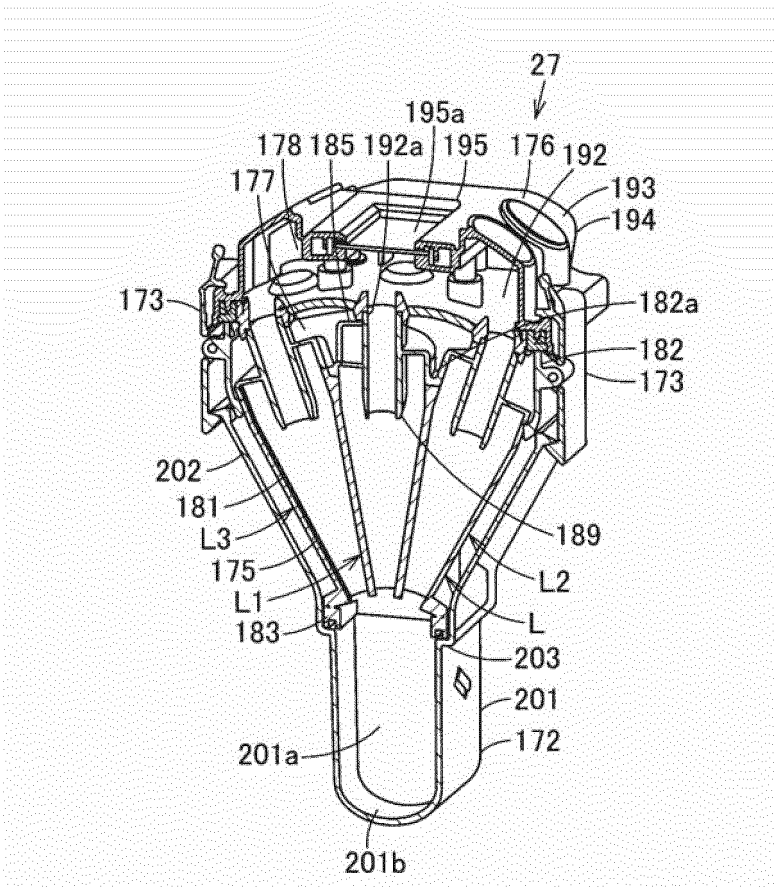

27
195a
178
185
192a
195
176
192
177
193
194
173
182a
182
173
202
181
L3
175
L1
183
189
L2
L
203
201
172
201a
201b

