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Inventor(s)	Cho; Youngjun et al.

Cleaner

Abstract

A cleaner comprises a housing having a dust collection chamber formed in the housing and configured to open and close, a main body movable relative to the housing between a first position whereby the main body closes the dust collection chamber and a second position whereby the main body opens the dust collection chamber, and a motor filter mountable to and demountable from the main body, wherein the main body includes a fan motor unit to generate a suction force, and a shutter device mountable into the main body and configured to open and close a flow path between the motor filter and the fan motor unit.

Inventors: **Cho; Youngjun (Suwon-si, KR), Kwon; Ohkyu (Suwon-si, KR), Chu; Seongtae (Suwon-si, KR)**

Applicant: **SAMSUNG ELECTRONICS CO., LTD.** (Suwon-si, KR)

Family ID: **1000008762390**

Assignee: **SAMSUNG ELECTRONICS CO., LTD. (Suwon-si, KR)**

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References Cited

U.S. PATENT DOCUMENTS

Patent No.	Issued Date	Patentee Name	U.S. Cl.	CPC
6108864	12/1999	Thomas et al.	N/A	N/A
9521936	12/2015	Holz	N/A	N/A
2019/0167058	12/2018	Cho	N/A	A47L 9/104

FOREIGN PATENT DOCUMENTS

Patent No.	Application Date	Country	CPC
2 292 317	12/2000	CA	N/A
10 2013 101 809	12/2013	DE	N/A
10 2016 124 786	12/2016	DE	N/A
2 064 980	12/2012	EP	N/A
2004-298495	12/2003	JP	N/A
10-1012197	12/2010	KR	N/A
10-1411711	12/2013	KR	N/A
10-2019-0024195	12/2018	KR	N/A
10-2019-0066239	12/2018	KR	N/A
WO 2008/023474	12/2007	WO	N/A

OTHER PUBLICATIONS

Communication from European Patent Office dated Feb. 20, 2024 for corresponding European application 21841980.2. cited by applicant
International Search Report dated Sep. 17, 2021 for International Application No. PCT/KR2021/006469. cited by applicant
Written Opinion of the International Searching Authority dated Sep. 17, 2021 for International Application No. PCT/KR2021/006469. cited by applicant

European Search Report dated Aug. 7, 2023 in European Patent Application No. 21841980.2. cited by applicant

Primary Examiner: Horton; Andrew A

Attorney, Agent or Firm: STAAS & HALSEY LLP

Background/Summary

CROSS-REFERENCE TO RELATED APPLICATION (1) This application is a continuation application, under 35 USC § 111(a), of International Application No. PCT/KR2021/006469, filed on May 25, 2021, which claims priority to Korean Patent Application No. 10-2020-0089008, filed on Jul. 17, 2020, in the Korean Intellectual Property Office, the disclosures of which are incorporated by reference herein in their entirety.

BACKGROUND
1. Field
(1) The present disclosure relates to a cleaner, and more particularly, to a cleaner with an improved structure.
2. Description of Related Art
(2) Cleaners are devices that remove rubbish from indoors to clean an indoor space, and generally, vacuum cleaners are commonly used in households. Vacuum cleaners suction air using the suction force of a fan motor unit and then separate rubbish from the suctioned air using a device such as a filter to clean an indoor space. Such vacuum cleaners include a canister type and an upright type. In recent years, robot vacuums that perform a cleaning task by autonomously traveling around a cleaning area without a user's manipulation and suctioning rubbish such as dust from a surface to be cleaned have become popular.
(3) A vacuum cleaner includes a dust collection device therein so that rubbish is filtered by a predetermined filtering device in order to filter rubbish included in suctioned air. Examples of the filtering device that allows rubbish to be filtered in the dust collection device include a porous filter device which allows rubbish to be forcibly filtered as air passes through a porous filter and a cyclone-type dust collection device which allows rubbish to be filtered during a cyclonic flow of air.
(4) In the vacuum cleaner, rubbish such as human hair or animal hair gets tangled in the dust collection device in the process of being filtered, and a user has to directly separate such rubbish from the dust collection device. Thus, it is unsanitary and inconvenient to use.
SUMMARY
(5) In accordance with one aspect of the present disclosure, a cleaner includes a housing having a dust collection chamber formed in the housing and configured to open and close, a main body movable relative to the housing between a first position whereby the main body closes the dust collection chamber and a second position whereby the main body opens the dust collection chamber, and a motor filter mountable to and demountable the main body, wherein the main body includes a fan motor unit to generate a suction force and a shutter device mountable into the main body and configured to open or close a flow path between the motor filter and the fan motor unit.
(6) The shutter device may be configured to open the flow path between the motor filter and the fan motor unit while the motor filter is mounted into the main body and close the flow path between the motor filter and the fan motor unit while the motor filter is demounted from the main body.
(7) The shutter device may include a shutter door and an elastic body to support the shutter door at a position at which the shutter door closes the flow path between the motor filter and the fan motor

