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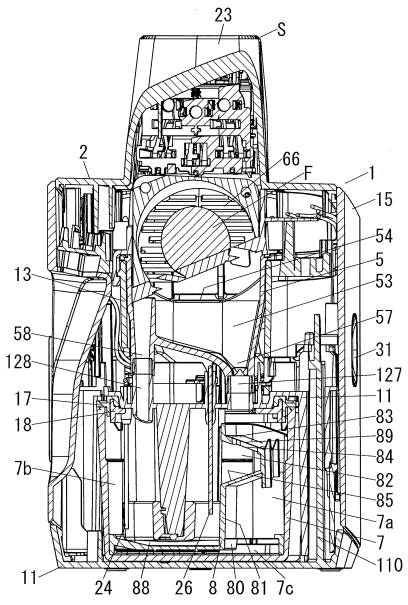
(54) CLEANING DEVICE FOR SMALL ELECTRICAL APPLIANCE

(57) The cleaning device includes: a cleaning bowl for receiving a part, needing to be cleaned, of the small electrical appliance; a container for storing cleaning liquid to be supplied into the cleaning bowl; a cleaning liquid supply means configured to supply the cleaning liquid stored in the container into the cleaning bowl; a discharge path for returning the cleaning liquid in the cleaning bowl into the container therethrough; and a filter. The discharge path is provided at a downstream thereof with a first flow path via which part of the cleaning liquid passes through the filter and a second flow path via which other part of the cleaning liquid flows over the filter.

FIG. 1



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Description

TECHNICAL FIELD

[0001] The invention relates to a cleaning device for a small electrical appliance such as an electric shaver or a depilator, which needs to be cleaned regularly.

BACKGROUND ART

[0002] There has been provided a cleaning device that includes: a cleaning bowl; a container that stores a cleaning liquid to be supplied to the cleaning bowl; a cleaning liquid supply means configured to supply the cleaning liquid stored in the container into the cleaning bowl; and a discharge path through which the cleaning liquid in the cleaning bowl is returned to the container.

[0003] In this type of cleaning device, since cleaning liquid is circulated between the container and the cleaning bowl, dirt factors that are included in the cleaning liquid returned to the container are preferably removed from the cleaning liquid before the cleaning liquid is supplied to the cleaning bowl again.

[0004] For this purpose, in each of devices of JP2008-302093A and JP2009-504299A for example, a filter means for capturing dirt factors is disposed in a container. In such a device, the filter means or the container itself should be replaced if the filter means gets dirty. However, in view of recent demand for environmental protection and the like, it is desired that a wear-out component(s) should be recyclable, or reusable, or formed of materials with reduced amount. From this view point, it is desirable that a container or a filter means be usable repeatedly.

[0005] JP2008-509772A discloses a device configured to deposit dirt factors (clipped hairs) onto a partition wall that is disposed on a bottom of a container, and therefore this device does not include components that need to be replaced. However, this device has a disadvantage that the hairs accumulated on the partition wall of the container are difficult to be cleaned. In addition, this device has a concern that the accumulated dirt factors are risen up and adhered to a shaver head during cleaning because the container is also used as a cleaning bowl.

SUMMARY OF INVENTION

[0006] The present invention has been made in view of above circumstance, and an object thereof is to provide a cleaning device for a small electrical appliance, of which a container can be used repeatedly and which can effectively capture, in the container, dirt factors that is included in a cleaning liquid discharged from a cleaning bowl to the container.

[0007] A cleaning device (1) for a small electrical appliance according to the invention includes: a cleaning bowl (5) for receiving a part needing to be cleaned (Ea) of the small electrical appliance (E); a container (7) for storing cleaning liquid to be supplied into the cleaning bowl (5); a cleaning liquid supply means (P) configured to supply the cleaning liquid stored in the container (7) into the cleaning bowl (5); a discharge path (57, 127) for returning the cleaning liquid in the cleaning bowl (5) into the container (7) therethrough; and a filter (89). The discharge path (57, 127) is provided at a downstream thereof with a first flow path (C1) via which part of the cleaning liquid pass through the filter (89) and a second flow path (C2) via which other part of the cleaning liquid flows over the filter (89).

[0008] In the cleaning device, preferably, the filter (89) is arranged so as to intersect with a flow direction of the cleaning liquid which is returned to the container (7) through the discharge path (57, 127). The first flow path (C1) is a path via which the part of the cleaning liquid passes through the filter (89) to reach the cleaning liquid supply means (P). The second flow path (C2) is a path via which the other part of the cleaning liquid, after flowing along a surface of the filter (89), reaches the cleaning liquid supply means (P) while dirt factors included in the cleaning liquid are deposited onto a region other than the filter (89).

[0009] In the cleaning device, preferably, a flow rate of the cleaning liquid flowing in the first flow path (C1) is set to be larger than a flow rate of the cleaning liquid flowing in the second flow path (C2).

[0010] In the cleaning device, preferably, a flow path length of the first flow path (C1) is defined as a shortest length of a path, which leads from the filter (89) to the cleaning liquid supply means (P), through the filter (89). A flow path length of the second flow path (C2) is defined as a shortest length of a path, which leads from the filter (89) to the cleaning liquid supply means (P), over a surface of the filter (89). The flow path length of the second flow path (C2) is longer than the flow path length of the first flow path (C1).

[0011] In the cleaning device, preferably, at least part of the filter (89) is placed above a liquid surface of the cleaning liquid stored in the container (7).

[0012] In the cleaning device, preferably, a flow direction of the cleaning liquid flowing along the filter (89) is an opposite side to that of the cleaning liquid after passing through the filter (89).

[0013] In the cleaning device, preferably, the filter (89) is inclined with respect to a flow direction of the cleaning liquid which is returned to the container (7) through the discharge path (57, 127). Further preferably, the filter (89) has an inclination direction which is inclined downward so that part of the filter is positioned lower, as distance from the cleaning liquid supply means (P) increases.

[0014] The cleaning device may include a wall (812) which is provided around the filter (89) and extends upward to be above the filter (89).

[0015] Preferably, the cleaning device includes a partition wall (81) by which the discharge path is partitioned into the first flow path (C1) and the second flow path (C2).

The partition wall (81) intervenes in the shortest distance between the cleaning liquid supply means (P) and a drop point to the filter (89), of the cleaning liquid flowing in the discharge path (57, 127).

[0016] In the cleaning device, preferably, the partition wall (81) has an end face which is in contact with an inner wall of the container (7) to partition the container (7).

[0017] Preferably, the cleaning device includes a second bottom plate (80) that is disposed above a bottom face (75) of the container (7) so as to form a bottom space (7c) between the bottom face (75) and the second bottom plate (80). The second flow path (C2) is a path that passes through the bottom space (7c) to reach a space (7b), above the second bottom plate (80), in which the cleaning liquid supply means (P) is disposed.

[0018] Preferably, the cleaning device includes a rib (85) provided on a face surrounding the bottom space (7c), to reduce a fluid velocity of the cleaning liquid. Further preferably, the rib (85) is formed on a lower face of the second bottom plate (80) and is shaped like a grid or a polygon.

[0019] In the cleaning device, preferably, the filter (89) and the second bottom plate (80) are detachably attached to the container (7).

[0020] Preferably, the cleaning device includes a partition structure (8a) by which the discharge path is partitioned into the first flow path (C1) and the second flow path (C2). The partition structure (8a) includes: a flow dividing plate (83) that intersects with a flow direction of the cleaning liquid which is returned to the container (7) through the discharge path (57, 127); an opening (84) formed in the flow dividing plate (83); a dividing wall (811, 86, 813) extending downward from the flow dividing plate (83); and the filter (89) disposed so as to cover the opening (84).

[0021] In the cleaning device, preferably, the opening (89) is located vertically below an outlet port of the discharge path (127).

[0022] In the cleaning device of the invention, a flow of the cleaning liquid is divided into two flows: a flow that passes through the filter; and a flow that flows over the filter (along the filter). The former reaches directly the cleaning liquid supply means, whereas the latter does, after flowing along the surface of the filter, reach the cleaning liquid supply means while depositing dirt factors included in the cleaning liquid onto a region other than the filter. It is accordingly possible to effectively separate dirt factors from cleaning liquid as well as to supply, into the cleaning bowl, cleaning liquid with few dirt factors. Furthermore, it is possible to reuse the filter and the container by simply washing the dirt factors off because the filter is not configured to capture the dirt factors.

BRIEF DESCRIPTION OF DRAWINGS

[0023]

FIG. 1 is a sectional view (taken along line N-N of FIG. 10) of a cleaning device according to an embodiment of the invention;

FIG. 2 is a perspective view of the cleaning device to which a small electrical appliance is attached;

FIG. 3 is a sectional view taken along line X-X of FIG. 2;

FIG. 4 is a perspective view of the cleaning device in a state where a body side thereof is lifted;

FIG. 5 is an exploded perspective view of part of the cleaning device;

FIG. 6 is an exploded perspective view of part of the cleaning device;

FIG. 7 is a sectional view of the cleaning device in a state where its side cover is detached;

FIG. 8 is a partially enlarged sectional view of the cleaning device around a folded part of a container;

FIG. 9 is a perspective view of the cleaning device in a state where its top-face cover, a support mount, the side cover and a front cover are detached;

FIG. 10 is a plan view of the cleaning device in a state where its top-face cover and the support mount are detached;

FIG. 11 is a sectional view taken along line L-L of FIG. 10;

FIG. 12 is a side view of a cleaning bowl in the cleaning device;

FIG. 13 is a plan view of the cleaning bowl in the cleaning device;

FIG. 14 is a perspective view of the cleaning bowl in the cleaning device;

FIG. 15 is an exploded perspective view of the container and a filter frame in the cleaning device;

FIG. 16 is a perspective view of the container and the filter frame in the cleaning device;

FIGS. 17A and 17B show the container and the filter frame in the cleaning device, where FIG. 17A is a sectional view thereof, and FIG. 17B is a sectional view taken along line Y-Y of FIG. 17A;

FIGS. 18A to 18D show the filter frame in the cleaning device, where FIG. 18A is a plan view thereof, FIG. 18B is a back view thereof, FIG. 18C is a side view thereof, and FIG. 18D is a bottom view thereof, respectively; and

FIG. 19 is a view illustrating level detecting pins in the cleaning device.

DESCRIPTION OF EMBODIMENTS

[0024] Hereinafter, an embodiment of the invention is described in detail with reference to drawings.

[0025] FIG. 1 is a sectional view of a cleaning device **1** according to the embodiment. As shown in FIGS. 2 and 3, the cleaning device **1** of the embodiment is a device for cleaning a part needing to be cleaned (such as a blade head **Ea**) of a small electrical appliance **E** that is an electric shaver (e.g., a reciprocating type electric shaver). The cleaning device **1** is provided, in an upper face thereof, with an opening **20** into which the blade head **Ea** is

inserted while the small electrical appliance **E** is made upside down. The opening **20** is placed on a first side in a first direction (a left side in a right-left direction in FIG. 1) of the cleaning device **1,** and defines a front side of the cleaning device **1,** for example.

[0026] As shown in FIGS. 3 to 7, the cleaning device **1** includes therein a cleaning bowl **5,** a container **7** for storing cleaning liquid, and a pump **P** (a cleaning liquid supply means) for circulating the cleaning liquid between the container **7** and the cleaning bowl **5** (i.e., for supplying the cleaning liquid stored in the container **7** into the cleaning bowl **5**). The cleaning device **1** further includes: a heater unit **H** and a motor fan **F** for drying the blade head **Ea** after it is cleaned; and a supporting portion **S** that is disposed on an upper rear side of the cleaning device **1** and includes a connector for electrical connection with the small electrical appliance **E.**

[0027] The cleaning liquid stored in the container **7** can be supplied into the cleaning bowl **5** through the pump **P** by setting the container **7** storing the cleaning liquid to the cleaning device **1,** electrically connecting the small electrical appliance **E** and the cleaning device **1** through the connector of the supporting portion **S** while placing the blade head **Ea** of the small electrical appliance **E** in the cleaning bowl **5** through the opening **20,** and activating the pump **P.** Specifically, as shown in FIG. 7, the cleaning bowl **5** is disposed above a base **12.** The base **12** is disposed on an upper opening of the container **7.** As shown in FIG. 3, the pump **P** includes a connecting pipe **126** that protrudes downward from the base **12** into an inside of the container **7** and communicates with a bottom side of the cleaning bowl **5** and a bottom side of the container **7.** The cleaning liquid stored in the container **7** is supplied into the cleaning bowl **5** through the connecting pipe **126** of the pump **P.** The cleaning liquid going over an overflow weir **54** provided in the cleaning bowl **5** is to return into the container **7** located below the cleaning bowl **5.** As shown in FIGS. 1 and 11, connecting pipes **127** and **128** protrude downward from the base **12** into the inside of the container **7,** and the cleaning liquid going over the overflow weir **54** is to return into the container **7** through the connecting pipe **127** or **128.** The blade head **Ea** of the small electrical appliance **E** can be cleaned more quickly and effectively by supplying electric power and transmitting a signal via the above-mentioned connector to drive the blade head **Ea** during the cleaning.

[0028] Each component of the cleaning device **1** is described in detail with reference to FIGS. 5 and 6. The cleaning device **1** includes: a bottom plate **11;** the base **12** configured to vertically move with respect to the bottom plate **11;** a support frame **13** disposed on the base **12;** the cleaning bowl **5** of which periphery of four upper edges is supported by an upper edge of the support frame **13;** a top-face cover **2** provided with the opening **20;** a support mount **6** to which the connector is attached; a side cover **15** that forms side faces of the device; and a front cover **16** that forms a front face of the device.

