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Remarks:

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(54) **ELECTRIC VACUUM CLEANER**

(57) An object of this invention is to provide a vacuum cleaner that uses a dust collection section having a dust compression function that operates stably, is compact and lightweight, and on which maintenance such as washing with water can be performed. To achieve the above object, a vacuum cleaner includes a body having therein a motor-driven blower that generates a suction force, and a cyclone dust collection section that is attachable/detachable to/from the body. The cyclone dust collection section includes a centrifugal separation section that separates air and dust that are taken into the inside thereof, and a first dust collection chamber and a second dust collection chamber that communicate with the centrifugal separation section and accumulate dust that has been separated by the centrifugal separation section. The first dust collection chamber and the second dust collection chamber communicate with each other.

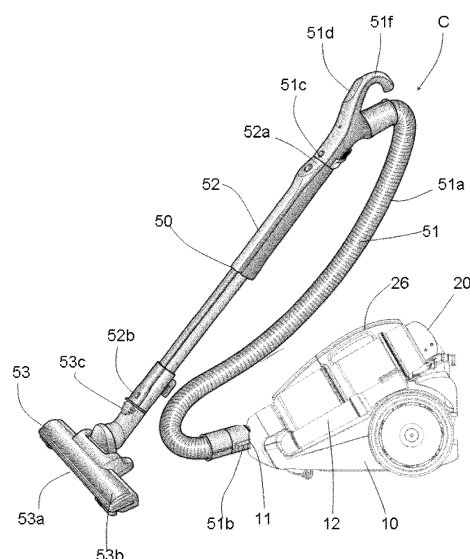


Fig.1

Description**Technical Field**

[0001] The present invention relates to a vacuum cleaner having a cyclone dust collection section that produces a swirling flow therein, and separates air and dust and only accumulates the dust therein.

Background Art

[0002] The types of dust collection sections of conventional vacuum cleaners include a paper bag dust collection section and a cyclone dust collection section.

[0003] In a vacuum cleaner that has a paper bag dust collection section, dust is accumulated inside a dust collection chamber by using a paper bag to filter out dust from air that flows downward.

[0004] Consequently, since a force in a compressing direction that is generated by the flow of air acts on the dust that is accumulating inside the dust collection chamber while the vacuum cleaner is being used, the dust is compressed and it is possible to accumulate a large amount of dust inside the paper bag.

[0005] In contrast, in a vacuum cleaner having a cyclone dust collection section, air and dust that are sucked from a surface to be cleaned are separated utilizing a centrifugal force, and the dust is accumulated inside a dust collection chamber.

[0006] Consequently, unlike a paper bag dust collection section, in general there is almost no flow of air inside the dust collection chamber of a cyclone dust collection section, and hence it is difficult for dust to be compressed therein.

[0007] Accordingly, comparing a cyclone dust collection section and a paper bag dust collection section, if the capacities of the spaces that can retain dust of the respective dust collection chambers are the same, the amount of dust accumulated by the cyclone dust collection section will be less than the paper bag dust collection section.

[0008] Consequently, the frequency of disposing of dust by emptying dust from the inside of the dust collection chamber is higher in the case of a cyclone dust collection section compared to a paper bag dust collection section.

[0009] Therefore, to accumulate a larger amount of dust in the dust collection chamber of a cyclone dust collection section, vacuum cleaners have been proposed in which a mechanism that compresses dust mechanically that is driven by electric power is provided in a cyclone dust collection section (for example, see Patent Literature 1).

Citation List**Patent Literature**

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[0010]

Patent Literature 1: Japanese Patent Laid-Open No. 2009-56039 (Figure 1)

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Summary of Invention**Problem to be Solved by the Invention**

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[0011] However, with the configuration described in Patent Literature 1, because a mechanism that is driven by electric power for mechanically compressing dust inside a dust collection chamber of a cyclone dust collection section is provided in the cyclone dust collection section, there is the problem that the inner structure of the dust collection section is complicated and the dust collection section is large and heavy.

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[0012] In addition, it is common for a dust collection section to be attachable and detachable with respect to the vacuum cleaner body in order to discard accumulated dust and enable maintenance thereof thereafter.

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[0013] However, when using a dust compression mechanism that is driven by electric power, as in the configuration disclosed in Patent Literature 1, it is necessary to make the vacuum cleaner body and the dust collection section electrically connectable, and there is thus the problem that it is difficult to perform maintenance such as washing with water on the dust collection section.

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[0014] Further, because the above described dust compression mechanism operates inside a dust collection chamber that accumulates dust, there is the problem that operation thereof is unstable due to dust entering inside the mechanism.

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[0015] The present invention has been conceived to solve the above described problems, and an object of the present invention is to provide a vacuum cleaner that uses a dust collection section having a dust compression function that operates stably, is compact and lightweight, and on which maintenance such as washing with water can be performed.

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Means for Solving the Problem

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[0016] To solve the above described problems, it is sufficient to provide a vacuum cleaner, comprising: a body having therein a motor-driven blower that generates a suction force, and a cyclone dust collection section that is detachable from the body; wherein: the cyclone dust collection section comprises a centrifugal separation section that separates air and dust that are taken into the cyclone dust collection section, and a first dust collection chamber and a second dust collection chamber that communicate with the centrifugal separation section and accumulate dust that is separated by the centrifugal separation section.

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ration section; and the first dust collection chamber and the second dust collection chamber communicate with each other.

Advantageous Effect of Invention

[0017] According to the present invention, in a dust collection chamber, dust can be compressed without using means that mechanically compresses dust that is driven by electric power or the like.

Brief Description of Drawings

[0018]

Figure 1 is a general view that shows a vacuum cleaner C.

Figure 2 includes (a) a front view, (b) a side view, and (c) a cross-sectional view along a line X-X that show a dust collection section 20.

Figure 3 is a central cross-sectional view taken along the center in the transverse direction of a body 10 and the dust collection section 20, that shows a state in which the dust collection section 20 is fixed to the body 10.

Figure 4 is a perspective view of the body 10.

Figure 5 is an enlarged view of a fitting concavity 29 of the dust collection section 20 and a fitting protrusion 13a of the body 10 that are shown in Figure 3. Figure 6 is a view that illustrates a state in which engagement between the fitting concavity 30 and the fitting protrusion 13a that is illustrated in Figure 5 has been released.

Figure 7 is a cross-sectional view that illustrates the vicinity of a lock section 31 shown in Figure 3.

Figure 8 is a cross-sectional view of a state in which the lock section 31 shown in Figure 7 has been unlocked.

Figure 9 is a plan view illustrating a state in which the dust collection section 20 has been disassembled into respective sections thereof.

Figure 10 includes (a) a cross-sectional view along a line Y-Y, (b) a side view, and (c) and (d) partially enlarged views of the dust collection section 20.

Figure 11 is a longitudinal sectional view of the dust collection section 20.

Figure 12 is an exploded view illustrating the relationship between a dust collection chamber and a centrifugal separation section.

Figure 13 is an exploded view illustrating the relationship between centrifugal separation sections 21, 22 and a communication section 23.

Figure 14 is an exploded view illustrating the relationship between a first centrifugal separation section 21 and a discharge pipe.

Figure 15 includes (a) a plan view, (b) a cross-sectional view, and (c) a partially enlarged view of a state in which the discharge pipe is set in the first centrif-

ugal separation section 21, as viewed from above.

Figure 16 is a perspective view that illustrates a dust collection chamber shown in embodiment 2.

Description of Embodiments

(Embodiment 1)

[0019] Embodiment 1 is described hereunder with reference to the accompanying drawings.

[0020] Figure 1 is a general view of a vacuum cleaner C.

[0021] Figure 2 includes (a) a front view, (b) a side view, and (c) a cross-sectional view that show a dust collection section 20.

[0022] Note that the side view in Figure 2(b) is a view as seen from the side of a first centrifugal separation section 21 that is described later. Further, the cross-sectional view in Figure 2(c) is a cross-sectional view in the transverse direction of the first centrifugal separation section 21 and a second centrifugal separation section 22 that are arranged side by side as described later.

[0023] Referring to Figure 1, the vacuum cleaner C includes a body 10 inside which various functional components are housed, a cyclone dust collection section 20 (hereunder, referred to as "dust collection section 20") that is detachably attached to an upper portion of the body 10, and dust suction means 50 that forms a suction passage for sucking dust from a cleaning surface and causing the dust to flow into the body.

[0024] A control section that performs control of each section of the vacuum cleaner C, a motor-driven blower that generates a suction force as a force for sucking in dust from a site to be cleaned, a power cord for obtaining electric power from an external power source, and a cord reel around which the power cord is wound and the like are housed inside the body 10.

[0025] A connection opening 11 to which a hose unit 51, described later, communicatively connects is formed at a front portion of the body 10. In addition, at an upper face side part of the body 10, a communication passage 12 is provided that communicates with the connection opening 11 and communicatively connects to a dust intake opening 21c formed in the first centrifugal separation section 21 that is described later.

[0026] The dust suction means 50 includes the hose unit 51, an extension pipe 52, and a floor surface suction tool 53.

[0027] In the hose unit 51, a first connection section 51b that detachably connects to the connection opening 11 of the body 10 is formed at one end of a hose 51a, a second connection section 51c that is connected to the extension pipe 52 or the like is formed at the other end of the hose 51a, and a hand-held handle 51f is provided on which an operation section 51d that a user uses to operate the vacuum cleaner C is provided integrally with the second connection section 51c.

[0028] In the extension pipe 52, two pipes having dif-

ferent outer-shape sizes to each other are combined so that the overall length of the extension pipe 52 can be expanded and contracted. A first connection section 52a that connects with the hose unit 51 is formed at one end of the extension pipe 52, and a second connection section 52b that connects with the floor surface suction tool 53 is formed at the other end thereof.

[0029] The floor surface suction tool 53 includes a base body 53b in which a suction opening 53a that sucks dust on the floor surface side is formed, and a connection section 53c that is provided so as to communicate with and be rotatable with respect to the base body 53b and that connects with the extension pipe 52 at one end. The floor surface suction tool 53 is configured to be capable of travelling along a floor surface that is a cleaning surface at a time of use.

[0030] The body 10, the dust collection section 20, and the dust suction means 50 that are described above are communicatively connected from the dust suction means 50 to the body 10. That is, dust that is sucked from a site to be cleaned flows into the body 10 through the dust suction means 50 together with air, and thereafter flows into the inside of the dust collection section 20.

[0031] Subsequently, in the dust collection section 20, the dust is separated from the air, the dust is accumulated inside the dust collection section 20, and the air flows into the body 10 once more and is discharged to outside of the body through a discharge port via the motor-driven blower.

[0032] Note that the floor surface suction tool 53 is not limited to the form described above, and various kinds of floor surface suction tools 53 are used in accordance with the site to be cleaned.

[0033] Next, the dust collection section 20 is described with reference to Figure 2, Figure 9, and Figure 10.

[0034] The dust collection section 20 includes the centrifugal separation sections 21, 22, a communication section 23, and dust collection chambers 24, 25, and 65.

[0035] The centrifugal separation sections 21, 22 are parts that produce a swirling flow with respect to air that has flowed into the dust collection section 20 to thereby separate the dust and air by means of a centrifugal force, and are made up of the first centrifugal separation section 21 and the second centrifugal separation section 22.

[0036] Note that the first centrifugal separation section 21 and the second centrifugal separation section 22 are communicatively connected by the communication section 23 so that air can flow down from the first centrifugal separation section 21 to the second centrifugal separation section 22.

[0037] The first centrifugal separation section 21 is a cylindrical shape in which a first circular cylindrical section 21a and a first conical section 21b having a shape that narrows in the downward direction are vertically connected on the same central axis. In the first conical section 21b, a first distal end opening 21e is formed in which a distal end formed in a narrowing shape is open.

[0038] Since the first centrifugal separation section 21

is formed in a cylindrical shape in which the first circular cylindrical section 21a and the first conical section 21b are vertically connected in this manner, a cross-sectional shape thereof is a circular shape.

[0039] A dust intake opening 21c for causing air containing dust to flow into the first centrifugal separation section 21 from the communication passage 12 that is provided in the body 10, and a branched opening 21f that communicates with a second dust collection chamber 25, described later, are formed in a side face of the first centrifugal separation section 21. A communication opening 21d that connects with the communication section 23 is formed on the upper face of the first centrifugal separation section 21.

[0040] The dust intake opening 21c opens in a tangential direction of a circle that is the cross-sectional shape of the first circular cylindrical section 21a. As a result, since air that flows into the first centrifugal separation section 21 flows along an inner wall of the first circular cylindrical section 21a, the structure facilitates efficient generation of a swirling flow.

[0041] The branched opening 21f is located in the vicinity of a boundary between the first circular cylindrical section 21a and the first conical section 21b, and is formed in a size that allows comparatively large dust such as hair and cotton dust to pass therethrough.

[0042] The communication opening 21d is an opening for discharging air from which dust was removed inside the first centrifugal separation section 21 from the first centrifugal separation section 21. A mesh-shaped filter 27, described later, is provided in the communication opening 21d.

[0043] The positional relationship between the dust intake opening 21c, the branched opening 21f, and the first distal end opening 21e along an airflow R that flows through the first centrifugal separation section 21 will now be described.

[0044] Because the dust intake opening 21c is an opening that takes dust into the inside of the first centrifugal separation section 21, the dust intake opening 21c is located at the most upstream position of the airflow R. Since the branched opening 21f is formed in the vicinity of the boundary between the first circular cylindrical section 21a and the first conical section 21b, the branched opening 21f is at an intermediate position of the airflow R.

[0045] Since the first distal end opening 21e is positioned at an end of the first centrifugal separation section 21, the first distal end opening 21e is positioned further downstream than the branched opening 21f.

[0046] Further, because the first centrifugal separation section has a shape that narrows from the position of the branched opening 21f towards the first distal end opening 21e, the configuration thereof is such that the swirling speed of the airflow R increases as the airflow R approaches the first distal end opening 21e.

[0047] The first centrifugal separation section 21 configured as described above is a part that takes in air in which dust is mixed that has flowed down through the

body 10 from the dust intake opening 21c, and by producing a swirling flow of the air, separates dust (hereunder, referred to as "dirt A") that has a large bulk and easily receives the influence of an air current such as hair, candy wrappers, cotton dust, and comparatively large sand, and dust that is finer than the dirt A, excluding minute dust such as pollen, (for example, fine sand dust and the like; hereunder, referred to as "dirt B") from the air that was taken in.

[0048] That is, since the dirt A easily receives the influence of an air current, the dirt A is separated from the air at the position of the first circular cylindrical section 21a at which the speed of the swirling flow is not particularly high compared to the position of the first conical section 21b. The dirt B is separated from the air at the position of the first conical section 21b at which the speed of the swirling flow increases compared to the position of the first circular cylindrical section 21.