unit.
(8) The shutter door may include a lever to be pressed by the motor filter.
(9) The main body may include a filter case couplable to and decouplable from the fan motor unit and in which the motor filter is mountable to and demountable from the filter case.
(10) The cleaner may further include a sensor to detect whether the flow path between the motor filter and the fan motor unit is blocked and a controller provided to receive information from the sensor and control the fan motor unit.
(11) The fan motor unit may include a fan motor, the sensor measures revolutions per minute of the fan motor, and the controller is configured to stop the fan motor in response to the revolutions per minute of the fan motor measured by the sensor being higher than a predetermined revolutions per minute.
(12) The sensor measures a flow rate of air passing through the fan motor unit, and the controller may be provided to stop the fan motor in response to the flow rate of the air measured by the sensor being lower than a predetermined flow rate.
(13) The sensor measures a vacuum level inside the fan motor unit, and the controller configured to stop the fan motor in response to the vacuum level of the fan motor unit measured by the sensor being higher than a predetermined vacuum level.
(14) The controller may be disposed on one end of the fan motor unit that is opposite to one end of the fan motor unit where the shutter device is disposed.
(15) The main body may include a rubbish removal member movable in the dust collection chamber and an opening/closing device to open or close the dust collection chamber and configured to operate in conjunction with the rubbish removal member.
(16) The dust collection chamber may be a first dust collection chamber, the main body may include a rubbish separation device provided to remove rubbish from air which has passed through the first dust collection chamber, and a second dust collection chamber in which rubbish separated from the rubbish separation device is collected inside the housing.
(17) The rubbish removal member may be a first rubbish removal member, and the main body may include a second rubbish removal member to slide in the second dust collection chamber and the first dust collection chamber to discharge rubbish from the second dust collection chamber while the main body moves from the first position to the second position.
(18) The rubbish separation device may be disposed on one side of the motor filter, and the fan motor unit may be disposed on another side of the motor filter that is opposite to the one side.
(19) The second dust collection chamber may be disposed a side of the rubbish separation device that is opposite to one side of the rubbish separation device where the motor filter is disposed, and the first dust collection chamber may be disposed on another side of the second dust collection chamber that is opposite to one side of the second dust collection chamber where the rubbish separation device is disposed.
(20) In accordance with another aspect of the present disclosure, a cleaner includes a housing having a dust collection chamber provided therein, a main body provided to be movable relative to the housing between a first position closing the dust collection chamber and a second position opening the dust collection chamber, and a motor filter detachably mounted in the main body, wherein the main body includes a filter case provided so that the motor filter is mounted therein, a fan motor unit provided to generate suction force, and a shutter device provided to allow the filter case and the fan motor unit to communicate while the motor filter is mounted in the filter case and partition the filter case and the fan motor unit from each other while the motor filter is separated from the filter case.
(21) The cleaner may further include a sensor provided to detect whether the filter case and the fan motor unit communicate and a controller provided to receive information from the sensor and control the fan motor unit.
(22) The sensor may be provided to measure a driving state of a fan motor disposed in the fan

