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(54) **WASHING DEVICE FOR MINIATURE ELECTRICAL EQUIPMENT**

WASCHVORRICHTUNG FÜR EINE ELEKTRISCHE MINIATURVORRICHTUNG

DISPOSITIF DE LAVAGE POUR ÉQUIPEMENT ÉLECTRIQUE MINIATURE

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(56) References cited:
EP-A1- 1 811 274
JP-A- 2005 349 140
JP-A- 2010 057 837
JP-A- 2010 063 477
JP-A- 2010 069 030
US-A- 4 203 325

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Description

TECHNICAL FIELD

[0001] The invention relates to a cleaning device for a small electrical appliance which requires periodical cleaning, such as an electric shaver or an epilation device.

BACKGROUND ART

[0002] JP 2010 069030 A discloses a cleaning device for a small electrical appliance, comprising a cleaning part configured to clean a cleaned part of the small electrical appliance, and a container for storing cleaning liquid to be supplied to the cleaning part. The cleaning device further comprises detection pins for detecting a level of the cleaning liquid by conduction via the cleaning liquid. The detection pins are disposed so as to hang down in the container.

When being removed from a living body surface by an appliance, such as an electric shaver or an epilation device, body hairs and the like necessarily adhere to a head part of the appliance. Consequently, such an appliance requires periodical cleaning. Conventionally, as a device for performing this kind of cleaning, there has been a cleaning device for a small electrical appliance (e.g., see JP2010-63477A).

[0003] The cleaning device in the above-mentioned document includes: a cleaning tub into which the head part is inserted; a container which stores cleaning liquid and has an electrolytic means of electrolyzing the cleaning liquid; a pump mechanism which is configured to supply the cleaning liquid from the container to the cleaning tub; and a drain pipe for returning the cleaning liquid from the cleaning tub to the container. Further, the container includes an electrode plate for detection. The cleaning device is configured to apply a prescribed voltage between an electrode plate of the electrolytic means and the electrode plate for detection, and measure current flowing between those electrode plates through the cleaning liquid. Further, a determination means of the cleaning device is configured to compare the measured current with a prescribed threshold to determine whether or not the cleaning liquid is injected up to a prescribed level in the container.

[0004] However, in the conventional cleaning device, because the number of electrode plate for detection is one, the determination means is merely configured to determine a level of the cleaning liquid only about whether the cleaning device is in an available state where the cleaning liquid is injected up to the prescribed level, or an unavailable state where the cleaning liquid is not injected up to the prescribed level. Therefore, the convenience is not high. In addition, conventionally, the cleaning device may be put on an inclined surface or put while a comb, a power supply cord or the like being located between an installation surface and the cleaning device, and accordingly, may be used in a state where a surface of the cleaning liquid in the container is inclined relative to a bottom face of the container. However, the above-mentioned document does not disclose this matter.

[0005] Here, a case is considered, where current flowing between electrode plates of the electrolytic means, which are provided for determining the type of cleaning liquid, is used for detecting the level of the cleaning liquid. However, in this case, because bottom ends of the electrode plates are positioned at the same heights, there is fear that, when the surface of the cleaning liquid is inclined relative to the bottom face of the container, a bottom end of one electrode plate is immersed in the cleaning liquid, but a bottom end of the other electrode plate is not immersed in the cleaning liquid. Thus, it is hard to enhance the detection accuracy while the cleaning device is inclined, by merely providing more than two electrode plates for detecting the level of the cleaning liquid.

DISCLOSURE OF THE INVENTION

[0006] It is an object of the present invention to provide a cleaning device for a small electrical appliance, which can reduce influence on detection for a cleaning liquid level, depending on a surface of cleaning liquid in a container being inclined relative to a bottom face of the container and further enhance detection accuracy for the cleaning liquid level, even when the cleaning device is put while being inclined.

[0007] A cleaning device for a small electrical appliance, according to the present invention, includes: a cleaning part configured to clean a cleaned part of the small electrical appliance; and a container for storing cleaning liquid to be supplied to the cleaning part. The cleaning device further includes three or more detection pins for detecting a level of the cleaning liquid by conduction via the cleaning liquid. The three or more detection pins are disposed so as to hang down in the container. One detection pin of the three or more detection pins is defined as a common pin which is conducted in common with the other detection pins. The other detection pins are defined as two or more conduction pins for detection. A bottom end of the common pin is disposed below bottom ends of the two or more conduction pins.

[0008] In the cleaning device, preferably, one conduction pin of the two or more conduction pins has the lowest bottom end among the bottom ends of the two or more conduction pins. A dimension in a vertical direction from the bottom end of the one conduction pin to the bottom end of the common pin is defined as H1. A distance on a horizontal plane between the one conduction pin and the common pin is defined as L1. An allowable angle, at which the cleaning liquid is allowed to be supplied from the container to the cleaning part and further the cleaned part is allowed to be cleaned at the cleaning part while the cleaning device is inclined, is defined as α. In this case, preferably, the dimension in the vertical direction H1 is set so as to satisfy the following conditional equa-

tion: H1 >= L1 × tanα.

[0009] The cleaning device, preferably, further includes three or more fixing parts for respectively fixing the three or more detection pins, and the three or more fixing parts are provided above an immersion region where the cleaning liquid is stored.

[0010] In the cleaning device, preferably, the three or more detection pins are respectively fixed to the three or more fixing parts by any one of elastically press-inserting, insert molding, and press-inserting in a melted state.

[0011] In the cleaning device, preferably, the three or more detection pins are disposed so that a gap is provided between an immersion portion of each detection pin which is immersed in the cleaning liquid, and a peripheral member which is disposed around the each detection pin.

[0012] The cleaning device, preferably, further includes: three or more fixing parts for respectively fixing top end sides of the three or more detection pins; and three or more ribs for making the cleaning liquid flow down, which respectively correspond to the three or more fixing parts. In this case, each of the three or more ribs is preferably provided so as to extend downward from a boundary portion between a corresponding fixing part and a detection pin corresponding to the fixing part.

[0013] In the cleaning device, preferably, at least a bottom end side of each of the three or more ribs is provided to be in contact with a wall surface of a peripheral member which is disposed around the detection pin corresponding to the fixing part.

[0014] In the cleaning device, preferably, the three or more detection pins are disposed so that a distance between the common pin and the closest conduction pin to the common pin, of the two or more conduction pins, is larger than a distance between two adjacent conduction pins, of the two or more conduction pins.

[0015] In the present invention, by providing the above configuration, even while the surface of the cleaning liquid is inclined relative to a bottom face of the container, it is possible to more easily secure electrically conduction between the common pin and the conduction pins for detection via the cleaning liquid, compared with the case where the number of conduction pin for detection is one. Furthermore, in the present invention, by providing the above configuration, even while the surface of the cleaning liquid is inclined relative to the bottom face of the container, it is possible to more easily secure the electrically conduction via the cleaning liquid, compared with the case where bottom ends of the common pin and the conduction pin for detection are positioned at substantially the same heights. In other words, the cleaning device of the present invention can easily reduce influence on detection for the cleaning liquid level, depending on the surface of the cleaning liquid inclined relative to the bottom face of the container. Therefore, the cleaning device of the present invention can more easily enhance detection accuracy for the level of the cleaning liquid in the container, even when the cleaning device is put while being inclined.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] Preferred embodiments of the present invention will now be described in further details. Other features and advantages of the present invention will become better understood with regard to the following detailed description and accompanying drawings where:

Fig. 1 is a schematic vertical cross-section view of a cleaning device according to an embodiment;

Fig. 2 is a perspective view of the cleaning device according to the embodiment, in a state where a small electrical appliance is attached to the cleaning device;

Fig. 3 is a vertical cross-section view of the cleaning device according to the embodiment;

Fig. 4 is a perspective view of the cleaning device according to the embodiment, in a state where part of the cleaning device is pulled up;

Fig. 5 is an exploded perspective view of a base and parts around the base in the cleaning device according to the embodiment;

Fig. 6 is an exploded perspective view of a cleaning part and parts around the cleaning part in the cleaning device according to the embodiment;

Fig. 7 is a transverse cross-section view of the cleaning device according to the embodiment, in a state where a lateral cover is removed;

Fig. 8 is a partially enlarged cross-section view of the cleaning device according to the embodiment;

Fig. 9 is a perspective view of the cleaning device according to the embodiment, in a state where a top-face cover, a support block, the lateral cover and a front cover are removed;

Fig. 10 is a plan view of the cleaning device according to the embodiment, in a state where the top-face cover and the support block are removed;

Fig. 11 is a cross-section view taken along line N-N of Fig. 10;

Fig. 12 is a cross-section view taken along line L-L of Fig. 10;

Fig. 13 is a lateral view of a cleaning tray in the cleaning device according to the embodiment;

Fig. 14 is a plan view of the cleaning tray in the cleaning device according to the embodiment;

Fig. 15 is a perspective view of the cleaning tray in the cleaning device according to the embodiment;

Fig. 16 is an exploded perspective view of a container and a filter frame in the cleaning device according to the embodiment;

Fig. 17 is a partially-broken perspective view of the container and the filter frame in the cleaning device according to the embodiment;

Fig. 18A is a vertical cross-section view of the container and the filter frame in the cleaning device according to the embodiment;

Fig. 18B is a transverse cross-section view of the container and the filter frame in the cleaning device according to the embodiment;
Fig. 19A is a plan view of the filter frame in the cleaning device according to the embodiment;
Fig. 19B is a back view of the filter frame in the cleaning device according to the embodiment;
Fig. 19C is a lateral view of the filter frame in the cleaning device according to the embodiment;
Fig. 19D is a bottom view of the filter frame in the cleaning device according to the embodiment;
Fig. 20A is a partially-broken back view of the cleaning device according to the embodiment;
Fig. 20B is a partially cross-section view taken along line K-K of Fig. 10;
Fig. 20C is a bottom view of the base and parts around the base in the cleaning device according to the embodiment;
Fig. 20D is a cross-section view taken along line J-J of Fig. 20C;
Fig. 21A is a schematic cross-section view of the container in the cleaning device according to the embodiment, in a state where a surface of cleaning liquid is horizontal relative to a bottom face of the container;
Fig. 21B is a schematic cross-section view of the container in the cleaning device according to the embodiment, in a state where the surface of the cleaning liquid is inclined relative to the bottom face of the container;
Fig. 22 is a schematic cross-section view of one example of a container in the cleaning device according to the embodiment, where arrangement of detection pins is changed, in a state where the surface of the cleaning liquid is inclined relative to the bottom face of the container;
Fig. 23 is a schematic lateral view of a detection pin and parts around the detection pin, in a variation of the cleaning device according to the embodiment; and
Fig. 24 is a schematic lateral view of a detection pin and parts around the detection pin, in another variation of the cleaning device according to the embodiment.

BEST MODE FOR CARRYING OUT THE INVENTION

[0017] Hereinafter, a cleaning device according to the present embodiment will be described in detail with reference to drawings. As shown in Figs. 1 and 2, a cleaning device **1** according to the present embodiment is for cleaning a blade head **Ea** of a small electrical appliance **E** that is a reciprocating electric shaver. The cleaning device 1 is provided in an upper face thereof with an opening part **20,** through which the blade head **Ea** is inserted while the small electrical appliance **E** is inverted.

[0018] As shown in Figs. 3, 5 and 6, the cleaning device **1** includes inside thereof, a cleaning tray **5a**, a container **7** for storing cleaning liquid, a pump **P** for circulating the cleaning liquid between the container **7** and the cleaning tray **5a**, and a heater unit **H** and a motor fan **F** for drying the blade head **Ea** after cleaning. Further, the cleaning device **1** includes a support part **S** that is disposed on the upper rear side of the cleaning device **1.** The support part **S** includes a connecting part for electrically connecting the small electrical appliance **E** and the cleaning device **1.**

[0019] In the cleaning device **1,** the container **7** containing the cleaning liquid is set. The blade head **Ea** of the small electrical appliance **E** is disposed in the cleaning tray **5a** through the opening part **20** of the cleaning device **1.** The electrically connection between the small electrical appliance **E** and the cleaning device **1** is completed by the connecting part of the support part **S.** When being activated in this state, the pump **P** starts supplying of the cleaning liquid stored in the container **7** into the cleaning tray **5a**. Here, the cleaning tray **5a** includes an overflow weir **54,** and accordingly, cleaning liquid, which overflows the overflow weir **54**, is returned into the container **7** that is disposed below the cleaning tray **5a**. During the cleaning, the blade head **Ea** of the small electrical appliance **E** can be activated by power supply and transmission of signals through the above-mentioned connecting part. Therefore, it is possible to perform the cleaning of the blade head **Ea** more quickly and effectively.

[0020] Thus, in the present embodiment, the blade head **Ea** corresponds to a cleaned part **E1**, and the cleaning tray **5a** of the cleaning device **1** corresponds to a cleaning part **5** that is configured to clean the cleaned part **E1**.

[0021] Next, each part of the cleaning device **1** will be described in detail with reference to Figs. 5 and 6. The cleaning device **1** further includes: a bottom plate **11**; a base **12** that is vertically movable with respect to the bottom plate **11**; a support frame **13** that is disposed on the base **12**; and the cleaning tray **5a** of which four side upper edges are supported by an upper edge of the support frame **13.** The cleaning device **1** further includes: a top-face cover **2** that includes the opening parts **20**; a support block **6** to which the connecting part is attached; a lateral cover **15** for covering a lateral face; and a front cover **16** that is disposed on a front face.

[0022] As shown in Fig. 5, the bottom plate **11** is provided with two guide posts **110** and **110** that are respectively erected from both right and left sides of the bottom plate. The base **12** is vertically movable along the guide posts **110.** Further, a pushing-up rod **111** is disposed in each guide post **110** of the bottom plate **11.** The pushing-up rod **111** is provided with a spring **112.** The base **12** is biased upward by the pushing-up rod **111.** On the base **12,** a switch plate **31** is disposed slidably in the lateral direction.

[0023] One end of the switch plate **31** is exposed to the outside from the lateral cover **15**. The switch plate **31** is biased toward a side of the one end from a side of the other end of the switch plate **31** by a spring **32.** The switch

plate **31** includes an engagement part for engaging with a hook part **115** that is provided at an upper end of each guide post **110.** When the switch plate **31** is pushed against the biasing of the spring **32,** the engagement with the hook part **115** is disengaged, and accordingly, the base **12** is moved upward by receiving biasing of the spring **112.** When the base **12** is pushed downward, the switch plate **31** engages with the hook part **115** again, and accordingly, the base **12** is kept in a state of being pushed down.

[0024] As shown in Fig. 5, the base **12** is formed by resin molding for example, and includes a cylindrical motor cover part **120** that projects downward. The motor cover part **120** houses a motor **M** through a motor casing **121.** An output shaft of the motor **M** projects downward from a bottom face of the motor cover part **120** through an M-shaped sealing part **122.** As shown in Fig. 12, an impeller **123** is attached to this output shaft. Further, a pump cover **124** is attached around the impeller **123** to cover the impeller **123.** A suction port is opened in a central part of the bottom of the pump cover **124.** When the impeller **123** is rotated, the cleaning liquid is sucked from the suction port of the pump cover **124,** and then supplied to a water supply/discharge port **56** (described later in detail) of the cleaning tray **5a** through a connecting pipe **126** that is provided integrally with the motor cover part **120.**

[0025] The cleaning tray **5a** is disposed on the base **12** through the support frame **13.** The cleaning tray **5a** is formed of soft material, such as rubber, and includes a folded-back part **50** that is provided by an upper edge thereof projecting toward an outer periphery side, and an end thereof being folded downward. A groove **51** is provided in a top-face of the upper edge of the cleaning tray **5a**. The top-face cover **2** is assembled to the cleaning tray **5a** in a state where the upper edge of the support frame **13** is covered with the folded-back part **50**. In this way, as shown in Fig. 8, a back cover **23** provided at a lower edge of the top-face cover **2** is fitted into the groove **51.** Therefore, the upper edge of the cleaning tray **5a** is compressed between the top-face cover **2** and the support frame **13,** and accordingly, this portion is waterproofed.

[0026] Also as shown in Figs. 13 to 15, the cleaning tray **5a** includes, therein, the overflow weir **54.** By the overflow weir **54,** the cleaning tray **5a** is partitioned into a cleaning space **52** on the front part side of the overflow weir **54**, and an overflow part **53** on the rear part side of the overflow weir **54**. A rib **55** is provided integrally with a wall face of the overflow weir **54** on the side of the cleaning space **52**. In a portion of the cleaning space **52** for housing the blade head **Ea** of the small electrical appliance **E,** a position of the blade head **Ea** in a front-back direction is determined between the rib **55** and a supporting part **36** of a head guide **35** disposed on an inner face of the cleaning tray **5a**. Further, plural projected strips **59** are provided on the bottom of the cleaning tray **5a**. Due to the projected strips **59**, the blade head **Ea** is supported while slightly floating from the bottom of the cleaning tray **5a**.

[0027] The cleaning tray **5a** is provided at the lowest portion of the cleaning space **52** with the water supply/discharge port **56**. The overflow part **53** is provided with two water discharge ports **57** and **58**. The water supply/discharge port **56** is connected to the pump **P** via the connecting pipe **126** provided at the base **12.** The respective water discharge ports **57** and **58** are connected to connecting pipes **127** and **128** provided at the base **12.** Those connecting pipes **127** and **128** are located directly above the container **7.** The cleaning liquid passing through the water discharge ports **57** and **58** is returned to the container **7** via the connecting pipes **127** and **128.**

[0028] An upper face opening of the water discharge port **57** is at a lower position than that of the water discharge port **58.** On the other hand, an upper face opening of the water discharge port **58** is at a higher position than that of the water discharge port **57**, and further is at a position farther from the overflow weir **54** than that of the water discharge port **57**. For this reason, the water discharge port **57** of the two water discharge ports **57** and **58** is provided to discharge the cleaning liquid for the circulation of the cleaning liquid. The water discharge port **58** is provided as a port for emergency (an auxiliary port) when the water discharge port **57** is clogged with some cause and cannot exert the function, or when the function is reduced. A bottom face of the overflow part **53** is provided as a sloping face that slopes downward toward the water discharge port **57** disposed on one side.