[0049] Air from which the dirt A and the dirt B have been removed passes through the filter 27 from the communication opening 21d, and flows down to the second centrifugal separation section 22 via the communication section 23 that is described later.

[0050] The dirt A that was separated from the air at the first centrifugal separation section 21 is sent to and accumulated in the second dust collection chamber 25, described later, via the branched opening 21f, and the dirt B is sent to and accumulated in a first dust collection chamber 24, described later, via the first distal end opening 21e.

[0051] The external shape of the second centrifugal separation section 22 narrows in the downward direction to form the second conical section 22a in which the second distal end opening 22b opens at the distal end. A second circular cylindrical section 22b that covers the circumference of the second conical section 22a and has an opening section 22f that opens in the same direction as the direction in which the second distal end opening 22b opens is integrally connected to the outer side of the second conical section 22a and forms a cylindrical shape.

[0052] That is, the second conical section 22a forms a conical shape as far as the inside of the second circular cylindrical section 22b. Since the external shape is configured in this manner, the cross-sectional shape of the second centrifugal separation section 22 is a circular shape.

[0053] A dust-collection circular cylindrical section 22d is connected to the second distal end opening 22e so as to communicate with the inside of the second conical section 22a of the second centrifugal separation section 22 (see Figure 10). The dust-collection circular cylindrical section 22d constitutes a third dust collection section 65 that is described later.

[0054] An inner wall 22i at a site on a side that connects with the second conical section 22a of the dust-collection circular cylindrical section 22d is formed in a conical shape that connects in a continuous manner with an inner wall of the second conical section 22a. As a result, a

conical-shaped inner wall face is formed in a continuous manner with an inner wall face of the second conical section 22a as far as the inside of the dust-collection circular cylindrical section 22d.

[0055] Therefore, since the dust-collection circular cylindrical section 22d is a shape in which a conical-shaped area and a circular cylindrical-shaped area are vertically combined, because of the difference in the shapes of the two areas, a space 22g is formed between the circular cylindrical-shaped portion and the conical-shaped portion of the dust-collection circular cylindrical section 22d.

[0056] In a state in which the dust-collection circular cylindrical section 22d is connected to the second distal end opening 22b, entry of dust into the space 22g is prevented by the circumference thereof being surrounded by a wall section 22h that is provided at the second distal end opening 22b.

[0057] In this case, a technique is adopted whereby, after the second centrifugal separation section 22 and the dust-collection circular cylindrical section 22d are respectively molded as separate components using resin, the second centrifugal separation section 22 and the dust-collection circular cylindrical section 22d are adhered by bonding or ultrasonic welding or the like in a post-process.

[0058] Since a phenomenon such as "sink marks" is liable to occur when molding components having a complex shape or parts of different thicknesses, the above technique is adopted in order to reliably form an ideal centrifugal separation section shape by constructing the relevant part in component units in which variations are not liable to occur at the time of molding and assembling the component units.

[0059] That is, in the case of integrally constructing the wall section 22h, the dust-collection circular cylindrical section 22d, and the second conical section 22a using resin, making the inside of an approximately triangular area that is constituted by the wall section 22h, the dust-collection circular cylindrical section 22d, and the second conical section 22a hollow is extremely difficult in the respect of molding to a target thickness when performing resin molding. Consequently, when constructing the aforementioned area by resin molding, the area becomes a thickness-deviation section that has a wall thickness that is extremely thicker than the other portions.

[0060] In particular, when the thickness-deviation section is formed with a resin such as ABS, sink marks (irregularities in the shape) are liable to occur when molding the resin, and if sink marks occur within the second conical section 22a there is a high possibility that the sink marks will obstruct the flow of air, and consequently the swirling speed of the air will not rise to a predetermined speed and it will not be possible to reliably separate dust and the air.

[0061] Therefore, according to the present embodiment, the technique is adopted whereby the second conical section 22a and the dust-collection circular cylindrical section 22d are constructed as respectively separate

components and are adhered in a post-process (ultra-sonic welding or the like).

[0062] The diameter of the second conical section 22a constructed in this manner is made smaller than that of the first conical section 21b of the first centrifugal separation section 21. Further, the cross-sectional centers of the second conical section 22a and the dust-collection circular cylindrical section 22d that is connected to the second distal end opening 22b are arranged so as to be entirely on the same axis.

[0063] A communication opening 22c that connects with the communication section 23 is formed in the upper face of the second centrifugal separation section 22.

[0064] The communication opening 22c is an opening for taking air from which dirt A and dirt B were separated in the first centrifugal separation section 21 into the second centrifugal separation section 22, and for discharging air from which dust was separated inside the second centrifugal separation section 22 towards the body 10.

[0065] Although, the second centrifugal separation section 22 is also a part that separates dust from air that has been taken in, similarly to the first centrifugal separation section 21, the diameter of the second conical section 22a is made smaller than the diameter of the first conical section 21b, and hence a swirling flow arises therein that flows at a higher speed than the swirling flow that arises inside the first centrifugal separation section 21.

[0066] Accordingly, by taking in air from which the dirt A and dirt B were removed in the first centrifugal separation section 21 and generating a swirling flow of the air therein, the second centrifugal separation section 22 can separate minute dust (for example, fine sand grains and pollen and the like; hereunder, referred to as "dirt C") from the air that was taken in.

[0067] The air from which the dirt C has been removed is discharged to the body 10 via a discharge path 23b that is formed in the communication section 23 that is described later, and the dirt C is sent to a third dust collection chamber 65, described later, and accumulated therein.

[0068] The first centrifugal separation section 21 and the second centrifugal separation section 22 configured as described above are arranged in the following manner to constitute integrated centrifugal separation sections 21, 22.

[0069] First, the first centrifugal separation section 21 and the second centrifugal separation section 22 are arranged side by side. In this state, the first centrifugal separation section 21 and the second centrifugal separation section 22 are arranged so that a central axis M1 that passes through the cross-sectional center of the first circular cylindrical section 21a and the first conical section 21b constituting the first centrifugal separation section 21 and a central axis M2 that passes through the cross-sectional center of the second conical section 22a and the second circular cylindrical section 22b constituting the second centrifugal separation section 22 are parallel.

[0070] Further, the first distal end opening 21e and the second distal end opening 22e are facing in the same direction. That is, the directions in which the first centrifugal separation section 21 and the second centrifugal separation section 22 become narrow are matching.

[0071] Further, a handle 26 is provided at a site that, when the dust collection section 20 is mounted to the body 10, is sandwiched between the first centrifugal separation section 21 and the second centrifugal separation section 22, and that is at a position that is opposite the body 10 side of the dust collection section 20. The handle 26 is used by the user to carry only the dust collection section 20 or, in a state in which the dust collection section 20 is attached to the body 10, to carry the dust collection section 20 and the body 10.

[0072] The handle 26 is arranged so as to extend in a long manner between the central axis M1 and the central axis M2 in a direction along the respective axes. That is, the central axis M1, the central axis M2, and the handle 26 are arranged side by side parallel to each other.

[0073] In a state in which the dust collection section 20 and the communication section 23 are connected, the handle 26 protrudes from the dust collection section 20 and extends so as to overlap with the communication section 23. Thus, the communication section 23 is protected by the handle 26 from a shock caused by an external impact.

[0074] In addition, between the handle 26 and the respective centrifugal separation sections 21, 22, an opening section 26a is formed that opens in a (lateral) direction that is perpendicular to the axial direction of the central axis M1 and the central axis M2.

[0075] The opening section 26a is used as a hand-grip position into which the user inserts a hand when grasping the handle 26. The opening section 26a opens so that one part thereof when the dust collection section 20 is viewed from the side overlaps with a space that is sandwiched between the first centrifugal separation section 21 and the second centrifugal separation section 22, that is, overlaps with a hollow section 20a that is a position surrounded by the outer face of the first centrifugal separation section 21 and the outer face of the second centrifugal separation section 22.

[0076] The communication section 23 communicatively connects the first centrifugal separation section 21 and the second centrifugal separation section 22. A communication path 23a and the discharge path 23b that is independent from the communication path 23a are formed inside the communication section 23.

[0077] In the communication section 23 configured in this manner, the communication opening 21d and the communication opening 22c communicate through the communication path 23a, and upper portions of the centrifugal separation sections 21, 22 are provided so that an opening of the discharge path 23b is positioned at the center of the communication opening 22c (see Figure 10).

[0078] Dust collection chambers in which the dust (dirt

A, dirt B, and dirt C) that was separated in the first centrifugal separation section 21 and the second centrifugal separation section 22 is accumulated are configured as follows.

[0079] The dust collection chambers 24, 25 are made from a base body having a space formed in the interior thereof that is a cup shape. A partition 70 is provided inside the base body to thereby form the first dust collection chamber 24 and the second dust collection chamber 25 so as to be adjacent to each other through the partition 70.

[0080] A partition opening section 70a that allows the adjacent dust collection chambers to communicate is formed in the partition 70. A mesh-shaped cloth made of polyester or the like or a stainless-steel plate in which minute openings are formed by executing an etching process or a punching process that serves as filter means 70f, described later, is provided in the partition opening section 70a.

[0081] That is, the partition opening section 70a is configured to allow air to pass therethrough while not allowing dust to pass therethrough.

[0082] A concave section 25c is formed in the bottom of the second dust collection chamber 25. Ring-shaped packing 25d is provided in the concave section 25c.

[0083] The dust collection chambers 24, 25 configured in this manner couple with the centrifugal separation sections in the following manner.

[0084] First, opening sections 24a, 25a of the cup-shaped base bodies forming the respective dust collection chambers 24, 25 are arranged facing upwards at the lower parts of the centrifugal separation sections 21, 22.

[0085] Subsequently, in a state in which the first centrifugal separation section 21 has entered the inside of the first dust collection chamber 24, and the dust-collection circular cylindrical section 22d has entered the inside of the second dust collection chamber 25, the opening sections 24a, 25a are fitted together with the centrifugal separation sections 21, 22 are coupled therewith and retained in a closed state.

[0086] In this state, a clearance K is formed between the bottom of the first dust collection chamber 24 and the first distal end opening 21e. That is, a state is entered in which the first centrifugal separation section 21 and the first dust collection chamber 24 communicate through the first distal end opening 21e.

[0087] Further, at the ring-shaped packing 25 provided in the concave section 25c that is formed at the bottom of the second dust collection chamber 25, the entire opening edge that is the distal end of the dust-collection circular cylindrical section 22d contacts against the ring-shaped packing 25d and enters a state of intimate contact therewith. That is, a state is entered in which the inside of the dust-collection circular cylindrical section 22d and the second dust collection chamber 25 are not directly communicating.

[0088] The third dust collection chamber 65 is formed by forming an independent space inside the second dust

collection chamber 25 in this manner.

[0089] As described above, the first dust collection chamber 24 directly communicates with the first centrifugal separation section 21 via the first distal end opening 21e.

[0090] Further, the second dust collection chamber 25 directly communicates with the first centrifugal separation section 21 via the branched opening 21f, and directly communicates with the first dust collection chamber 24 via the partition opening section 70a. That is, it is possible for an airflow that has flown into the second dust collection chamber 25 from the branched opening 21f to pass through the partition opening section 70a and flow into the first dust collection chamber 24, and furthermore, to pass through the first distal end opening 21e and flow down to the inside of the first centrifugal separation section 21.

[0091] In addition, the third dust collection chamber 65 directly communicates with the second centrifugal separation section 22 via the second distal end opening.

[0092] Thus, the first dust collection chamber 24 is a part that accumulates the dirt B that was separated from air in the first centrifugal separation section 21, the second dust collection chamber 25 is a part that accumulates the dirt A that was separated from air in the first centrifugal separation section 22, and the third dust collection chamber 65 is a part that accumulates the dirt C that was separated from air in the second centrifugal separation section 22.

[0093] Note that a protruding section 28 is integrally formed with the respective dust collection chambers at an outer side in an area between the first dust collection chamber 24 and the second dust collection chamber 25. The outer face of the protruding section 28 is configured as a curved surface that connects with the outer face of the handle 26 in a continuous manner. By configuring the outer face of the protruding section 28 as a curved surface in this manner, the design of the vacuum cleaner C is enhanced and, furthermore, the structure is one that makes it difficult for the vacuum cleaner C to be caught in an obstructing article.

[0094] A second handle 29 that a user grasps when detaching the dust collection chambers 24, 25 is provided between the first dust collection chamber 24 and the second dust collection chamber 25, on a side opposite to the side on which the protruding section 28 is located.

[0095] By configuring the dust collection section 20 as shown in Figure 3 to Figure 8, the dust collection section 20 can be attached to and detached from the body 10. Figure 3 is a central cross-sectional view taken along the center in the transverse direction of the body 10 and the dust collection section 20, that shows a state in which the dust collection section 20 is fixed to the body 10. Figure 4 is a perspective view of the body 10. Figure 5 is an enlarged view of a fitting concavity 34 of the dust collection section 20 and a fitting protrusion 13a of the body 10 that are shown in Figure 3. Figure 6 is a view that illustrates a state in which engagement between the

fitting concavity 30 and the fitting protrusion 13a that is illustrated in Figure 5 has been released. Figure 7 is a cross-sectional view that illustrates the vicinity of a lock section 31 shown in Figure 3. Figure 8 is a cross-sectional view of a state in which the lock section 31 shown in Figure 7 has been unlocked.

[0096] Referring to Figure 3 to Figure 8, an upper face 13 of the body 10 inclines towards the front, the fitting protrusion 13a is formed at a lower end of the upper face, a concave section 13b is formed in the inclined face, and an engagement receiving section 13c is provided at an upper end of the upper face.

[0097] The fitting concavity 34 that opens in the downward direction is formed at a lower end (the left diagonal lower end in Figure 5) portion at an area constituting the dust collection chambers 24, 25 of the dust collection section 20. The lock section 31 is operably provided at an upper portion of the communication section 23 of the dust collection section 20.

[0098] The lock section 31 is constituted by a lever 31a that is operated by a user, an engagement section 31b that moves in response to movement of the lever 31a, and an erroneous operation prevention cover 31c for preventing erroneous operation of the lever 31a.

[0099] The dust collection section 20 in which each section is configured as described above is provided on the upper face 13 of the body 10 in a state in which the fitting concavity 34 and the fitting protrusion 13a fit together and the second handle 29 has entered the concave section 13b.

[0100] The dust collection section 20 is retained so as not to drop off from the body 10 by engagement of the engagement section 31b of the lock section 31 with the engagement receiving section 13c.

[0101] Note that the engagement state between the engagement section 31b and the engagement receiving section 13c can be released by operating the lever 31a to thereby detach the dust collection section 20 from the body 10.

[0102] The lock section 31 is covered by the erroneous operation prevention cover 31c that is constantly urged in a closing direction (state in Figure 7), and the structure is such that the user cannot operate the lever 31a unless the erroneous operation prevention cover 31c is moved in an opening direction (state in Figure 8).