motor unit or measure an internal state of the fan motor unit.
(23) The shutter device may include a shutter opening provided to be able to communicate with the filter case and a shutter door provided to close the shutter opening while the filter case is separated from the fan motor unit.
(24) The shutter device may include an elastic body provided to press the shutter door in a direction in which the shutter door closes the shutter opening.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
(1) The above and other aspects, features, and advantages of certain embodiments of the present disclosure will be more apparent from the following description taken in conjunction with the accompanying drawings, in which:
(2) FIG. **1** is a perspective view of a cleaner according to one embodiment of the present disclosure.
(3) FIG. **2** is an exploded view of the cleaner illustrated in FIG. **1**.
(4) FIG. **3** is a cross-sectional view of the cleaner illustrated in FIG. **1**.
(5) FIG. **4** is an enlarged view of portion A shown in FIG. **3**.
(6) FIG. **5** is an enlarged view of portion B shown in FIG. **3**.
(7) FIG. **6** is a view illustrating a state in which dust is emptied from the cleaner illustrated in FIG. **1**.
(8) FIG. **7** is a view illustrating a state in which a shutter device illustrated in FIG. **5** is separated from a first body.
(9) FIG. **8** is a view illustrating a state in which a second body having a motor filter illustrated in FIG. **5** mounted therein is coupled to the first body.
(10) FIG. **9** is a view illustrating an operation of the shutter device when the second body illustrated in FIG. **8** is coupled to the first body.
(11) FIG. **10** is a view illustrating a state of the shutter device while the motor filter illustrated in FIG. **5** is not mounted in the main body.
(12) FIG. **11** is a control block diagram of the cleaner illustrated in FIG. **1**.
(13) FIG. **12** is a flowchart illustrating a process in which the cleaner illustrated in FIG. **1** is selectively operated according to whether the motor filter is present which is detected by measuring a revolutions per minute of a fan motor.
(14) FIG. **13** is a flowchart illustrating a process in which the cleaner illustrated in FIG. **1** is selectively operated according to whether the motor filter is present which is detected by measuring a flow rate of air passing through a fan motor unit.
(15) FIG. **14** is a flowchart illustrating a process in which the cleaner illustrated in FIG. **1** is selectively operated according to whether the motor filter is present which is detected by measuring a vacuum level inside the fan motor unit.
DETAILED DESCRIPTION
(16) Embodiments described herein and configurations illustrated in the drawings are merely exemplary embodiments of the present disclosure, and various modifications which may replace the embodiments and the drawings herein may be present at the time of filing this application.
(17) Like reference numerals or symbols presented in each drawing herein indicate parts or elements that perform substantially the same functions.
(18) Terms used herein are for describing the embodiments and are not intended to limit and/or restrict the disclosure. A singular expression includes a plural expression unless context clearly indicates otherwise. In the application, terms such as “include” or “have” should be understood as designating that features, number, steps, operations, elements, parts, or combinations thereof are