[0029] The cleaning tray **5a** is provided on one side of a front edge thereof with a wall body **500** formed into a bag-shape. A portion that is surrounded by the wall body **500** is provided for installing a selecting button **29** that is for operation instructions. The selecting button **29** is exposed from the top-face cover **2.** When the selecting button **29** is operated by a user, a switch that is provided at a switch substrate **27** (see Fig. 5) is driven via a switch rod **290** (see Fig. 6). In this way, the user can direct an operation of the cleaning device 1 with the selecting button **29.** Upon this operation, a display lamp for displaying the operation, which is provided at the switch substrate **27,** displays a content corresponding to the directed operation, on the top-face cover **2** via a light guide plate **28.** Further, a display lamp for displaying the amount of the cleaning liquid in the container **7** may be also provided.

[0030] The top-face cover **2** includes the back cover **23.** The back face side of the support block **6** is covered by the back cover **23.** The support block **6** and the back cover **23** constitute the support part **S.** The support block **6** is provided with a plurality of contact parts **39.** The plurality of contact parts **39** are respectively individually biased forward by a plurality of springs **37** via a plurality of supporting members **38.** The plurality of contact parts **39** are exposed through a front face of the support block **6** so as not to project further than the front face of the support block **6.**

[0031] A magnet **43** and a yoke **44** for attracting the

small electrical appliance **E** are located above the plurality of contact parts **39.** When the blade head **Ea** is fitted into the cleaning tray **5a**, the small electrical appliance **E** is magnetically attracted to the support part **S** by the magnet **43,** and then terminal parts **Eb** of the small electrical appliance **E** come into contact with the plurality of contact parts **39,** and further the terminal parts **Eb** push the plurality of contact parts **39** against the plurality of springs **37,** and accordingly, the small electrical appliance **E** is held by the cleaning device **1** in a state of securing contact pressures. By the terminal parts **Eb** coming into contact with the plurality of contact parts **39,** it becomes a state capable of performing power supply to the small electrical appliance **E** and transmission of signals from the cleaning device 1 to the small electrical appliance **E.**

[0032] A main-body-detecting plate **42** is disposed in the support part **S** for coming into contact with the plurality of contact parts **39.** When the small electrical appliance **E** is installed to the cleaning device 1 and the plurality of contact parts **39** are retracted, the main-body-detecting plate **42** is separated from the plurality of contact parts **39,** and accordingly, installing of the small electrical appliance **E** to the cleaning device 1 is detected.

[0033] The support block **6** is provided in a lower part thereof with a blowing port **66.** A lower edge of the blowing port **66** is placed on a rear upper edge of the cleaning tray **5a**. A motor fan **F** is installed on the back side of the blowing port **66.** The motor fan **F** is provided for sucking air through a sucking port **150** that is positioned at a back face of the cleaning device 1, and sending the air to the blade head **Ea** through the blowing port **66.** Therefore, the blowing port **66** for the motor fan **F** is directed obliquely downward so as to be capable of drying the blade head **Ea** by sending the air to the blade head **Ea** from the upper side. Further, the blowing port **66** is provided with straightening plates **67** for efficiently changing a direction of the sent air.

[0034] For heating, a heater unit **H** is installed on a rear face (lower face) side of the cleaning space **52** of the cleaning tray **5a**. The heater unit **H** includes a heater wire, a heater plate, a heater base, a temperature detector for controlling temperature, and a protection component functioning upon abnormal heating (all those are not shown). The heater unit **H** transmits heat from the heater wire to the blade head **Ea** through the heater plate, the cleaning tray **5a** and the plural projected strips **59** of the cleaning tray **5a** to promote the drying of the blade head **Ea** after the cleaning.

[0035] The cleaning tray **5a** and the top-face cover **2** are assembled on the base **12** through the support frame **13,** and then the lateral cover **15** and the front cover **16** are attached so as to surround outer peripheries of the cleaning tray **5a** and the top-face cover **2.** Accordingly, when the base **12** is moved vertically with respect to the bottom plate **11,** all members other than the bottom plate **11** and the container **7** detachably installed on the bottom plate **11** are vertically moved integrally with the base **12.** This vertically movement is performed for attaching or detaching operation of the container **7** disposed on the bottom plate **11.**

[0036] Next, the container **7** and a filter frame 8, which is detachably disposed in the container **7,** will be described with reference to Figs. 16, **17,** 18A, 18B, and 19A to 19D. The container **7** is formed into a cup-shape in which a lateral width of a rear side thereof is set to be smaller than that of a front side thereof. The container **7** has an upper face opened, and is installed on the bottom plate **11.** Further, a line **70** for water supply is marked on an inner wall of the container **7.** Further, the container **7** is provided on a lower face thereof with a plurality of convex raised parts **76.** Accordingly, it is possible to secure stability in a case where the container **7** is located outside the cleaning device **1,** and further even when water droplets are adhered on the lower face of the container **7** due to washing with water or the like, it is possible to prevent the water droplets from accidentally moving to a place where the container **7** is located.

[0037] The filter frame **8** includes a bottom plate part **80** that almost covers the bottom face of the container **7** (a surface on an inner side of the container **7),** and a partition wall **81** that 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.** The filter frame **8** is positioned in the container **7** by a projected part **74** for positioning, which is provided at the inner wall of the container **7.** By the filter frame **8,** the inside of the container **7** is divided into three spaces: two spaces **7a** and **7b** that are partitioned by the partition wall **81**; and a space **7c** that is between the bottom face of the container **7** and the bottom plate part **80,** which is in a state of slightly floating from the bottom face of the container **7.** The bottom plate part **80** is provided on a lower face side thereof with a grid-like rib **85**. Further, the bottom plate part **80** is provided with a recess **88.** The recess **88** is disposed in a part that is at a rear part of an upper face of the bottom plate part **80,** and faces the space **7b.** When the filter frame **8** is located in the container **7,** it becomes a state where a gap is formed between a front edge of a periphery of the bottom plate part **80** and the inner wall face of the container **7.**

[0038] Further, a flow dividing part **82** is provided at an upper part of the partition wall **81.** The flow dividing part **82** includes: a permeation port **84** that is provided in an inclined face **83** formed at the upper part of the partition wall **81**; and a slope **86** that is provided directly below the permeation port **84,** and slopes in a reverse direction to the inclined face **83.** Further, a filter **89** is disposed on the inclined face **83** of the flow dividing part **82.** The filter **89** is configured as a mesh sheet that has holes finer than sizes of body hairs and the like.

[0039] Cleaning liquid, which does not flow through the filter **89** and the permeation port **84,** flows to the space **7b** on the upper face side of the bottom plate part **80,** via: the space **7a** that is between the partition wall **81** and the inner wall of the container **7**; the space **7c** that is between the bottom plate part **80** and the bottom face of

the container **7**; and the gap that is between the front edge of the bottom plate part **80** and the inner wall face of the container **7.** On the other hand, cleaning liquid, which does flow through the filter **89** and the permeation port **84,** flows into the space **7c** along the slope **86.** An opening area of the permeation port **84** is set so that the amount of the cleaning liquid, which does flow through the filter **89** and the permeation port **84,** is larger than the amount of the cleaning liquid, which flows into the space **7c** via the space **7a** without flowing through the filter **89** and the permeation port **84.**

[0040] When cleaning the blade head **Ea** of the small electrical appliance **E,** a user first floats the whole from the bottom plate **11** by operating the switch plate **31,** and then puts cleaning liquid into the container **7** that houses the filter frame **8,** and then installs the container **7** on the bottom plate **11.** At this time, the container **7** is guided by guide plates **117** that are provided on the bottom plate **11,** and further positioned by positioning projections **116.** The positioning projections **116** are fitted into engagement recesses **77** that are provided in an outer wall face of the container **7** (see Figs. 18A and 18B), and accordingly, it is possible to prevent the container **7** from floating.

[0041] Then, when the user pushes the whole of the cleaning device **1** toward the side of the bottom plate **11,** a lower part of the pump **P** provided at the base **12** is immersed in the cleaning liquid stored in the container **7.** Here, a packing **17** is mounted, by a mounting frame **18,** to a lower surface of a periphery of the base **12.** At this time, the packing **17** is held between a lower face of the base **12** and a flange part **72** that is provided at an upper edge of the container **7** so as to project toward the outer periphery side, and accordingly, this portion is waterproofed.

[0042] The user puts the blade head **Ea** of the small electrical appliance **E** into the cleaning tray **5a** through the opening part **20** of the upper face of the cleaning device **1,** and makes the terminal parts **Eb** of the small electrical appliance **E** come into contact with the contact parts **39** of the support part **S.** The cleaning device **1** is connected to an external power supply (not shown) at this state or before this state.

[0043] The cleaning device **1** connected to the external power supply starts the cleaning, when the selecting button **29** is operated. Thus, the pump **P** of the cleaning device **1** is activated and sends the cleaning liquid stored in the container **7** into the cleaning space **52** of the cleaning tray **5a** via the connecting pipe **126** and the water supply/discharge port **56**. Then, cleaning liquid overflowing the overflow weir **54** of the cleaning tray **5a** is returned into the container **7** via the water discharge port **57** and the connecting pipe **127.** Therefore, the cleaning liquid is circulated between the container **7** and the cleaning tray **5a**. During the cleaning, it is preferred that the cleaning device **1** activates a blade of the blade head **Ea** through the support part **S.** In this case, it is possible to perform the cleaning of the blade head Ea more quickly and effectively.

[0044] Here, the cleaning liquid in the cleaning tray **5a** overflows the overflow weir **54**, and flows into the overflow part **53**, and is returned into the container **7** via the water discharge port **57** and the connecting pipe **127** as described above. The connecting pipe **127** is located directly above the filter **89,** and the filter **89** is in the space **7a** of the container **7.** Therefore, when the cleaning liquid, including body hairs and the like by the cleaning, passes through the filter **89,** the body hairs and the like is removed from the cleaning liquid (that is, it becomes filtered cleaning liquid). Then, the filtered cleaning liquid flows to, via the slope **86,** the side of the recess **88** that is located in the space **7b.** Because a sucking port of the pump **P** is located on this recess **88,** cleaning liquid almost without body hairs and the like, such as filtered cleaning liquid, is sent to the cleaning tray **5a** by the pump **P** again.

[0045] Part of the cleaning liquid with body hairs and the like flows down to the space **7a** without passing through the filter **89,** and then flows into the space **7c** that is on the bottom of the container **7.** For example, the cleaning liquid with body hairs and the like without passing through the filter **89** flows into the space **7c,** located between the lower face of the filter frame **8** and the bottom face of the container **7,** from the space **7a** located on one side of a rear part of the container **7.** Then, this cleaning liquid with the body hairs and the like spreads along the bottom face of the container **7,** and then flows into the space **7b** from the gap that is between the front edge of the bottom plate part **80** of the filter frame **8** and the front inner wall of the container **7.** Here, cleaning liquid sent to the cleaning tray **5a** by the pump **P** mainly includes the cleaning liquid almost without the body hairs and the like described above. Therefore, the amount of the cleaning liquid passing through the space **7c** is small, and the flowing speed thereof is considerably low (slow). Furthermore, staying of the cleaning liquid, the body hairs and the like entering the space **7c** easily occurs due to, for example, the bottom plate part **80** and the grid-like rib **85** provided on the lower face of the bottom plate part **80.** Therefore, the body hairs and the like in the cleaning liquid, entering the space **7c** without passing through the filter **89,** are easily settled and deposited in the space **7c,** and accordingly, the cleaning liquid passing through the space **7c** becomes a state where the body hairs and the like are reduced.

[0046] After passing through the space **7c,** the cleaning liquid passes on the bottom plate part **80** of the filter frame **8** via the front part side of the container **7,** and then flows to the recess **88** below which the sucking port of the pump **P** is opened near the rear part of the container **7.** In addition, the bottom plate part **80** is disposed between the sucking port and the body hairs and the like settled and deposited. Therefore, in the cleaning device **1,** it is unlikely that the pump **P** sucks the body hairs and the like and returns those into the cleaning tray **5a** again.

[0047] The size of the space **7c** is normally set so as to be capable of securing the amount of the body hairs

deposited by the cleaning operations that are performed several tens times. The user can wash away the deposited body hairs by taking the container **7** out from the cleaning device **1** and removing the filter frame **8.** After that, when the user puts new cleaning liquid into the container **7,** the cleaning device **1** can obtain initial cleaning capability again. The above-mentioned flange part **72** provided at the upper edge of the container **7** is formed so as to extend toward the outer periphery side. Therefore, when the user allows the opening of the container **7** to turn downward in order to discard old cleaning liquid in the container **7,** it is possible to discharge the old cleaning liquid (and body hairs and the like) smoothly. The flange part **72** is provided for securing the rigidity for water stop. However, if it is possible to secure the rigidity by increasing a thickness of a lateral wall of the container **7,** the flange part **72** is not required.

[0048] When the cleaning is completed and the pump **P** is stopped, the cleaning liquid remaining in the cleaning space **52** of the cleaning tray 5a is returned into the container **7** by natural falling via the water supply/discharge port **56**, the connecting pipe **126** and the pump **P** (a space between the impeller **123** and the pump cover **124** of the pump **P**). The impeller **123** is in a state of being immersed in the cleaning liquid stored in the container **7,** and further, the cleaning liquid remaining in the cleaning space **52** hardly includes body hairs and the like upon completion of the cleaning. Therefore, although the cleaning liquid passes through the pump **P,** clogging due to the body hairs and the like hardly occurs. In addition, even when the water discharge port **57** of the overflow part **53** is clogged during the cleaning operation, because the water discharge port **58** is additionally provided, the cleaning liquid hardly overflows the cleaning tray **5a.**

[0049] The cleaning device 1 according to the present embodiment further includes three detection pins **24** for detecting a level of cleaning liquid, a detection part (not shown), and a determination part (not shown). The detection part is configured to apply a prescribed voltage between two pins of the three detection pins **24** to measure an electric resistance value in a conducted state. The determination part is configured to determine a level of cleaning liquid based on the measured electric resistance value.

[0050] Hereinafter, the three detection pins **24** of the present embodiment will be described specifically. As shown in Figs. 20A to 20D, the three detection pins **24** (**24a, 24b, 24c**) are disposed so as to hang down in a space between an inner wall face on the rear side in the container **7** and an outer periphery of the motor cover part **120.** In other words, each detection pin **24** is disposed so as to hang down in the space **7b** of the container **7.** A bottom end of each detection pin **24** is disposed below the line **70** for water supply marked on the inner wall of the container **7.** For this reason, the bottom of each detection pin **24** is immersed into the cleaning liquid almost without body hairs and the like, stored in the container **7.**

[0051] Note that, Fig. 1 is a schematic drawing. Therefore, for convenience, in the drawing, the three detection pins **24** are illustrated so as to be disposed on the front side of the container **7.** However, as shown in Figs. 20A to 20D, those pins **24** are actually disposed in the space between the inner wall face on the rear side in the container **7** and the outer periphery of the motor cover part **120.**

[0052] Because the cleaning liquid has conductivity, any two of the three detection pins **24** can be electrically connected via the cleaning liquid. The detection part and the determination part of the cleaning device **1** determines a level of the cleaning liquid stored in the container **7** based on an electric resistance value measured when any two of the three detection pins **24** can be electrically conducted with each other. Specifically, the cleaning device **1** detects the level of the cleaning liquid, utilizing a change of the electric resistance value in a case where no cleaning liquid exists between the detection pins **24a** and **24b,** or in a case where no cleaning liquid exists between the detection pins **24a** and **24c** (for example, a change that the electric resistance value become larger than a prescribed value). For this reason, the detection pin **24a** is defined as a so-called common pin **25** that is used in common in the conducted state, and further the other two pins **24b** and **24c** are defined as conduction pins **26** for detection, each of which is to be electrically conducted with the common pin **25** via the cleaning liquid.

[0053] The top end sides of the three detection pins **24** are respectively fixed to three fixing parts **129** that are provided integrally with the base **12.** A bottom end of each fixing part **129** is disposed above the line **70** for water supply. In other words, each fixing part **129** is provided above an immersion region (outside the immersion region) where the cleaning liquid is stored in the container **7.** Therefore, in the cleaning device **1,** the cleaning liquid in the container **7** is hardly adhered on the three fixing parts **129,** a portion (a boundary portion) between each detection pin **24** and a fixing part **129** corresponding to the each detection pin **24,** and the like, and it is possible to prevent staying of the cleaning liquid from occurring at the three fixing parts **129,** the boundary portion, and the like. Accordingly, the cleaning device **1** can prevent erroneous detection of the cleaning liquid level due to staying of the cleaning liquid at the boundary portion and the like.

[0054] The three detection pins **24** are respectively fixed to the three fixing parts **129** by elastically press-inserting, press-inserting in a melted state, or formation of the base **12** through resin-molding in a state where the three detection pins **24** are inserted (by insert molding). In this way, in the cleaning device **1,** a gap hardly occurs at a portion (boundary portion) between each fixing part **129** and a corresponding detection pin **24,** and accordingly, it is possible to prevent staying of cleaning liquid from occurring at this boundary portion. Therefore, the cleaning device **1** can prevent erroneous detection of the cleaning liquid level due to staying of the cleaning

liquid at the boundary portion.