[0103] Referring to Figure 10, by attaching the dust collection section 20 to the body 10 as described above and using the vacuum cleaner C, air that is taken into the dust collection section 20 forms a swirling flow and flows downward, and the air and dust are separated by a centrifugal force.

[0104] Note that an airflow R and a branch airflow S in the drawing indicate the flow of air inside the dust collection section 20.

[0105] First, air containing dust that flows into the first centrifugal separation section 21 from the dust intake opening 21c forms the swirling airflow R and flows in the direction of the first distal end opening 21e along the inner

wall of the first centrifugal separation section 21 that is the shape of a circular cylindrical section.

[0106] When the airflow R approaches the branched opening 21f, by the action of a centrifugal force generated by the swirling flow, some of the flow of air separates from the airflow R and, together with dirt A that has a large bulk and easily receives the influence of an air current, forms the branch airflow S.

[0107] In this case, since the position at which the branched opening 21f opens is in the first circular cylindrical section 21a, the swirling speed of the airflow R is slower than the swirling speed in the first conical section 21b. Accordingly, at the position of the branched opening 21f, only the dirt A that has a large bulk and that easily receives the influence of an air current flows down to the second dust collection chamber 25 together with the branch airflow S.

[0108] In a state in which the branch airflow S includes the dirt A, the branch airflow S enters the inside of the second dust collection chamber 25 from the branched opening 21f and flows down through the inside of the second dust collection chamber 25. The branch airflow S that flowed down through the inside of the second dust collection chamber 25 enters the first dust collection chamber 24 from the partition opening section 70a formed in the partition 70 and passes through the first distal end opening 21e and merges with the airflow R.

[0109] That is, the path along which the branched airflow S flows is a bypass air passage of the airflow R.

[0110] In this case, filter means 70f such as a mesh cloth made of polyester or the like or a stainless-steel plate in which minute openings are formed by executing an etching process or a punching process is provided in the partition opening section 70a.

[0111] Accordingly, the partition opening section 70a is configured to allow air to pass therethrough while not allowing dust of a predetermined size to pass therethrough.

[0112] That is, the dirt A included in the branch airflow S is filtered out by the filter means 70f at the partition opening section 70a and is accumulated inside the second dust collection chamber 25.

[0113] Further, the dirt A that is accumulated in the second dust collection chamber 25 is always in the flow of the branch airflow S while the vacuum cleaner is being used.

[0114] Therefore, a force in a compressing direction that is generated by the flow of air acts on the dirt A that is accumulating in the second dust collection chamber 25, and compressing the volume that the dirt A occupies in this manner makes it possible to accumulate a greater amount of dust inside the second dust collection chamber 25.

[0115] In particular, since the dirt A accumulated in the second dust collection chamber 25 is dust with a large bulk, a significant effect is obtained with respect to increasing the amount of dust that can be accumulated inside the dust collection chamber by compressing and

accumulating the dust in the above described manner. That is, in the case of a conventional dust collection chamber, in a state in which the dirt A that has a large bulk is retained in the dust collection chamber, there are relatively large spaces between adjacent pieces of dust in comparison to a case where fine sand grains and the like are accumulated therein. Therefore, by compressing and accumulating the dirt A as in the present embodiment, the above described spaces between adjacent pieces of dust can be eliminated to enable more space to be utilized to accumulate dust.

[0116] Air that does not form the branch airflow S from the branched opening 21f and that instead flows down through the inside of the first centrifugal separation section 21 as it is as the airflow R approaches the first conical section 21b.

[0117] As a result, the swirl radius of the swirling flow of the air that includes dust decreases, and hence the swirling speed increases and the centrifugal force strengthens and the dirt B that could not be separated at the branched opening 21f is separated from the airflow.

[0118] The dirt B that was separated from the airflow is pushed downward by the airflow and enters the first dust collection chamber 24 from the first distal end opening 21e and is accumulated therein.

[0119] The minute dirt C that was not completely separated from the air in the first centrifugal separation section 24 flows upward through the center of the swirling flow that flows down along the inner wall of the first centrifugal separation chamber 24 together with the airflow R, is discharged from the first centrifugal separation section 21 via the filter 27 provided in the opening 21d, passes through the communication section 23, and flows down into the second centrifugal separation section 22.

[0120] When the air that includes the dirt C that flowed down to the second centrifugal separation section 22 flows down to the second conical section 22a, the air generates a centrifugal force that is produced by a swirling flow in a similar manner as the air inside the first centrifugal separation section 21. However, the diameter of the second conical section 22a is configured to be smaller than the diameter of the first conical section 21b.

[0121] Consequently, in the second conical section 22a, the swirling speed of the airflow R becomes faster than in the first conical section 21b and it is possible to generate a centrifugal force that is stronger than the centrifugal force generated in the first centrifugal separation section 21.

[0122] Accordingly, the minute dirt C that it is difficult to separate from the air in the first centrifugal separation section 21 can be separated from the air in the second centrifugal separation section 22.

[0123] The dirt C that is separated from the air in this manner enters the inside of the third dust collection section 65 from the second distal end opening 22e and is accumulated therein.

[0124] The air from which the dirt C was removed flows upward through the center of the airflow R that flows down

while swirling along the inner wall of the second centrifugal separation section 22, passes along the discharge path 23b formed in the communication section 23, and flows down into the body 10 from a discharge/intake port 15 that opens into the body 10.

[0125] Subsequently, the air that flowed into the body 10 is discharged to outside the body 10 from a discharge port that opens into the body 10, via the motor-driven blower.

[0126] The following effects are obtained by configuring the centrifugal separation sections and dust collection chambers as described above.

[0127] As described above, air containing dust is taken into the respective centrifugal separation sections 21, 22 in accordance with the airflow R from the dust intake opening 21c. Subsequently, the dirt A, the dirt B, and the dirt C are separated from the air in three stages, and are accumulated in the second dust collection section 25, the first dust collection section 24, and the third dust collection section 65, respectively.

[0128] Normally, since the dirt A has a large bulk, the dirt A has an extremely large volume at the separation stage, and if the dirt A remains in that state the dust collection section will quickly become full, and thus the frequency at which it is necessary to dispose of the dust will be extremely high.

[0129] However, according to the present embodiment, since the branch airflow S is formed that serves as a bypass air passage of the airflow R, the dirt A accumulates in the second dust collection section 25 in a compressed state, and there is thus an effect of decreasing the frequency of dust disposal.

[0130] Note that since the volume of the dirt B and the dirt C is extremely small compared to that of the dirt A, the dirt B and the dirt C do not occupy a large volume among dust included in air that is sucked from a surface to be cleaned, and a decrease in the frequency of dust disposal can be achieved without difficulty by only compressing the dirt A.

[0131] Further, according to the present embodiment, since compression of dust is performed utilizing the flow of an airflow and without using a mechanical structure, stable operations can be continuously performed.

[0132] Furthermore, when dust has accumulated in the dust collection chambers 24, 25, the user first detaches the dust collection section 20 from the body 10, and then separates the dust collection chambers 24, 25 and the centrifugal separation sections 21, 22 and disposes of the dust that is inside the dust collection chambers.

[0133] In addition, if the dust collection section 20 has been dirtied by sucked dust, since a mechanical structure that utilizes electrical means is not used, it is possible to wash the entire dust collection section 20 with water.

[0134] Furthermore, since a mechanical structure utilizing electrical means is not adopted for the dust collection section 20, the dust collection section 20 can be made light and compact.

[0135] Further, the following effects are obtained by

arranging the handle 26 as in the present embodiment.

[0136] First, by providing the handle 26 for carrying the dust collection section 20, or the body 10 and the dust collection section 20 when the dust collection section 20 is attached thereto, between the first centrifugal separation section 21 and the second centrifugal separation section 22 that are adjacent, the amount by which the handle 26 protrudes from the dust collection section 20 can be suppressed to a minimum and the dust collection section can be made compact.

[0137] That is, since the cross-sectional shape of each of the centrifugal separation sections 21, 22 is a circular shape, by arranging the centrifugal separation sections 21, 22 adjacent to each other the hollow section 20a is formed between the adjacent centrifugal separation sections 21, 22. By arranging the handle 26 at the position of the hollow section 20a, the handle 26 can be formed in a manner in which the protruding amount thereof from the dust collection section 20 is suppressed.

[0138] In particular, by positioning the opening 26a of the handle 26 in the hollow section 20a, a hand-grip section that a user uses to grasp the handle 26 can be adequately secured without forming the handle 26 in a large size.

[0139] Thus, since the protruding amount of the handle 26 from the dust collection section 20 is small, the overall size of the cleaner can be kept to a small size, and damage to the handle 26 can be prevented even if, during use, the cleaner overturns, the cleaner is dropped, or the cleaner comes in contact with an obstacle.

[0140] Further, the centrifugal separation sections are formed in a cylindrical shape, the adjacent centrifugal separation sections are arranged so that the central axes M1 and M2 of the respective cylinders thereof are substantially parallel, and the handle 26 is formed so that a longitudinal direction thereof is the same as the axial directions of the central axes M1 and M2. Hence, the position of the handle 26 is the center of the dust collection section 20, and thus the user can grasp the handle 26 in a well-balanced manner.

[0141] Further, by providing the handle 26 at a position on the opposite side to the side on which the dust collection section 20 is attached to the body 10, the dust collection section 20 and the body 10 can be carried in a state in which the dust collection section 20 is attached to the body 10.

[0142] It is thus possible to use a common handle as the handle of the dust collection section 20 and the handle of the body 10, and thereby reduce the number of components and the weight of the cleaner C and also decrease the size of the cleaner C.

[0143] In addition, since the handle 26 is positioned between the adjacent centrifugal separation sections 21, 22, when the plurality of centrifugal separation sections are integrally formed to constitute a single unit, the handle 26 can serve as a reinforcing member that links the respective centrifugal separation sections.

(Embodiment 2)

[0144] Next, Embodiment 2 of the present invention will be described referring to Figure 16. Note that components that are the same as in Embodiment 1 are denoted by the same reference symbols hereunder, and a description thereof is omitted.

[0145] The present embodiment includes, as respectively separate components, a cup-shaped member constituting the dust collection chambers 24, 25, and a partition 75 that partitions the inside of the dust collection chamber to form the first dust collection chamber 24 and the second dust collection chamber 25.

[0146] A partition opening section 75a that allows the first dust collection chamber 24 and the second dust collection chamber 25 to communicate is formed in the partition 75. Filter means 75f through which air can pass but through which dust cannot pass is mounted in the opening section 75a.

[0147] A pair of guide sections 25g for attaching the partition 75 are provided on inner wall surfaces of the dust collection chambers 24, 25. The guide sections 25g are formed in a concave shape, and are provided on facing wall surfaces so that openings thereof face each other.

[0148] The plate-shaped partition 75 is inserted along the inside of the openings of the guide sections 25g to be provided inside the dust collection chambers 24, 25, and is adhered by ultrasonic welding or the like.

[0149] A seal section 75b constituted by a flexible material is provided at areas of the partition 75 that contact with the guide sections 25g, to thereby seal a space between the partition 75 and the inner wall surfaces of the dust collection chambers 24, 25.

[0150] By configuring the dust collection chambers 24, 25 and the partition 75 as separate components, molding of the respective components is facilitated.

[0151] That is, although the filter means 75f having the above described function is provided in the partition opening section 75a of the partition 75, since insert molding that includes the filter means 75f can be performed when molding the partition 75 with resin, it is possible to integrally form the partition 75 and the filter means 75f.

[0152] Thus, since the filter means 75f is included in the partition 75, a configuration can be achieved in which it is difficult for the filter means 75f to fall out from the partition 75.

[0153] Note that it is favorable to use, for example, a mesh-shaped cloth made of polyester or the like or a metal plate made of stainless steel or the like in which minute openings are formed by executing an etching process or a punching process as the filter means 75f that is provided in the partition opening section 75a.

[0154] When a metal plate in which minute openings are formed is used as the filter means 75f, damage and the like of the filter means 75f can be prevented since the strength of filter means 75f can be enhanced thereby.

[0155] When a mesh-shaped cloth is used as the filter

means 75f, it is possible to construct the filter means 75f with finer openings compared to when using the aforementioned metal plate as the filter means 75f.

[0156] Further, a method of integrally forming the filter means 75f with the partition 75 is not limited to insert molding, and the filter means 75f may be affixed using an adhesive or the like to a peripheral wall surface of the partition opening section 75a so as to cover the partition opening section 75a or may be inserted in a separate frame body and fixed thereto.

(Reference Example)

[0157] Respective embodiments of the present invention have been described above. A reference example of a divided structure applicable to the dust collection section 20 of the foregoing embodiments will now be described referring to Figure 9 to Figure 15. Note that components that are the same as in the foregoing embodiments are denoted by the same reference symbols hereunder, and a description thereof is omitted.

[0158] Figure 9 is a plan view illustrating a state in which the dust collection section 20 has been disassembled into respective sections thereof. Figure 10 includes a cross-sectional view and partially enlarged views of the dust collection section 20. Figure 11 is a longitudinal sectional view of the dust collection section 20. Figure 12 is an exploded view illustrating the relationship between a dust collection chamber and a centrifugal separation section. Figure 13 is an exploded view illustrating the relationship between the centrifugal separation sections 21, 22 and the communication section 23. Figure 14 is an exploded view illustrating the relationship between the first centrifugal separation section 21 and a discharge pipe. Figure 15 includes a cross-sectional view and a partially enlarged view of a state in which the discharge pipe is set in the first centrifugal separation section 21.

[0159] Referring to Figure 9 and Figure 10, the dust collection section 20 is disassemblable into three components thereof, namely, the centrifugal separation sections 21, 22, the communication section 23, and the dust collection chambers 24, 25.

[0160] A first groove section 32 is formed in the respective opening edges on a side that fits together with the communication section 23 of the centrifugal separation sections 21, 22 that have the first centrifugal separation section 21 and the second centrifugal separation section 22. A first seal member 32a for maintaining airtightness between both members when the communication section 23 and the centrifugal separation sections 21, 22 are fitted together is press-fitted into the first groove section 32.

[0161] Further, a second groove section 33 is formed in an opening edge that fits together with the dust collection chambers 24, 25 of the centrifugal separation sections 21, 22. A second seal member 33a for maintaining airtightness between both members when the dust collection chambers 24, 25 and the centrifugal separation sections 21, 22 are fitted together is press-fitted into the

second groove section 33.

[0162] These seal members 32a and 33a are configured to be detachable from the respective groove sections 32 and 33, and maintenance thereof such as washing with water or replacement can be performed.

[0163] Referring to Figure 11 and Figure 12, a claw receiving section 35 that opens in the direction of the centrifugal separation sections 21, 22 is formed at a site that is on an opposite side to a face that attaches to/detaches from the body 10 of the dust collection chambers 24, 25.