present and not as precluding the possibility of the presence or addition of one or more other features, numbers, steps, operations, elements, parts, or combinations thereof in advance.
(19) Terms including ordinals such as first and second may be used herein to describe various elements, but the elements are not limited by the terms. The terms are only used for the purpose of distinguishing one element from another element. For example, a first element may be referred to as a second element while not departing from the scope of the present disclosure, and likewise, a second element may also be referred to as a first element. The term “and/or” includes a combination of a plurality of associated listed items or any one item among the plurality of associated listed items.
(20) It is an aspect of the present disclosure to provide a cleaner allowing rubbish collected in a dust collection chamber to be easily discharged.
(21) It is another aspect of the present disclosure to provide a cleaner preventing damage to a fan motor unit due to an erroneous operation.
(22) According to one aspect of the present disclosure, since a cleaner is provided so that a dust collection chamber is opened or closed as a main body slides relative to a housing, rubbish collected in the dust collection chamber can be easily discharged.
(23) According to one aspect of the present disclosure, since a cleaner is provided so that a shutter device is opened while a motor filter is mounted, damage to a fan motor unit due to an erroneous operation can be prevented.
(24) Hereinafter, embodiments according to the present disclosure will be described in detail with reference to the accompanying drawings. In FIG. **1**, a portion where a suction head **10** is disposed may be defined as the front, and a portion where a handle **90** is disposed may be defined as the rear. That is, air may be defined as being introduced through the front of a cleaner **1** and discharged through the rear. However, the shape and position of each element are not limited by the terms defined as above.
(25) FIG. **1** is a perspective view of a cleaner according to one embodiment of the present disclosure. FIG. **2** is an exploded view of the cleaner illustrated in FIG. **1**. FIG. **3** is a cross-sectional view of the cleaner illustrated in FIG. **1**. FIG. **4** is an enlarged view of portion A shown in FIG. **3**. FIG. **5** is an enlarged view of portion B shown in FIG. **3**. FIG. **6** is a view illustrating a state in which dust is emptied from the cleaner illustrated in FIG. **1**.
(26) Referring to FIGS. **1** and **2**, the cleaner **1** may include the suction head **10** provided to, using suction force of air, suction rubbish such as human hair from a surface to be cleaned, a housing **20** connected to the suction head **10**, and a main body **30** movably provided inside the housing **20**.
(27) The suction head **10** is provided to suction rubbish, such as dust present on a surface to be cleaned, while moving on the surface to be cleaned. The suction head **10** may include a head assembly **11**, a neck portion **12**, and a head switch **13**.
(28) An air flow path may be formed inside the head assembly **11**. The air flow path formed inside the head assembly **11** may communicate with the housing **20** through the neck portion **12**. Outside air and rubbish introduced through the head assembly **11** may move into the housing **20** through the neck portion **12**.
(29) The neck portion **12** may be connected to a lower end portion of the housing **20**. The neck portion **12** may be rotatably coupled to the head assembly **11**. As the neck portion **12** rotates relative to the head assembly **11**, the head assembly **11** may rotate relative to the housing **20** connected to the neck portion **12**. Accordingly, a degree of freedom of driving the cleaner **1** can be improved.
(30) The head switch **13** is provided to fix or release a coupling state between the suction head **10** and the housing **20**. A user may operate the head switch **13** to separate the housing **20** from the suction head **10**. As the head switch **13** is disposed on the suction head **10**, the user may separate the housing **20** from the suction head **10** by operating the head switch **13** using his or her foot without bending the waist.