[0055] Furthermore, each detection pin **24** is disposed so as to be separated from a wall surface of a peripheral member, which is disposed around the each detection pin, by a prescribed dimension **C1** or more (see Fig. 20D). Examples of the wall surface of the peripheral member include an inner wall face of the container **7,** an outer peripheral face of the motor cover part **120,** and the like. In this way, in the cleaning device **1,** the gap with the prescribed dimension **C1** or more is provided between the wall surface and an immersion portion of each detection pin **24,** which is immersed in the cleaning liquid, and accordingly, it is possible to prevent staying of the cleaning liquid due to surface tension and the like from occurring at the gap. In other words, in plan view, the gap at which no staying of the cleaning liquid due to the surface tension occurs is provided between the wall surface and the immersion portion of each detection pin **24.** In this way, the cleaning device **1** can prevent erroneous detection of the cleaning liquid level due to staying of the cleaning liquid occurring between the immersion portion and the wall surface. Note that, the prescribed dimension **C1** in the present embodiment is about 8 mm for example. However, this dimension may be set appropriately depending on a component member and a shape of each detection pin **24** or each wall surface, or the present or absence of surface treatment. For this reason, the dimension is not limited to the above value.

[0056] In addition, as shown in Figs. 1, 20A to 20D, 21A and 21B, portions positioned in the container **7,** of the three detection pins **24,** have different vertical lengths. Specifically, the detection pin **24a** has the longest length, and the detection pin **24b** has the shortest length, and the detection pin **24c** has a length that is shorter than the length of the detection pin **24a** but longer than the length of the detection pin **24b.** In the container **7,** vertical positions of bottom ends of the three detection pins **24** are different from each other. Specifically, a bottom end of the detection pin **24a** is at the lowest position, and a bottom end of the detection pin **24b** is at the highest position and further below the line **70** for water supply, and a bottom end of the detection pin **24c** is disposed above the bottom end of the detection pin **24a** but below the bottom end of the detection pin **24b.** In other words, the bottom end of the common pin **25** is disposed closer to the bottom face of the container **7** than the bottom ends of the other two conduction pins **26** for detection.

[0057] For this reason, the cleaning device **1** can measure the cleaning liquid level in two steps, for example: when the residual amount of the cleaning liquid is somewhat small; and when the residual amount thereof is smaller than the amount required for circulating the cleaning liquid to perform the cleaning (cleaning operation) (that is, when it becomes impossible to perform the cleaning). Specifically, the cleaning device **1** is configured to detect a state where a liquid surface of the cleaning liquid (a cleaning liquid surface **W**) is below the position of the bottom end of the detection pin **24b** (below a cleaning liquid surface **W1** in Fig. 21A), namely, a state where the residual amount of the cleaning liquid is somewhat small although the cleaning can be performed. Further, the cleaning device 1 is configured to detect a state where the cleaning liquid surface **W** becomes lower than the level in the former state and is below the position of the bottom end of the detection pin **24c** (below a cleaning liquid surface **W2** in Fig. 21A), namely, a state where the residual amount thereof is smaller than the amount required for circulating the cleaning liquid to perform the cleaning (a state where it is impossible to perform the cleaning). In this way, because the cleaning device **1** can measure the cleaning liquid level in two steps, the convenience of the level detection can be easily improved.

[0058] Further, for example, the bottom end of the detection pin **24b** may be at substantially the same vertical position as a top end of the pump cover **124,** and the bottom end of the detection pin **24c** may be slightly above a bottom surface of the motor cover part **120,** or be at substantially the same vertical position as the bottom surface. Therefore, the cleaning device **1** can prevent the motor **M** from rotating idly when it becomes impossible to perform the cleaning.

[0059] Here, when the cleaning device **1** is installed on a substantially horizontal installation surface, the cleaning liquid surface **W** becomes substantially parallel to the bottom surface of the container **7,** as shown in Fig. 21A. However, the cleaning device 1 may be not always installed on such a substantially horizontal installation surface. That is, the cleaning device **1** may be installed in a state where the bottom plate **11** is inclined relative to the horizontal plane, such that the cleaning device **1** is put on an inclined installation surface, or is put on an installation surface while a power supply cord, a comb or the like is accidentally located between the bottom plate **11** and the installation surface.

[0060] When the cleaning device **1** is installed in the state where the bottom plate **11** is inclined, the cleaning liquid surface **W** becomes a state of being inclined relative to the bottom surface of the container **7,** as shown in Fig. 21B for example. Note that, in Fig. 21B, a state where the cleaning liquid surface **W** is inclined relative to the horizontal plane is illustrated in order to facilitate understanding, but, the bottom surface of the container **7** is actually inclined relative to the horizontal plane due to a power supply cord, a comb or the like being accidentally located. When a cleaning liquid surface **W3** is inclined relative to the bottom surface of the container **7,** regarding a height in a direction substantially perpendicular to the bottom surface of the container **7,** a position of an intersection **P1** of the detection pin **24a** and the cleaning liquid surface **W3** becomes below an intersection **P2** of the detection pin **24b** and the cleaning liquid surface **W3** and an intersection **P3** of the detection pin **24c** and the cleaning liquid surface **W3.** When a cleaning liquid surface **W4** is inclined relative to the bottom surface of the container **7,** a position of an intersection **P4** of the detection pin **24a** and the cleaning liquid surface **W4** be-

comes below an intersection **P5** of the detection pin **24c** and the cleaning liquid surface **W4.** In other words, when the cleaning liquid surface **W** is inclined relative to the bottom surface of the container **7,** a position of an intersection of the common pin **25** and the cleaning liquid surface **W** becomes closer to the bottom surface of the container **7** than a position(s) of an intersection(s) of the conduction pin(s) **26** and the cleaning liquid surface **W.**

[0061] Here, the cleaning device 1 includes the two or more conduction pins **26** for detection, and the bottom end of one conduction pin **26** (detection pin **24c)** of the conduction pins **26** is provided to be disposed below the bottom end of the other conduction pin **26** (detection pin **24b).** Therefore, in the cleaning device **1,** in the state where the cleaning liquid surface **W** is inclined relative to the bottom surface of the container **7,** even if a part of the two or more conduction pins **26** is in a state of not being immersed in the cleaning liquid, the other part of the two or more conduction pins **26** can be made to be in a state of being immersed. In other words, when the cleaning liquid surface **W** is inclined relative to the bottom surface of the container **7,** the detection pin **24c** is provided so as to more easily come into contact with the cleaning liquid (so as to be more easily immersed in the cleaning liquid), compared with the detection pin **24b.**

[0062] For this reason, in the cleaning device **1,** when the cleaning liquid surface **W** is inclined relative to the bottom surface of the container **7,** it is possible to more easily secure electrically conduction between the common pin **25** and the conduction pins **26** for detection via the cleaning liquid, compared with the case where the number of conduction pin for detection is one. Accordingly, even when being inclined as described above, the cleaning device **1** can easily reduce influence on detection for the cleaning liquid level, depending on inclination of the cleaning liquid surface **W,** and enhance detection accuracy for the level of the cleaning liquid in the container **7.**

[0063] Furthermore, as shown in Figs. 21A and 21B, the bottom end of the detection pin **24a** (common pin **25)** is provided to be disposed below the bottom ends of the other detection pins **24b** and **24c** (conduction pins **26),** and accordingly, the common pin **25** can more easily come into contact with the cleaning liquid (be immersed in the cleaning liquid), compared with the conduction pins **26,** when the cleaning liquid surface **W** is inclined relative to the bottom surface of the container **7.** Therefore, it is possible to give a margin to the level detection even when the cleaning device **1** is put while being inclined, and suppress a reduction of the detection accuracy depending on the degree of inclination of the bottom plate **11** relative to the horizontal plane. In other words, even when the cleaning device **1** is put while being inclined, it is possible to more easily secure the state where the common pin **25** is immersed in the cleaning liquid, compared with the conduction pins **26,** and easily reduce influence on the number of times of use due to the degree of the inclination.

[0064] In addition, an inclined angle (an allowable angle α) is set, which is allowed when the cleaning liquid surface **W** is inclined relative to the bottom surface of the container **7.** The allowable angle α is set as a limit value of the inclined angle at which the cleaning liquid is allowed to be supplied from the container **7** to the cleaning tray **5a** and further the cleaned part **E1** is allowed to be cleaned at the cleaning tray **5a** (cleaning part **5**) for example.

[0065] A difference (dimension H1) in a vertical direction between the bottom end of the conduction pin **26** (detection pin **24c**), which has the lowest bottom end among the bottom ends of the two or more conduction pins **26,** and the bottom end of the detection pin **24a** is set based on the allowable angle α.

[0066] Specifically, as shown in Fig. 21B, when a distance on a horizontal plane between the detection pin **24c** and the common pin **25** is defined as L1, the dimension H1 in the vertical direction is set to a value or more obtained by multiplying the distance L1 by the tangent of the allowable angle α ($\tan\alpha$) (that is, H1 >= L1 $\times$ $\tan\alpha$). In other words, the dimension H1 of the extended portion of the pin is set to be substantially equal to or more than a height of a virtual right-angled triangle, which has a bottom side on a horizontal plane passing through the bottom end of the detection pin **24c** and has an acute angle that is the allowable angle α and has the height along the common pin **25**.

[0067] Accordingly, when being installed at the allowable angle α or less, the cleaning device **1** can detect, through the detection pins **24a** and **24c,** a state where it is impossible to perform the cleaning for example, and can suppress a reduction of the detection accuracy depending on the degree of inclination.

[0068] Furthermore, as shown in Figs. 21A and 21B, a distance L2 between the common pin **25** and the closest conduction pin **26** (detection pin **24b**) to the common pin **25** on the horizontal plane is set to be larger than a distance L3 between two adjacent conduction pins **26** (detection pins **24b** and **24c**) on the horizontal plane. In other words, the three detection pins **24** are arranged so that a distance between each conduction pin **26** and the common pin **25** is longer than a distance between the two conduction pins **26.**

[0069] Accordingly, in the cleaning device **1,** it is possible to easily increase the electric resistance value in the state where the common pin **25** and each conduction pin **26** are electrically conducted with each other via the cleaning liquid. Therefore, the cleaning device **1** can easily suppress a progression of an electric corrosion (electrochemical corrosion) generating at the detection pins **24** due to the conduction, and suppress decrease in durability performance (deterioration) or decrease in detection accuracy due to the electric corrosion.

[0070] The arrangement of the three detection pins **24** is not limited to the illustrated example. For example, as shown in Fig. 22, the bottom end of the detection pin **24b** may be provided to be disposed below that of the detec-

tion pin **24c.** In other words, positions of the detection pins **24b** and **24c** may be replaced with each other.

[0071] Next, a variation according to the present embodiment will be described. A configuration of this variation is similar to that of the above cleaning device **1** except for ribs **9** described later. Hereinafter, the cleaning device **1** not including the ribs **9** is referred to as a first example, and this variation is referred to as a second example. The constituent elements of the second example similar to those of the first example are assigned with same reference numerals, and while the explanation thereof being omitted, characteristics and the like of this variation (the second example) will be explained.

[0072] A cleaning device **1** of the second example further includes three ribs **9** for making cleaning liquid flow down, which respectively correspond to three detection pins **24.** As shown in Fig. 23, each rib **9** is provided so as to extend downward along a detection pin **24** from an end of a fixing part **129** on a side of a boundary portion between the detection pin **24** and the fixing part **129.** Each rib **9** is provided so that one lateral end thereof (a left lateral end face of the rib **9** in Fig. 23) is in contact with the detection pin **24.**

[0073] Accordingly, even when cleaning liquid is adhered to the boundary portion, this cleaning liquid is easily made to flow down along the lateral end and the like of the rib **9.** Therefore, the cleaning device **1** can prevent staying of the cleaning liquid from occurring at the boundary portion, and suppress erroneous detection of the cleaning liquid level due to staying of the cleaning liquid, and easily improve the detection accuracy.

[0074] In a case where the rib **9** is provided along the detection pin **24,** it is preferred to provide the rib **9** by resin molding or the like such that the detection pin **24** is inserted into a resin member, in order to prevent a gap from generating between the rib **9** and the detection pin **24.** It is not limited to the rib **9** provided so as to be along the detection pin **24.** The rib **9** may be provided to be inclined so as to be more separated from the detection pin **24** as goes down for example, in order to make cleaning liquid flow down and prevent staying of the cleaning liquid from generating between the rib **9** and the detection pin **24.**

[0075] Next, another variation (hereinafter, referred to as a third example) will be described. The constituent elements of the third example similar to those of the above-mentioned first and second examples are assigned with same reference numerals, and while the explanation thereof being omitted, characteristics and the like of this variation (the third example) will be explained.

[0076] In the third example, as shown in Fig. 24, each rib **9** for making cleaning liquid flow down is provided over between an outer periphery of a motor cover part **120** and a fixing part **129.** The almost wholes of lateral ends of each rib **9** are in contact with the motor cover part **120** and the fixing part **129,** respectively. Each rib **9** is formed integrally with the motor cover part **120** and the fixing part **129.** Further, part of each rib **9,** below the boundary portion between the detection pin **24** and the fixing part **129,** has an inclined surface that is inclined so as to come closer to a side of the motor cover part **120** as goes down. In other words, each rib **9** is shaped so that the part thereof on the bottom side is more separated from the detection pin **24** as goes down.

[0077] Accordingly, the cleaning device **1** can make cleaning liquid adhered to the boundary portion between the detection pin **24** and the fixing part **129** easily flow down along the inclined surface and the like of the rib **9.** By making the cleaning liquid easily flow down through the ribs **9,** the cleaning device **1** can prevent staying of the cleaning liquid due to surface tension and the like from occurring between the detection pin **24** and the wall surface of the peripheral member. Furthermore, by the part of each rib **9** below the boundary portion being shaped so as to be more separated from the detection pin **24** as goes down, the cleaning device **1** can prevent the cleaning liquid made to flow down from staying between the detection pin **24** and the rib **9.**

[0078] Therefore, the cleaning device **1** can prevent staying of the cleaning liquid from occurring at the detection pins **24,** and suppress erroneous detection of the cleaning liquid level due to staying of the cleaning liquid or the like, and improve the detection accuracy. Note that, each rib **9** may be provided so that a lateral end thereof is in contact with an inner wall surface of the container **7.** In addition, it is not limited to the ribs **9,** each of which is provided so that the whole of the lateral end thereof is in contact with a peripheral member such as a motor cover part **120** or an inner wall surface of the container **7.** For example, each rib **9** may be provided so that only part thereof on the bottom side (such as, only the bottom end) is in contact with the peripheral member.

[0079] Note that, the above-mentioned cleaning device **1** according to the present embodiment may include a single common pin **25** and three or more conduction pins **26** for detection, for example. In addition, for example, the detection pins **24** may be formed so as to have the same lengths and shapes, and instead, the bottom ends of the pins may be disposed at different vertical positions by adjusting the projection amounts of the fixing part projecting downward or the like.

Claims

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

a cleaning part (5) configured to clean a cleaned part (E1) of the small electrical appliance (E); and

a container (7) for storing cleaning liquid to be supplied to the cleaning part (5),

wherein the cleaning device (1) further comprises three or more detection pins (24: 24a, 24b, 24c) for detecting a level of the cleaning liquid

by conduction via the cleaning liquid, the three or more detection pins (24: 24a, 24b, 24c) being disposed so as to hang down in the container (7),
characterized in that
one detection pin (24a) of the three or more detection pins (24: 24a, 24b, 24c) is defined as a common pin (25) which is conducted in common with the other detection pins (24b, 24c),
the other detection pins (24b, 24c) being defined as two or more conduction pins (26) for detection, and
wherein a bottom end of the common pin (25) is disposed below bottom ends of the two or more conduction pins (26).

2. The cleaning device (1), according to claim 1,
wherein one conduction pin of the two or more conduction pins (26) has the lowest bottom end among the bottom ends of the two or more conduction pins (26),
wherein a dimension in a vertical direction from the bottom end of the one conduction pin to the bottom end of the common pin (25) is defined as H1,
a distance on a horizontal plane between the one conduction pin and the common pin (25) being defined as L1,
an allowable angle, at which the cleaning liquid is allowed to be supplied from the container (7) to the cleaning part (5) and further the cleaned part (E1) is allowed to be cleaned at the cleaning part (5) while the cleaning device is inclined, being defined as a, and
wherein the dimension in the vertical direction H1 is set so as to satisfy the following conditional equation:

$$H1 >= L1 \times \tan\alpha.$$

3. The cleaning device (1), according to claim 1 or 2, further comprising three or more fixing parts (129) for respectively fixing the three or more detection pins (24: 24a, 24b, 24c), the three or more fixing parts (129) being provided above an immersion region where the cleaning liquid is stored.

4. The cleaning device (1), according to claim 3,
wherein the three or more detection pins (24: 24a, 24b, 24c) are respectively fixed to the three or more fixing parts (129) by any one of elastically press-inserting, insert molding, and press-inserting in a melted state.

5. The cleaning device (1), according to any one of claims 1 to 4,
wherein the three or more detection pins (24: 24a, 24b, 24c) are disposed so that a gap is provided between an immersion portion of each detection pin (24) which is immersed in the cleaning liquid, and a peripheral member which is disposed around the each detection pin (24).

6. The cleaning device (1), according to any one of claims 1 to 5, further comprising:

three or more fixing parts (129) for respectively fixing top end sides of the three or more detection pins (24: 24a, 24b, 24c); and
three or more ribs (9) for making the cleaning liquid flow down, which respectively correspond to the three or more fixing parts (129), each of the three or more ribs (9) being provided so as to extend downward from a boundary portion between a corresponding fixing part and a detection pin (24) corresponding to the fixing part.

7. The cleaning device (1), according to claim 6,
wherein at least a bottom end side of each of the three or more ribs (9) is provided to be in contact with a wall surface of a peripheral member which is disposed around the detection pin (24) corresponding to the fixing part (129).

8. The cleaning device (1), according to any one of claims 1 to 7,
wherein the three or more detection pins (24: 24a, 24b, 24c) are disposed so that a distance between the common pin (25) and the closest conduction pin (26) to the common pin (25), of the two or more conduction pins (26), is larger than a distance between two adjacent conduction pins (26), of the two or more conduction pins (26).