[0164] Further, a dust collection chamber lock section 37 is provided at a site on a side that attaches to/detaches from the body 10 of the dust collection chambers 24, 25. The dust collection chamber lock section 37 is constituted by an engagement section 37a that protrudes in the direction of the centrifugal separation sections 21, 22 and an engagement release button 37b that actuates the engagement claw section 37a.

[0165] Note that the dust collection chamber lock section 37 is provided on the second handle 29 for carrying the dust collection chambers 24, 25.

[0166] A claw section 36 that protrudes in the direction of the dust collection chambers 24, 25, and a claw receiving section 39 that opens in the direction of the dust collection sections 24, 25 are formed in the centrifugal separation sections 21, 22.

[0167] That is, the dust collection chamber lock section 37 is provided on a side that joins with the centrifugal separation sections 21, 22 of the second handle 39 for carrying the dust collection chambers 24, 25, and the engagement claw section 37a that rotates has a structure that is urged in a direction of engagement with the claw receiving section 39 and engages with the claw receiving section 39.

[0168] The centrifugal separation sections 21, 22 and the dust collection chambers 24, 25 that are configured in this manner are fitted together and fixed in the following manner. First, the claw section 36 is inserted into the claw receiving section 35 and engaged therein. Next, the engagement claw section 37a is inserted into the claw receiving section 39 and engaged therein.

[0169] Note that in this state, opening edges 24b, 25b of the dust collection chambers 24, 25 are in intimate contact with the second seal member 33a. As a result, the centrifugal separation sections 21, 22 and the dust collection sections 24, 25 are coupled and held in a state in which airtightness is maintained between both members.

[0170] Further, since engagement between the claw receiving section 39 and the engagement claw section 37a can be released by operating the engagement release button 37b in a state in which the user holds the second handle 29, it is possible to easily separate the centrifugal separation sections 21, 22 and the dust collection chambers 24, 25 by using the hand that holds the second handle 29 as a pivot.

[0171] Furthermore, since the engagement release

button 37b is positioned on the side of the second handle that is provided at the dust collection chambers 24, 25, in a state in which the dust collection section 20 is attached to the body 10, the engagement release button 37b is positioned at a site that is sandwiched between the dust collection section 20 and the body 10 and therefore cannot be operated by the user.

[0172] Consequently, when cleaning using the vacuum cleaner C, a situation does not arise in which the user mistakenly operates the engagement release button 37b and dust that has accumulated inside the dust collection chambers 24, 25 is released.

[0173] Referring to Figure 11 and Figure 13, a first claw receiving section 40 and a second claw receiving section 41 are provided on the communication section 23. A communication section lock section 42 is provided on the centrifugal separation sections 21, 22. The communication section lock section 42 includes a first claw 43, a second claw 44, and an interlocking rod 45.

[0174] By engaging the first claw 43 in the first claw receiving section 40 and engaging the second claw 44 in the second claw receiving section 42, the communication section 23 and the centrifugal separation sections 21, 22 are retained in a connected state.

[0175] Note that in this state an opening edge 23d of the communication section 23 intimately contacts the first seal member 32a. As a result, the centrifugal separation sections 21, 22 and the communication section 23 are coupled in a state in which airtightness is maintained between both members.

[0176] In this case, the interlocking rod 45 is provided so that the second claw 44 moves in response to movement of the first claw 43. Therefore, when releasing an engaged state between the second claw receiving section 42 and the second claw 44 in a state in which the first claw receiving section 40 and the first claw 43 are engaged, the user can release the engaged state of the second claw 44 by merely moving the first claw 43 to release the engaged state.

[0177] As shown in Figure 14 and Figure 15, the filter 27 is constituted by a filter section in which a cylindrical mesh-like opening constituted by a circular cylindrical section 27a and a conical section 27b that is integrally connected to the circular cylindrical section 27a, and a flange-shaped base section 27c that spreads from an opening end of the circular cylindrical section 27a.

[0178] By making the shape of the filter 27 a circular cylindrical shape in this manner, generation of a swirling flow inside the first centrifugal separation chamber 21 can be facilitated.

[0179] In addition, by forming the filter 27 in a cylindrical shape, a wide area in which the mesh-like opening is formed can be secured, and the flow of air that flows through the filter 27 can be increased.

[0180] A groove section 27d that opens towards the outside is formed at the outer edge of the base section 27c. A seal member 52 is provided in the groove section 27d.

[0181] The seal member 52 is a member for securing airtightness between the filter 27 and the first centrifugal separation section 21 when the filter 27 is fitted in the communication opening 21d of the first centrifugal separation section 21, by joining with an inner wall face 21h of the first centrifugal separation section 21 to fill a gap between the filter 27 and the first centrifugal separation section 21.

[0182] The seal member 52 has a packing section 52a. The packing section 52a contacts against the first centrifugal separation section 21 to secure the aforementioned airtightness. An end of the packing section 52a is housed inside the groove section 27d, and an area of the packing section 52a that serves as a sealing surface protrudes to the outside from the groove section 27d. The protruding area contacts with the inner wall face 21h of the first centrifugal separation section 21.

[0183] Note that when the filter 27 is fitted in the communication opening 21d, the seal member 52 is mounted inside the groove section 27d without projecting (protruding) from the space that is surrounded by the groove section 27d and the inner wall face 21h of the first centrifugal separation section 21.

[0184] That is, the seal member 52 is in a state in which the seal member 52 is surrounded by the groove section 27d and a wall surface of the first centrifugal separation section 21, and is not exposed inside the first centrifugal separation section 21.

[0185] The filter 27 configured in this manner is provided in the communication opening 21d so that the central axis M1 of the first centrifugal separation section 21 and the axial center of the circular cylindrical section 27a and the conical section 27b coincide.

[0186] In this case, referring to Figure 13, a rotary baffle plate 54 that is constantly urged in a slanting direction with respect to the central axis M1 of the first centrifugal separation section 21 is provided in the vicinity of the communication opening 21d of the first centrifugal separation section 21.

[0187] When the rotary baffle plate 54 is in a slanting state, if the user attempts to attach the communication section 23 to the centrifugal separation sections 21, 22, a baffle plate end 55 interferes with a rib 56 that is formed on the communication section 23, and the communication section 23 can not be attached to the centrifugal separation sections 21, 22. That is, in a state in which the filter 27 is not attached to the centrifugal separation sections 21, 22, the rotary baffle plate 54 serves as attachment restriction means that inhibits attachment of the communication section 23 to the centrifugal separation sections 21, 22.

[0188] In this state, when the filter 27 is attached to the first centrifugal separation section 21, an interference plate 57 provided on the filter 27 contacts against the rotary baffle plate 54.

[0189] As a result, the rotary baffle plate 54 is rotated so as to become approximately parallel with the central axis M1, and when attaching the communication section

23 to the centrifugal separation sections 21, 22 a positional relationship is entered such that the baffle plate end 55 and the rib 56 do not interfere with each other and it is therefore possible to attach the communication section 23 to the centrifugal separation sections 21, 22.

[0190] Note that it is possible to utilize the interference plate 57 as a grip when removing the filter 27.

[0191] The following actions and effects are obtained by configuring the respective sections in the above described manner.

[0192] When dust has accumulated in the dust collection chambers 24, 25, the user first detaches the dust collection section 20 from the body 10. Thereafter, the user grips the handle 26 and moves the dust collection section 20 to a location at which to dispose of the dust.

[0193] Subsequently, after moving the dust collection section 20, the user holds the handle 26 with one hand and, with the other hand, releases the engagement between the engagement claw section 37a and the claw receiving section 39 by pushing the engagement release button 37b of the dust collection chamber lock section 37 while holding the second handle 29 provided on the dust collection chambers 24, 25. The user thereby releases the connection between the dust collection chambers 24, 25 and the centrifugal separation sections 21, 22 to separate the dust collection chambers 24, 25 and the centrifugal separation sections 21, 22, and then disposes of the dust that is inside the dust collection chambers.

[0194] When disposing of dust from the dust collection chambers 24, 25 in this manner, because a handle is provided on the dust collection chambers 24, 25 and the centrifugal separation sections 21, 22, respectively, the operability of the various release buttons is favorable.

[0195] In particular, since the dust collection chamber lock section 37 that releases the engagement state between the dust collection chambers 24, 25 and the centrifugal separation sections 21, 22 is arranged on the handle 29 of the dust collection chamber, the dust collection sections 24, 25 can be separated from the centrifugal separation sections 21, 22 in a state in which the handle 29 of the dust collection chambers 24, 25 is grasped.

[0196] Therefore, dust is not liable to spill out from inside the dust collection chambers 24, 25, and a user can empty the dust without dirtying their hands.

[0197] In addition, when performing maintenance such as washing the entire dust collection section with water, in addition to separating the dust collection chambers 24, 25 and the centrifugal separation sections 21, 22 as described above, by operating the first claw 43 of the centrifugal separation sections 21, 22 in a releasing direction, the connection between the first claw 43 and the first claw receiving section 40 and the connection between the second claw 44 and the second claw receiving section 41 can each be released, and the communication section 23 can be easily separated from the centrifugal separation sections 24, 25.

[0198] Thus, since the dust collection section 20 can

be disassembled into the communication section 23, the centrifugal separation sections 21, 22, and the dust collection chambers 24, 25 that have respectively separate functions, maintenance can be performed in accordance with the characteristics of the respective sections.

[0199] Further, since the dust collection section 20 can be disassembled into components for respective functions, such as the centrifugal separation chambers 21, 22 that separate air and dust, the communication section 23 that serves as an air passage that allows the respective centrifugal separation chambers to communicate with each other, and the dust collection chambers 24, 25 that accumulate dust that was separated from air, the operability with respect to disassembly and assembly and the like of the dust collection section 20 is favorable, and it is easy for the user to perform maintenance that is suited to the respective functional parts.

[0200] In addition, since the first seal member 32a and the second seal member 33a can be removed from the centrifugal separation sections 21, 22, meticulous maintenance can be performed.

[0201] Furthermore, when a large amount of comparatively large dust such as hair on which it is difficult for a centrifugal force to act is sucked into the first centrifugal separation chamber 21, since the dust cannot be carried by a centrifugal force into the first dust collection chamber 24 from the first centrifugal separation chamber 21 and also cannot pass through the mesh-like opening of the filter 27, in some cases the dust remains inside the first centrifugal separation chamber 21 in that state.

[0202] However, according to the configuration of the present embodiment, because the filter 27 can be removed, maintenance of the inside of the first centrifugal separation chamber 21 can easily be performed.

[0203] In addition, when fitting the filter 27 in the opening 21d of the first centrifugal separation chamber 21, since the configuration is such that an end of the packing section 53 of the seal member 52 provided in the filter 27 does not project from the groove section, that is, the packing section 53 fits inside the groove section and does not protrude from the groove section, the packing section 53 does not get turned up when attaching or detaching the filter 27.

[0204] Further, since the seal member 52 is not exposed in a space in which dust swirls inside the first centrifugal separation chamber 21, deterioration of the seal member can be prevented.

[0205] Furthermore, since the structure of the dust collection section 20 is one in which the communication section 23 can not be attached to the centrifugal separation sections 21, 22 unless the filter 27 is attached to the first centrifugal separation section 21, a situation does not arise in which the vacuum cleaner C is used in an incorrect state in which the filter 27 is not fitted therein.

Description of Reference Characters

[0206]

C	vacuum cleaner	
10	body	
20	dust collection section	
21	first centrifugal separation section	
22	second centrifugal separation section	5
23	communication section	
24	first dust collection chamber	
25	second dust collection chamber	
26	handle	
27	filter	10
29	second handle	
31	lock section	
37	dust collection chamber lock section	
50	dust suction means	
51	hose unit	15
52	extension pipe	
53	floor surface suction tool	
54	rotary baffle plate	
56	rib	
57	interference plate	20

[0207] The following are the claims of the translation of the PCT parent application as filed and are included as part of the description of the present application.

1. A vacuum cleaner, comprising:

a body having therein a motor-driven blower that generates a suction force, and a cyclone dust collection section that is detachable from the body;
wherein:

the cyclone dust collection section comprises a centrifugal separation section that separates air and dust that are taken into the cyclone dust collection section, and a first dust collection chamber and a second dust collection chamber that communicate with the centrifugal separation section and accumulate dust that is separated by the centrifugal separation section; and
the first dust collection chamber and the second dust collection chamber communicate with each other.

2. The vacuum cleaner according to claim 1, wherein:

the centrifugal separation section has a cylindrical shape comprising a circular cylindrical section and a conical section;
a dust intake opening that takes in dust from outside of the centrifugal separation section, and an opening that allows inside of the centrifugal separation section and inside of the second dust collection section to communicate with each other are formed in the circular cylindrical

section; and
an opening that allows inside of the centrifugal separation section and inside of the first dust collection section to communicate with each other is formed in the conical section.

3. The vacuum cleaner according to claim 1 or 2, wherein filter means is provided at an area that allows the first dust collection chamber and the second dust collection chamber to communicate with each other.

4. The vacuum cleaner according to any one of claims 1 to 3, wherein:

the first dust collection chamber and the second dust collection chamber comprise a base body within which a space is formed, and the respective dust collection sections are formed by partitioning inside of the base body with a partition; and
the partition is constituted by a separate component to the base body, an opening that allows the first dust collection chamber and the second dust collection chamber to communicate with each other is formed in the partition, and the filter means is provided in the opening.

5. The vacuum cleaner according to claim 4, wherein, in the partition, the filter means is provided in the opening by insert molding.

6. The vacuum cleaner according to claim 4 or 5, wherein the filter means is a metal plate in which minute openings are formed.

7. The vacuum cleaner according to claim 4 or 5, wherein the filter means is a mesh-shaped cloth.

Claims

1. A vacuum cleaner, comprising:

a body (10) having therein a motor-driven blower that generates a suction force, and a cyclone dust collection section (20) that is detachable from the body (10);

wherein:

the cyclone dust collection section (20) comprises a centrifugal separation section (21) that separates air and dust that are taken into the cyclone dust collection section (20), and a first dust collection chamber (24) and a second dust collection chamber (25) that communicate with the centrifugal separation section (21) and accumu-

late dust that is separated by the centrifugal separation section (21); and
the first dust collection chamber (24) and the second dust collection chamber (25) communicate with each other,

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wherein:

the centrifugal separation section (21) has a cylindrical shape comprising a circular cylindrical section (21a) and a conical section (21b);
a dust intake opening (21c) that takes in dust from outside of the centrifugal separation section (21), and an opening (21f) that allows inside of the centrifugal separation section (21) and inside of the second dust collection chamber (25) to communicate with each other are formed in the circular cylindrical section (21a); and
an opening (21e) that allows inside of the centrifugal separation section (21) and inside of the first dust collection chamber (24) to communicate with each other is formed in the conical section (21b).