FIG. 6

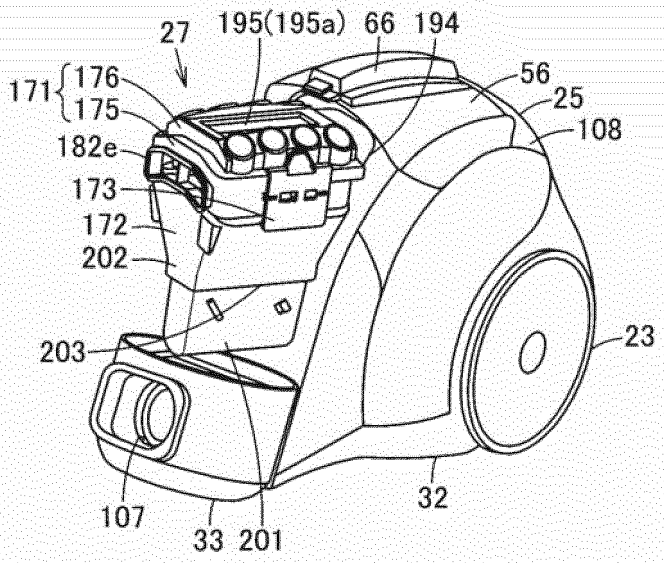

27
195(195a)
66
194
171
176
175
182e
173
172
202
203
56
25
108
23
107
33
201
32

FIG. 7

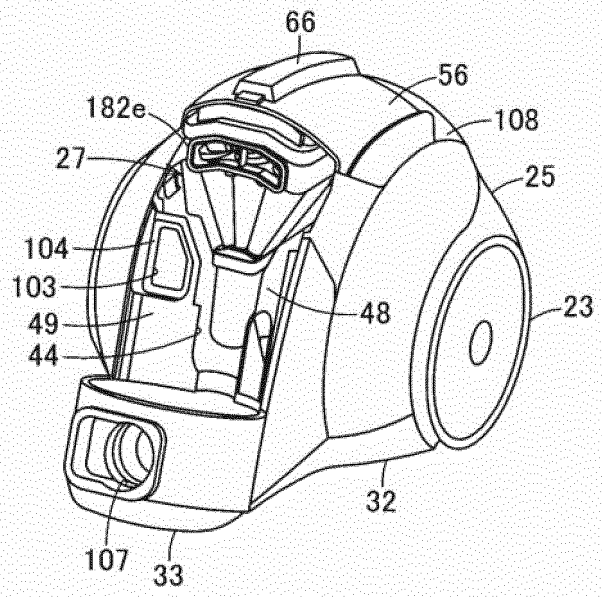

66
56
182e
108
27
25
104
103
49
44
48
23
32
107
33

FIG. 8

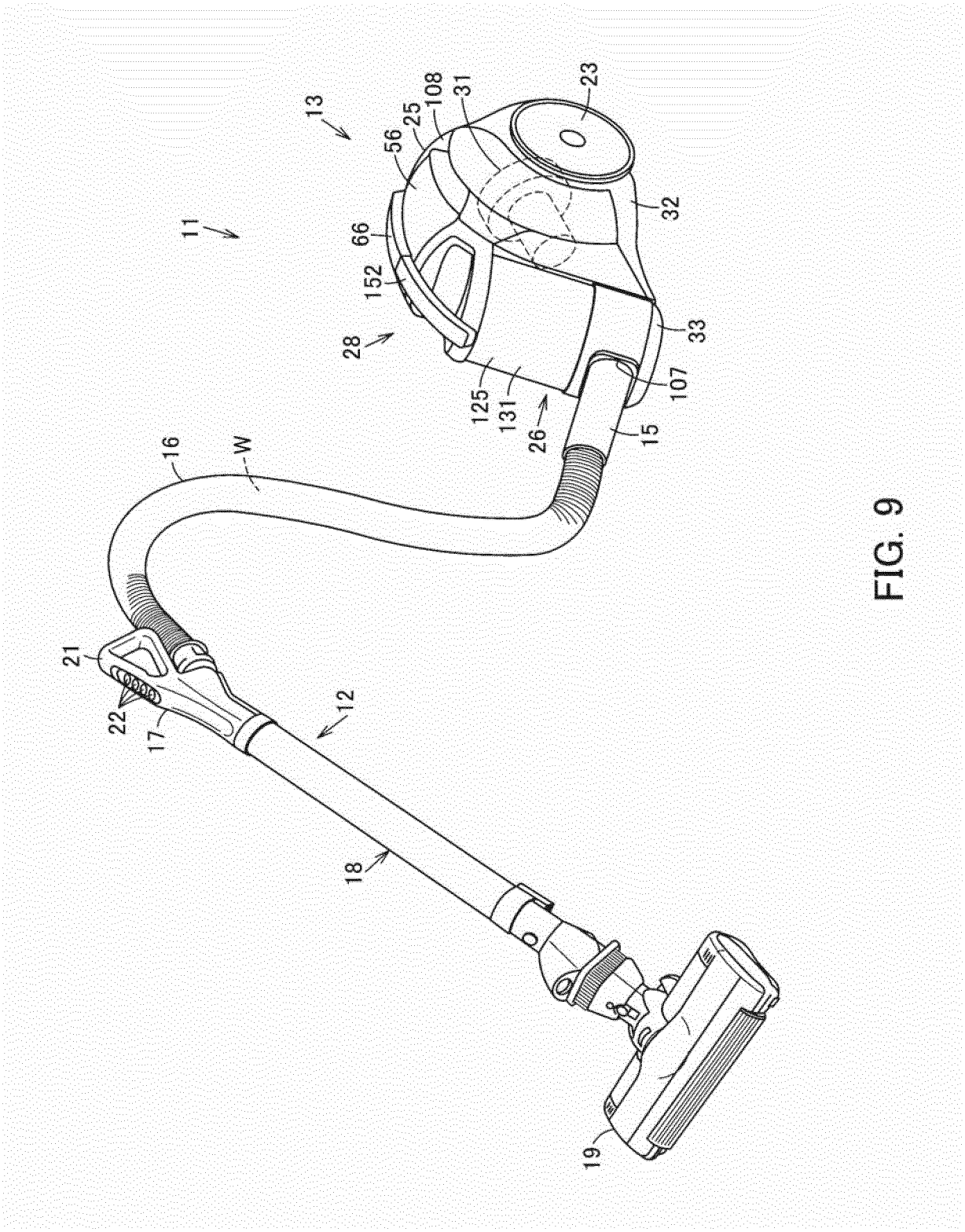