Patentansprüche

1. Reinigungsvorrichtung (1) für ein elektrisches Kleingerät (E), die umfasst:

einen reinigenden Teil (5), der so ausgeführt ist, dass er einen zu reinigenden Teil (E1) des elektrischen Kleingerätes (E) reinigt; und
einen Behälter (7) zum Aufbewahren von Reinigungsflüssigkeit, die dem reinigenden Teil (5) zugeführt wird,
wobei die Reinigungsvorrichtung (1) des Weiteren drei oder mehr Erfassungs-Stifte (24: 24a, 24b, 24c) umfasst, mit denen ein Pegel der Reinigungsflüssigkeit mittels Leitung über die Reinigungsflüssigkeit erfasst wird, wobei die drei oder mehr Erfassungs-Stifte (24: 24a, 24b, 24c) so angeordnet sind, dass sie in dem Behälter (7) nach unten hängen,
dadurch gekennzeichnet, dass
ein Erfassungsstift (24a) der drei oder mehr Erfassungs-Stifte (24: 24a, 24b, 24c) als ein ge-

meinsamer Stift (25) definiert ist, der gemeinsam mit den anderen Erfassungs-Stiften (24b, 24c) leitet,
die anderen Erfassungs-Stifte (24b, 24c) als zwei oder mehr Leitungs-Stifte (26) für Erfassung definiert sind, und
ein unteres Ende des gemeinsamen Stiftes (25) unterhalb unterer Enden der zwei oder mehr Leitungs-Stifte (26) angeordnet ist.

2. Reinigungsvorrichtung (1) nach Anspruch 1, wobei ein Leitungs-Stift der zwei oder mehr Leitungs-Stifte (26) das am tiefsten liegende untere Ende von den unteren Enden der zwei oder mehr Leitungs-Stifte (26) hat,
eine Abmessung von dem unteren Ende des einen Leitungs-Stiftes zu dem unteren Ende des gemeinsamen Stiftes (25) in einer vertikalen Richtung als H1 definiert ist,
ein Abstand zwischen dem einen Leitungs-Stift und dem gemeinsamen Stift (25) in einer horizontalen Ebene als L1 definiert ist,
ein zulässiger Winkel, in dem die Reinigungsflüssigkeit aus dem Behälter (7) dem reinigenden Teil (5) zugeführt werden darf und des Weiteren der zu reinigende Teil (E1) an dem reinigenden Teil (5) gereinigt werden darf, wenn die Reinigungsvorrichtung geneigt ist, als α definiert ist, und
die Abmessung H1 in der vertikalen Richtung so festgelegt ist, dass sie die folgende Bedingungsgleichung erfüllt:

$$H1 \geq L1 \times \tan\alpha.$$

3. Reinigungsvorrichtung (1) nach Anspruch 1 oder 2, die des Weiteren drei oder mehr fixierende Teile (129) umfasst, mit denen jeweils die drei oder mehr Erfassungs-Stifte (24: 24a, 24b, 24c) fixiert werden, wobei sich die drei oder mehr fixierenden Teile oberhalb eines Eintauchbereiches befinden, in dem die Reinigungsflüssigkeit aufbewahrt wird.

4. Reinigungsvorrichtung (1) nach Anspruch 3, wobei die drei oder mehr Erfassungs-Stifte (24: 24a, 24b, 24c) jeweils mittels Einpressen, Insert Molding oder Einpressen in einem geschmolzenen Zustand an den drei oder mehr fixierenden Teilen (129) fixiert werden.

5. Reinigungsvorrichtung (1) nach einem der Ansprüche 1 bis 4,
wobei die drei oder mehr Erfassungs-Stifte (24: 24a, 24b, 24c) so angeordnet sind, dass ein Zwischenraum zwischen einem Eintauch-Abschnitt jedes Erfassungs-Stiftes (24), der in die Reinigungsflüssigkeit eingetaucht wird, und einem Umfangselement vorhanden ist, das um jeden Erfassungs-Stift (24) herum angeordnet ist.

6. Reinigungsvorrichtung (1) nach einem der Ansprüche 1 bis 5, die des Weiteren umfasst:

drei oder mehr fixierende Teile, die jeweils oberste Enden der drei oder mehr Erfassungs-Stifte (24: 24a, 24b, 24c) fixieren; sowie
drei oder mehr Rippen (9), die die Reinigungsflüssigkeit nach unten fließen lassen und die jeweils den drei oder mehr fixierenden Teilen (129) entsprechen, wobei jede der drei oder mehr Rippen (9) so angeordnet ist, dass sie sich von einem Grenzabschnitt zwischen einem entsprechenden fixierenden Teil und einem dem fixierenden Teil entsprechenden Erfassungs-Stift (24) nach unten erstreckt.

7. Reinigungsvorrichtung (1) nach Anspruch 6, wobei wenigstens eine unterste Seite jeder der drei oder mehr Rippen (9) so angeordnet ist, dass sie in Kontakt mit einer Wandfläche eines Umfangselementes ist, das um den Erfassungs-Stift (24) herum angeordnet ist, der dem fixierenden Teil (129) entspricht.

8. Reinigungsvorrichtung (1) nach einem der Ansprüche 1 bis 7,
wobei die drei oder mehr Erfassungs-Stifte (24: 24a, 24b, 24c) so angeordnet sind, dass ein Abstand zwischen dem gemeinsamen Stift (25) und dem dem gemeinsamen Stift (25) am nächsten liegenden Leitungs-Stift (26) der zwei oder mehr Leitungs-Stifte (26) größer ist als ein Abstand zwischen zwei benachbarten Leitung-Stiften (26) der zwei oder mehr Leitungs-Stifte (26).

Revendications

1. Dispositif de nettoyage (1) destiné à un petit appareil électrique (E), comprenant :

une pièce de nettoyage (5) configurée pour nettoyer une pièce nettoyée (E1) du petit appareil électrique (E) ; et
un conteneur (7) destiné à stocker le liquide de nettoyage à alimenter au niveau de la pièce de nettoyage (5),
le dispositif de nettoyage (1) comprenant en outre trois tiges de détection ou plus (24 : 24a, 24b, 24c) pour détecter un niveau du liquide de nettoyage par conduction par l'intermédiaire du liquide de nettoyage, les trois tiges de détection ou plus (24 : 24a, 24b, 24c) étant disposées afin d'être suspendues vers le bas dans le conteneur (7),

caractérisé en ce que
une tige de détection (24a) des trois tiges de détection ou plus (24 : 24a, 24b, 24c) est définie comme tige commune (25) qui est conduite en commun avec les autres tiges de détection (24b, 24c),
les autres tiges de détection (24b, 24c) étant définies comme deux tiges de conduction ou plus (26) pour la détection, et
une extrémité inférieure de la tige commune (25) étant disposée en-dessous des extrémités inférieures des deux tiges de conduction ou plus (26).

2. Dispositif de nettoyage (1), selon la revendication 1, dans lequel une tige de conduction des deux tiges de conduction ou plus (26) présente l'extrémité inférieure la plus basse parmi les extrémités inférieures des deux tiges de conduction ou plus (26),
où une dimension dans un sens vertical depuis l'extrémité inférieure de ladite tige de conduction jusqu'à l'extrémité inférieure de la tige commune (25) est définie par H1,
une distance sur un plan horizontal entre ladite tige de conduction et la tige commune (25) étant définie par L1,
un angle admissible, auquel le liquide de nettoyage peut être alimenté depuis le conteneur (7) au niveau de la pièce de nettoyage (5) et en outre la pièce nettoyée (E1) peut être nettoyée au niveau de la pièce de nettoyage (5) tandis que le dispositif de nettoyage est incliné, étant défini par α, et
la dimension dans le sens vertical H1 étant paramétrée afin de satisfaire l'équation conditionnelle suivante :

$$H1 \geq L1 \times \tan\alpha.$$

3. Dispositif de nettoyage (1), selon la revendication 1 ou 2, comprenant en outre trois pièces de fixation ou plus (129) destinées à fixer respectivement les trois tiges de détection ou plus (24 : 24a, 24b, 24c), les trois pièces de fixation ou plus (129) étant prévues au-dessus d'une région d'immersion où le liquide de nettoyage est stocké.

4. Dispositif de nettoyage (1), selon la revendication 3, les trois tiges de détection ou plus (24 : 24a, 24b, 24c) étant respectivement fixées au niveau des trois pièces de fixation ou plus (129) par n'importe lequel d'une insertion élastiquement par pression, du moulage par insertion, et de l'insertion par pression sous un état fondu.

5. Dispositif de nettoyage (1), selon l'une quelconque des revendications 1 à 4,
dans lequel les trois tiges de détection ou plus (24 : 24a, 24b, 24c) sont disposées de sorte qu'un espace soit prévu entre une partie d'immersion de chaque tige de détection (24) qui est immergée dans le liquide de nettoyage, et un élément périphérique est disposé autour de chaque tige de détection (24).

6. Dispositif de nettoyage (1), selon l'une quelconque des revendications 1 à 5, comprenant en outre :

trois pièces de fixation ou plus (129) destinées à fixer respectivement les côtés d'extrémité supérieure des trois tiges de détection ou plus (24 : 24a, 24b, 24c) ; et
trois nervures ou plus (9) pour faire s'écouler le liquide de nettoyage vers le bas, qui correspondent respectivement aux trois pièces de fixation ou plus (129), chacune des trois nervures ou plus (9) étant prévue afin de s'étendre vers le bas depuis une partie formant frontière entre une pièce de fixation correspondante et une tige de détection (24) correspondant à la pièce de fixation.

7. Dispositif de nettoyage (1), selon la revendication 6, dans lequel au moins un côté d'extrémité inférieure de chacune des trois nervures ou plus (9) est prévu pour se trouver en contact avec une surface de paroi d'un élément périphérique qui est disposé autour de la tige de détection (24) correspondant à la pièce de fixation (129).

8. Dispositif de nettoyage (1), selon l'une quelconque des revendications 1 à 7,
les trois tiges de détection ou plus (24 : 24a, 24b, 24c) étant disposées de sorte qu'une distance entre la tige commune (25) et la tige de conduction la plus proche (26) de la tige commune (25), des deux tiges de conduction ou plus (26), soit supérieure à une distance entre deux tiges de conduction adjacentes (26), des deux tiges de conduction ou plus (26).

FIG. 1

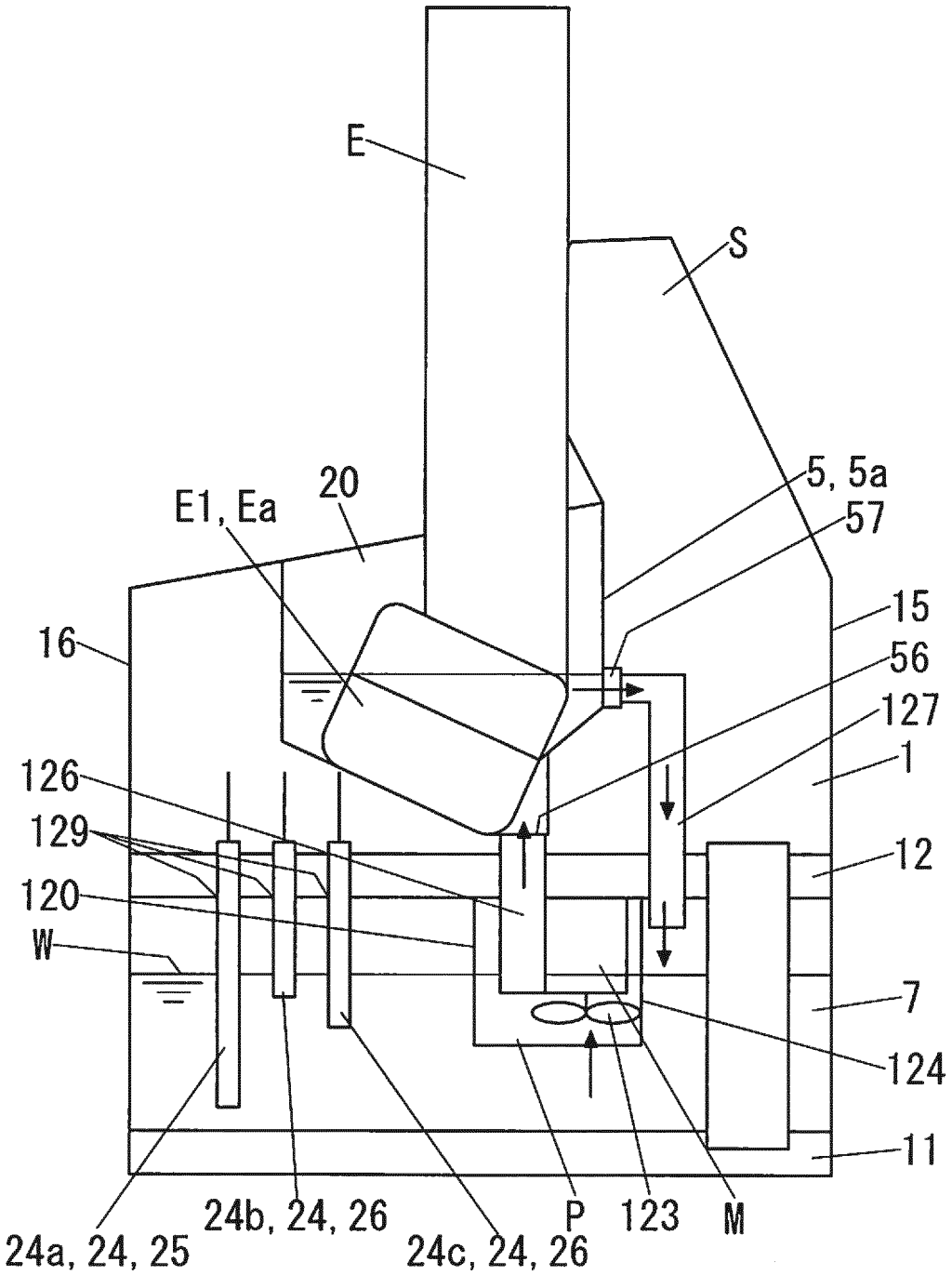

E
S
E1, Ea
20
5, 5a
57
15
16
56
127
1
126
129
12
120
W
7
124
11
24a, 24, 25
24b, 24, 26
24c, 24, 26
P
123
M