[0029] As shown in FIG. 5, the bottom plate **11** is provided with guide posts **110** and **110** standing on respective right and left sides thereof. The base **12** is configured to vertically move along the guide posts **110.** Push-up rods **111** and **111** provided with respective springs **112** and **112** are disposed in the respective guide posts **110** and **110** of the bottom plate **11.** The push-up rods **111** and **111** with the springs **112** and **112** exert an upward force on the base **12.**

[0030] A switch plate **31** is disposed on the base **12** so as to free to move in the right-left direction. A spring **32** exerts a force on the switch plate **31** in one direction, and one end of the switch plate **31** is exposed outside through the side cover **15** (see FIG. 9). The switch plate **31** includes engagement parts for engaging with respective hooks **115** and **115** formed at respective upper ends of the guide posts **110** and **110.** If the switch plate **31** is pressed in while compressing the spring **32,** the engagement between the switch plate **31** and the hooks **115** and **115** are released, and accordingly the base **12** moves upward by receiving force which the springs **112** and **112** exert. Then, if the base **12** is pressed downward, the switch plate **31** engages with the hooks **115** and **115** again, and accordingly the base **12** is kept in the pressed-down state.

[0031] The base **12** includes a motor cover **120** that is shaped like a cylinder protruding downward. A motor **M** is housed in the motor cover **120** via a motor case **121.** As shown in FIG. 11, an impeller **123** is attached to an output shaft of the motor, which protrudes downward from a bottom face of the motor cover **120** via a seal **122** having an M-shape in cross-section. Further, a pump cover **124** is attached to the motor cover **120** around the impeller **123.** The pump cover **124** is provided with a suction port that opens in a central part of a bottom thereof. When the impeller **123** is rotated, cleaning liquid sucked through the suction port of the pump cover **124** is sent to an inlet and outlet port **56** (described later) of the cleaning bowl **5** through the connecting pipe **126** with which the motor cover **120** is integrally provided. In the embodiment, the cleaning liquid supply means (the pump **P**) includes the motor **M,** the motor cover **120,** the motor case **121,** the seal **122,** the impeller **123,** the pump cover **124** and the connecting pipe **126.**

[0032] The cleaning device **1** further includes a controller formed of a switch circuit **21** (shown in FIG. 5) and the like. The controller is configured to control electric conduction with a small electrical appliance **E** through the connector, operation of the pump **P** and the like, in accordance with an instruction from the outside.

[0033] Three level detecting pins **24, 25** and **26** (a common pin **24,** a first detecting pin **25** and a second detecting pin **26**) are disposed on an outer side of the motor cover **120.** The three level detecting pins **24, 25** and **26** to be soaked in cleaning liquid stored in the container 7 are adapted to detect a level of the cleaning liquid by electric resistance values between them. That is, cleaning liquid has electric conductivity, and accordingly the level can be detected because an electric resistance value be-

tween the level detecting pins **24** and **25** (between the common pin **24** and the first detecting pin **25**) when cleaning liquid is absent therebetween is larger than a predetermined value and an electric resistance value between the level detecting pins **24** and **26** (between the common pin **24** and the second detecting pin **26)** when cleaning liquid is absent therebetween is larger than a predetermined value.

[0034] In the embodiment, a lower end of the level detecting pin (the common pin) **24** is located at the lowest position in the level detecting pins **24, 25** and **26,** and a lower end of the level detecting pin **25** is different in height from that of the level detecting pin **26.** In the embodiment, the lower end of the first detecting pin **25** is located at a position lower than that of the second detecting pin **26.** It is accordingly possible to detect a level of the cleaning liquid in two-stages, for example a state in which residual amount of the cleaning liquid is small (a state in which a liquid surface level of the cleaning liquid is lower than the position of the lower end of the second detecting pin **26** and thus only the common pin **24** and the first detecting pin **25** are soaked in the cleaning liquid), and a state in which the residual amount of the cleaning liquid is smaller than a liquid amount that is required for a cleaning operation while circulating the cleaning liquid (a state in which the cleaning is impossible; a state in which a liquid surface level of the cleaning liquid is lower than the position of the lower end of the first detecting pin **25** and thus only the common pin **24** is soaked in the cleaning liquid).

[0035] In order to secure a detection margin when the cleaning device 1 is put on an inclined plane as shown in FIG. 19, the lower end of the level detecting pin (the common pin) **24** is located at a position lower than those of the other two level detecting pins (the first and second detecting pins) **25** and **26.** In the figure 19, a reference sign **W** indicates a liquid surface. The liquid surface **W** is illustrated to be inclined with respect to a horizontal plane in FIG. 19, but this is for explanation. Actually, it is the container **7** that is inclined with respect to the horizontal plane due to, for example, an electric power code or a comb intervening below the container **7.**

[0036] As shown in FIG. 7, the cleaning bowl **5** is disposed on the base **12** via the support frame **13.** The cleaning bowl **5** is formed of soft material, such as rubber. As shown in FIGS. 7 and 8, the cleaning bowl **5** includes a folded part **50.** The folded part **50** protrudes sideways from an upper edge of the cleaning bowl **5** and an end thereof is folded downward. As shown in FIG. 8, if the folded part **50** is capped on an upper edge of the support frame **13** and the top-face cover **2** is installed in the cleaning bowl **5,** a rib **22** provided on a lower edge of the top-face cover **2** is fitted in a groove **51** provided in a top face of the upper edge of the cleaning bowl **5.** The upper edge of the cleaning bowl **5** is pressed between the top-face cover **2** and the support frame **13,** and accordingly this portion is kept waterproofed.

[0037] As shown in FIGS. 12 to 14 as well, the cleaning bowl **5** includes thereinside the overflow weir **54.** The overflow weir **54** is shaped like a wall which gradually lowers towards its center. The overflow weir **54** divides the inside of the cleaning bowl **5** into two parts. In the embodiment, the overflow weir **54** partitions the inside space of the cleaning bowl **5** into a cleaning part **52** on a front side and an overflow part **53** on a rear side. The cleaning part **52** is a part for housing a blade head **Ea** of a small electrical appliance **E.** A rib **55** is formed integrally with a wall surface of the cleaning part **52** on a side of the overflow weir **54.** As shown in FIG. 9, in the cleaning part **52,** the blade head **Ea** is positioned in a front-back direction between the rib **55** and a supporting part **36** of a head guide **35** disposed on an inner face of the cleaning bowl **5** (see FIG. 3). Furthermore, protruded belts **59** are provided on a bottom face of the cleaning bowl **5** (see FIGS. 9 and 10), and the blade head **Ea** is supported by the protruded belts **59** while slightly floated from the bottom face.

[0038] As shown in FIGS. 12 to 14, the cleaning bowl **5** is provided, at a lowest portion of the cleaning part **52,** with the inlet and outlet port **56.** The cleaning bowl **5** is further provided, in the overflow part **53,** with two outlets **57** and **58.** As shown in FIG. 11, the inlet and outlet port **56** is connected to the connecting pipe **126** provided at the base **12.** As shown in FIGS. 11 and 13, the outlets **57** and **58** are connected to the connecting pipes **127** and **128** provided at the base **12,** respectively. The connecting pipes **127** and **128** are placed just above the container **7** that stores cleaning liquid. Drainage passing through the outlets **57** and **58** is returned into the container **7** through the connecting pipes **127** and **128.** Specifically, as shown in FIGS. 1, 10 and 16, drainage passing through the outlet **57** and the connecting pipe **127** is returned into the container **7** (a space **b**) through a diversion **82** side. As shown in FIGS. 11, 10 and 16, drainage passing through the outlet **58** and the connecting pipe **128** is directly returned into the container **7** (the space **7b**).

[0039] As shown in FIG. 14, the outlet **57** has a top opening of which position is lower than that of an outlet **58,** and carries out discharge for circulating the cleaning liquid. The outlet **58** has a top opening of which position is higher than the outlet **57** and placed at a position farther than the outlet **57** away from the overflow weir **54,** and is used for emergency in a case where the outlet **57** is clogged up with some cause to lose a function thereof. As shown in FIGS. 13 and 14, a bottom face of the overflow part **53** is shaped into an inclined plane that is inclined downward towards the outlet **57** on one side.

[0040] In the embodiment, a discharge path for returning the cleaning liquid in the cleaning bowl **5** into the container **7** therethrough includes the outlet **57** and the connecting pipe **127.**

[0041] As shown in FIGS. 9 and 10, a part on one side in a front edge of the cleaning bowl **5** is surrounded by a wall **500** having a long hole shape in cross-section and is used for arrangement of a select button **29** for operation instruction. The select button **29** is exposed through the

top-face cover **2.** When the select button **29** is operated, a switch on the switch board **21** (see FIG. 5) is driven via a switch rod **290** (see FIG. 6). Accordingly, the operation of the cleaning device **1** can be instructed with the select button **29.** At this time, indicator lamps for operation indication provided on the switch board **21** are configured to conduct display on the top-face cover **2** via a light guide plate **28** in response to the instruction. The indicator lamps include a lamp for displaying amount of cleaning liquid stored in the container **7.**

[0042] As shown in FIG. 6, the supporting portion **S** includes the support mount **6** and the back cover **23** in the top-face cover **2.** The back cover **23** covers a back side of the support mount **6.** The support mount **6** includes contacts **39** on which springs **37** exert individual forward forces via respective contact supporting members **38.** The contacts **39** are exposed on a front face of the support mount **6** without protruding from the front face of the support mount **6.**

[0043] A magnet **43** and a yoke **44** for attracting a small electrical appliance **E** are disposed above the contacts **39.** When a blade head **Ea** is fitted in the cleaning bowl **5,** the small electrical appliance **E** is attracted to the supporting portion **S** by the magnetic attraction of the magnet **43,** and thus a terminal **Eb** included in the small electrical appliance **E** come into contact with the contacts **39,** and also the terminal **Eb** press the contacts **39** while compressing the springs **37** (see FIG. 3). Thus, contact pressures between the terminal **Eb** and the contacts **39** can be kept secured by the magnetic attraction of the magnet **43** and the spring force of the springs **37.** The contact between the contacts **39** and the terminal **Eb** allows power supply to the small electrical appliance **E** and signal transmission from the cleaning device **1** to the small electrical appliance **E.**

[0044] A body detecting plate **42** (see FIG. 6) is disposed in the supporting portion **S** so as to be in contact with the contacts **39** and configured to be separated from the contacts **39** when the contacts **39** are moved back as a result of attachment of the small electrical appliance **E,** thereby detecting that the small electrical appliance **E** is attached to the cleaning device 1.

[0045] As shown in FIG. 11, an air outlet **66** is provided in a lower part of the support mount **6,** and the motor fan **F** is attached at a back side of the air outlet **66.** A lower edge of support mount **6** near the air outlet **66** is put on an upper edge of a rear part of the cleaning bowl **5.** The motor fan **F** is configured to draw in air through an intake **150** that is formed in a back face of the cleaning device **1,** and send the air to the blade head **Ea** of the small electrical appliance **E** through the air outlet **66.** The air outlet **66** for the motor fan **F** faces diagonally downward so as to send air toward the blade head **Ea** from upside. The support mount **6** further includes current plates **67** in order to efficiently change the direction of the air.

[0046] The heater unit **H** for heating is disposed on a back (a lower face) side of the cleaning part **52** of the cleaning bowl **5.** The heater unit **H** includes a heater wire, a heater plate, a heater substrate, a temperature sensor for temperature control, and a protection component for aberrant heating (which are not shown). The heater unit **H** is configured to transmit heat from the heater wire to the blade head **Ea** through the heater plate, the cleaning bowl **5** and the protruded belts **59** of the cleaning bowl **5** to thereby dry the blade head **Ea** after cleaning.

[0047] The cleaning bowl **5** and the top-face cover **2** are installed on the base **12** via the support frame **13.** The side cover **15** and the front cover **16** are attached so as to surround an outer periphery of main parts of the cleaning device **1.** Therefore, when the base **12** is moved vertically with respect to the bottom plate **11,** all components other than the bottom plate **11** and the container **7** detachably disposed on the bottom plate **11** are vertically moved along with the base **12** (see FIG. 4). The vertical movement allows the container **7** disposed on the bottom plate **11** to be detached and attached again.

[0048] The container **7** and a filter frame **8** detachably disposed in the container **7** are described with reference to FIGS. 15 to 18. The container **7** is shaped like a cup having the upper opening. A width on a rear side of the container **7** is narrower than that on a front side thereof. The container **7** is disposed on the bottom plate **11.** A water line **70** is formed on an inner wall of the container **7.** As shown in FIG. 17B, some protrusions **76** are provided on a lower face of the container **7** (on a lower face of the bottom plate of the container **7**). As a result, when the container **7** is put outside the cleaning device **1,** the stability of the container **7** can be secured. In addition, even when water drop is adhered on the lower face of the container **7** by washing or the like, the water drop is prevented from accidentally moving to a place on which the container **7** is put.

[0049] As shown in FIGS. 18A to 18D, the filter frame **8** includes a bottom plate part (a second bottom plate) **80** and a partition wall **81.** The partition wall **81** extends upward from a rear part of the bottom plate part **80.** Both side edges of the partition wall **81** are in contact with an inner wall face of the container **7** (see FIGS. 15 and 16). In the embodiment, the bottom plate part **80** almost covers a bottom face **75** of the container **7.** Projecting pieces **74** for positioning are provided on the inner wall of the container **7** and determine the position of the filter frame **8** in the container **7.** As shown in FIGS. 16, 17A and 17B, an inside of the container **7** is divided by the filter frame **8** into three spaces in total which includes two spaces **7a** and **7b** (a first space **7a** and a second space **7b**) partitioned with the partition wall **81,** and a bottom space **7c** between the bottom face **75** of the container **7** and the bottom plate part **80** slightly floated from the bottom face **75** of the container **7.** As shown in FIG. 18D, the bottom plate part **80** is provided, on a lower face side thereof, with ribs **85** shaped like a grid. As shown in FIG. 18A, the bottom plate part **80** is provided with a recess **88** in part of an upper face of the rear part facing the second space **7b.** When the filter frame **8** is disposed in the container **7,** a gap is formed between a front edge of a pe-

riphery of the filter frame **8** and the inner wall face of the container **7** (see FIG. 17A).