11
13
23
108
31
25
56
32
66
152
28
33
125
131
107
26
15
16
W
21
22
17
12
18
19

FIG. 9

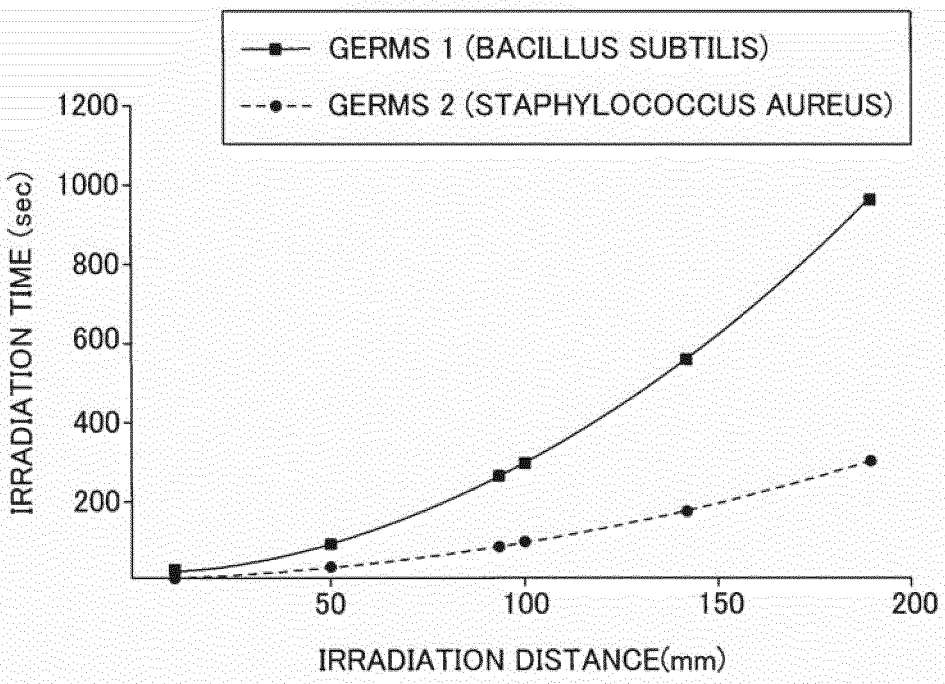

GERMS 1 (BACILLUS SUBTILIS)
GERMS 2 (STAPHYLOCOCCUS AUREUS)
IRRADIATION TIME (sec)
1200
1000
800
600
400
200
50
100
150
200
IRRADIATION DISTANCE(mm)