FIG. 2

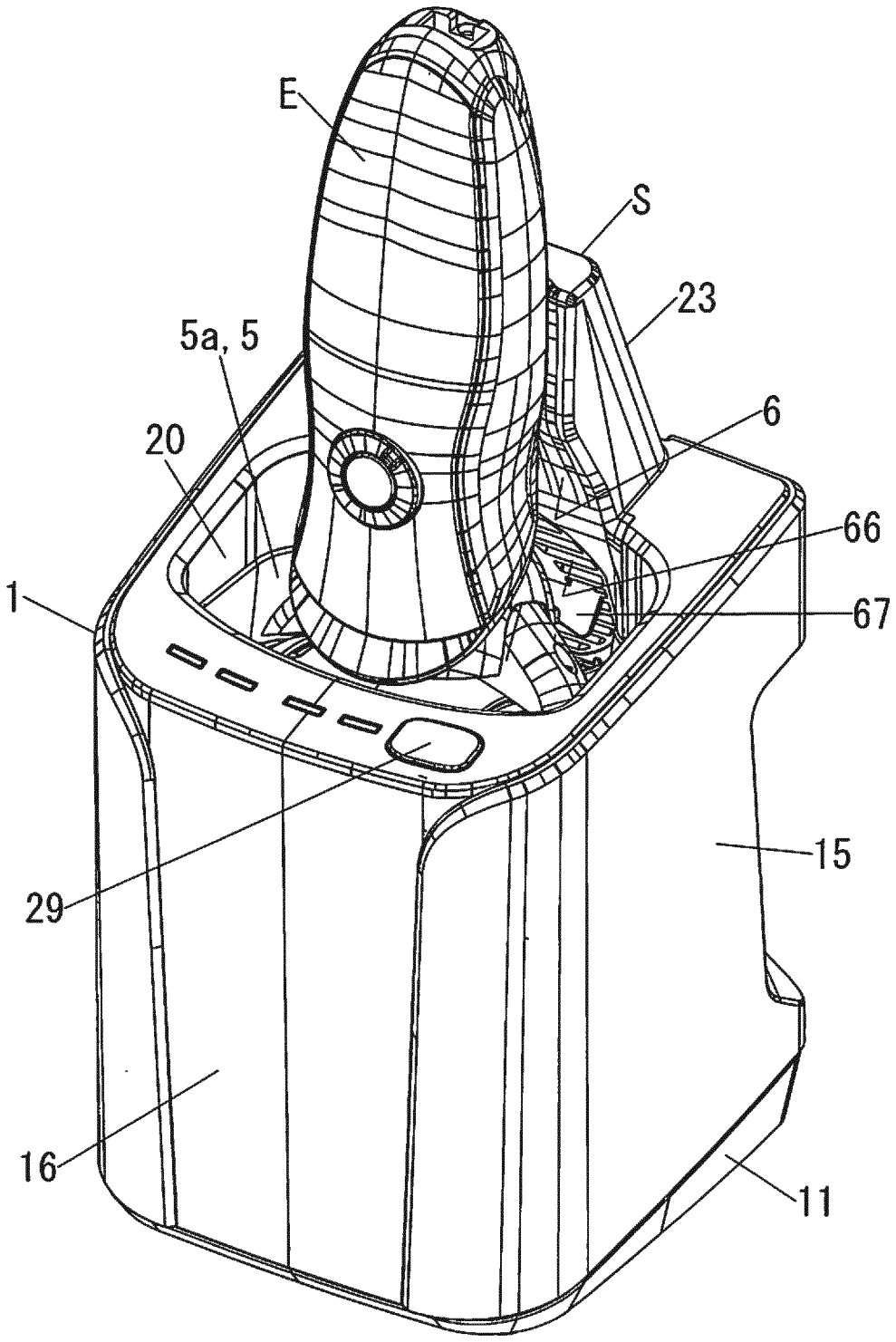


FIG. 3

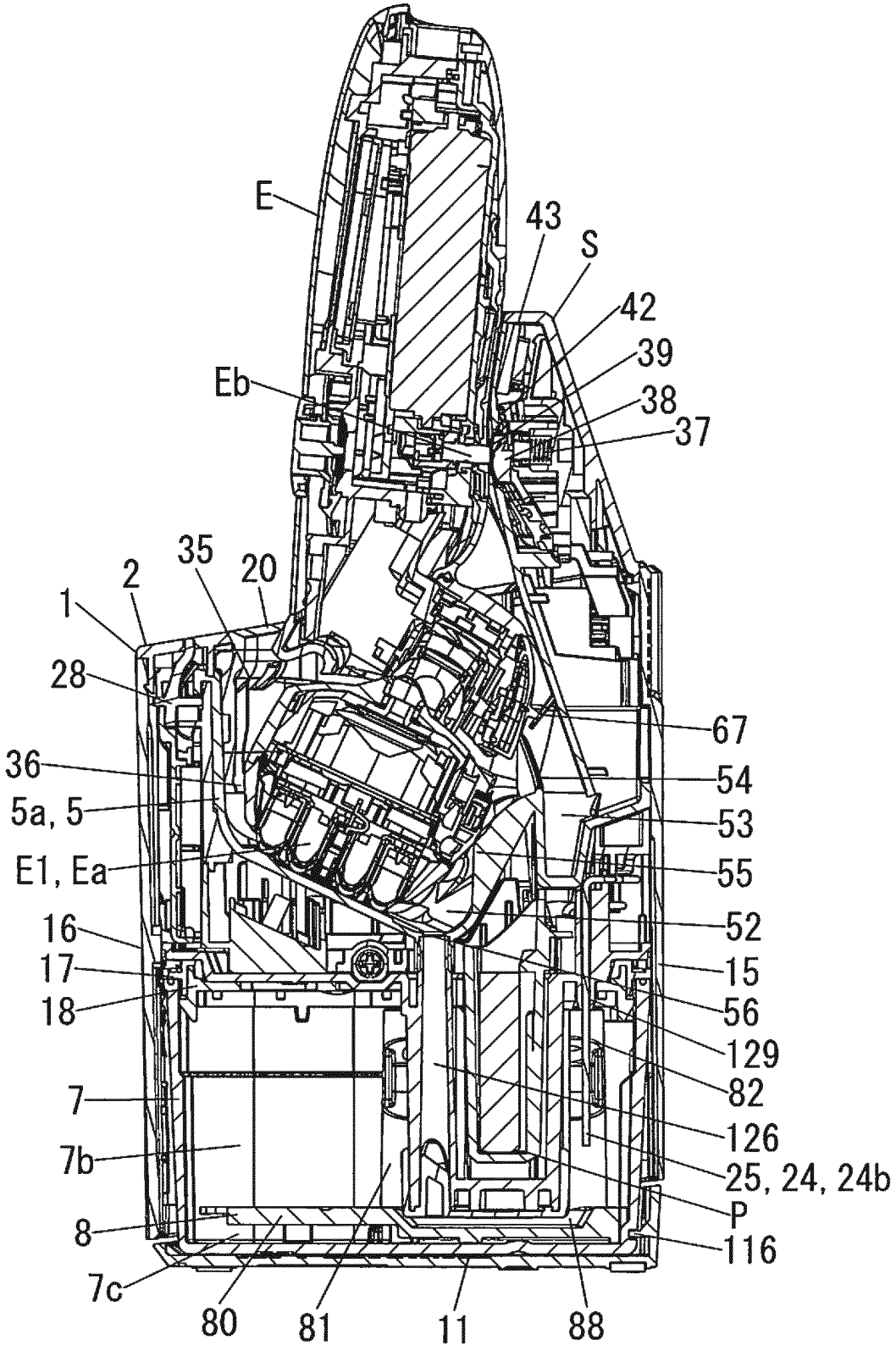

E
43
S
42
39
Eb
38
37
35
20
2
1
28
67
36
54
5a, 5
53
E1, Ea
55
52
16
15
17
56
18
129
82
7
126
7b
25, 24, 24b
P
8
116
7c
80
81
11
88

FIG. 4

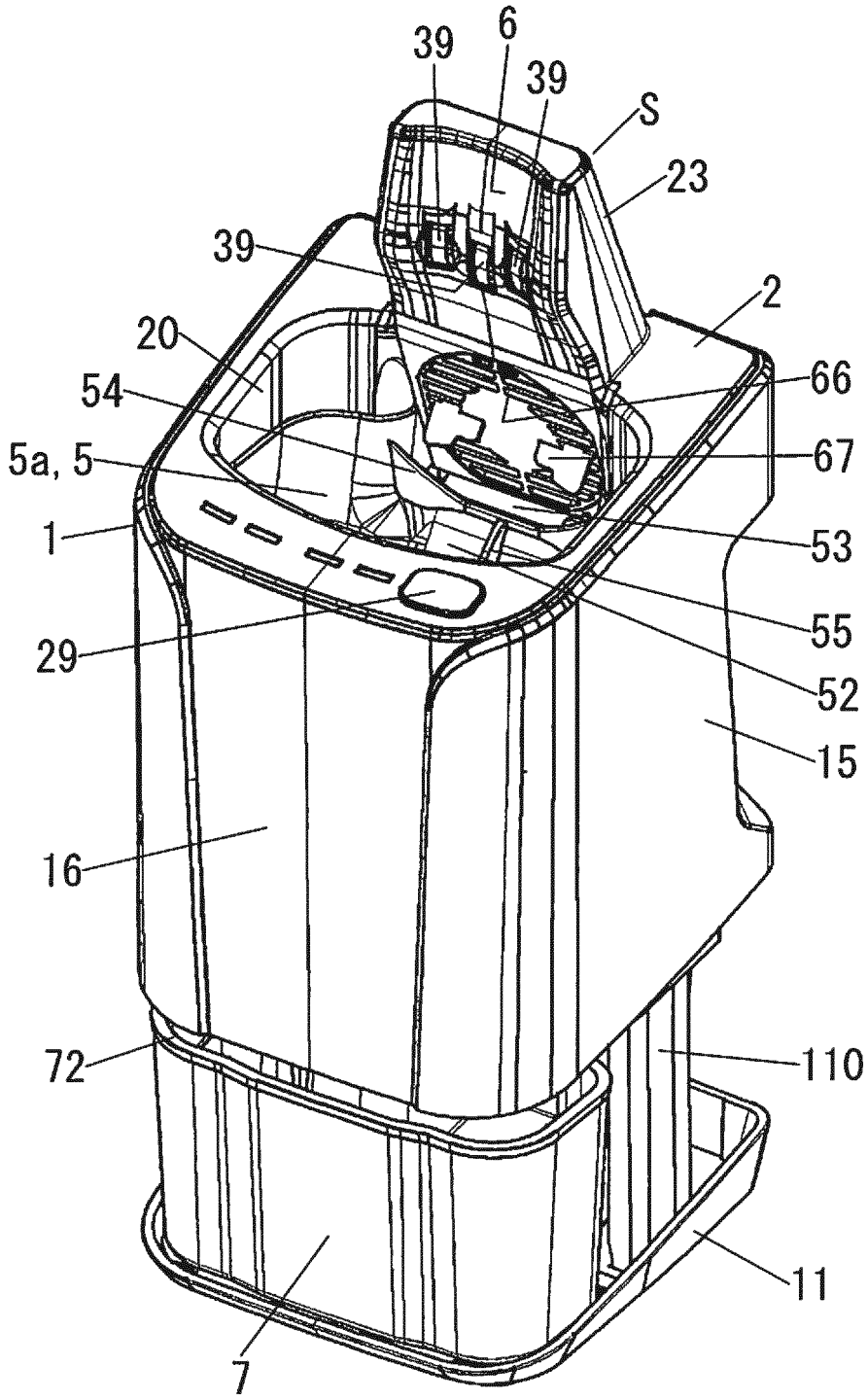


FIG. 5

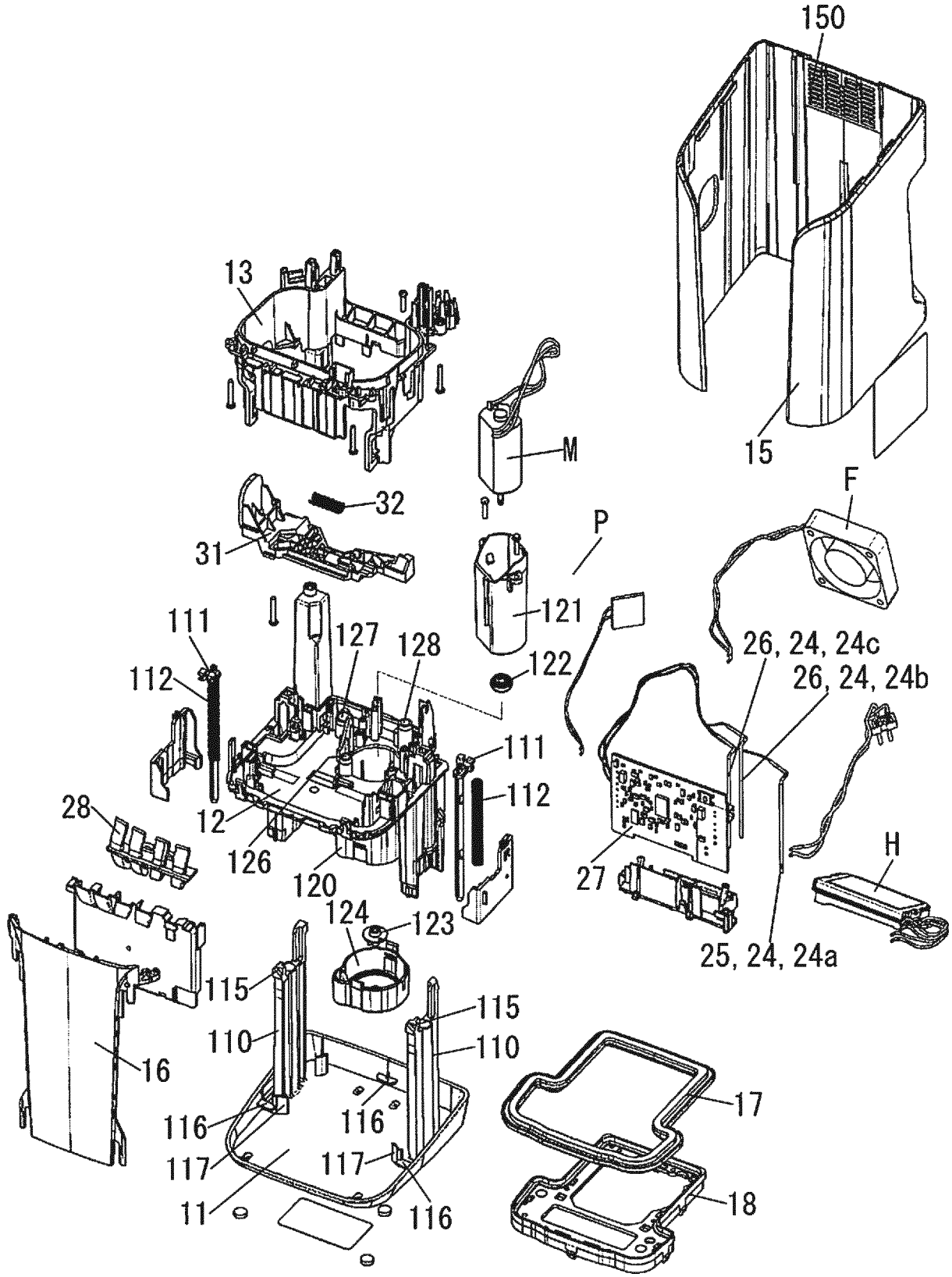

150
15
13
M
32
31
P
121
122
F
111
112
127
128
12
126
120
111
112
28
124
123
115
110
16
116
117
11
116
117
115
110
116
17
18
26, 24, 24c
26, 24, 24b
27
H
25, 24, 24a