[0050] The diversion **82** is provided at an upper part of the partition wall **81.** The diversion **82** includes: an inclined plane **83** formed at an upper part of the partition wall **81;** outlets **84** formed in the inclined plane **83;** and an inclined plane **86** that is located just under the outlets **84** and has an inverse inclination to the inclined plane **83.** Further, a filter **89** is detachably disposed on the inclined plane **83** of the diversion **82.** The filter **89** is formed of a mesh structure having holes smaller than body hair and the like. The filter **89** is disposed on the inclined plane **83** so as to cover whole of the outlets **84.** The inclined plane **83** is inclined with respect to a flow direction of cleaning liquid discharged from the connecting pipe **127** (a flow direction of the cleaning liquid which is returned to the container **7** through the discharge path). The inclined plane **83** has an inclination direction which is inclined downward so that part thereof is positioned lower, as distance from the pump **P** increases. Further, parts of the filter **89** and the inclined plane **83** are placed above a liquid surface of the cleaning liquid stored in the container **7** (above the water line **70**).

[0051] Some of cleaning liquid may enter the first space **7a** that is formed between the partition wall **81** and the inner wall of the container **7** without passing through the filter **89** and the outlets **84.** The cleaning liquid flows into the second space **7b** on an upper face side of the bottom plate part **80** through the bottom space **7c** between the bottom face **75** of the container **7** (the bottom plate of the container **7**) and the bottom plate part **80,** and the gap between the front edge of the bottom plate part **80** and the inner wall face of the container **7.** Cleaning liquid passing through the filter **89** and the outlets **84** (directly) enters the second space **7b** along the inclined plane **86.**

[0052] Opening areas of the outlets **84** are set so that the amount of the cleaning liquid passing through the filter **89** and the outlets **84** is larger than the amount of the cleaning liquid which enters the bottom space **7c** through the first space **7a** without passing therethrough. The inclined plane **83** may be formed with at least an outlet **84.**

[0053] On a side of the second space **7b** with respect to the filter **89,** the partition wall **81** has a higher height (a wall **812** which extends upward to be above the filter **89** is provided around the filter **89**). It is accordingly possible to prevent the cleaning liquid including dirt factors (such as body hairs and sebum) from spreading towards the second space **7b** even when the cleaning liquid hits to splash from the filter **89** or the inclined plane **83.**

[0054] That is, in the embodiment, the discharge path (the connecting pipe **127**) is provided at a downstream thereof with: a first flow path **C1** via which cleaning liquid passes through the filter **89;** and a second flow path **C2** via which cleaning liquid flows over the filter **89** (see FIG. 17B).

[0055] The first flow path **C1** and the second flow path **C2** are partitioned by a partition structure **8a.** The partition structure **8a** includes: a flow dividing plate (the inclined plane **83**) that intersects with a flow direction of cleaning liquid which is returned to the container **7** through the discharge path (the connecting pipe **127**) (the flow direction of the cleaning liquid discharged from the connecting pipe **127**); the outlets **84** (openings) formed in the flow dividing plate; a dividing wall **811** extending downward from the flow dividing plate; and the filter **89** disposed on the outlet **84.** The outlets **84** (the openings) are located vertically below an outlet port of the discharge path (the connecting pipe **127**).

[0056] The flow dividing plate is inclined with respect to the flow direction of the cleaning liquid which is returned to the container **7** through the discharge path (the flow direction of the cleaning liquid discharged from the connecting pipe **127**). The partition structure **8a** partitions the space inside the container **7** into: the first space **7a;** and the second space **7b** in which the pump **P** is disposed. The first space **7a** and the second space **7b** communicate with each other through the bottom of the container **7.**

[0057] The embodiment includes the second bottom plate (the bottom plate part **80**) which is formed continuously with the partition structure **8a.** The bottom space **7c** is formed between the second bottom plate **80** and the bottom face of the container **7** so that the bottom space **7c** communicates with the first space **7a.** The first flow path **C1** is a path via which cleaning liquid passes through the filter **89** to reach the second space **7b** in which the pump **P** is disposed. The second flow path **C2** is a path via which cleaning liquid passes through the first space **7a** and the bottom space **7c** to reach the second space **7b.**

[0058] In the embodiment, the partition wall **81** includes the dividing wall **811,** the inclined plane **86** and a dividing wall **813** so that the dividing wall **811** and the dividing wall **813** are connected by the inclined plane **86,** but may not include the inclined plane **86.** A lower end of a dividing wall **811** may be directly connected to a bottom plate part **80.**

[0059] For cleaning a blade head **Ea** of a small electrical appliance **E,** cleaning liquid is stored in the container **7** housing the filter frame **8** and the container **7** is then disposed on the bottom plate **11** while a whole of the device is floated with respect to the bottom plate **11** (see FIG. 4) by operating the switch plate **31.** At this time, the container **7** is guided by guide plates **117** that are formed on the bottom plate **11,** and further positioned by positioning protrusions **116.** The protrusions **116** are fitted into locking recesses **77** (see FIG. 17B) that are formed in outer wall faces of the container **7,** thereby preventing floating of the container **7.**

[0060] If the body side of the cleaning device **1** is pushed down, a lower part of the pump **P** with which the base **12** is provided is soaked in the cleaning liquid stored in the container **7.** At this time, a packing **17,** which is previously attached to an outer part of a lower face of the

base **12** via an attachment frame **18,** is held between the lower face of the base **12** and a flange **72** that protrudes sideways from an upper edge of the container **7.** Therefore, the part is waterproofed.

[0061] After the container **7** storing the cleaning liquid is set in the cleaning device **1,** the blade head **Ea** of the small electrical appliance **E** is fitted in the cleaning bowl **5** though the upper opening **20** so that the terminal **Eb** of the small electrical appliance **E** come into contact with the contacts **39** of the supporting portion **S.**

[0062] If cleaning (the operation of the pump) is then started by operating the select button **29** of the cleaning device **1** connected to an external power supply, the pump **P** is activated to supply the cleaning liquid stored in the container **7** into the cleaning part **52** of the cleaning bowl **5** through the connecting pipe **126** and the inlet and outlet port **56.** The cleaning liquid going over the overflow weir **54** of the cleaning bowl **5** is returned into the container **7** through the outlet **57** and the connecting pipe **127.** Therefore, the cleaning liquid is circulated between the container **7** and the cleaning bowl **5.**

[0063] During the cleaning, it is preferable that the controller drives blades in the blade head **Ea** of the small electrical appliance **E** through the supporting portion **S.** The blade head **Ea** can be cleaned more quickly and effectively.

[0064] The cleaning liquid in the cleaning bowl **5** goes over the overflow weir **54** and then enters the overflow part **53** to return into the container **7** through the outlet **57** and the connecting pipe **127** as described above. As described above, the connecting pipe **127** is located just above the filter **89** disposed in the first space **7a** in the container **7.** Therefore, body hairs and the like included in the cleaning liquid enters the bottom space **7c** of the container **7** while flowing along a surface of the filter **89** to flow down through the first space **7a** with the cleaning liquid without passing through the filter **89.** The cleaning liquid that passes through the filter **89** and the outlets **84** includes few body hairs and the like, and it flows (in an opposite side direction) towards a side of the recess **88** in the second space **7b** via the inclined plane **86.** Because the suction port of the pump **P** is located near the recess **88,** the cleaning liquid flows to the pump **P** in a shortest path and then is supplied again into the cleaning bowl **5** through the pump **P.** Dirt elements are hardly accumulated on the surface of the filter **89** because of the inclination of the filter **89,** gravity fall of the cleaning liquid, and the surface tension of the cleaning liquid.

[0065] In the embodiment, the cleaning liquid flowing over the filter **89** is flown into a direction away from the pump **P.** The partition wall **81** intervenes in the shortest distance between the pump **P** and a drop point of the cleaning liquid flowing down to the filter **89** (a drop point to a filter **89**). Further, the filter **89** has the inclination direction which is inclined downward so that part thereof is positioned lower, as distance from the pump **P** increases. With these configurations, it is possible to further lengthen a flow path length of a flow path that passes through the bottom space **7c** to reach the second space **7b.**

[0066] On the other hand, if the cleaning liquid and body hairs and the like enter the bottom space **7c** between the lower face of the filter frame **8** and the bottom face **75** of the container **7** through the first space **7a** located on one side of a rear part of the container **7,** they spread along the bottom face **75** of the container **7,** and then flow into the second space **7b** through the gap between the front edge of the bottom plate part **80** of the filter frame **8** and the inner wall face of a front part of the container **7.** In this case, the cleaning liquid entering the bottom space **7c** spreads as described above and the cleaning liquid supplied into the cleaning bowl **5** through the pump **P** is mainly cleaning liquid with few body hairs and the like after passing through the filter **89** and the outlets **84.** A flow rate of the cleaning liquid passing through the bottom space **7c** is considerably small, and a fluid velocity thereof is also considerably low. Moreover, the flow path passing through the first space **7a** has a long flow path length, and retention occurs at many places in the ribs **85** that are shaped like a grid and provided on the lower face of the bottom plate part **80** of the filter frame **8.** Accordingly, body hairs and the like included in the cleaning liquid are deposited and accumulated in the bottom space **7c.**

[0067] The cleaning liquid passing through the bottom space **7c** flows through the front of the container **7** and above the bottom plate part **80** of the filter frame **8** to reach the recess **88** facing the suction port of the pump **P** near the rear part of the container **7.** Moreover, the bottom plate part **80** intervenes between the suction port and deposited and accumulated body hairs and the like. Accordingly, it is less likely that the pump **P** sucks the body hairs and the like to return them into the cleaning bowl **5** again.

[0068] The bottom space **7c** may have a capacity for securing accumulation amount of body hairs corresponding to about several tens of times of normal cleaning operation. If taking the container **7** out from the cleaning device **1** and detaching the filter frame **8** from the container **7,** a user can wash away the accumulated body hairs from the container **7,** and then stores new cleaning liquid into the container **7** to recover initial cleaning capability. The above mentioned flange **72** is provided at the upper edge of the container **7** and formed to protrude sideways. It is accordingly possible to smoothly discharge the old cleaning liquid (and body hairs and the like) with a side of the opening of the container **7** down in order to discard the cleaning liquid in the container **7.** The flange **72** is provided for securing hardness for water stop, but is unnecessarily in a case where the hardness can be secured by a thickness of a side wall of the container **7.** When the filter **89** is detached from the filter frame **8,** the body hairs can be washed away from the filter **89.**

[0069] If the pump **P** is stopped after the cleaning is finished, the cleaning liquid in the cleaning part **52** of the

cleaning bowl **5** is returned into the container **7** by natural drop from the inlet and outlet port **56** through the connecting pipe **126** and the pump **P** (a space between the impeller **123** and the pump cover **124**). The impeller **123** is soaked in the cleaning liquid in the container **7** and few body hairs and the like are included in the cleaning liquid in the cleaning part **52** after the cleaning is finished. Therefore, clogging hardly occurs although the cleaning liquid passes through the pump **P.** Even if the outlet **57** in the overflow part **53** is clogged during cleaning operation, the cleaning liquid is prevented from overflowing from the cleaning bowl **5** because the outlet **58** is additionally provided.

[0070] In the embodiment, when the cleaning liquid is collected into the container **7** after the cleaning is finished, the motor fan **F** and the heater unit **H** are energized to dry the blade head **Ea.**

[0071] The grid-like rib **85** has advantages of: facilitating the depositing and accumulating of the dirt factors by generating an inverted fluid in the bottom space **7c;** and preventing the dirt factors from rising up from the bottom face **75** of the container **7** when the cleaning device **1** is carried or the like. The rib **85** may be formed on the bottom face **75** side, the inner wall, or the like, of the container **7,** instead of being formed on the bottom plate part **80** of the filter frame **8.** However, in view of facilitating washing of the dirt factors accumulated in the container **7,** the rib **85** is preferably formed on the lower face of the bottom plate part **80.**

[0072] In the embodiment, the filter **89,** in addition to the container **7,** is a reusable component. However, the filter **89** may be a type of a filter that captures dirt factors.

Claims

1. A cleaning device for a small electrical appliance, comprising:

a cleaning bowl for receiving a part, needing to be cleaned, of the small electrical appliance;
a container for storing cleaning liquid to be supplied into the cleaning bowl;
a cleaning liquid supply means configured to supply the cleaning liquid stored in the container into the cleaning bowl;
a discharge path for returning the cleaning liquid in the cleaning bowl into the container therethrough; and
a filter, wherein
the discharge path is provided at a downstream thereof with a first flow path via which part of the cleaning liquid passes through the filter and a second flow path via which other part of the cleaning liquid flows over the filter.

2. The cleaning device for the small electrical appliance according to claim 1, wherein
the filter is arranged so as to intersect with a flow direction of the cleaning liquid which is returned to the container through the discharge path,
the first flow path is a path via which the part of the cleaning liquid passes through the filter to reach the cleaning liquid supply means, and
the second flow path is a path via which the other part of the cleaning liquid, after flowing along a surface of the filter, reaches the cleaning liquid supply means while dirt factors included in the cleaning liquid are deposited onto a region other than the filter.

3. The cleaning device for the small electrical appliance according to claim 1 or 2, wherein a flow rate of the cleaning liquid flowing in the first flow path is set to be larger than a flow rate of the cleaning liquid flowing in the second flow path.

4. The cleaning device for the small electrical appliance according to any one of claims 1 to 3, wherein
a flow path length of the first flow path is defined as a shortest length of a path, which leads from the filter to the cleaning liquid supply means, through the filter,
a flow path length of the second flow path is defined as a shortest length of a path, which leads from the filter to the cleaning liquid supply means, over a surface of the filter, and
the flow path length of the second flow path is longer than the flow path length of the first flow path.

5. The cleaning device for the small electrical appliance according to any one of claims 1 to 4, wherein at least part of the filter is placed above a liquid surface of the cleaning liquid stored in the container.

6. The cleaning device for the small electrical appliance according to any one of claims 1 to 5, wherein a flow direction of the cleaning liquid flowing along the filter is an opposite side to that of the cleaning liquid after passing through the filter.