FIG. 10

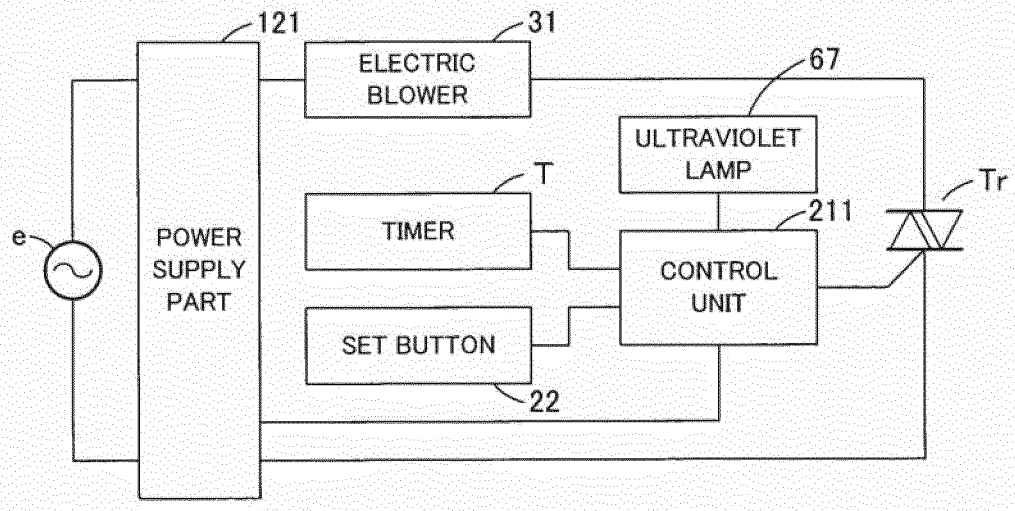

121
31
67
ELECTRIC BLOWER
ULTRAVIOLET LAMP
T
Tr
211
TIMER
CONTROL UNIT
e
POWER SUPPLY PART
SET BUTTON
22

FIG. 11

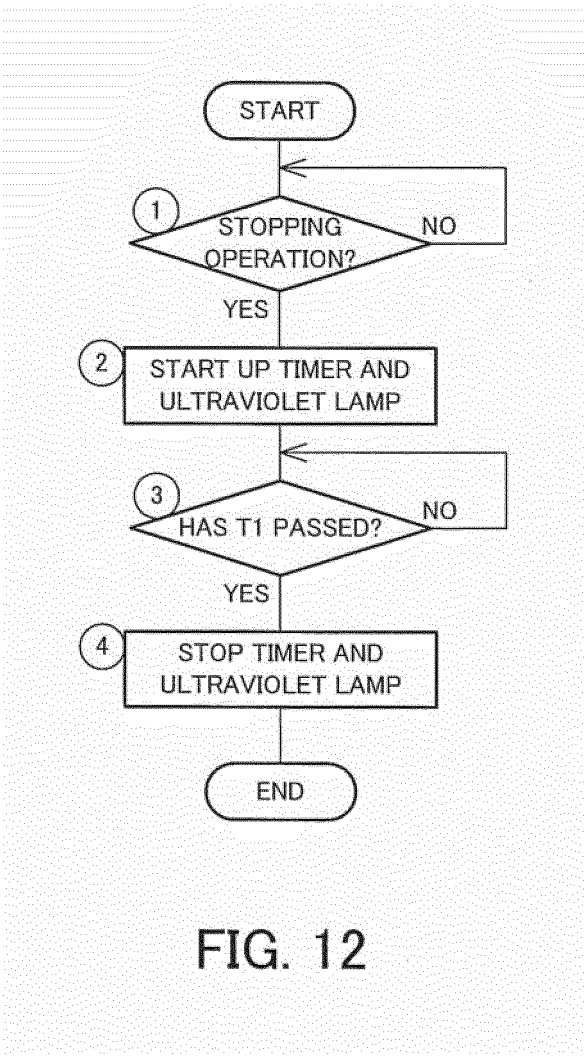

START
1
STOPPING OPERATION?
NO
YES
2
START UP TIMER AND ULTRAVIOLET LAMP
3
HAS T1 PASSED?
NO
YES
4
STOP TIMER AND ULTRAVIOLET LAMP
END