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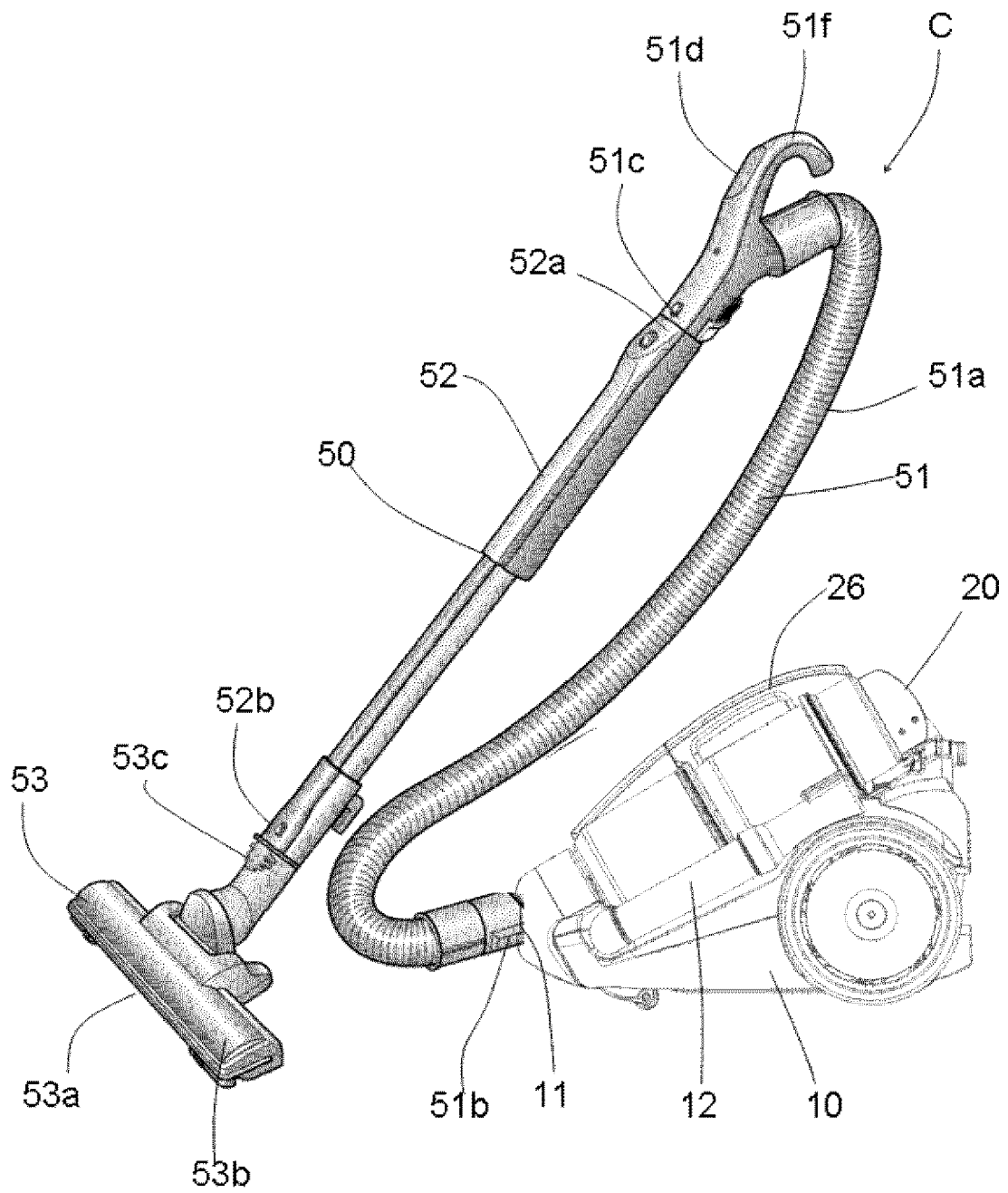