FIG. 6

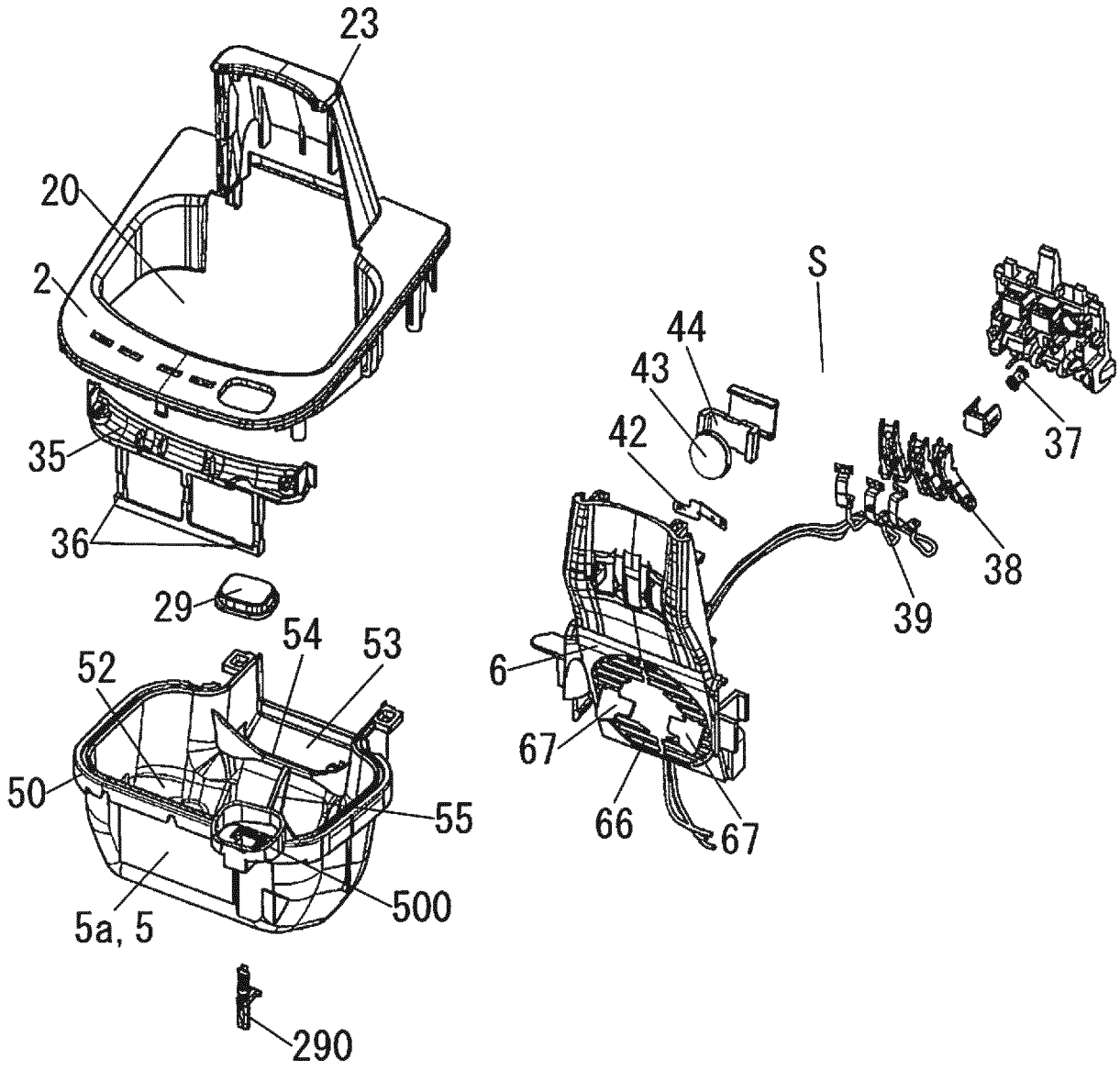

23
20
2
35
36
29
54
53
52
50
55
500
5a, 5
290
S
44
43
42
37
38
39
6
67
66
67

FIG. 7

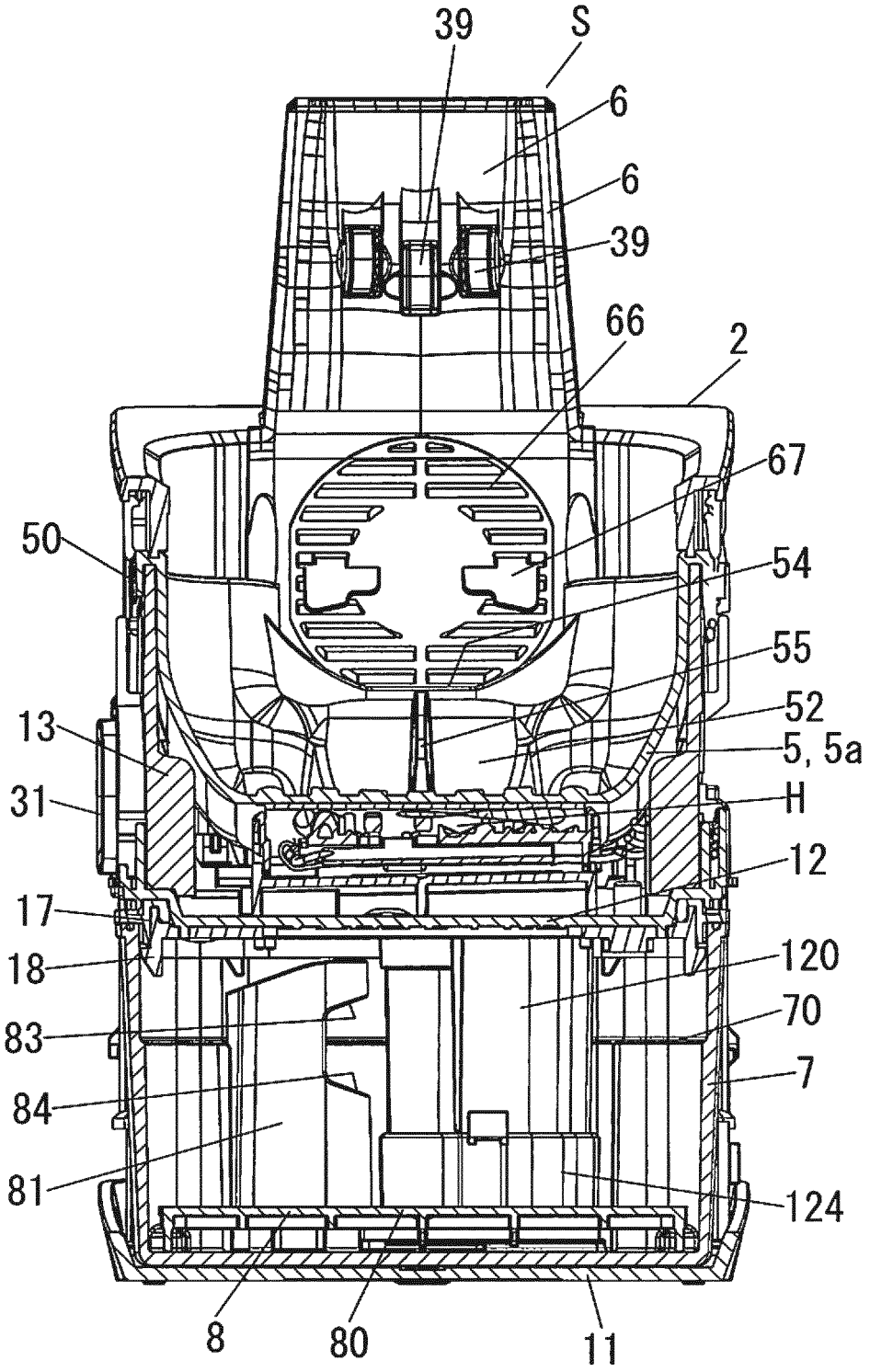

39
S
6
6
39
66
2
67
50
54
55
52
13
5, 5a
31
H
12
17
18
120
83
70
7
84
81
124
8
80
11

FIG. 8

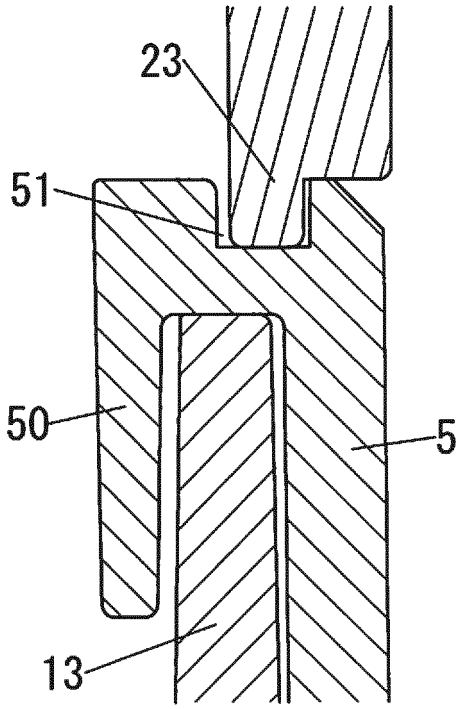


FIG. 9

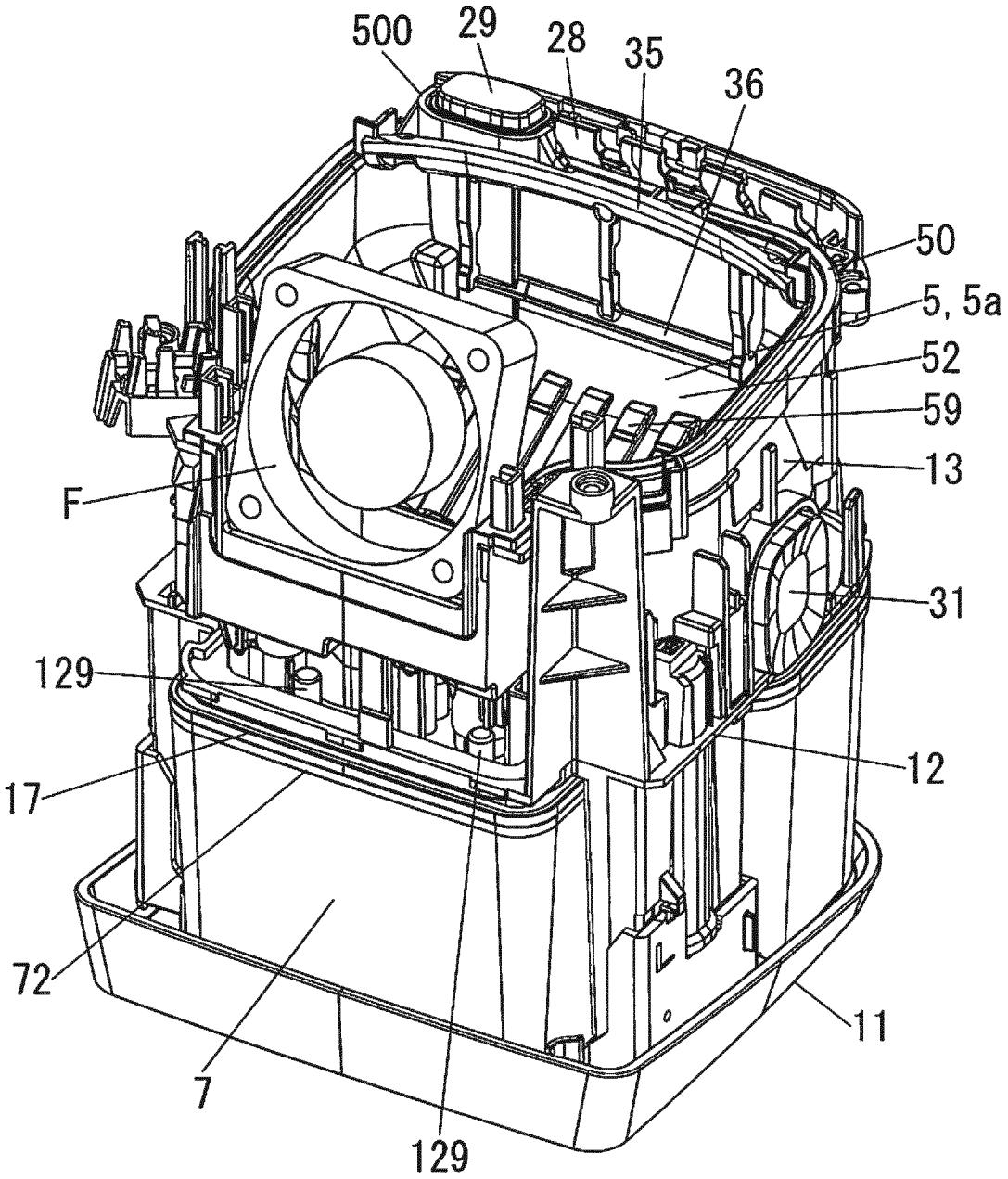


FIG. 10

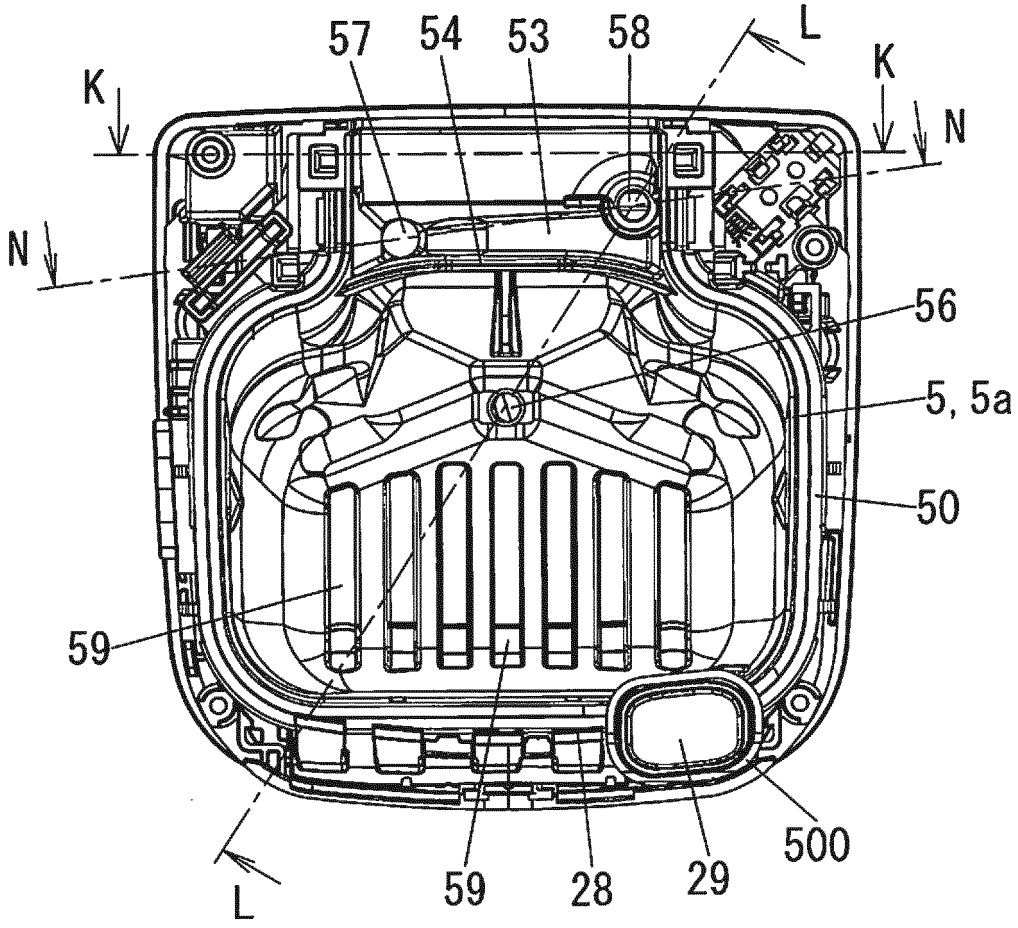


FIG. 11

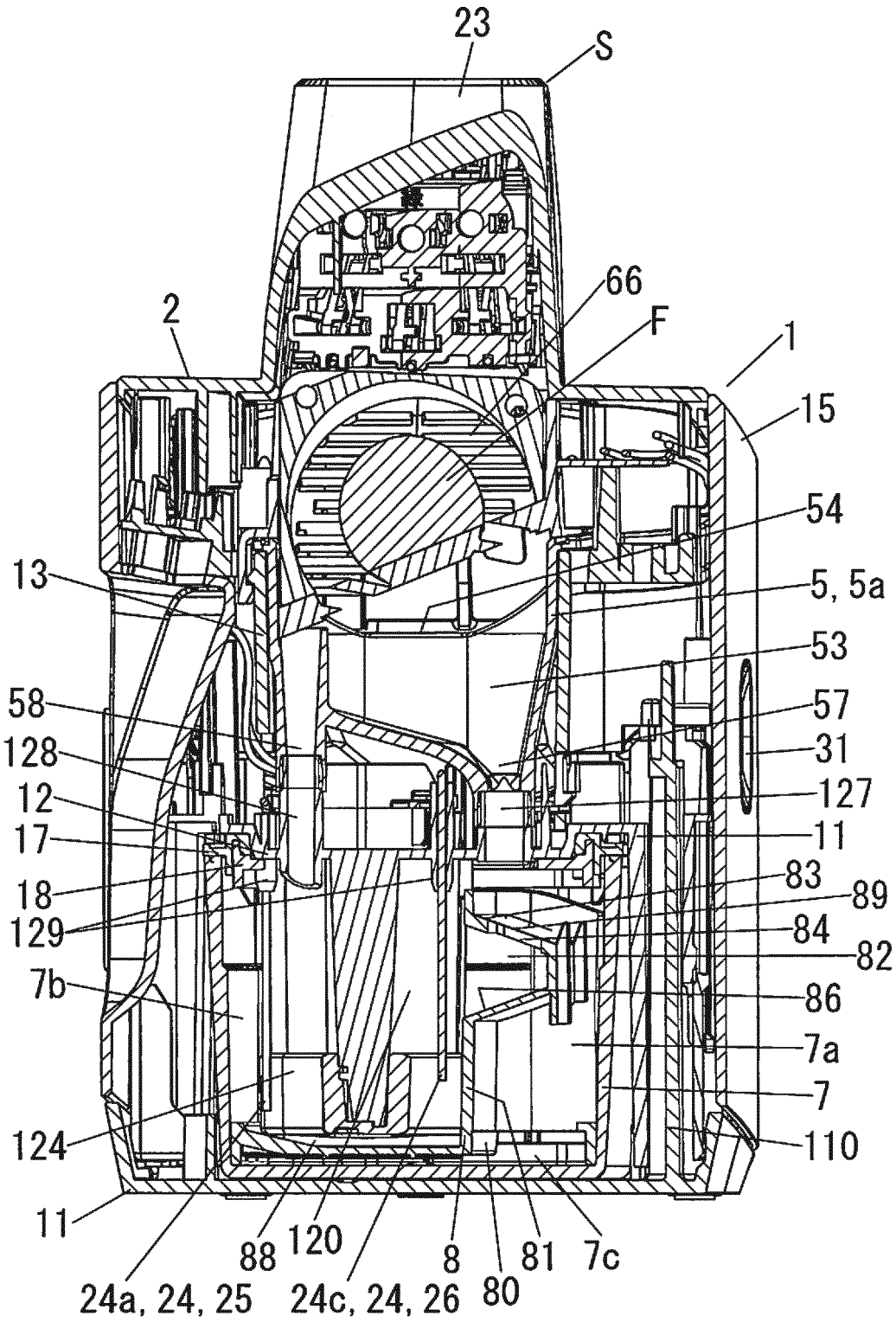

23
S
66
F
2
1
15
54
13
5, 5a
53
58
57
128
31
12
127
17
11
18
83
89
129
84
82
7b
86
7a
7
124
110
11
88
120
8
81
7c
24a, 24, 25
24c, 24, 26
80

FIG. 12

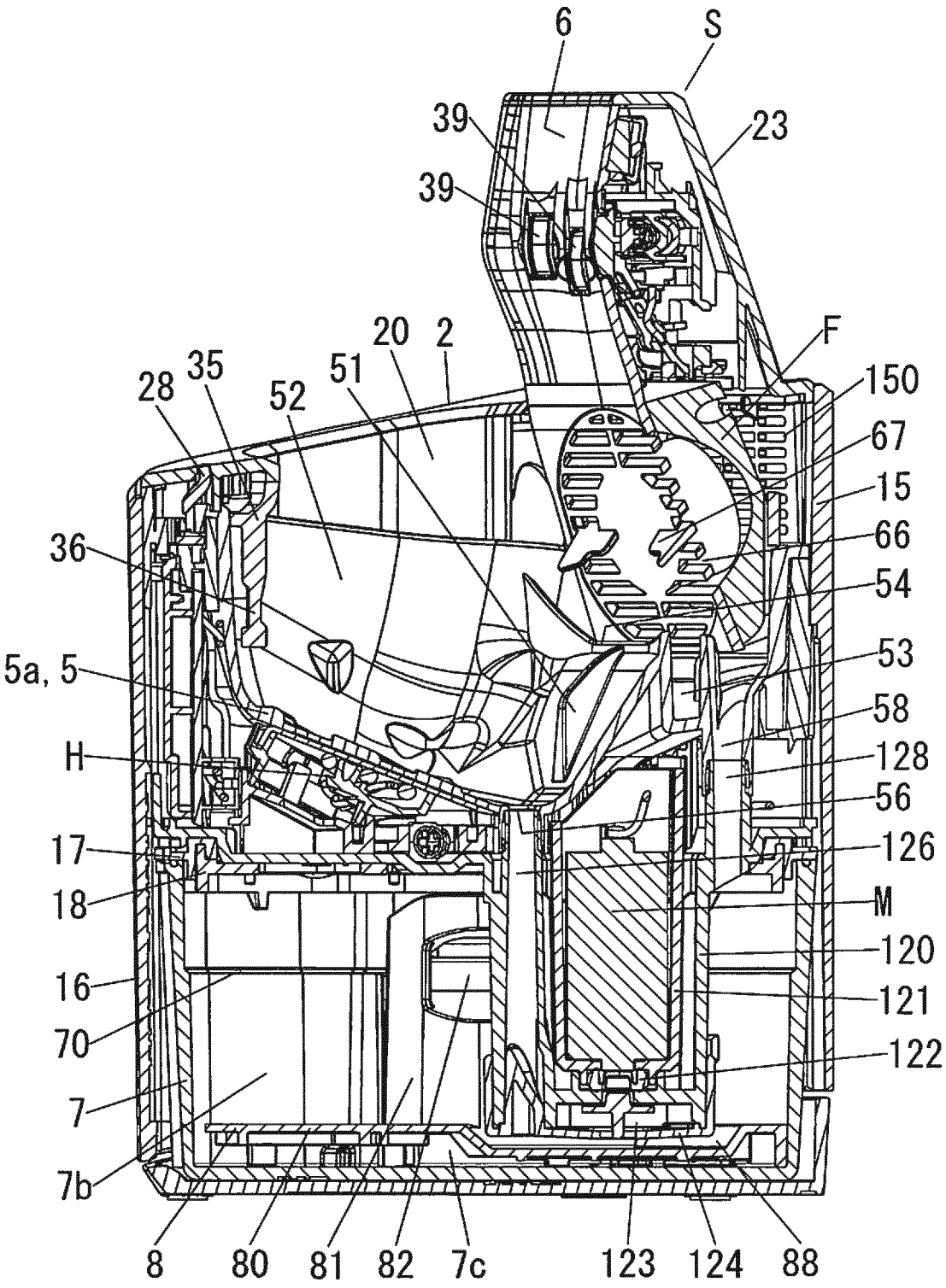

6
S
39
23
39
20
2
F
28
35
52
51
150
67
15
66
36
54
53
5a, 5
58
H
128
56
17
126
18
M
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16
121
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7
7b
8
80
81
82
7c
123
124
88