FIG. 12

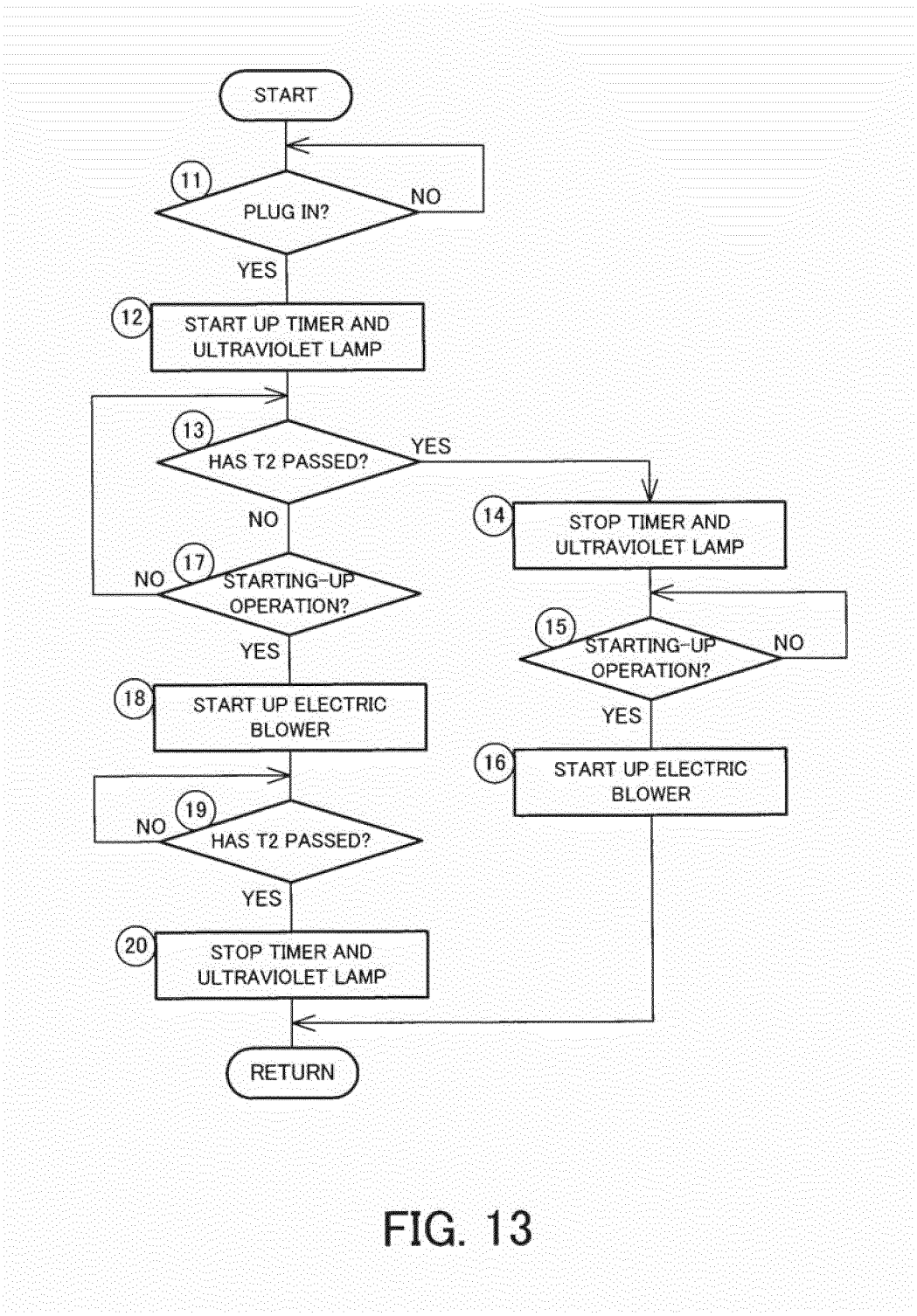

START
11
PLUG IN?
NO
YES
12
START UP TIMER AND ULTRAVIOLET LAMP
13
HAS T2 PASSED?
YES
NO
14
STOP TIMER AND ULTRAVIOLET LAMP
17
NO
STARTING-UP OPERATION?
15
STARTING-UP OPERATION?
NO
YES
YES
18
START UP ELECTRIC BLOWER
16
START UP ELECTRIC BLOWER
19
NO
HAS T2 PASSED?
YES
20
STOP TIMER AND ULTRAVIOLET LAMP
RETURN

FIG. 13

REFERENCES CITED IN THE DESCRIPTION

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- JP 2006231030 A **[0004]**
- JP 1007774 A **[0004]**
- JP 4263013 B **[0004]**
- JP 2004113469 A **[0010]**
- JP 2011177268 A **[0011]**