7. The cleaning device for the small electrical appliance according to any one of claims 1 to 6, wherein the filter is inclined with respect to a flow direction of the cleaning liquid which is returned to the container through the discharge path.

8. The cleaning device for the small electrical appliance according to claim 7, wherein the filter has an inclination direction which is inclined downward so that part of the filter is positioned lower, as distance from the cleaning liquid supply means increases.

9. The cleaning device for the small electrical appliance according to any one of claims 1 to 8, comprising a wall which is provided around the filter and extends upward to be above the filter.

10. The cleaning device for the small electrical appliance according to any one of claims 1 to 9, comprising a partition wall by which the discharge path is partitioned into the first flow path and the second flow path, wherein
the partition wall intervenes in the shortest distance between the cleaning liquid supply means and a drop point to the filter, of the cleaning liquid flowing in the discharge path.

11. The cleaning device for the small electrical appliance according to claim 10, wherein the partition wall has an end face which is in contact with an inner wall of the container to partition the container.

12. The cleaning device for the small electrical appliance according to any one of claims 1 to 11, comprising a second bottom plate that is disposed above a bottom face of the container so as to form a bottom space between the bottom face and the second bottom plate, wherein
the second flow path passes through the bottom space to reach a space, above the second bottom plate, in which the cleaning liquid supply means is disposed.

13. The cleaning device for the small electrical appliance according to claim 12, comprising a rib provided on a face surrounding the bottom space, to reduce a fluid velocity of the cleaning liquid.

14. The cleaning device for the small electrical appliance according to claim 13, wherein the rib is formed on a lower face of the second bottom plate and is shaped like a grid or a polygon.

15. The cleaning device for the small electrical appliance according to any one of claims 12 to 14, wherein the filter and the second bottom plate are detachably attached to the container.

16. The cleaning device for the small electrical appliance according to claim 1, comprising a partition structure by which the discharge path is partitioned into the first flow path and the second flow path, wherein
the partition structure comprises:

a flow dividing plate that intersects with a flow direction of the cleaning liquid which is returned to the container through the discharge path;
an opening formed in the flow dividing plate;
a dividing wall extending downward from the flow dividing plate; and
the filter disposed so as to cover the opening.

17. The cleaning device for the small electrical appliance according to claim 16, wherein the opening is located vertically below an outlet port of the discharge path.

Amended claims under Art. 19.1 PCT

1. (Amended) A cleaning device for a small electrical appliance, comprising:

a cleaning bowl for receiving a part, needing to be cleaned, of the small electrical appliance;
a container for storing cleaning liquid to be supplied into the cleaning bowl;
a cleaning liquid supply means configured to supply the cleaning liquid stored in the container into the cleaning bowl;
a discharge path for returning the cleaning liquid in the cleaning bowl into the container therethrough; and
a filter, wherein
the discharge path is provided at a downstream thereof with a first flow path via which part of the cleaning liquid passes through the filter and a second flow path via which other part of the cleaning liquid flows over the filter, and
a flow direction of the cleaning liquid flowing along the filter is an opposite side to that of the cleaning liquid after passing through the filter.

2. The cleaning device for the small electrical appliance according to claim 1, wherein
the filter is arranged so as to intersect with a flow direction of the cleaning liquid which is returned to the container through the discharge path,
the first flow path is a path via which the part of the cleaning liquid passes through the filter to reach the cleaning liquid supply means, and
the second flow path is a path via which the other part of the cleaning liquid, after flowing along a surface of the filter, reaches the cleaning liquid supply means while dirt factors included in the cleaning liquid are deposited onto a region other than the filter.

3. The cleaning device for the small electrical appliance according to claim 1 or 2, wherein a flow rate of the cleaning liquid flowing in the first flow path is set to be larger than a flow rate of the cleaning liquid flowing in the second flow path.

4. The cleaning device for the small electrical appliance according to any one of claims 1 to 3, wherein
a flow path length of the first flow path is defined as a shortest length of a path, which leads from the filter to the cleaning liquid supply means, through the filter,
a flow path length of the second flow path is defined as a shortest length of a path, which leads from the filter to the cleaning liquid supply means, over a surface of the filter, and
the flow path length of the second flow path is longer than the flow path length of the first flow path.

5. The cleaning device for the small electrical appli-

ance according to any one of claims 1 to 4, wherein at least part of the filter is placed above a liquid surface of the cleaning liquid stored in the container.

6. Cancelled)

7. (Amended) The cleaning device for the small electrical appliance according to any one of claims 1 to 5, wherein the filter is inclined with respect to a flow direction of the cleaning liquid which is returned to the container through the discharge path.

8. The cleaning device for the small electrical appliance according to claim 7, wherein the filter has an inclination direction which is inclined downward so that part of the filter is positioned lower, as distance from the cleaning liquid supply means increases.

9. (Amended) The cleaning device for the small electrical appliance according to any one of claims 1 to 5, 7 and 8, comprising a wall which is provided around the filter and extends upward to be above the filter.

10. (Amended) The cleaning device for the small electrical appliance according to any one of claims 1 to 5, and 7 to 9, comprising a partition wall by which the discharge path is partitioned into the first flow path and the second flow path, wherein
the partition wall intervenes in the shortest distance between the cleaning liquid supply means and a drop point to the filter, of the cleaning liquid flowing in the discharge path.

11. The cleaning device for the small electrical appliance according to claim 10, wherein the partition wall has an end face which is in contact with an inner wall of the container to partition the container.

12. (Amended) The cleaning device for the small electrical appliance according to any one of claims 1 to 5 and 7 to 11, comprising a second bottom plate that is disposed above a bottom face of the container so as to form a bottom space between the bottom face and the second bottom plate, wherein
the second flow path passes through the bottom space to reach a space, above the second bottom plate, in which the cleaning liquid supply means is disposed.

13. The cleaning device for the small electrical appliance according to claim 12, comprising a rib provided on a face surrounding the bottom space, to reduce a fluid velocity of the cleaning liquid.

14. The cleaning device for the small electrical appliance according to claim 13, wherein the rib is formed on a lower face of the second bottom plate and is shaped like a grid or a polygon.

15. The cleaning device for the small electrical appliance according to any one of claims 12 to 14, wherein the filter and the second bottom plate are detachably attached to the container.

16. The cleaning device for the small electrical appliance according to claim 1, comprising a partition structure by which the discharge path is partitioned into the first flow path and the second flow path, wherein
the partition structure comprises:

a flow dividing plate that intersects with a flow direction of the cleaning liquid which is returned to the container through the discharge path;
an opening formed in the flow dividing plate;
a dividing wall extending downward from the flow dividing plate; and
the filter disposed so as to cover the opening.

17. The cleaning device for the small electrical appliance according to claim 16, wherein the opening is located vertically below an outlet port of the discharge path.

FIG. 1

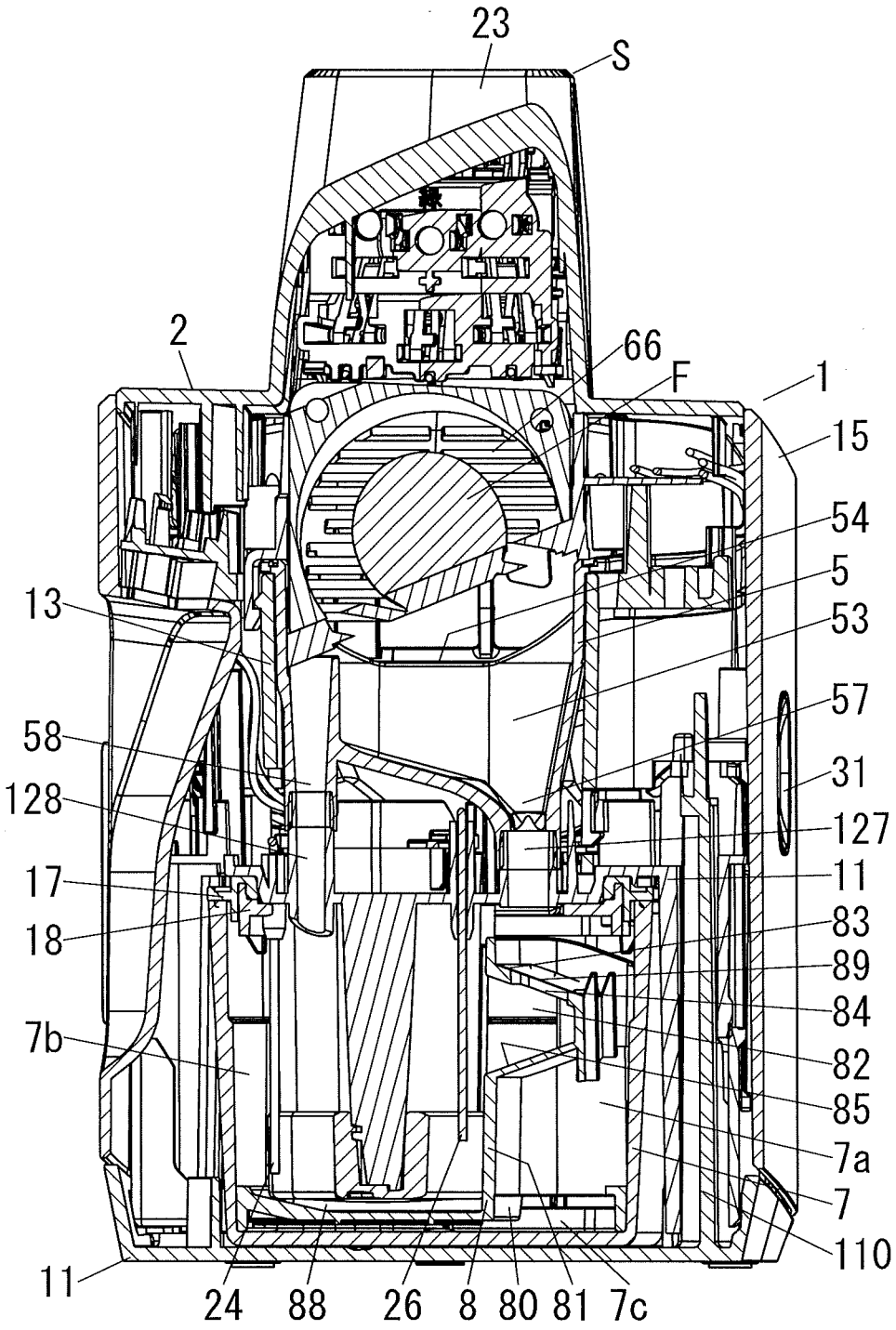
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FIG. 2