FIG. 13

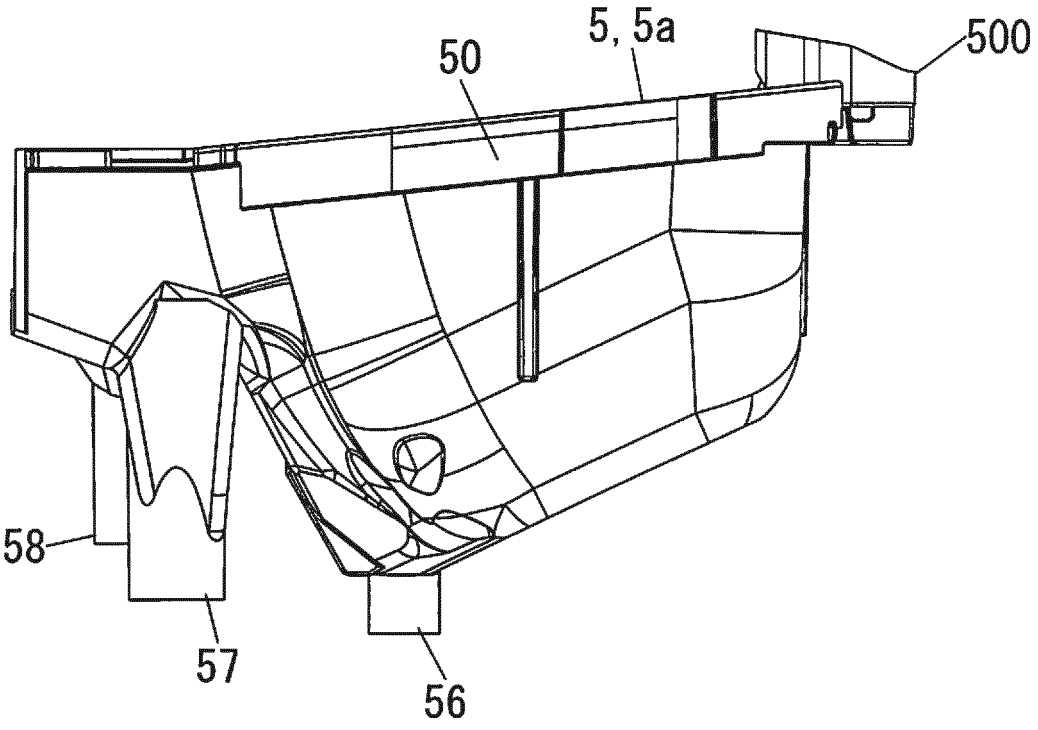


FIG. 14

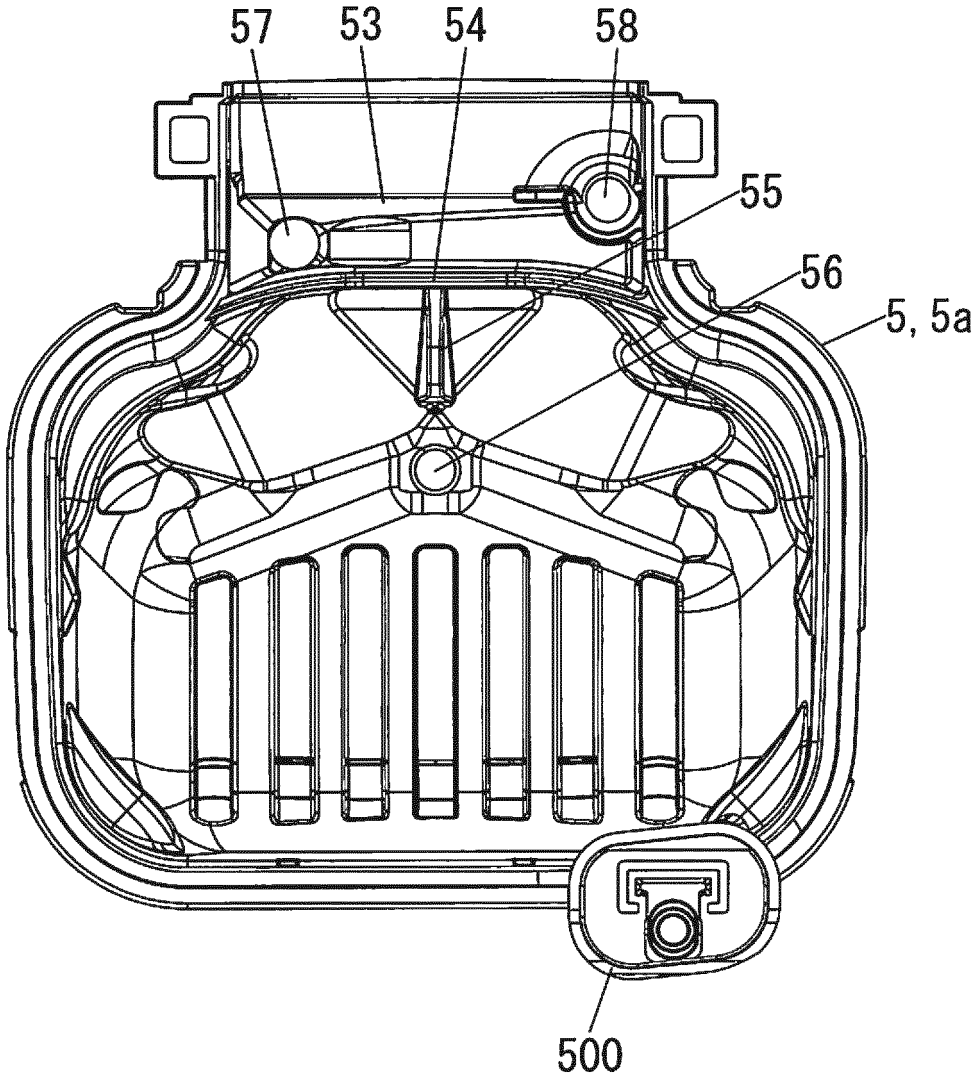


FIG. 15

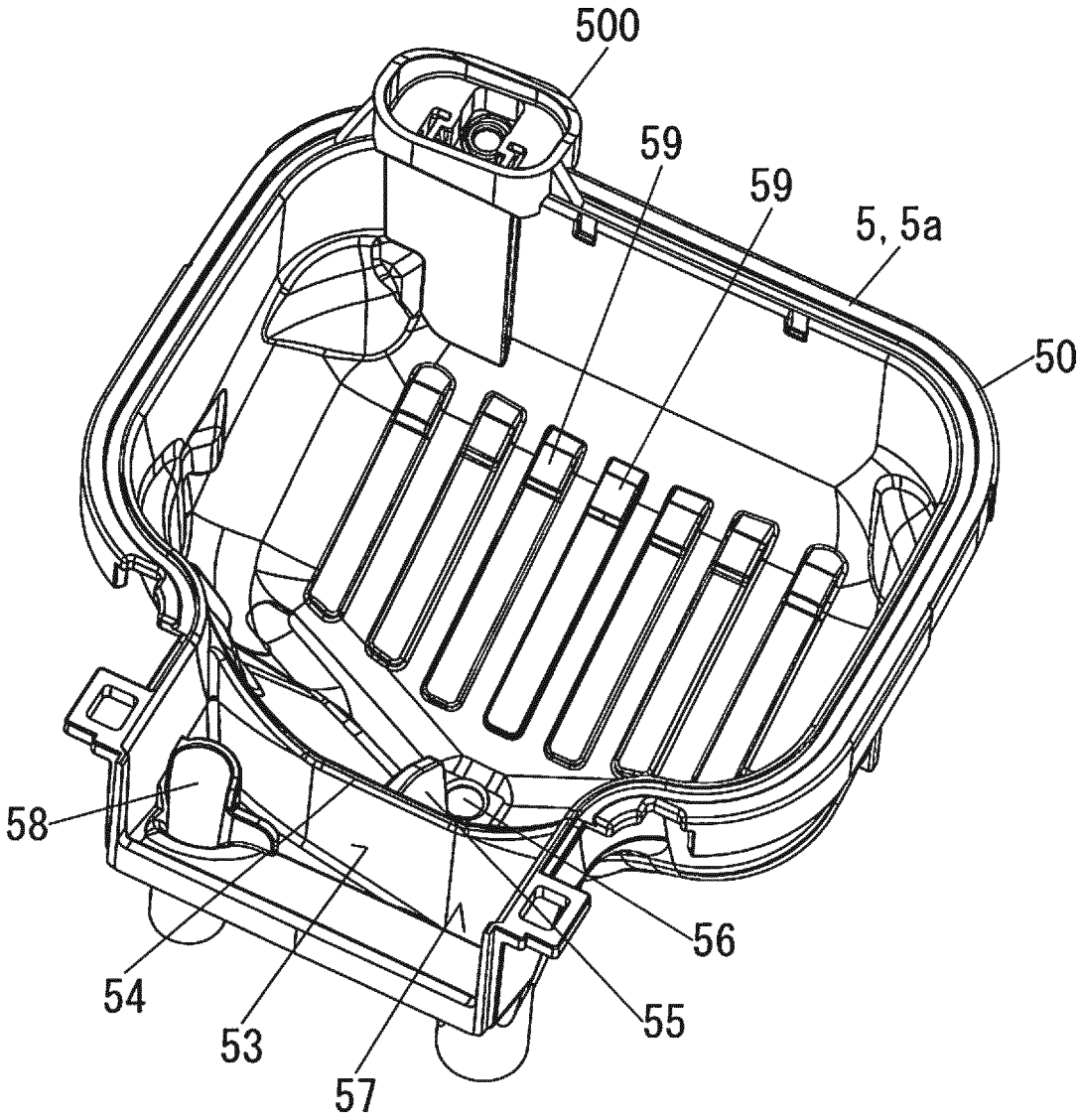


FIG. 16

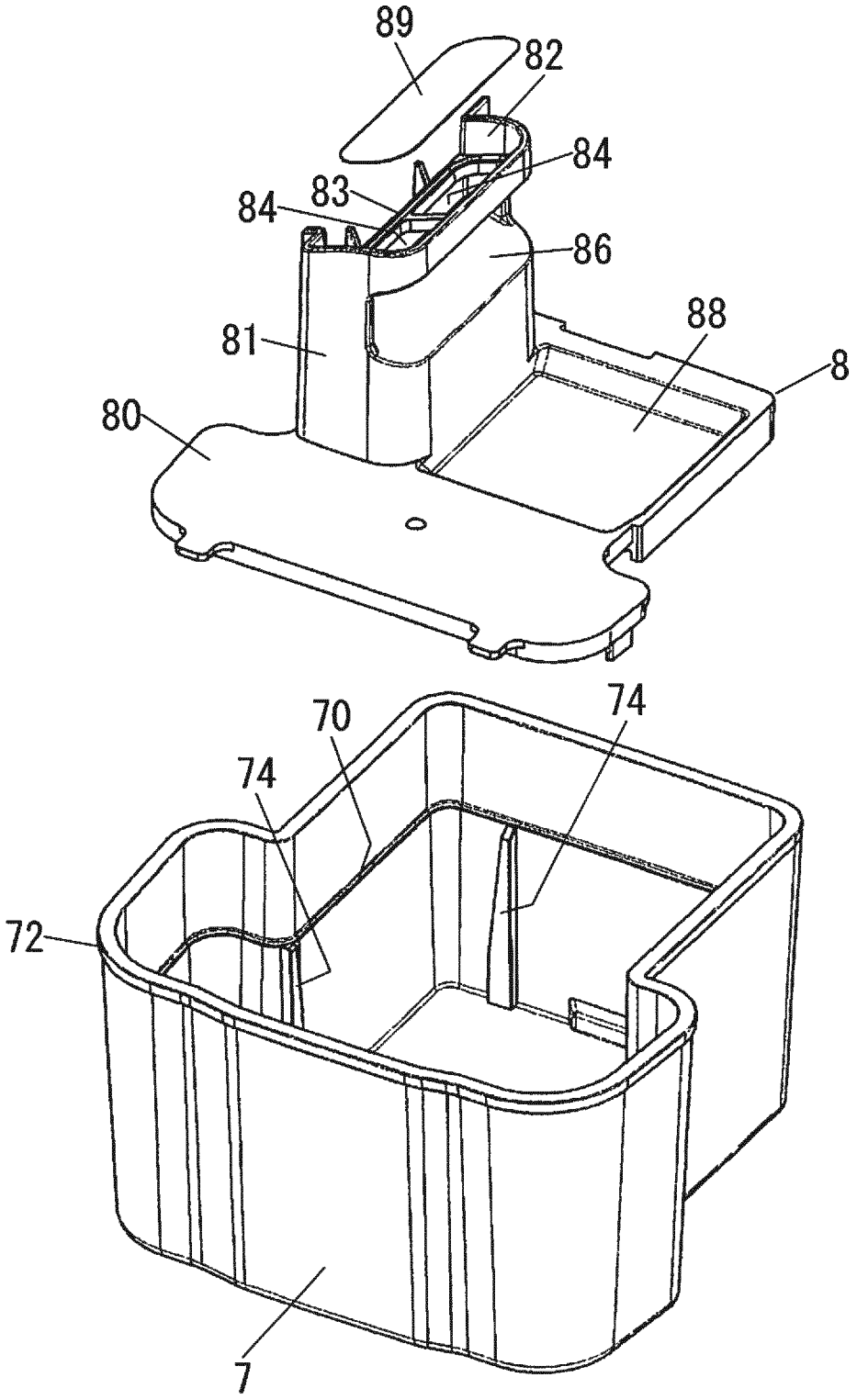


FIG. 17

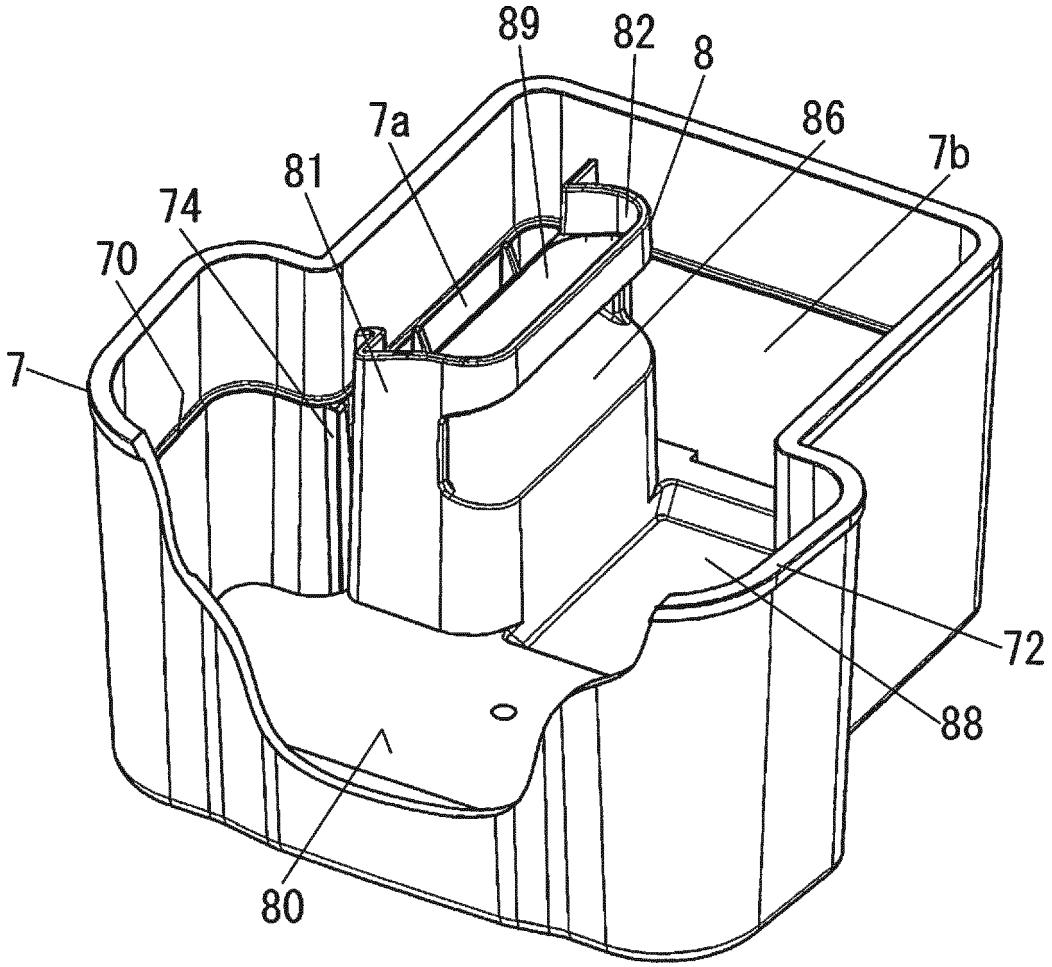


FIG. 18A

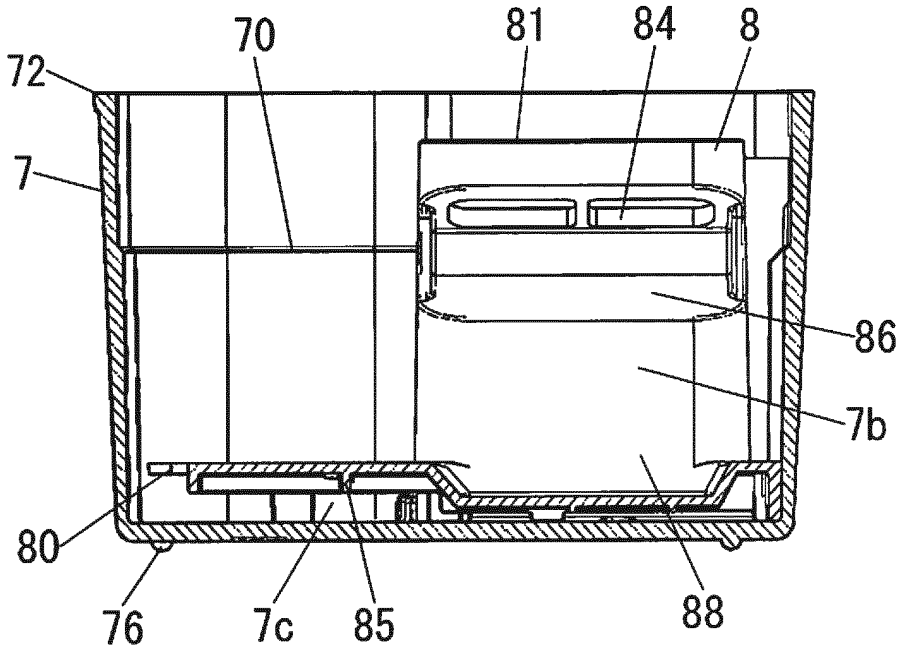


FIG. 18B

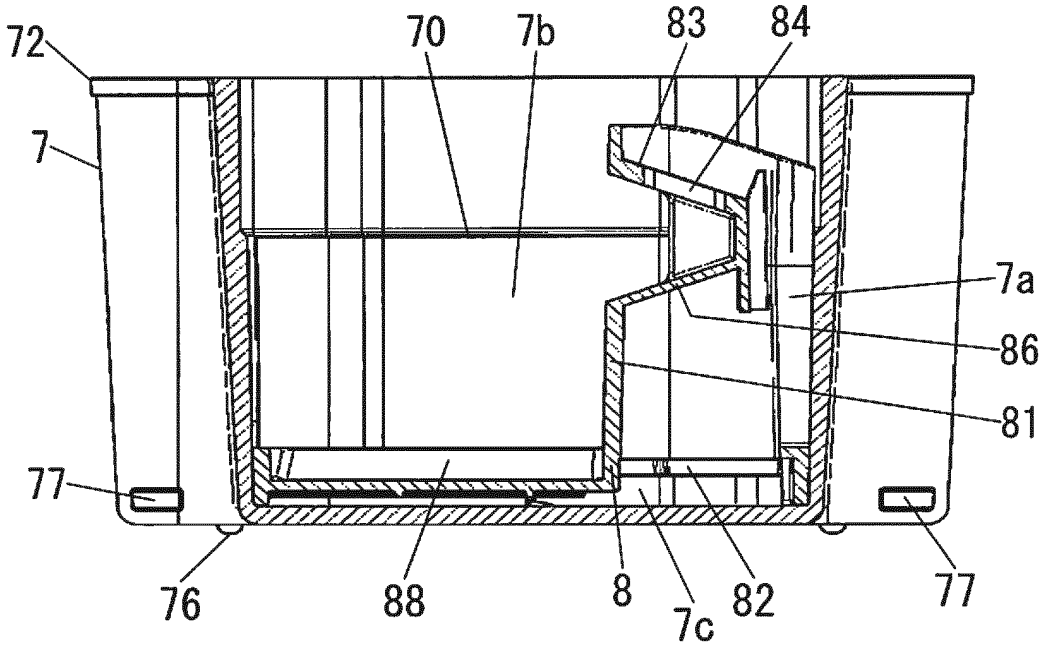


FIG. 19A

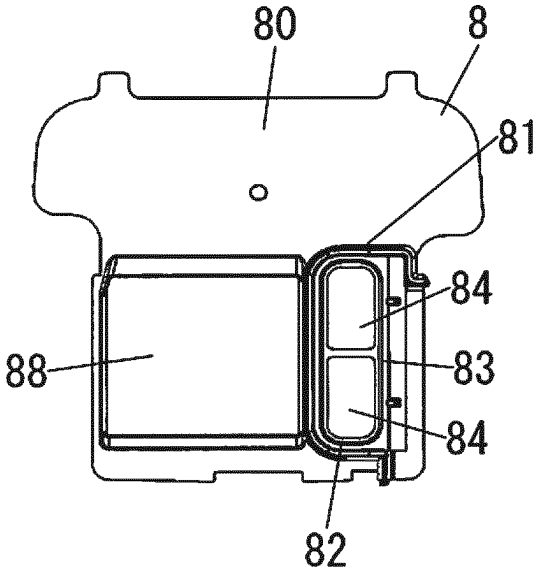


FIG. 19B

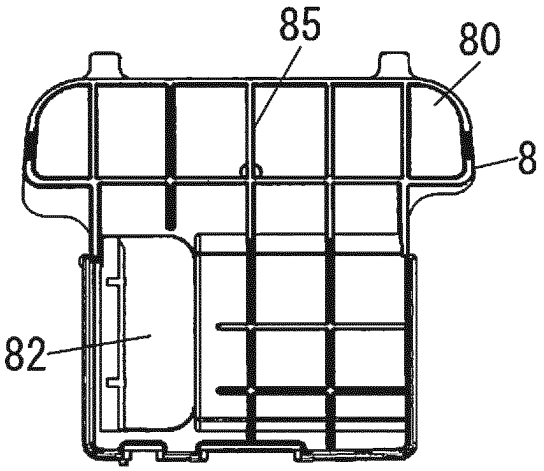


FIG. 19C

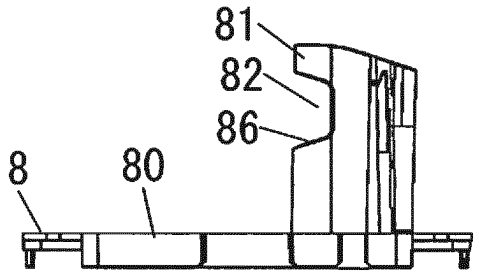


FIG. 19D

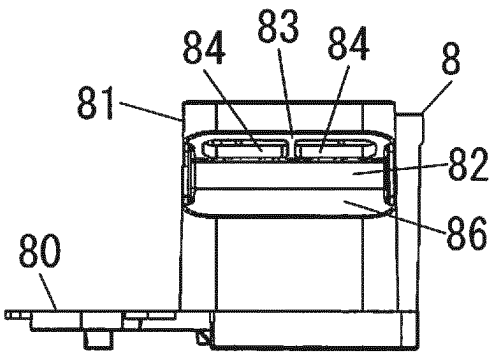