Fig.1

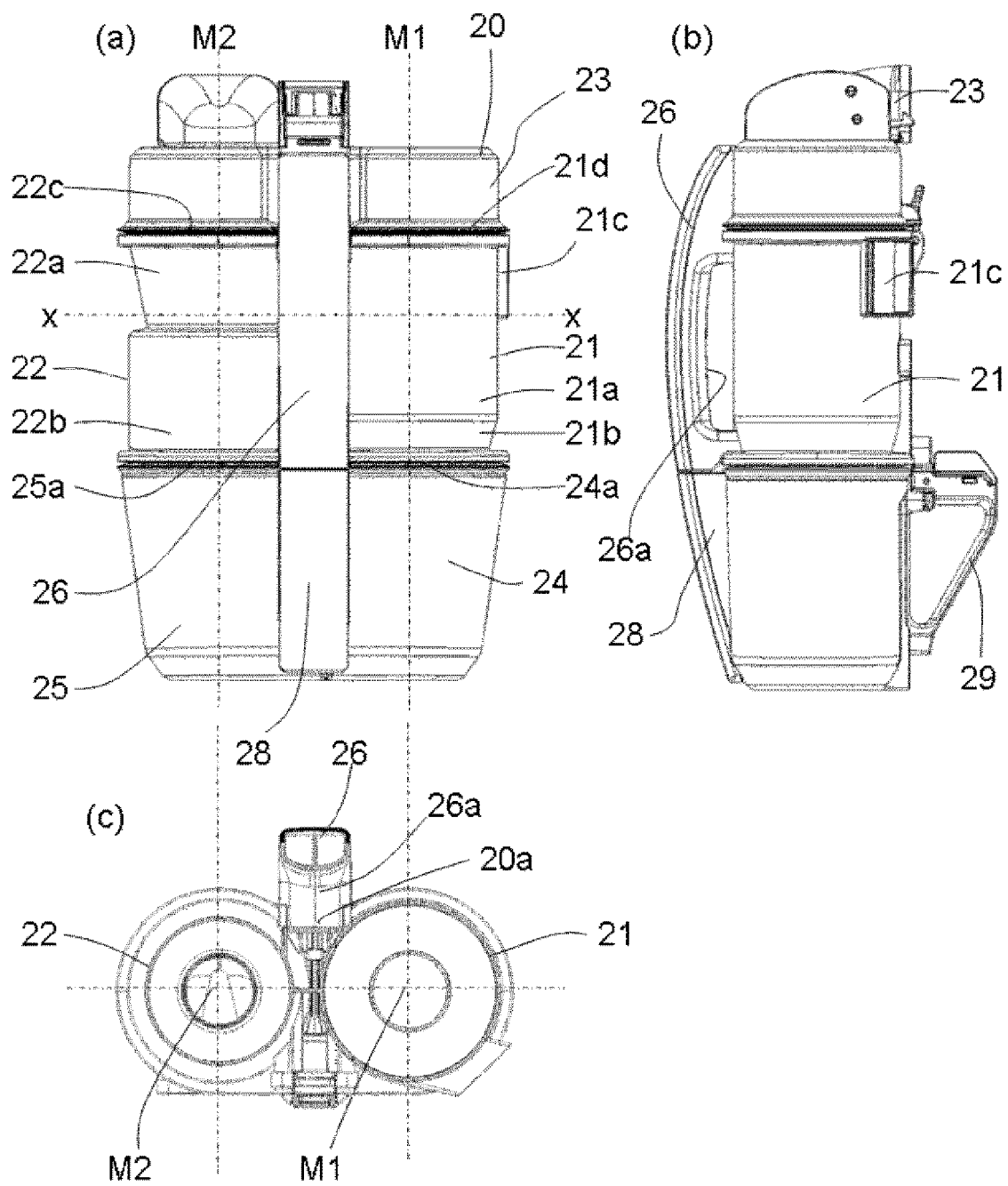


Fig.2

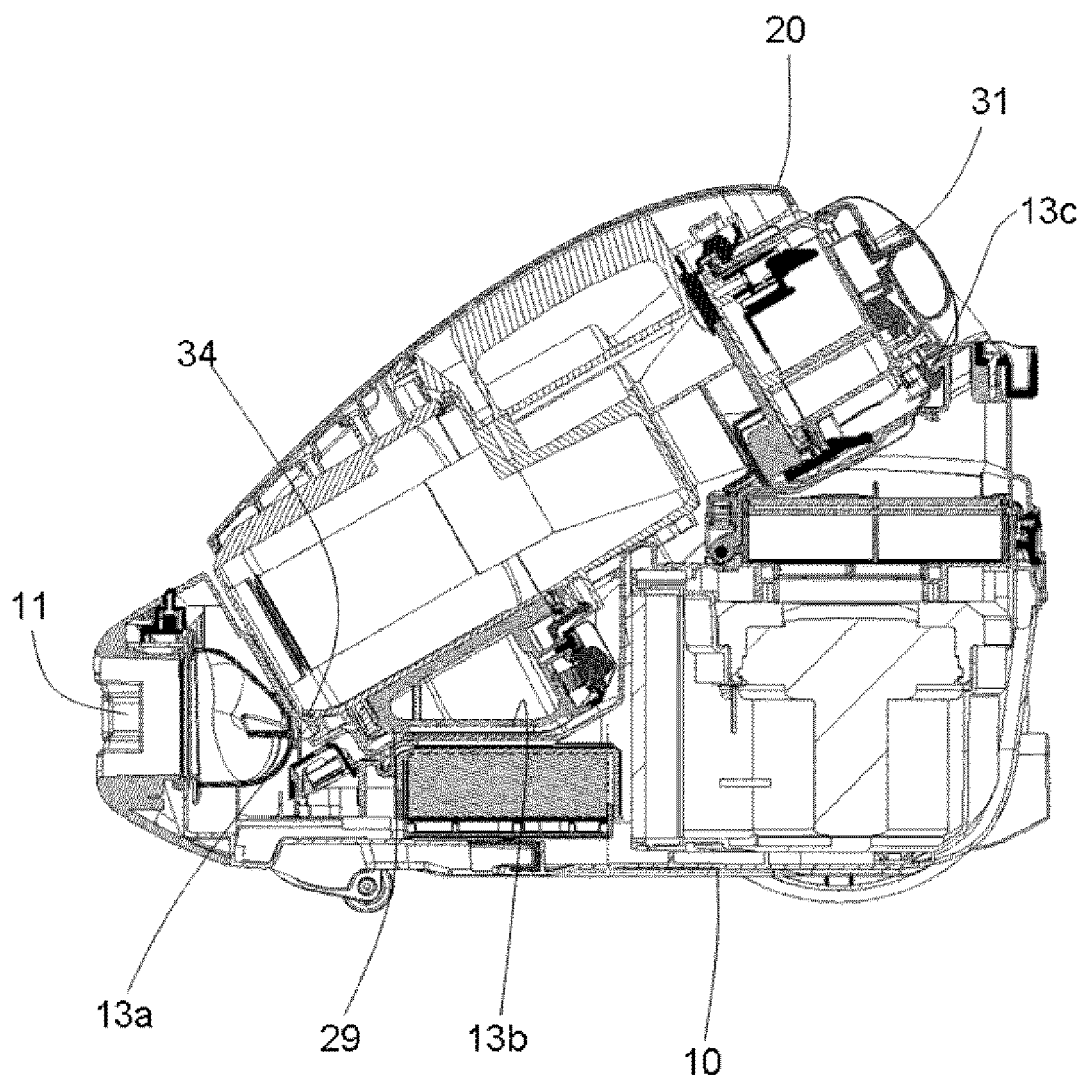


Fig.3

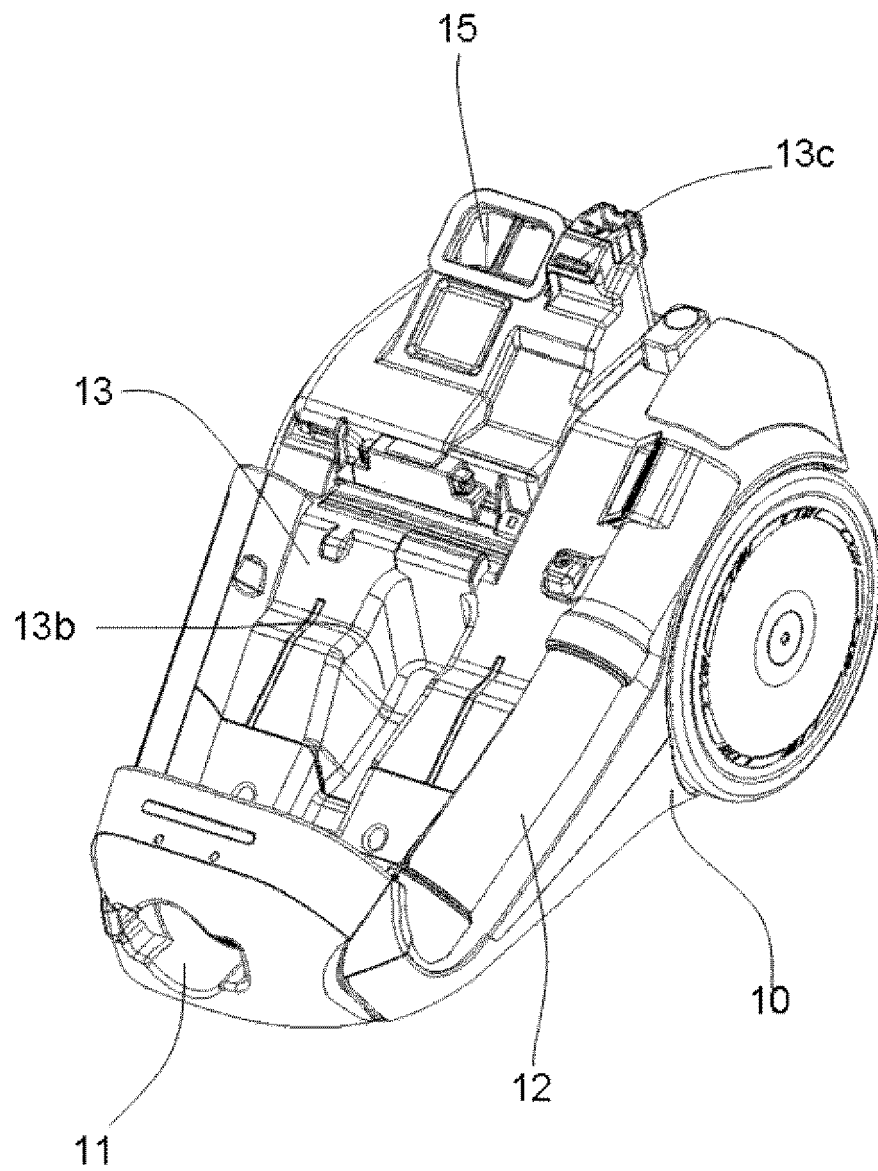


Fig.4

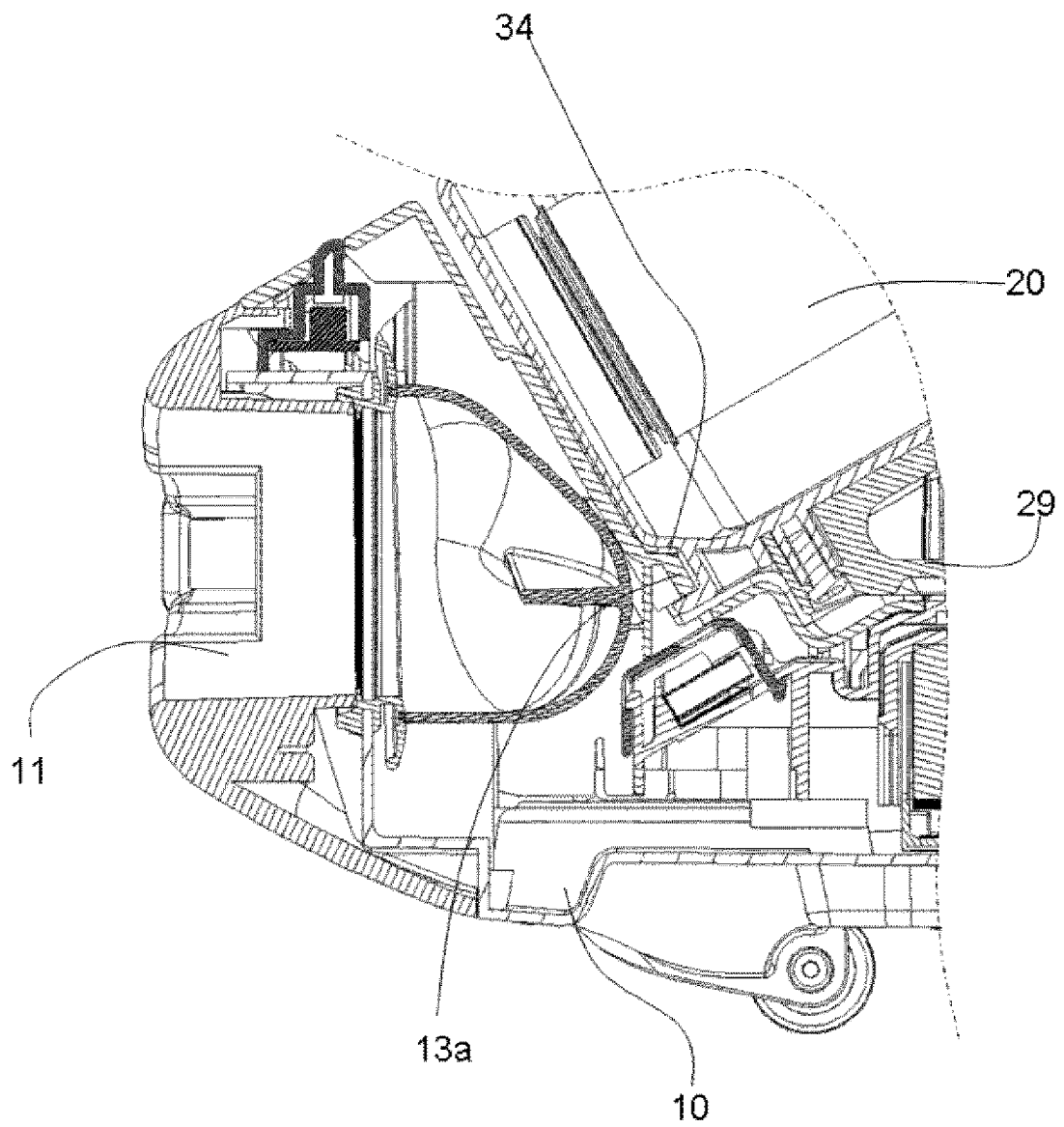


Fig.5

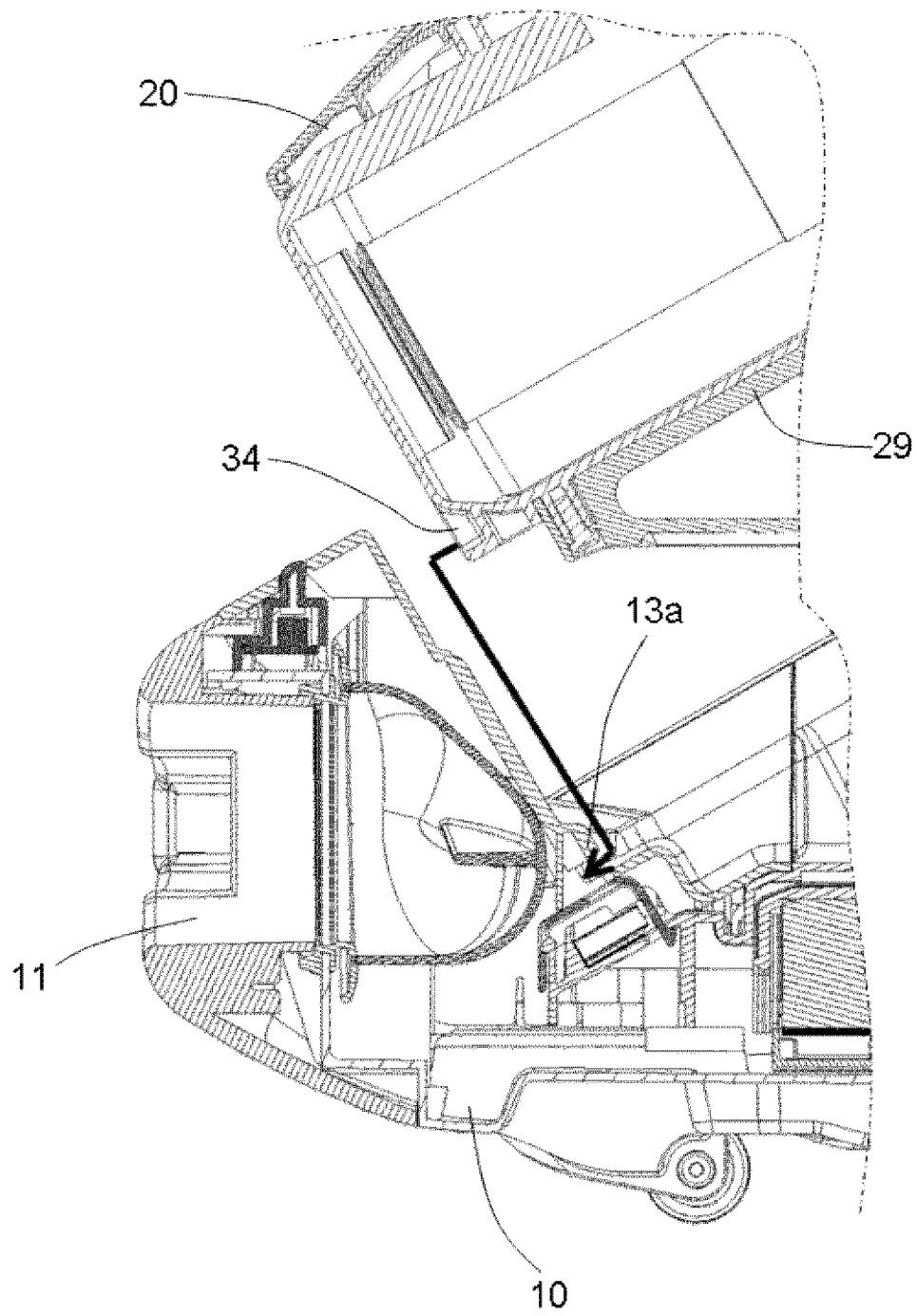


Fig.6

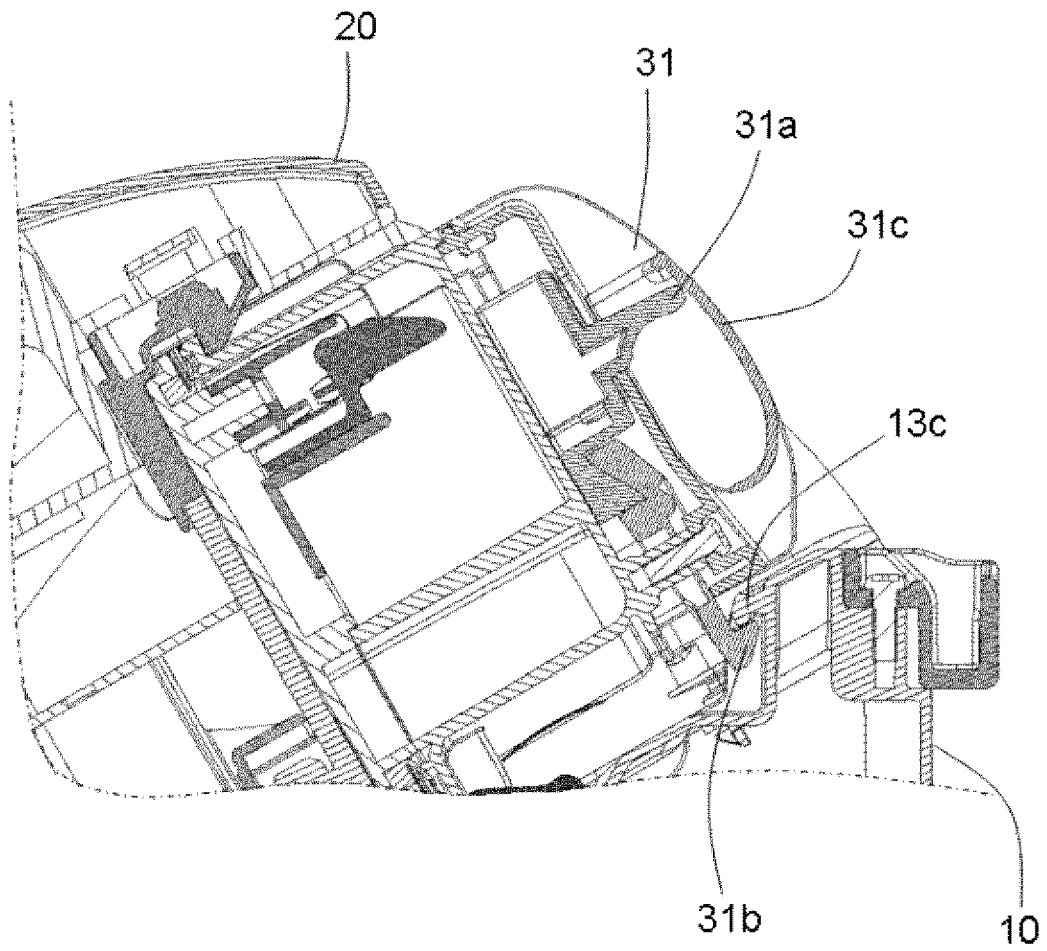