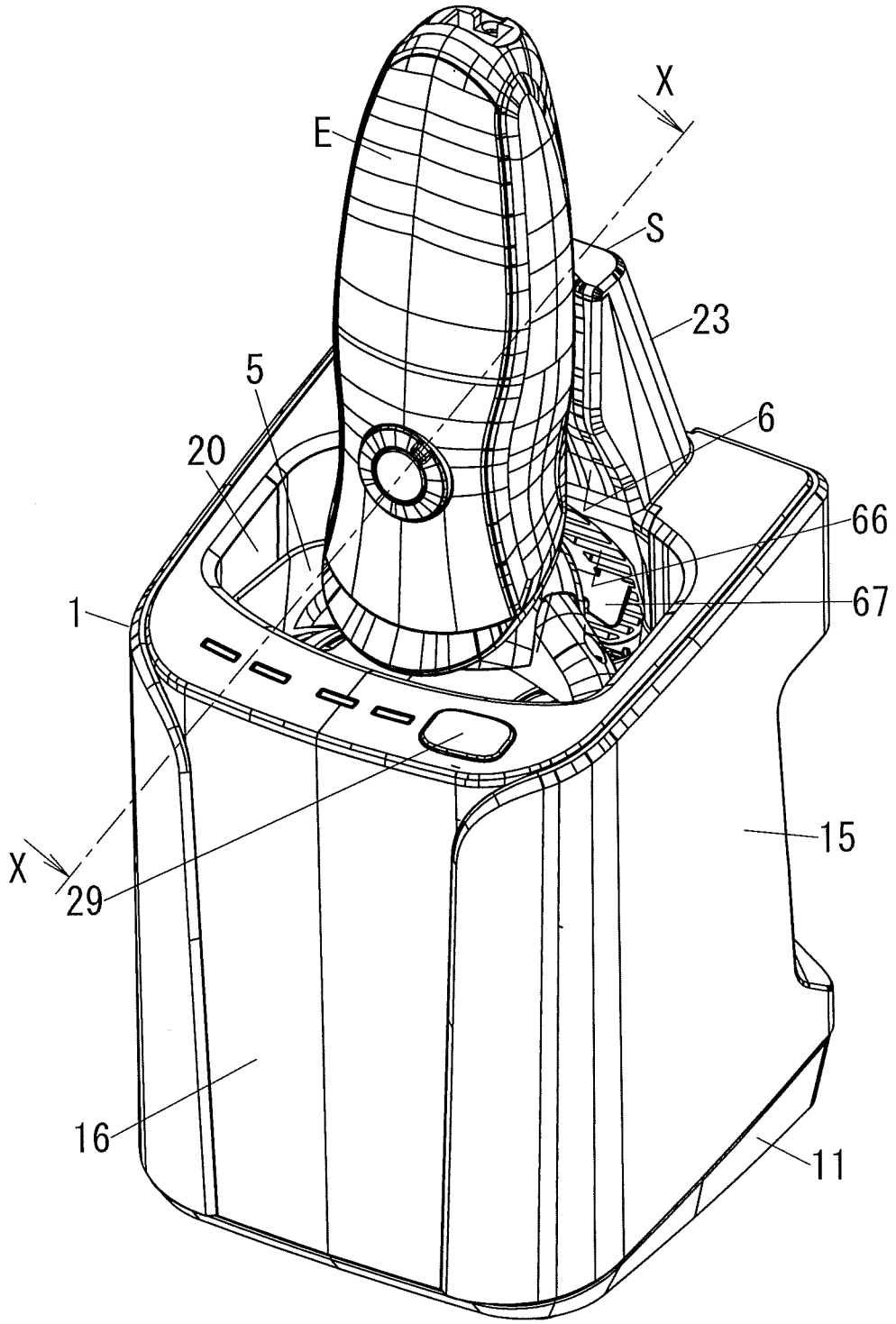

FIG. 3

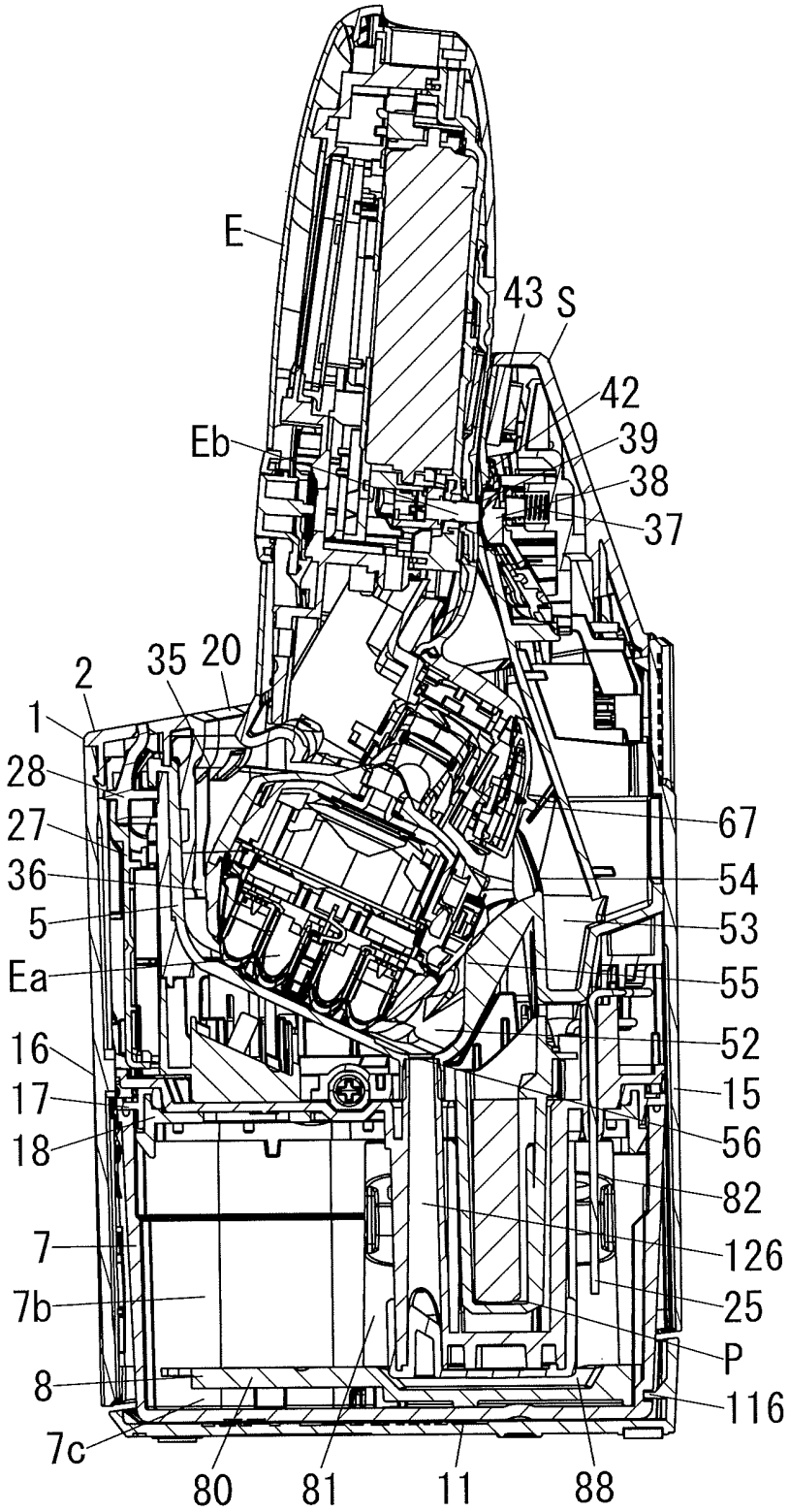
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FIG. 4

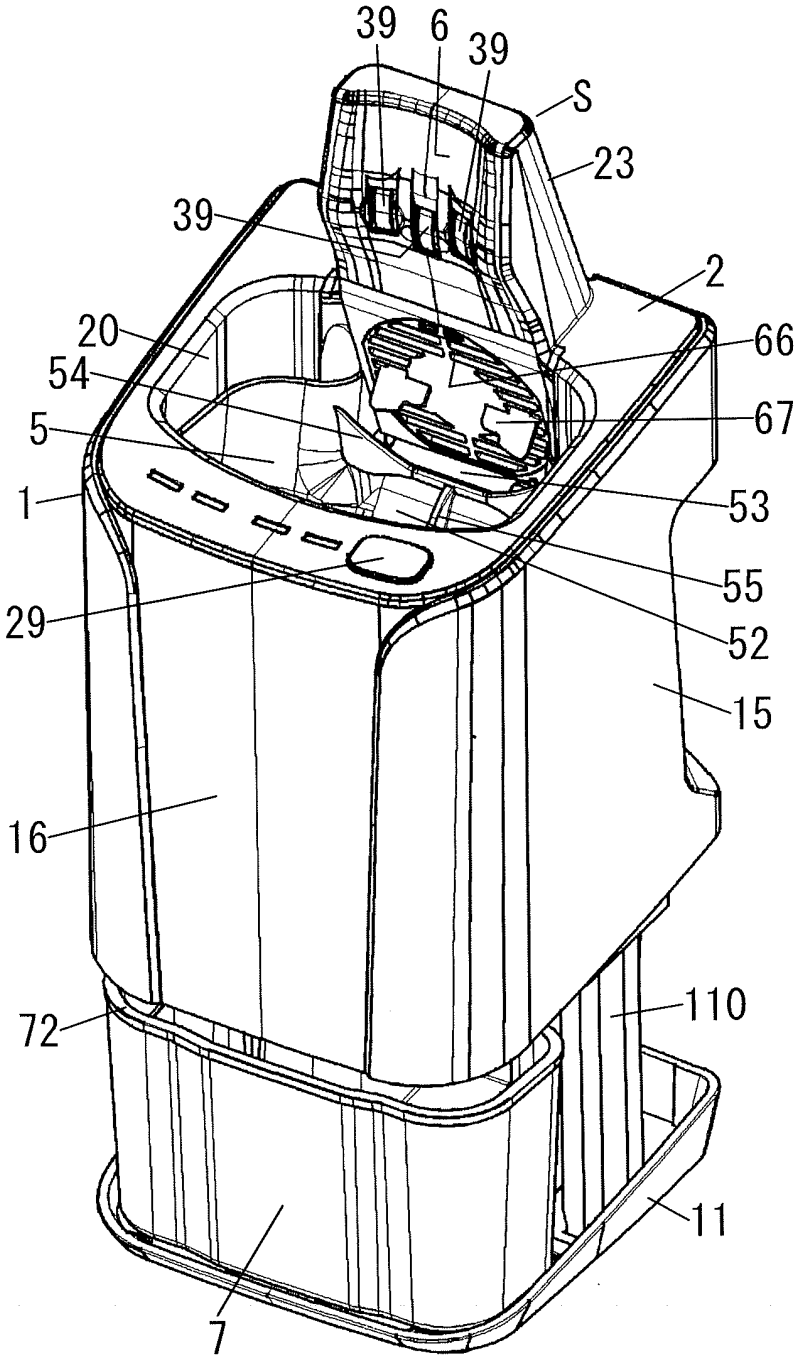

FIG. 5

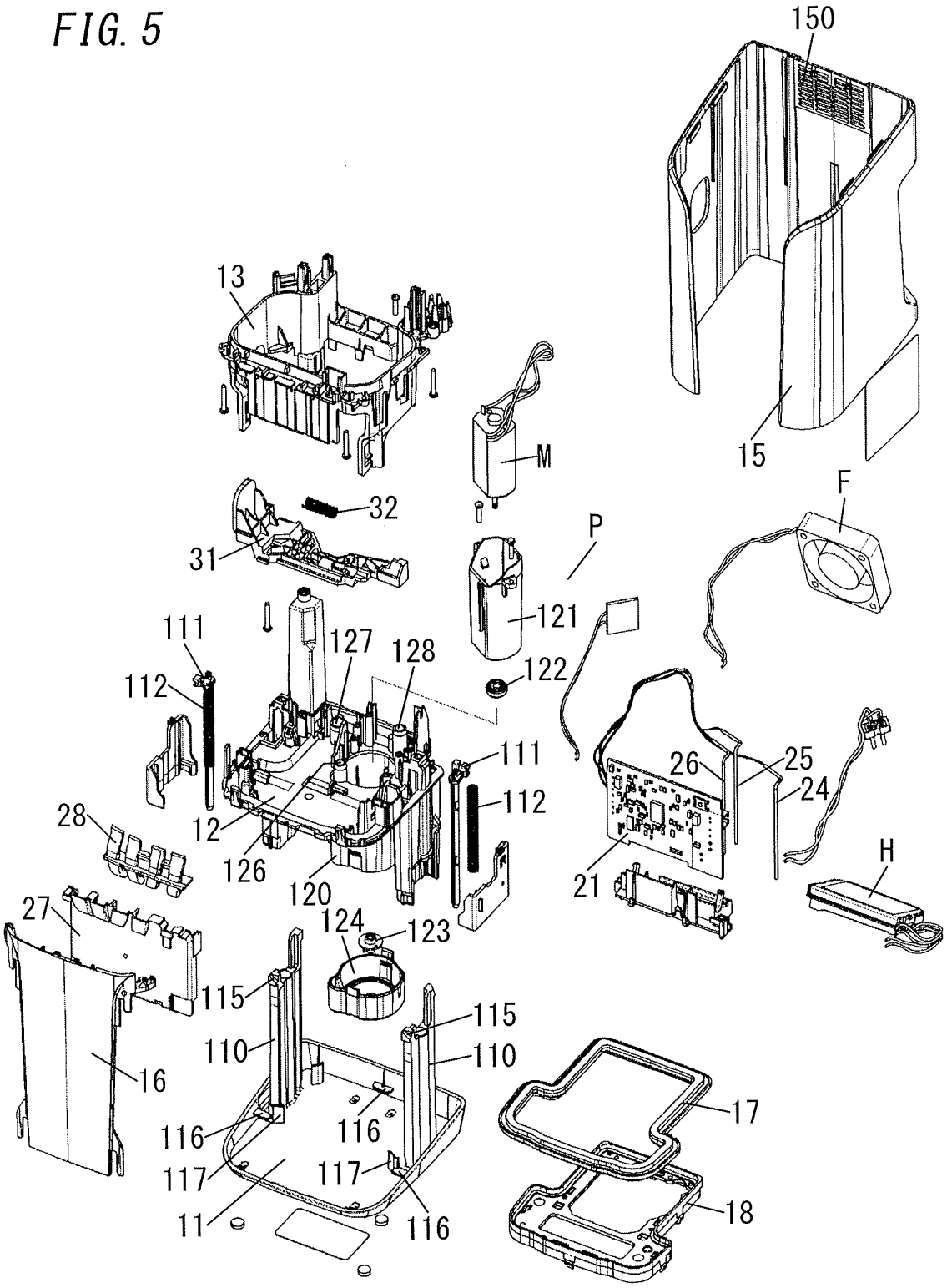
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FIG. 6