FIG. 20B

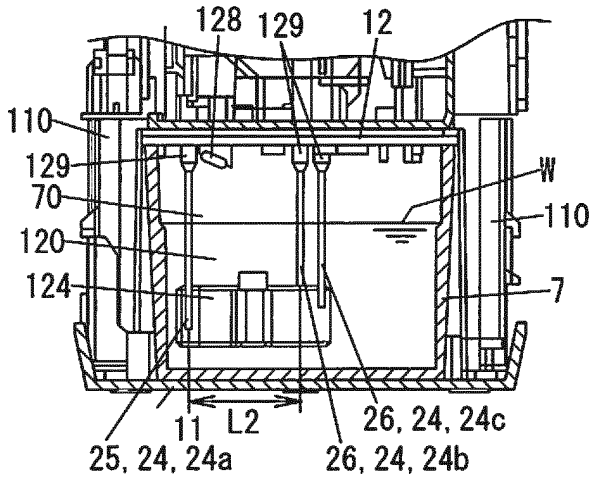


FIG. 20A

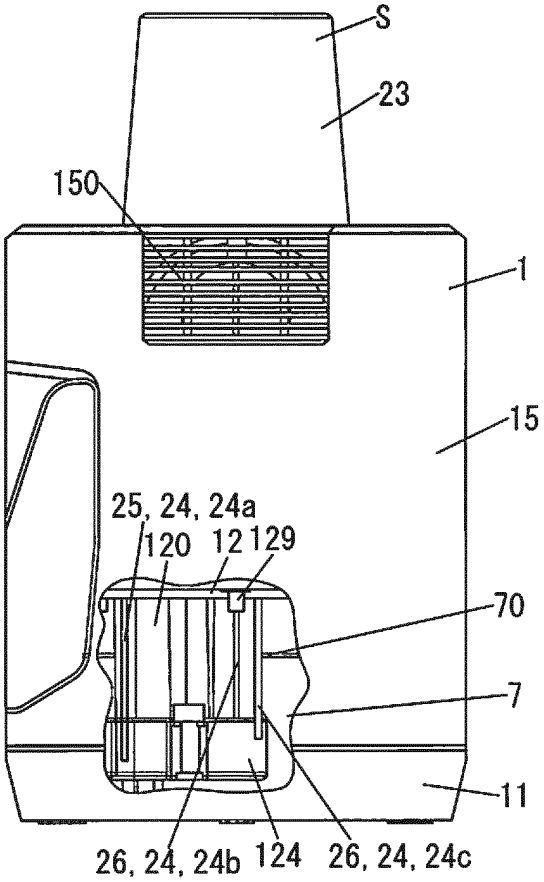


FIG. 20C

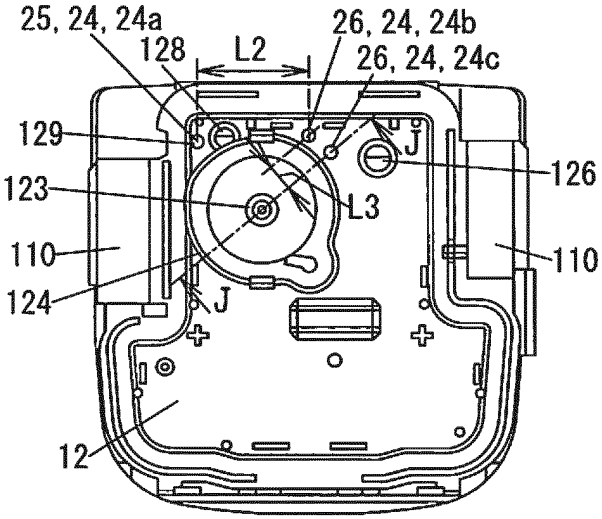


FIG. 20D

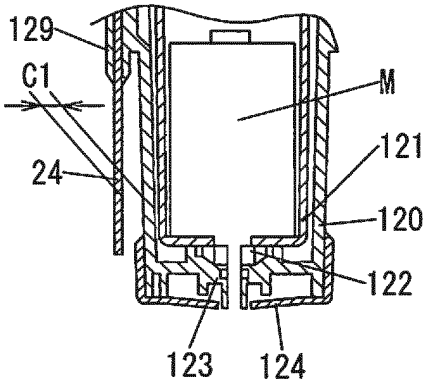


FIG. 21A

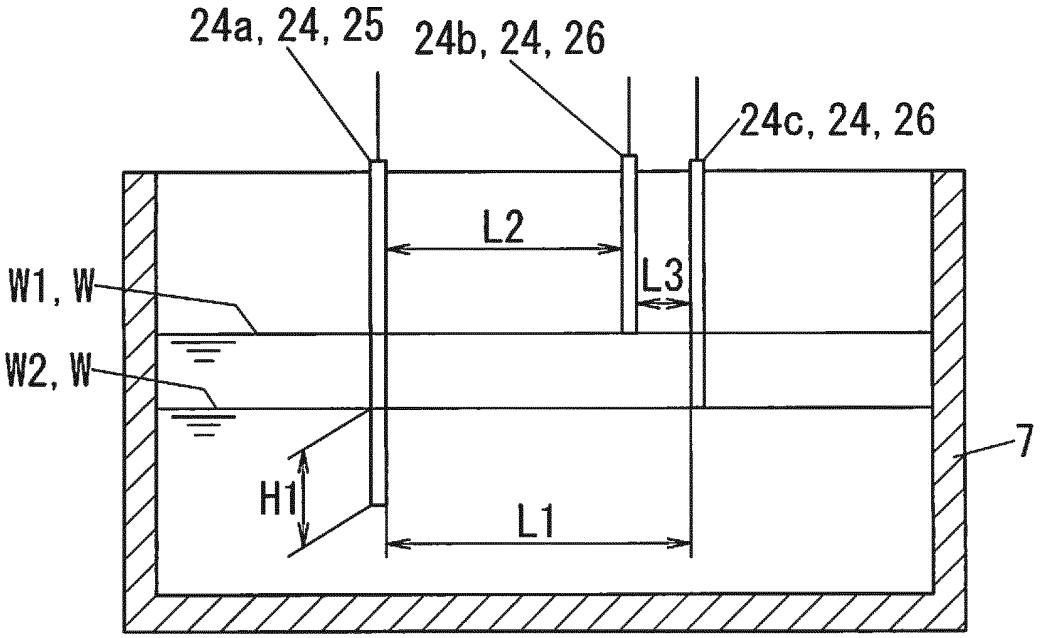


FIG. 21B

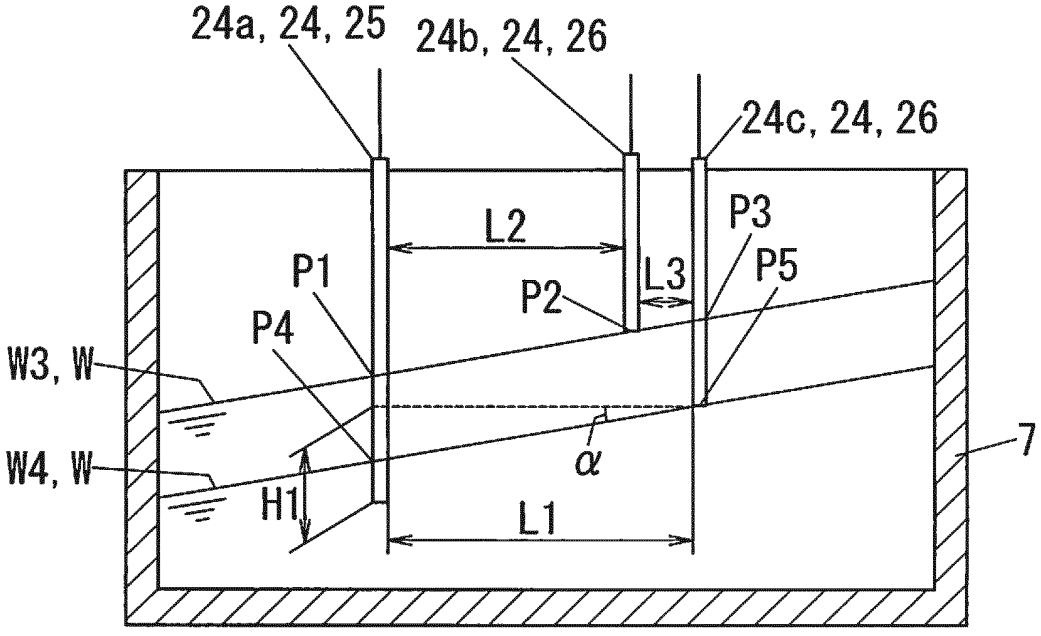


FIG. 22

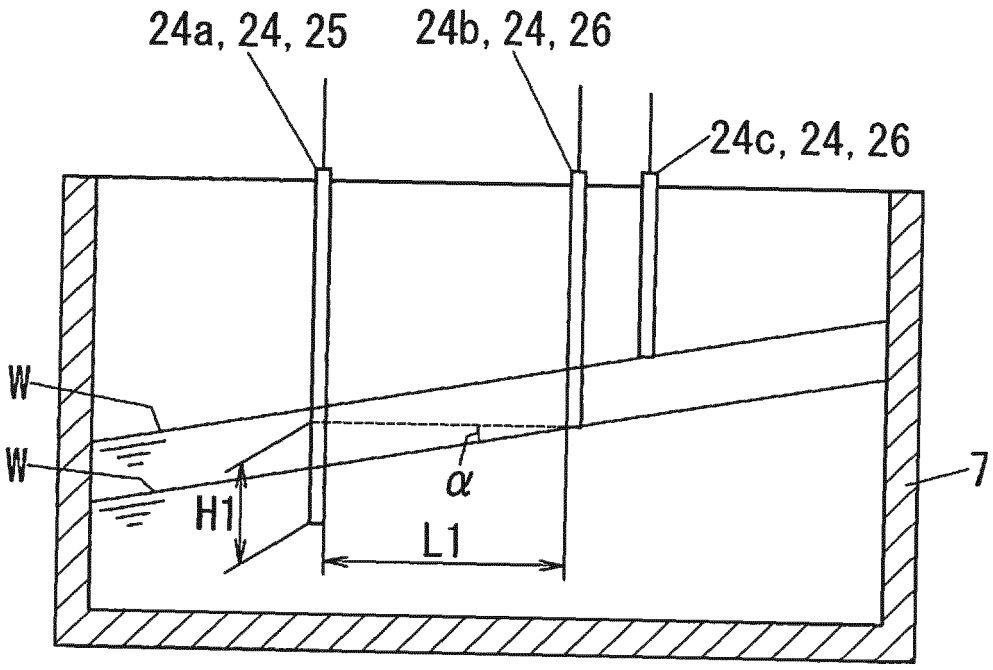


FIG. 23

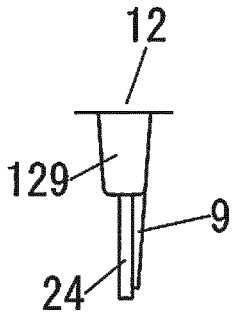
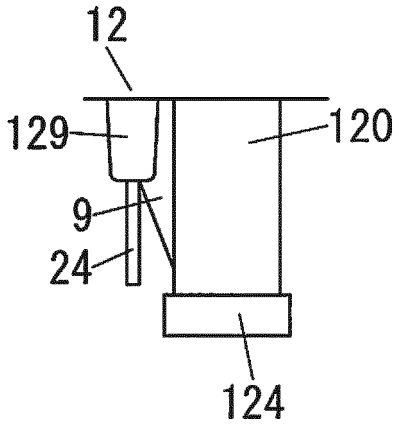


FIG. 24



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2010069030 A **[0002]**
- JP 2010063477 A **[0002]**