Fig.7

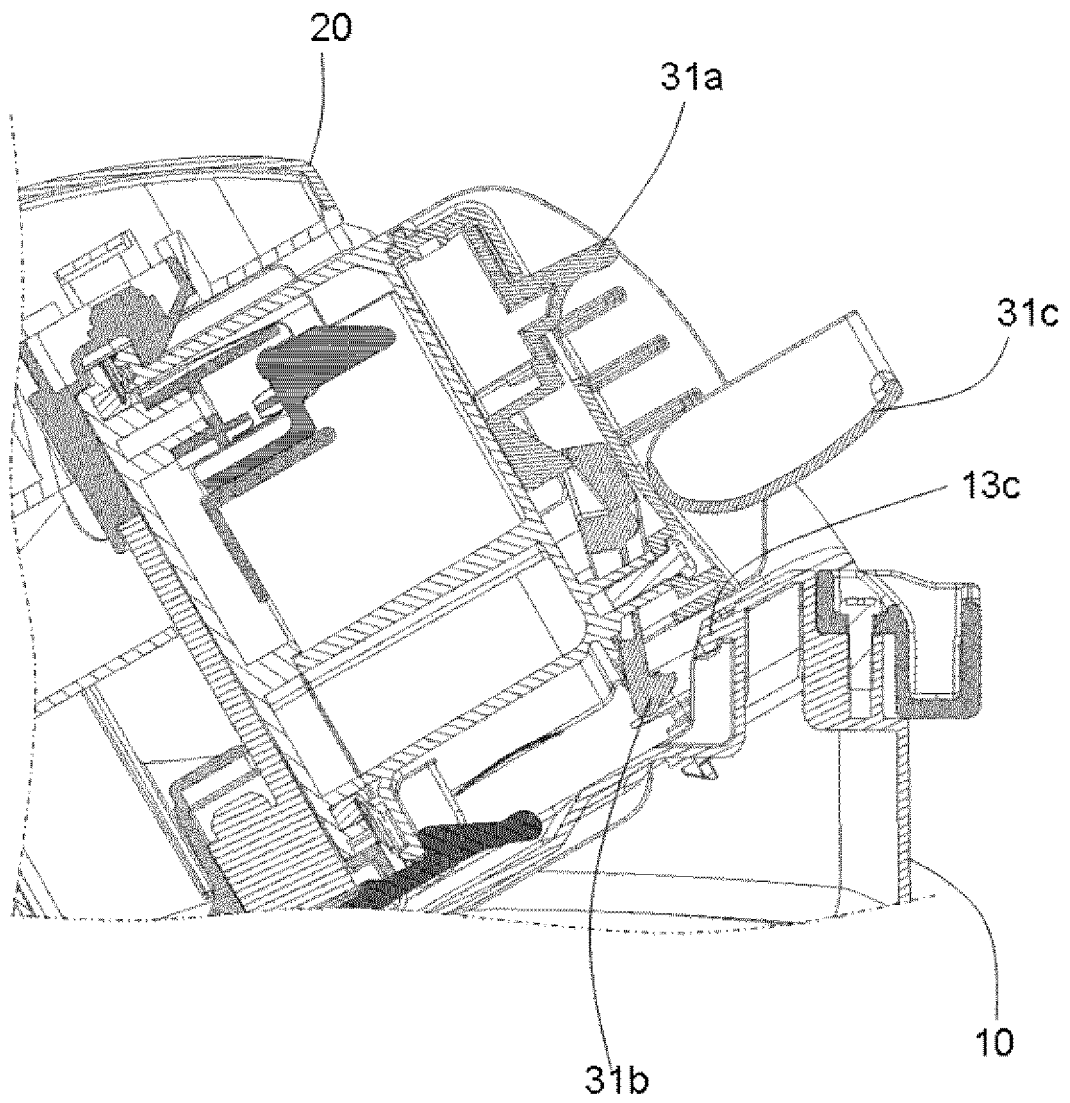


Fig.8

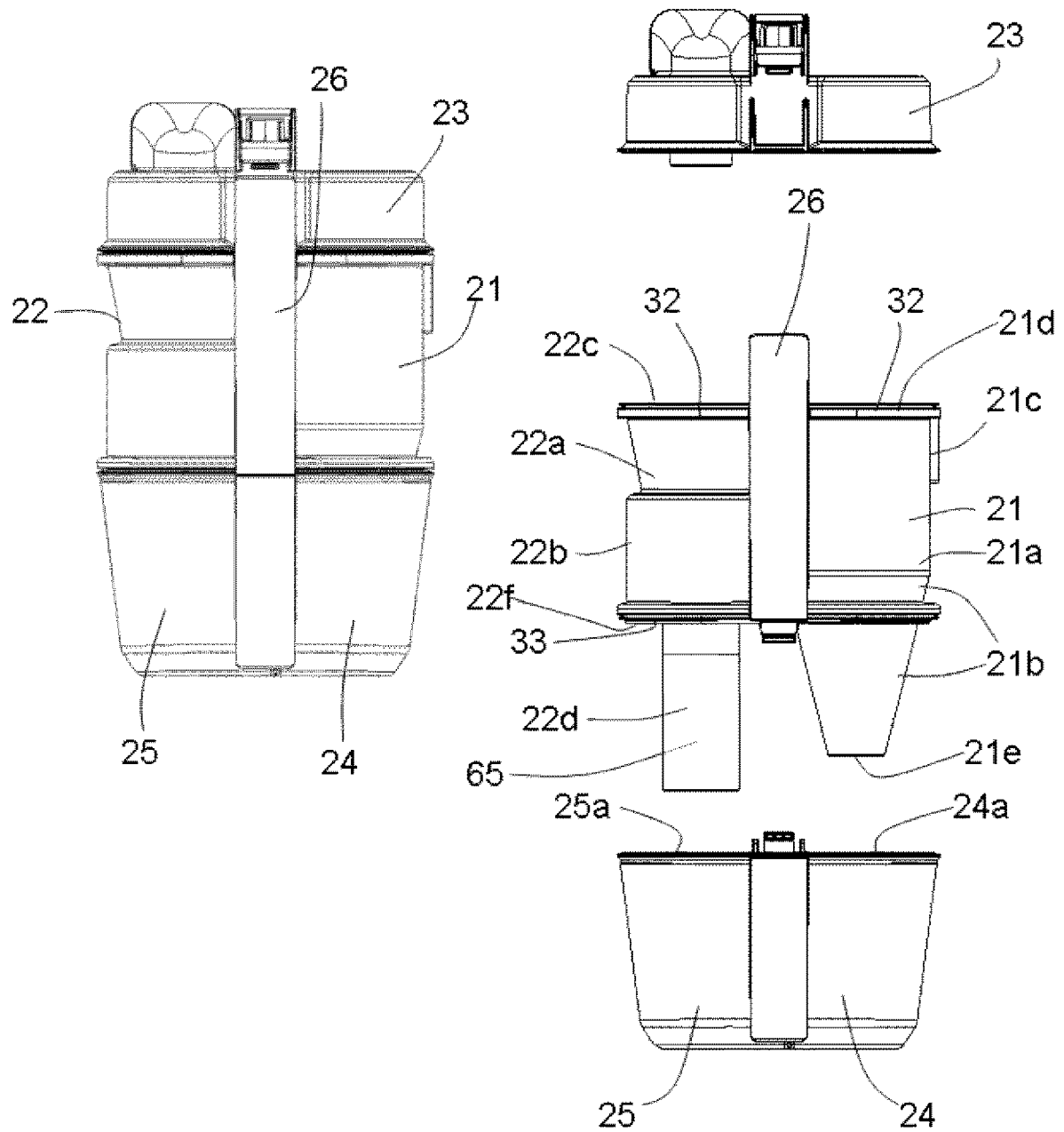


Fig.9

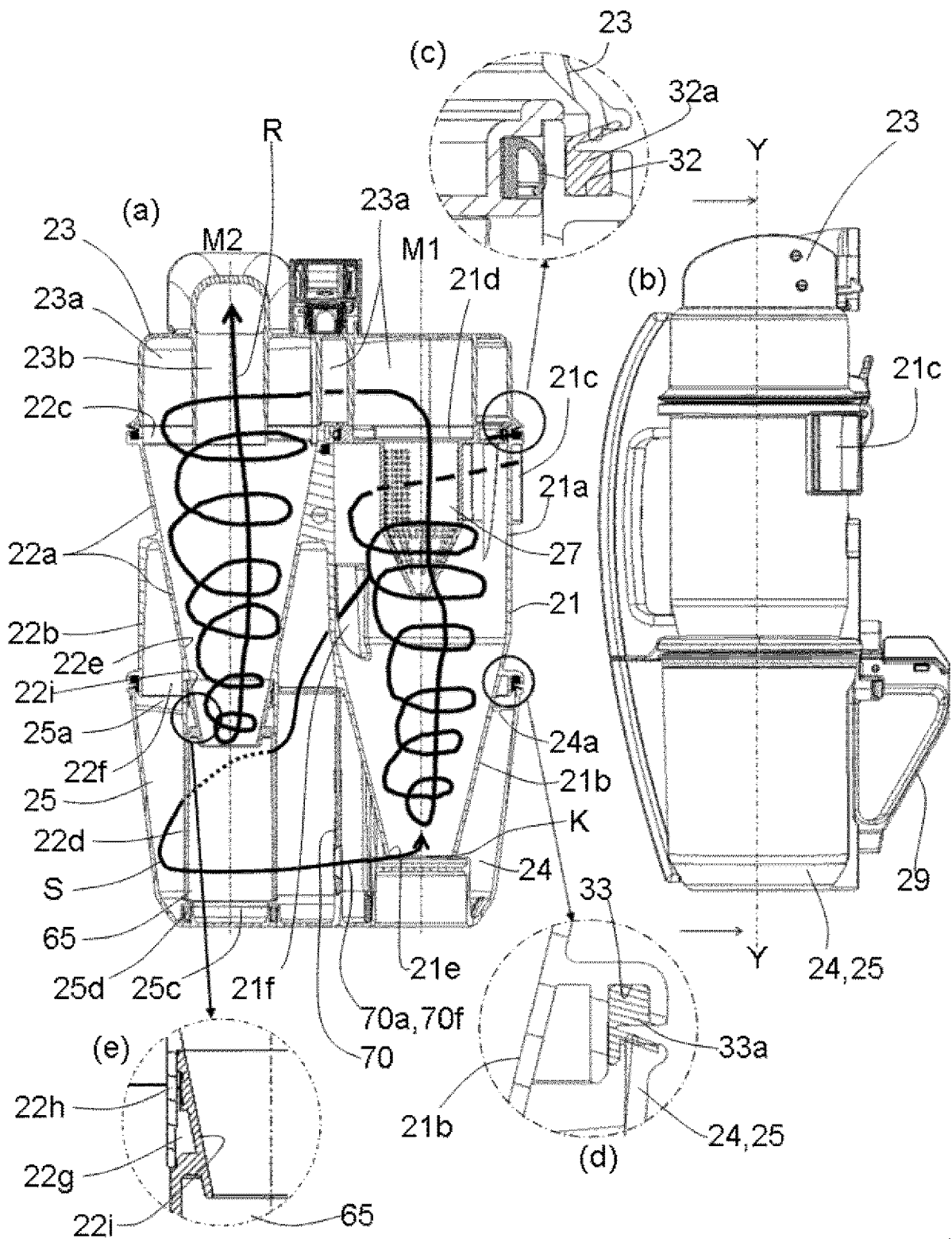


Fig.10

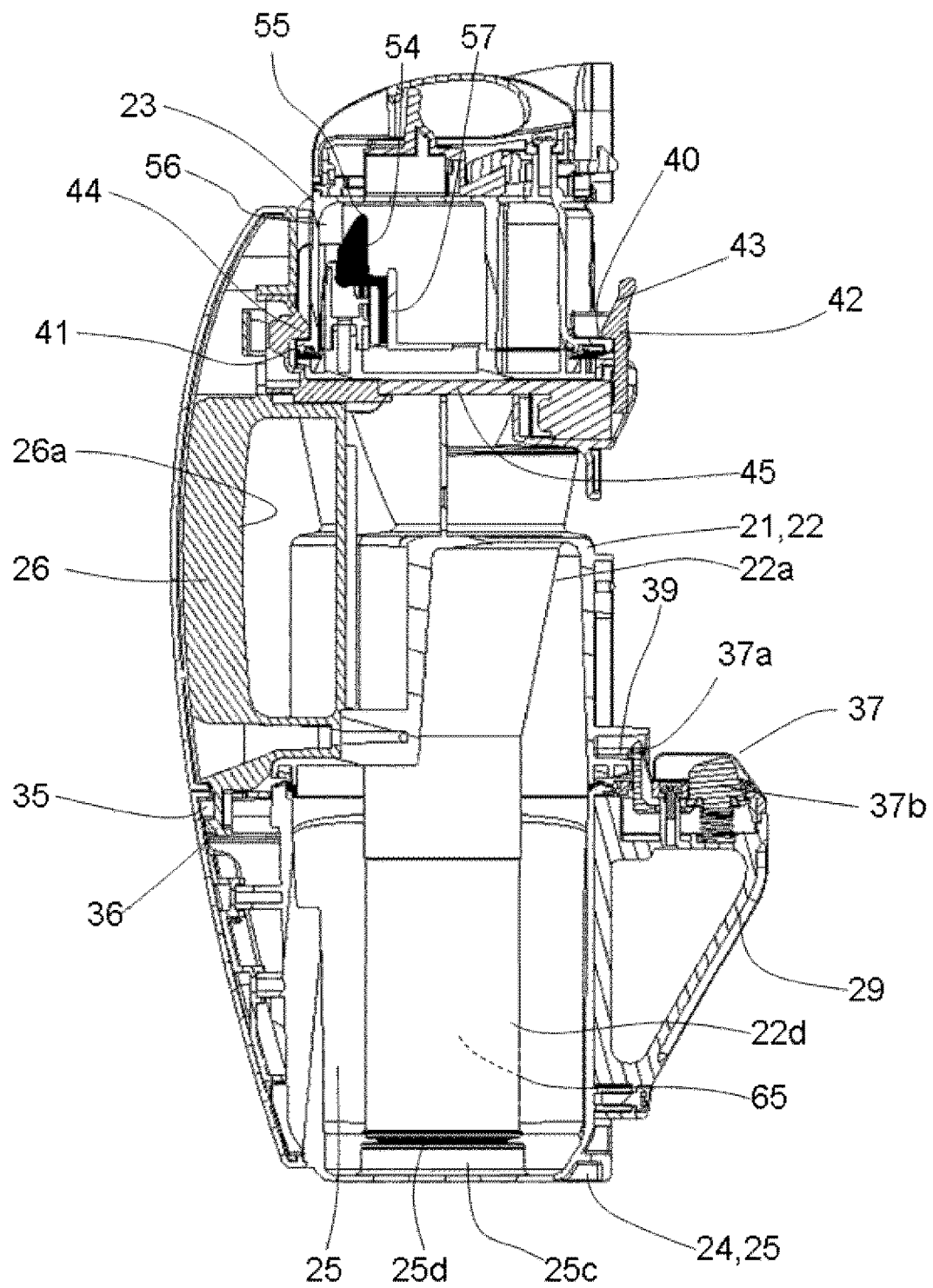


Fig.11

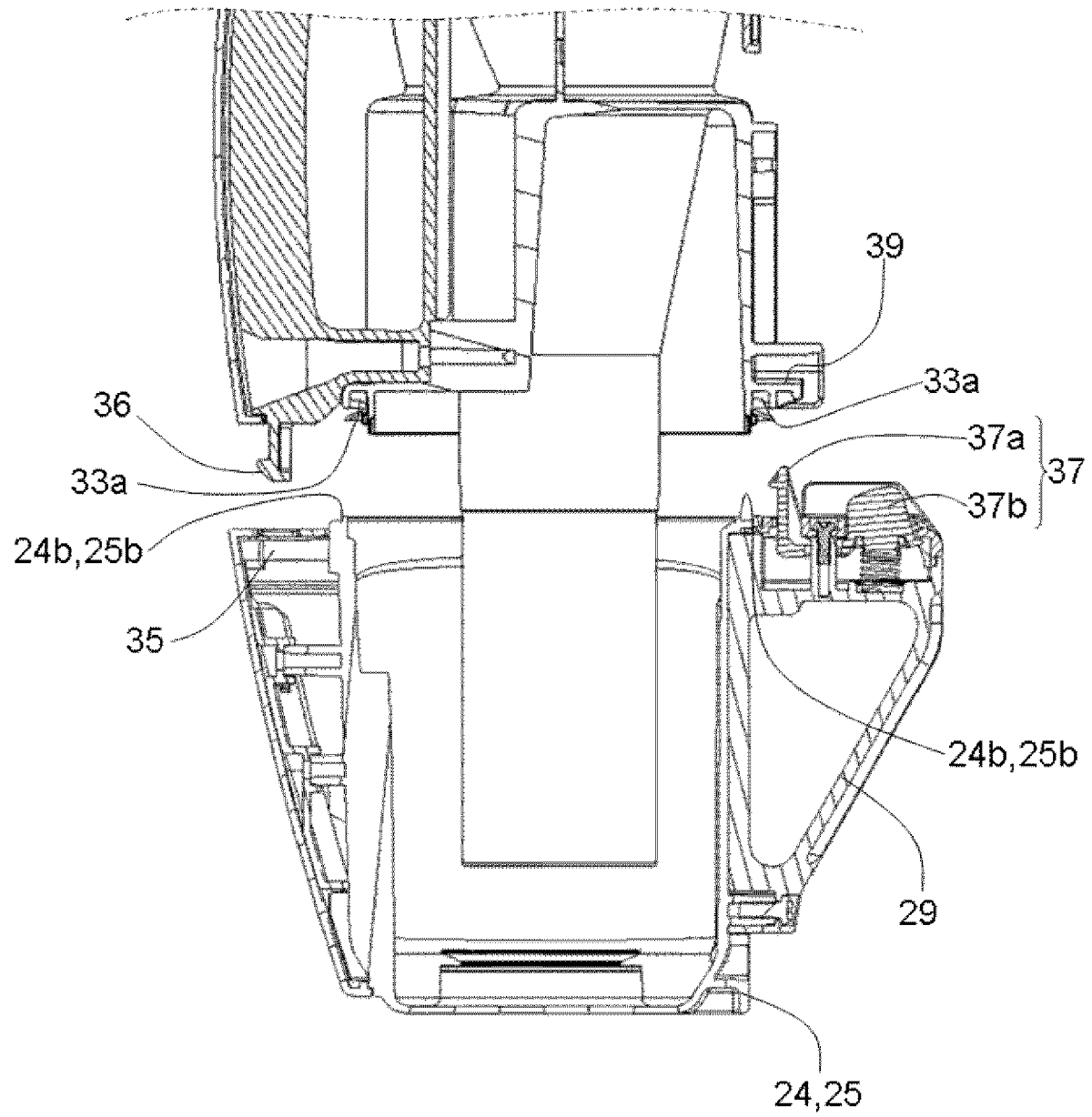


Fig.12

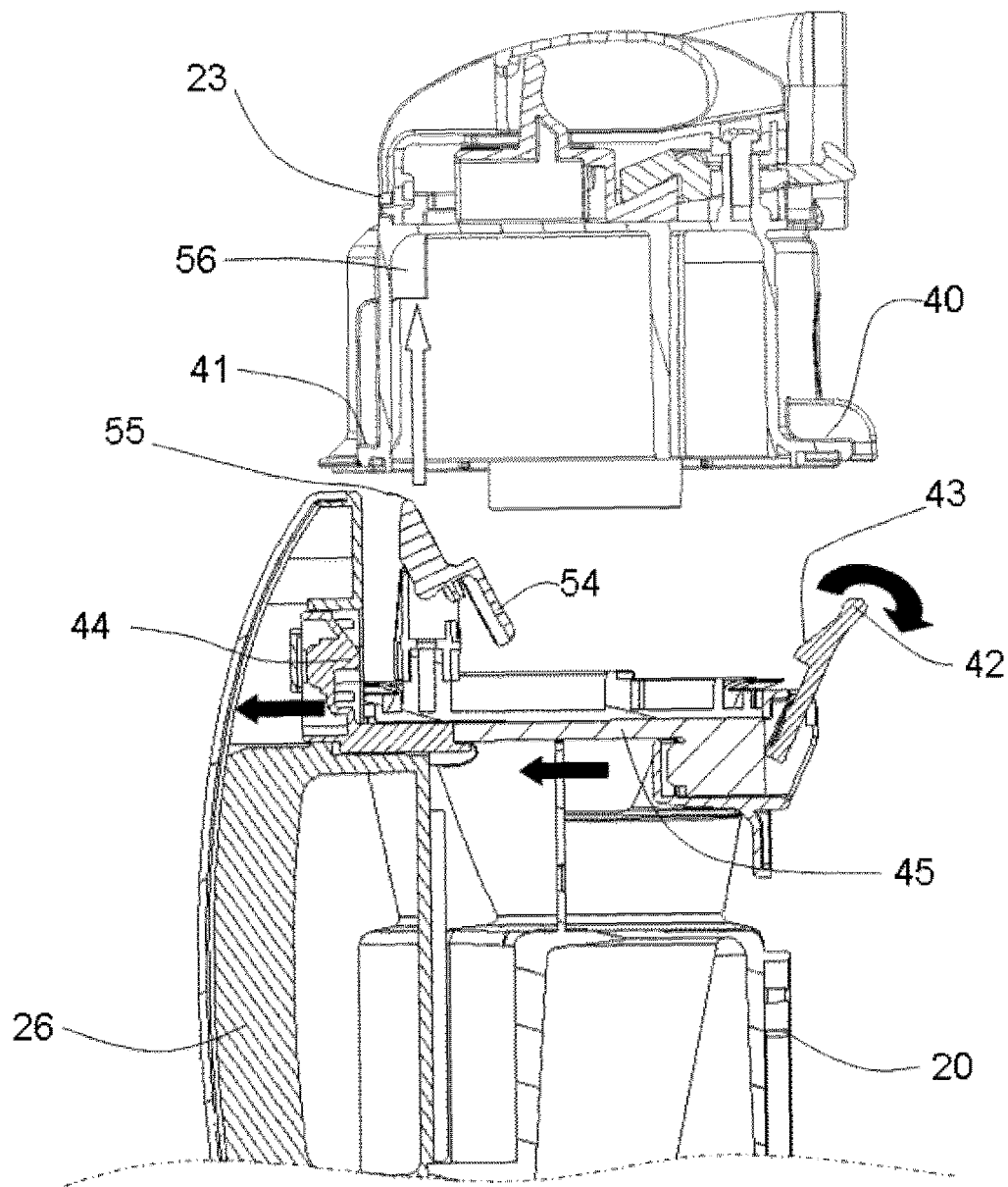