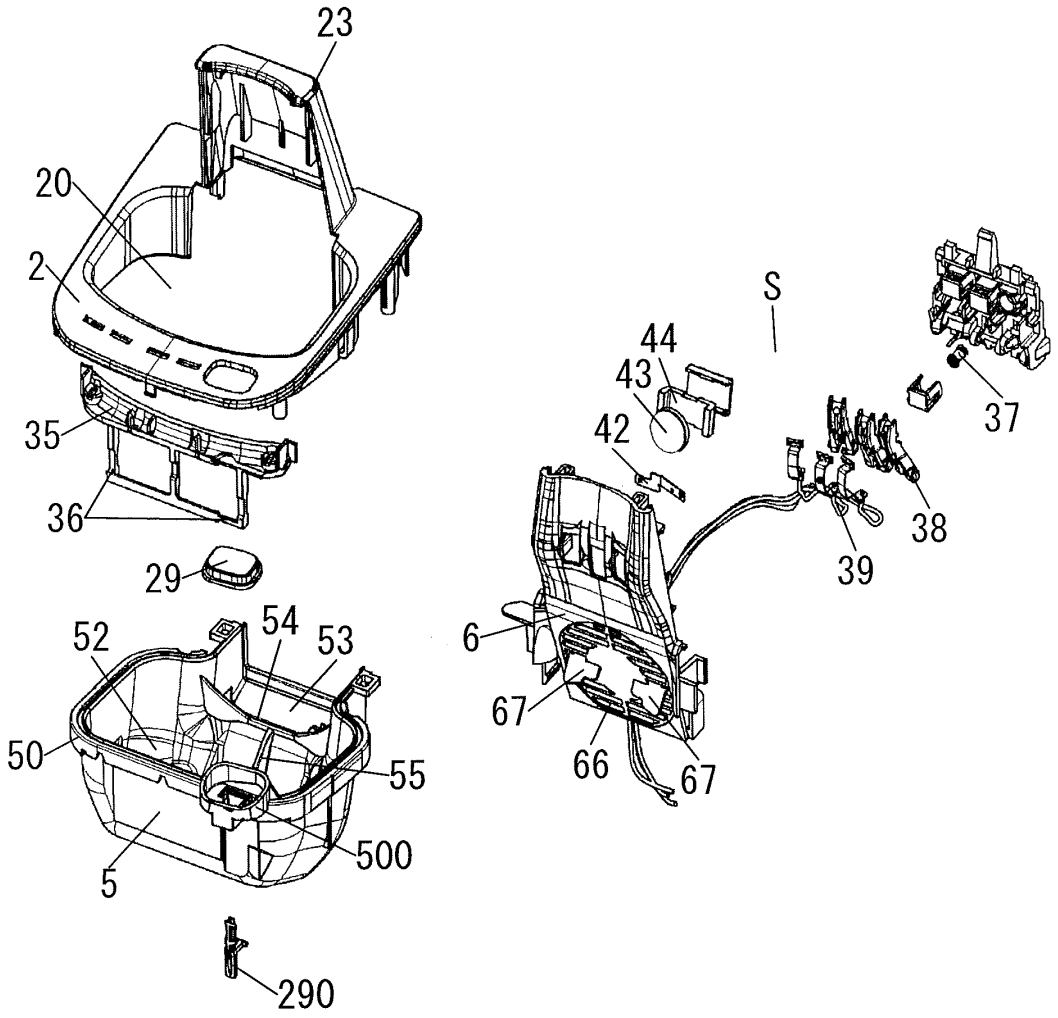

FIG. 7

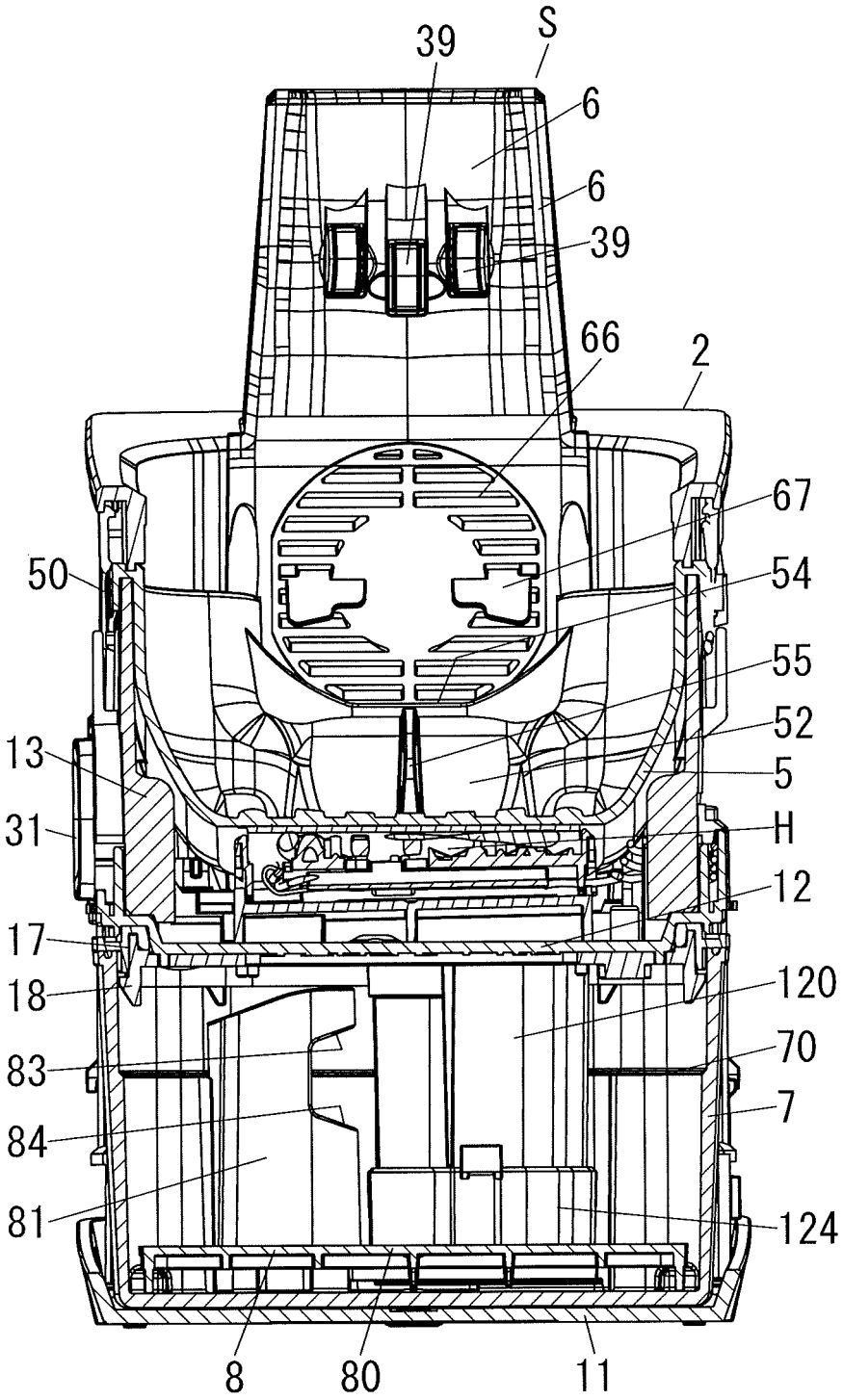
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FIG. 8

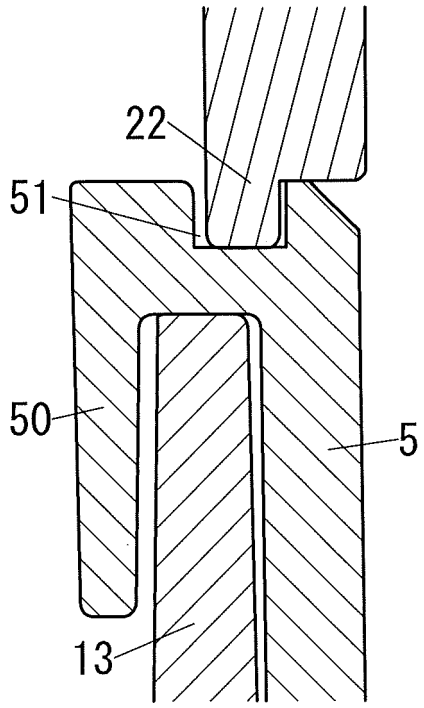


FIG. 9

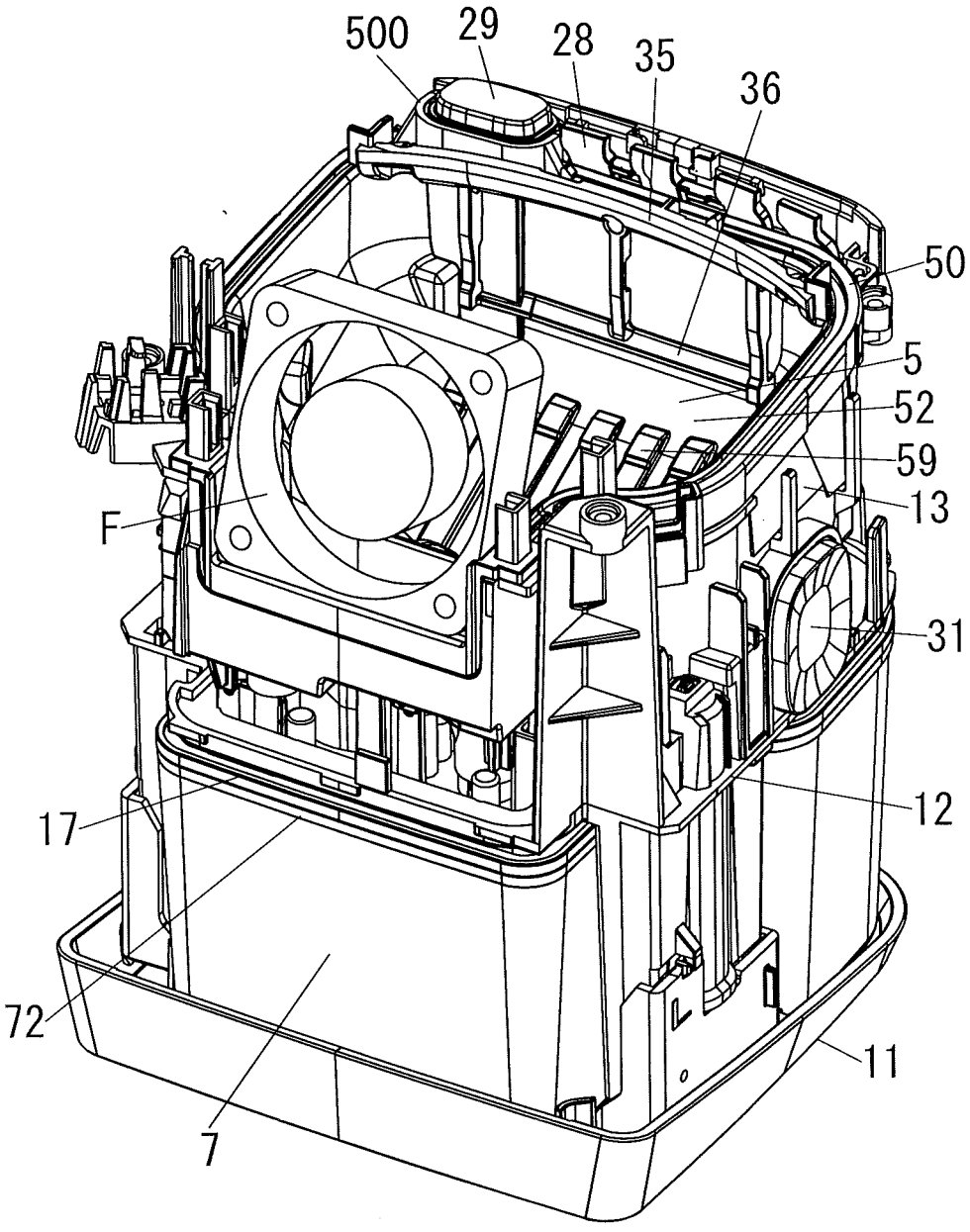


FIG. 10

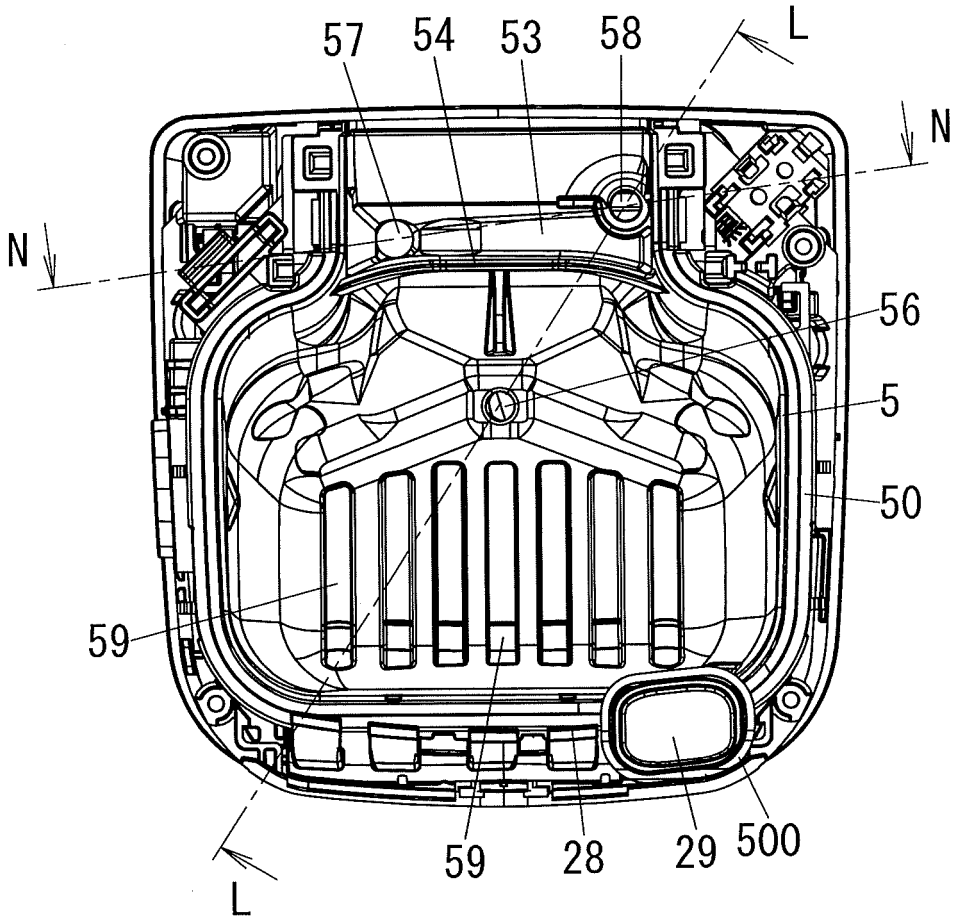
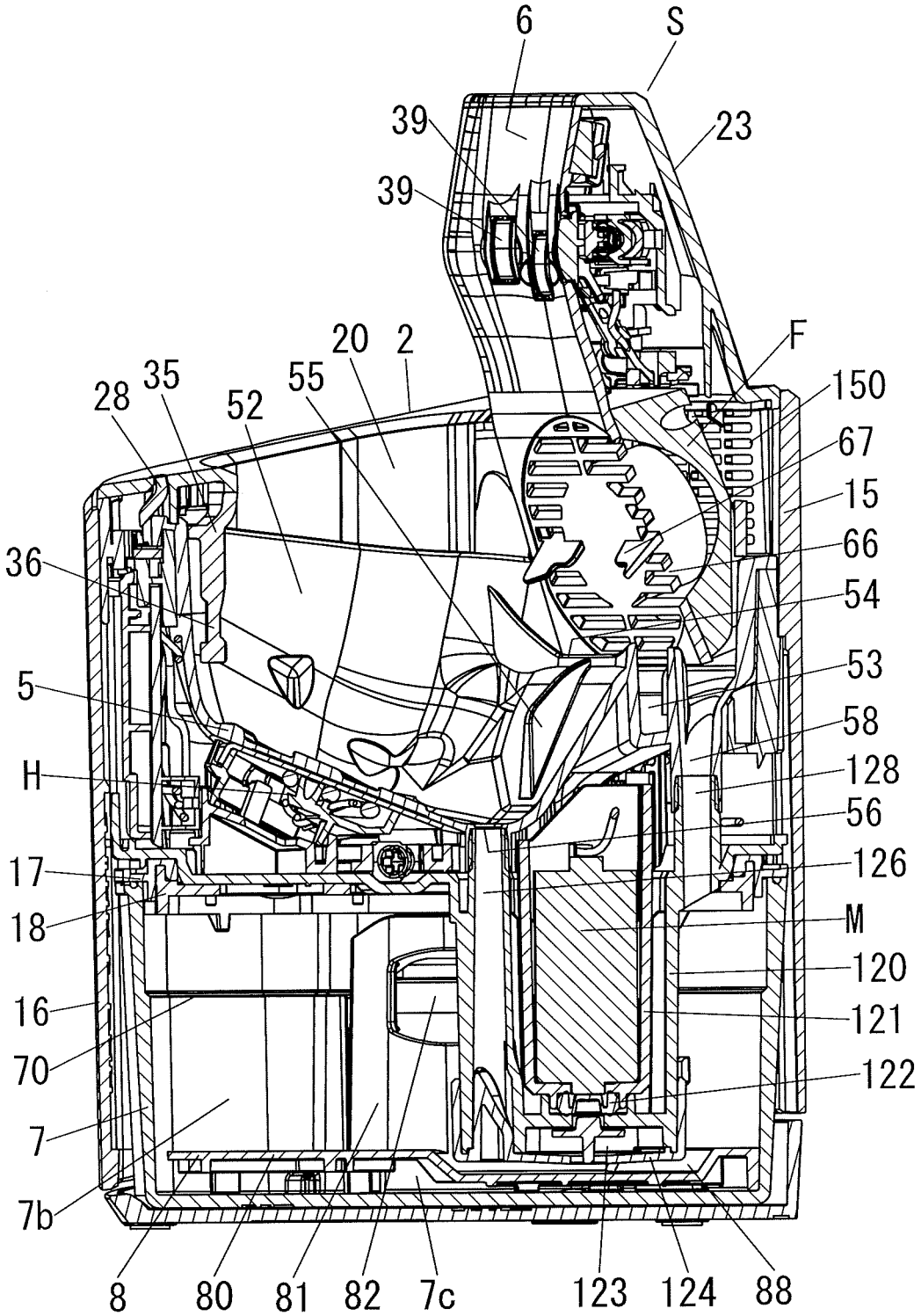