Fig.13

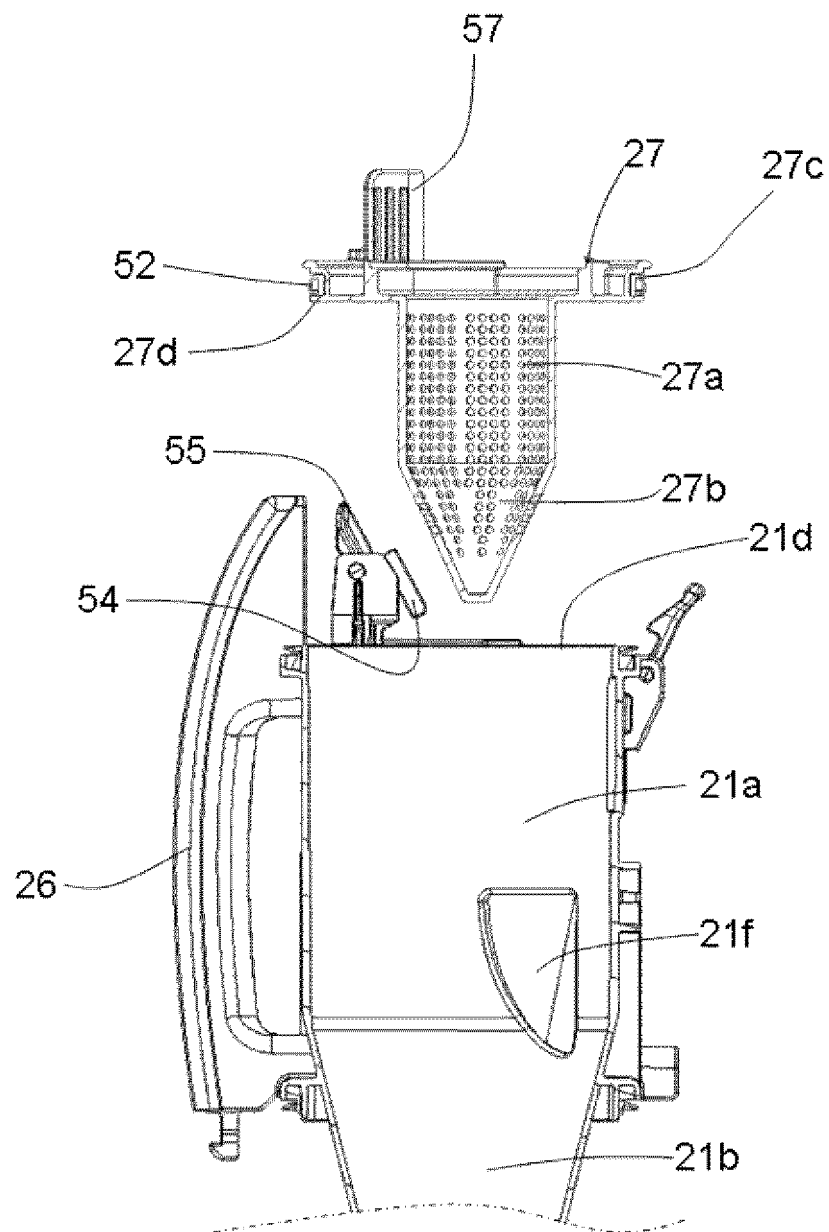


Fig.14

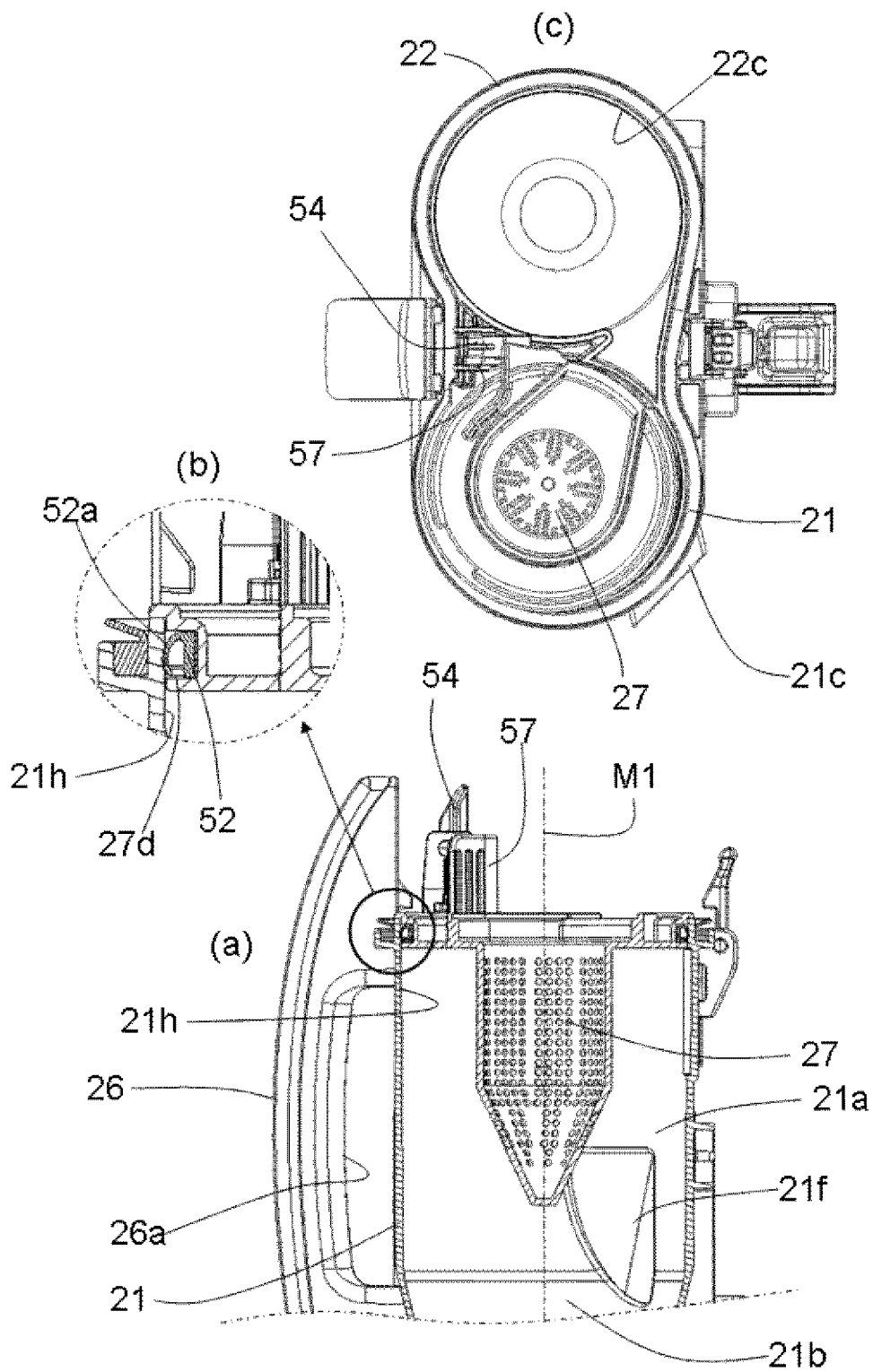


Fig.15

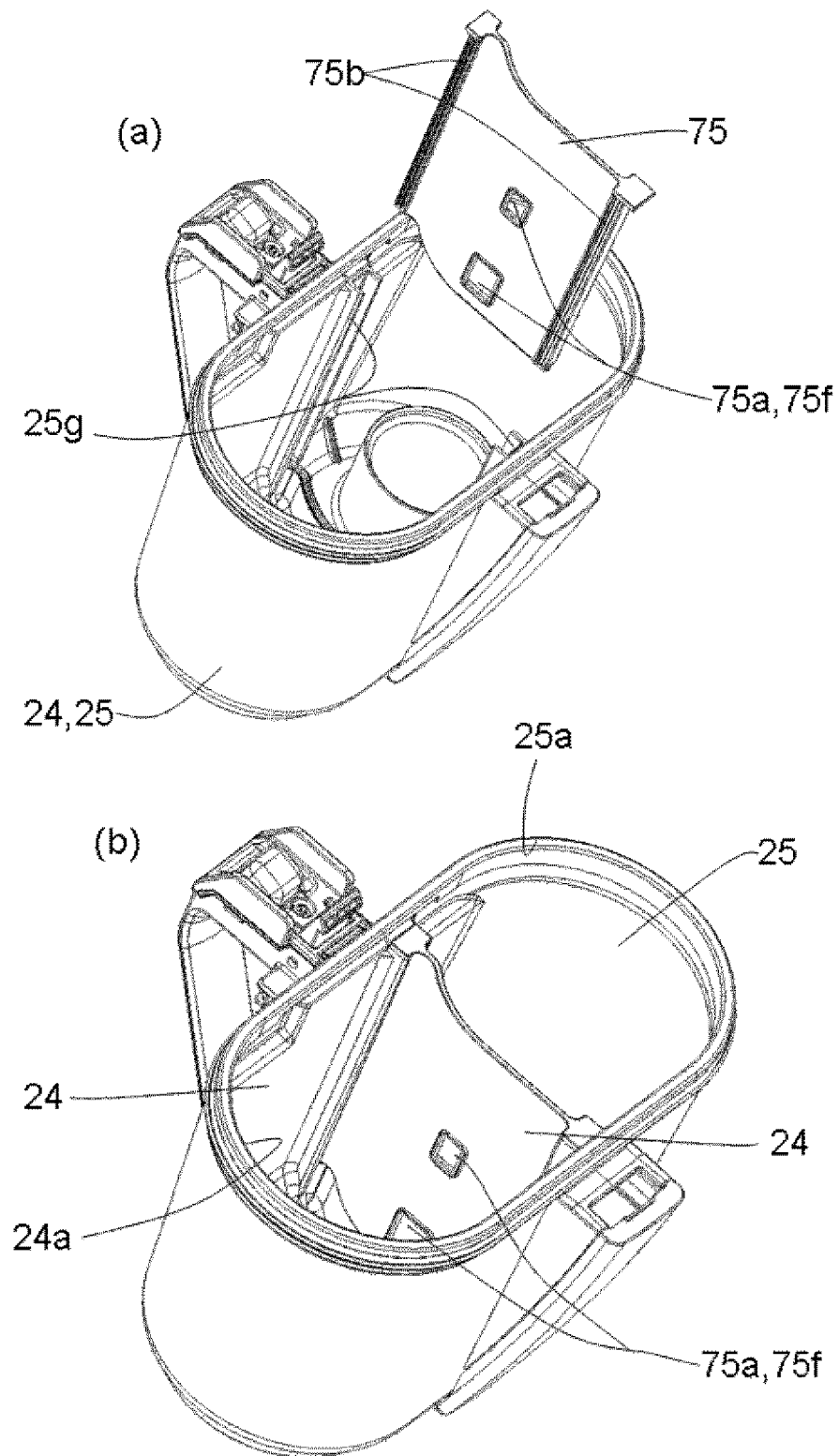


Fig.16



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Application Number
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