FIG. 11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7c
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FIG. 12

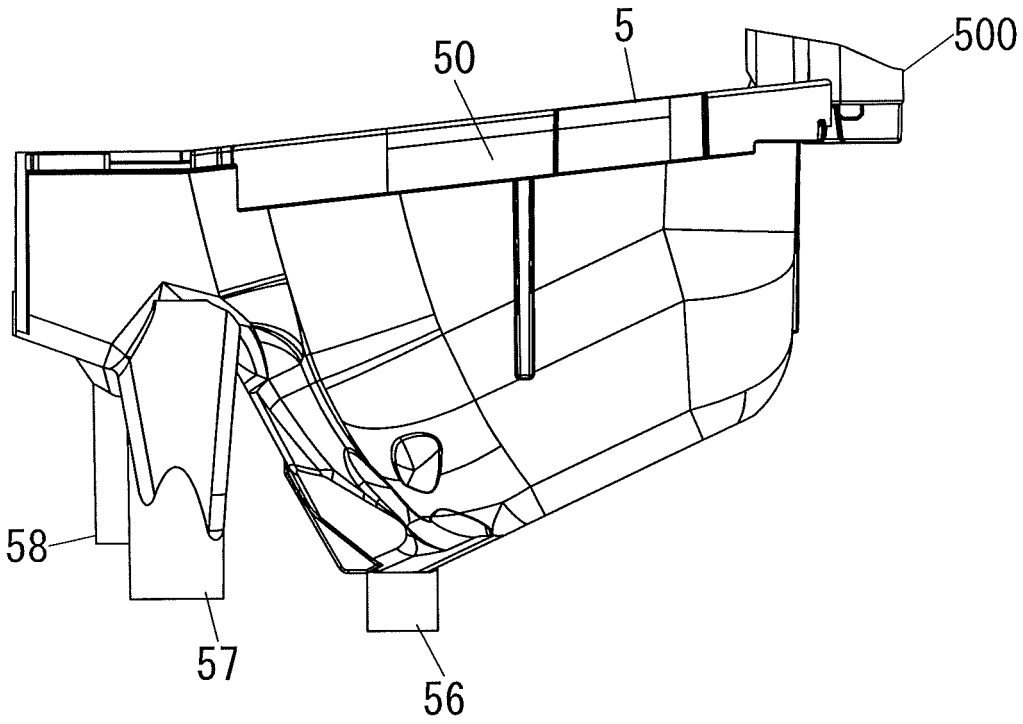


FIG. 13

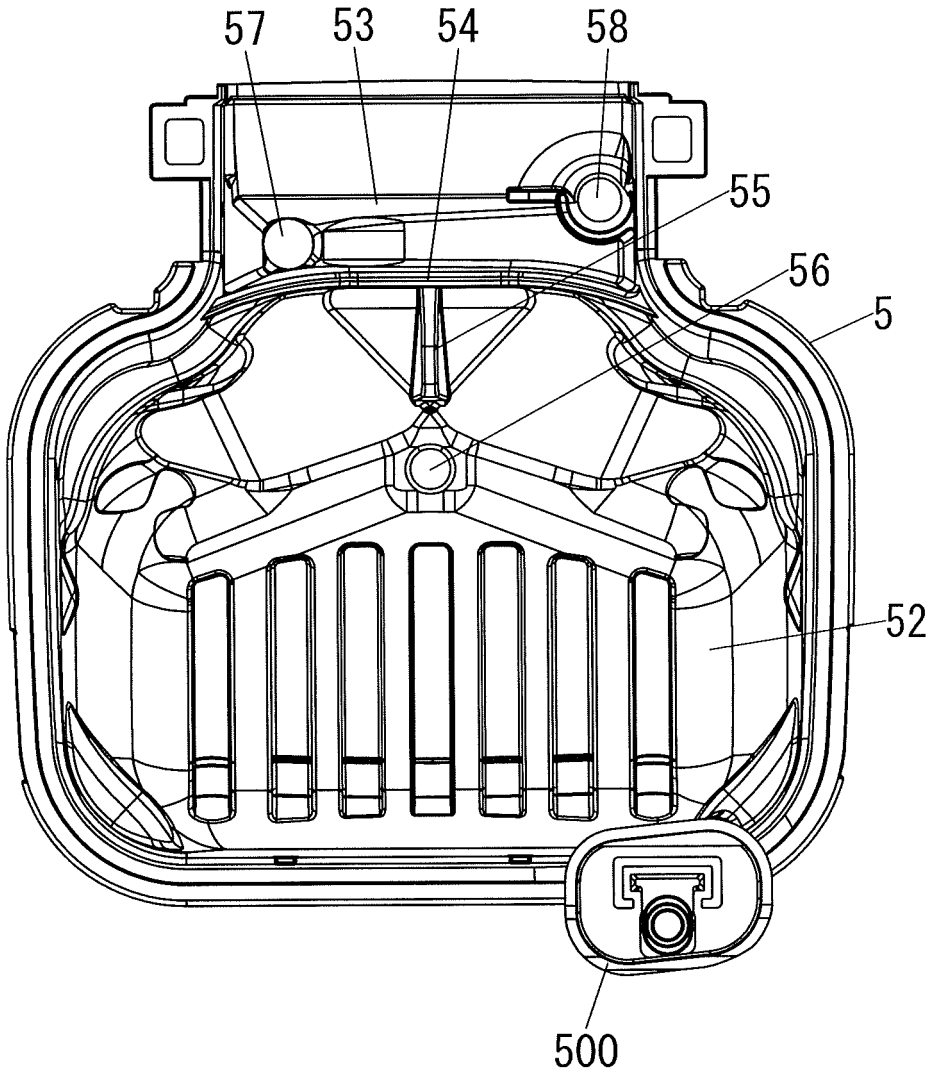


FIG. 14

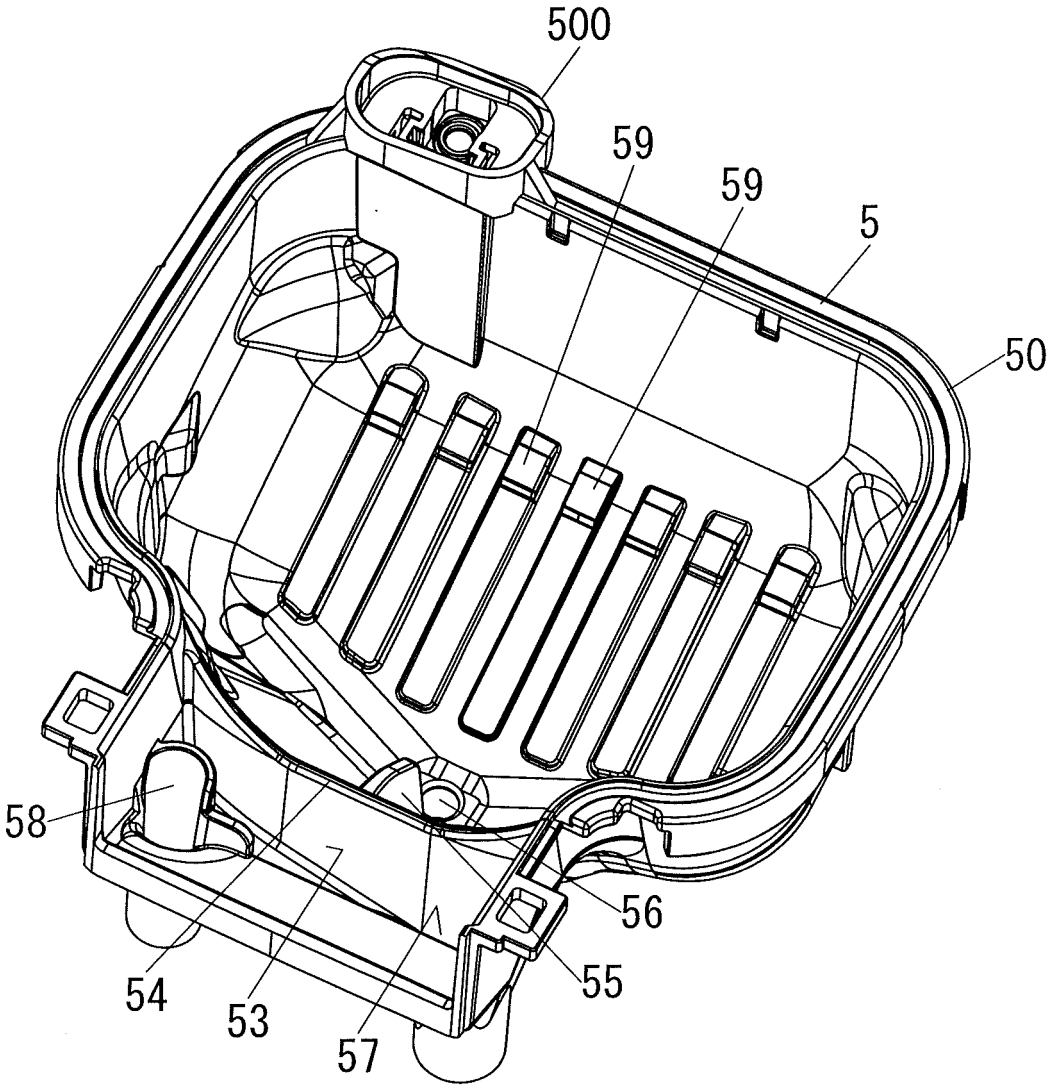


FIG. 15

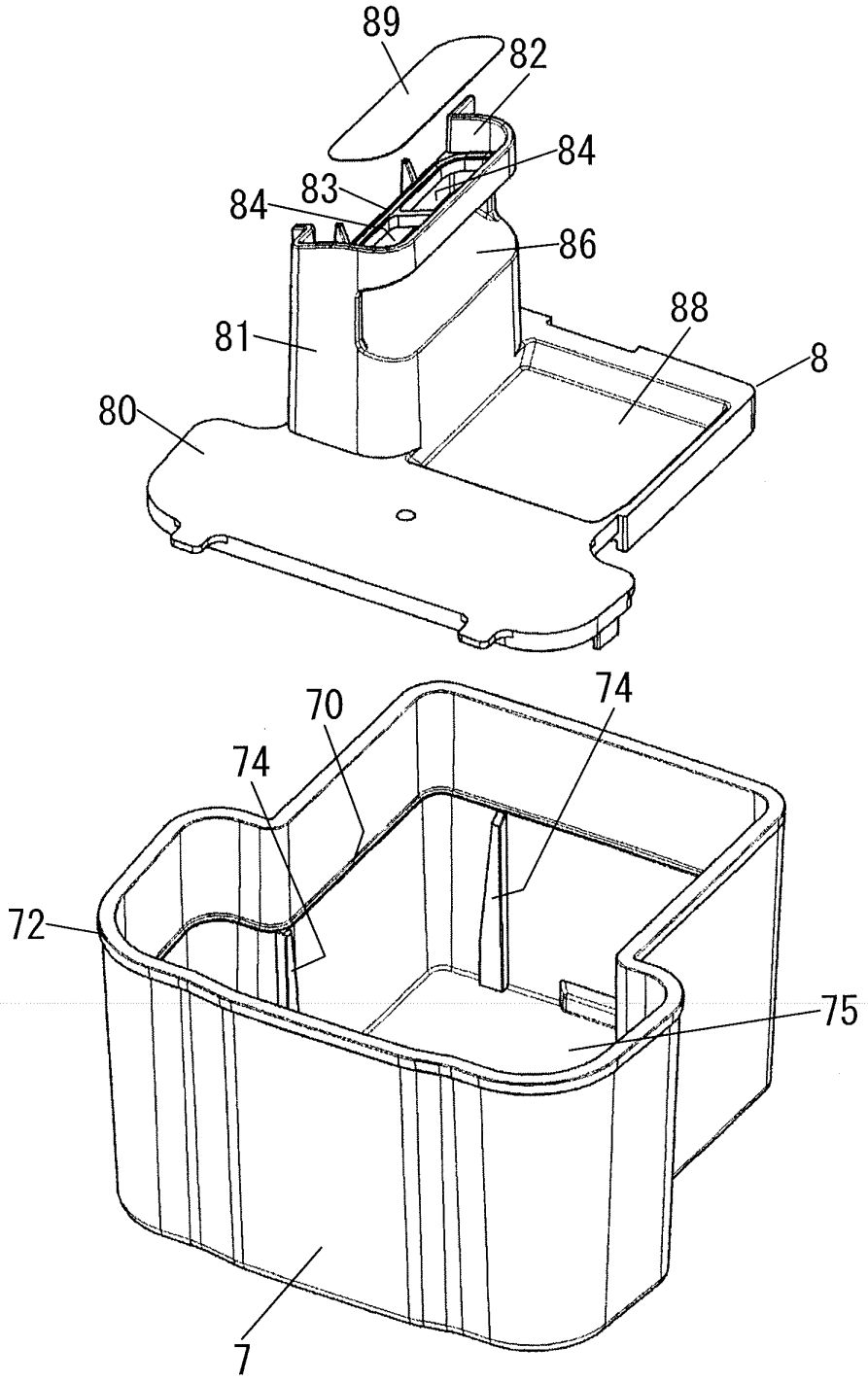


FIG. 16

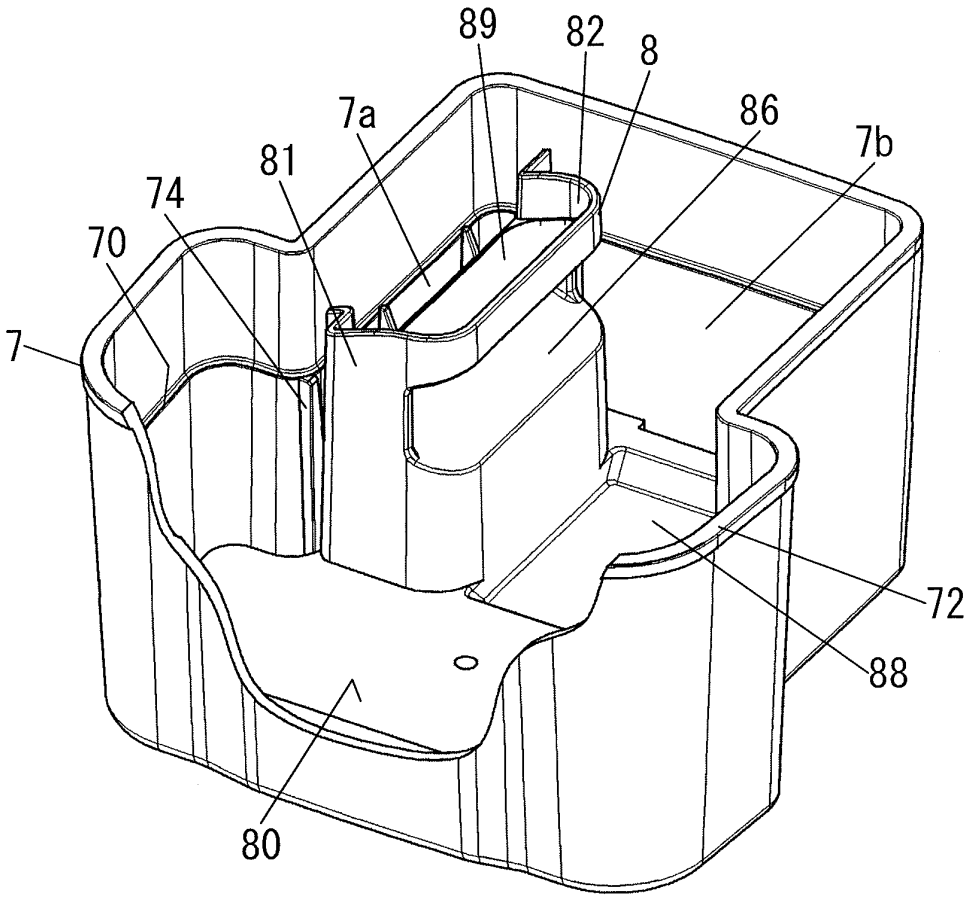


FIG. 17A

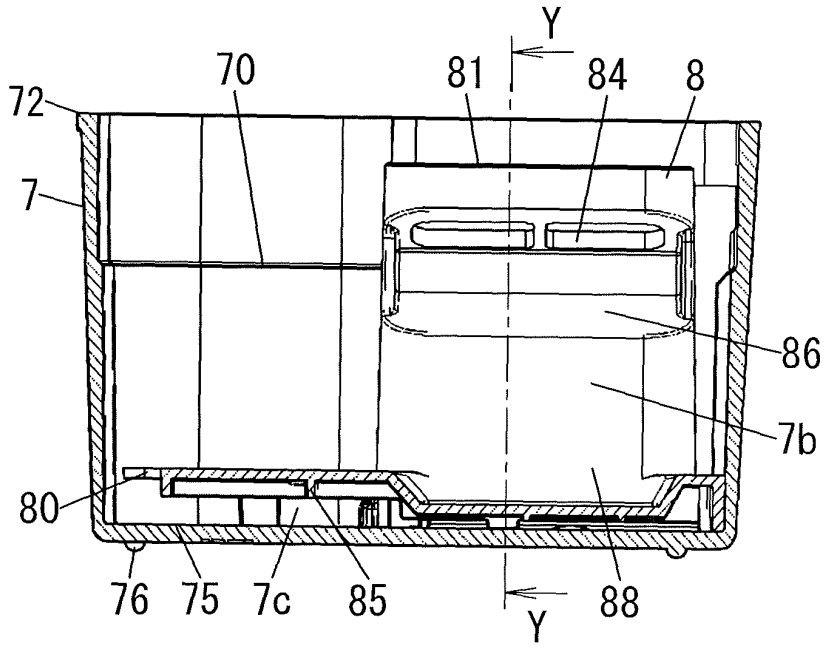


FIG. 17B

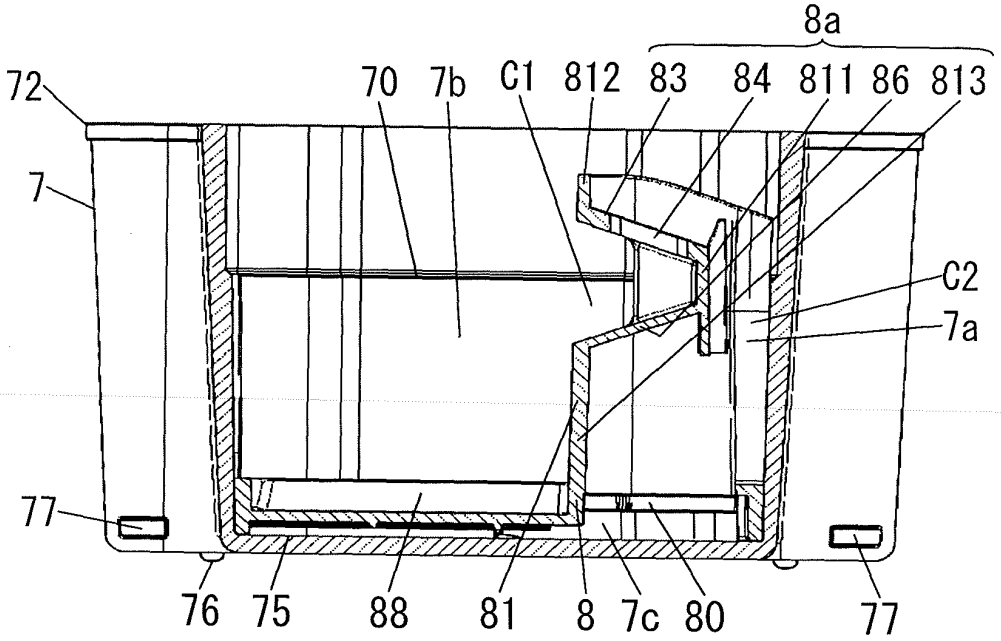


FIG. 18A

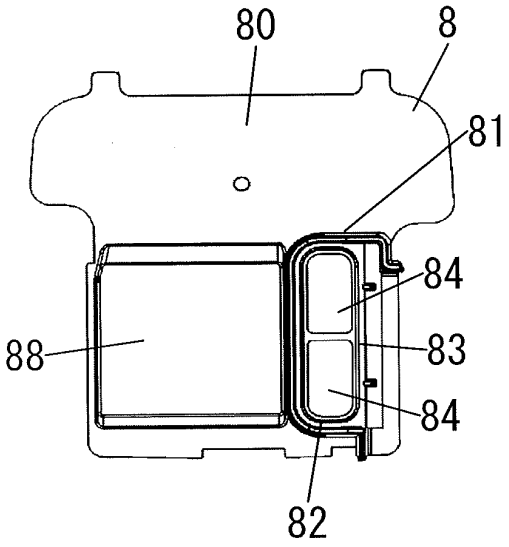


FIG. 18D

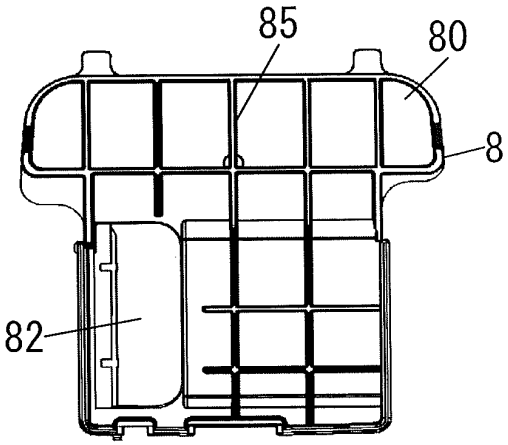


FIG. 18B

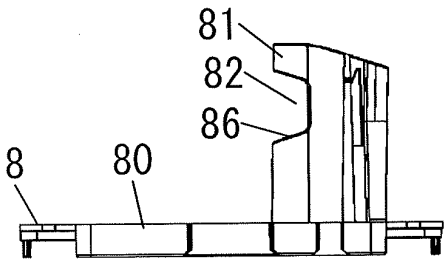


FIG. 18C

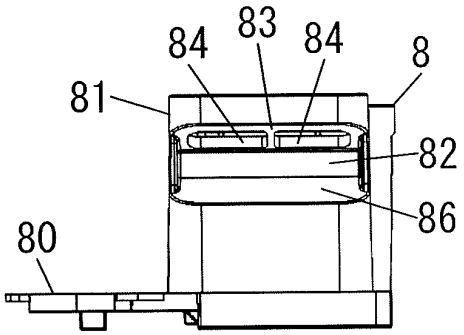
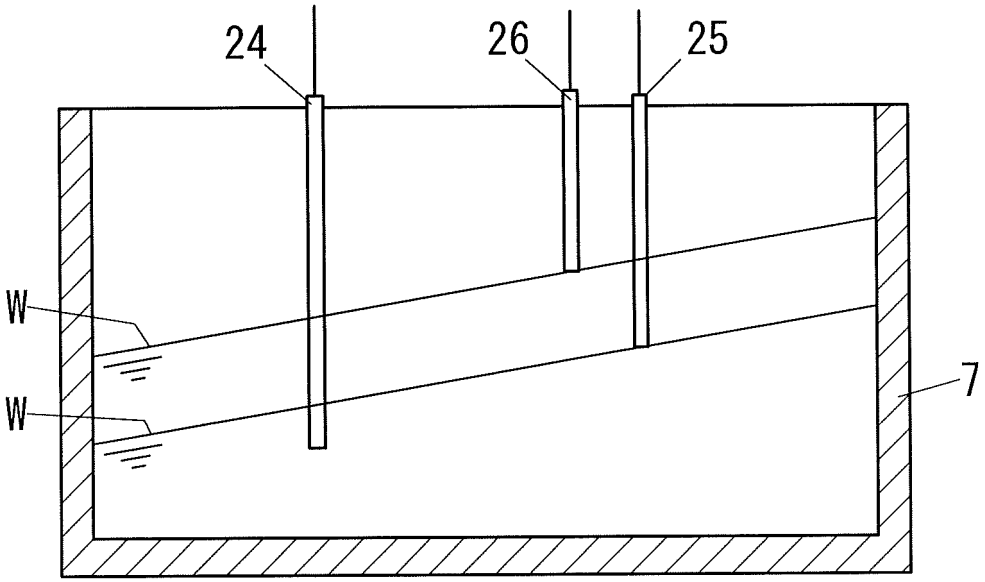


FIG. 19



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2013/001094

A. CLASSIFICATION OF SUBJECT MATTER
A45D27/46(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A45D27/46

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2013
Kokai Jitsuyo Shinan Koho 1971-2013 Toroku Jitsuyo Shinan Koho 1994-2013

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y A	JP 2005-526562 A (Braun GmbH), 08 September 2005 (08.09.2005), fig. 3 & US 2005/0126610 A1 & EP 1505891 A & WO 2003/099060 A1 & DE 10222716 A & CN 1627907 A & AT 385713 T & AU 2002367985 A	1-5,7-9 16-17 6,10-15
Y	JP 2010-57837 A (Sanyo Electric Co., Ltd.), 18 March 2010 (18.03.2010), fig. 31 (Family: none)	16-17

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
01 May, 2013 (01.05.13)	14 May, 2013 (14.05.13)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (July 2009)

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Patent documents cited in the description

- JP 2008302093 A **[0004]**
- JP 2009504299 A **[0004]**
- JP 2008509772 A **[0005]**