(31) The housing **20** may form a portion of an exterior of the cleaner **1**. The housing **20** may have one end portion **21** mounted on the suction head **10**. The housing **20** may include a hollow **22** formed so that the main body **30** is movably inserted thereinto.
(32) Referring to FIGS. **3** and **5**, a button device **26** configured to fix the position of the main body **30** relative to the housing **20** may be provided in the housing **20**. By operating the button device **26** and releasing the main body **30** from the housing **20**, a user may move the main body **30** relative to the housing **20**.
(33) The main body **30** may be slidably coupled to the housing **20**. The main body **30** may be provided to be movable relative to the housing **20** between a first position at which the main body **30** closes dust collection chambers **81** and **82** and a second position at which the main body **30** opens the dust collection chambers **81** and **82**.
(34) A guide device **29** may be provided between the housing **20** and the main body **30**. The guide device **29** may guide and support movement of the main body **30** relative to the housing **20**.
(35) The main body **30** may include an extension **31** forming a portion of the exterior of the cleaner **1**. A space **31***a* configured to accommodate a wire which extends toward a manipulation switch **91** may be formed inside the extension **31**.
(36) The handle **90** may be disposed on a rear end portion of the extension **31**. The handle **90** may be disposed on the other end of the main body **30** that is opposite to one end of the main body **30** where an opening/closing device **60** is disposed. A user may push or pull the suction head **10** while holding the handle **90** when using the cleaner **1**.
(37) The manipulation switch **91** for controlling an operation of the cleaner may be provided in the handle **90**. The manipulation switch **91** is provided to receive a command for operating the cleaner **1** from a user. The manipulation switch **91** may be disposed adjacent to the handle **90** so that, when cleaning, the user may operate the cleaner **10** while moving the cleaner **1**.
(38) The main body **30** may include a battery mounting portion **32**. A battery **33** may be mounted on the battery mounting portion **32**. The battery **33** may be provided as a single battery or two or more batteries. The battery mounting portion **32** may be disposed inside the housing **20**.
(39) A fan motor unit **40** configured to generate suction force necessary for suctioning rubbish from a surface to be cleaned may be provided in the main body **30**. The fan motor unit **40** may be configured to cause outside air to be introduced through the suction head **10** and discharged through exhaust ports **23** and **24** of the housing **20**. The fan motor unit **40** may be disposed inside the housing **20** while mounted in the main body **30**. The fan motor unit **40** may include a fan motor **42**.
(40) Referring to FIGS. **2** to **4**, while the main body **30** is coupled to the housing **20**, a first dust collection chamber **81** and a second dust collection chamber **82** may be formed in the cleaner **1**. Specifically, while the main body **30** is at the first position relative to the housing **20**, the first dust collection chamber **81** and the second dust collection chamber **82** may be formed in the cleaner **1**.
(41) An outer case **83** forming the dust collection chambers **81** and **82** and an inner case **84** disposed inside the outer case **83** may be provided inside the housing **20**. The outer case **83** may be disposed between the housing **20** and the inner case **84**.
(42) The outer case **83** may form a case flow path **85** together with the inner case **84**. The case flow path **85** may guide air, which has passed through the first dust collection chamber **81**, to the second dust collection chamber **82**.
(43) The inner case **84** may be disposed inside the outer case **83**. The first dust collection chamber **81** may be formed inside the inner case **84**. A filtering device **86** may be provided in the inner case **84**. The first dust collection chamber **81** may collect rubbish filtered while air introduced through the suction head **10** passes through the filtering device **86**.
(44) The filtering device **86** may primarily filter rubbish from air introduced through the suction head **10**. The filtering device **86** may extend along a portion of an inner side surface of the inner case **84**. The rubbish filtered by the filtering device **86** may be collected in the first dust collection

chamber **81**. The filtering device **86** may be provided as a mesh member.
(45) The inner case **84** may include a case opening **87** through which air guided through the case flow path **85** is introduced into a rubbish separation device **51**.
(46) Air introduced into the rubbish separation device **51** through the case opening **87** may be secondarily filtered in the rubbish separation device **51**. Rubbish filtered by the rubbish separation device **51** may be collected in the second dust collection chamber **82**. Air filtered in the rubbish separation device **51** may move toward a motor filter **46**.
(47) The main body **30** may include the opening/closing device **60** configured to open or close the first dust collection chamber **81**. The opening/closing device **60** may be disposed on an end portion of the main body **30** that faces the suction head **10**. The opening/closing device **60** may be configured to operate in conjunction with a first rubbish removal member **70** and a second rubbish removal member **75**.
(48) As the opening/closing device **60** operates in conjunction with the first rubbish removal member **70** and/or the second rubbish removal member **75**, the first dust collection chamber **81** can be prevented from being opened unintentionally, and the dust collection chambers **81** and **82** can be opened only when it is attempted to discharge rubbish. The opening/closing device **60** may include an opening/closing member **61**, an opening/closing cover **62**, and an opening/closing sealing member **63**.
(49) The opening/closing device **60** may be provided to, in response to the first rubbish removal member **70** being withdrawn by sliding from the first dust collection chamber **81**, move in a direction moving away from the housing **20** in order to open the first dust collection chamber **81**. The opening/closing device **60** may be provided to, in response to the first rubbish removal member **70** being inserted by sliding to the first dust collection chamber **81**, move in a direction approaching the housing **20** in order to close the first dust collection chamber **81**.
(50) The opening/closing member **61** may open or close the first dust collection chamber **81** as the main body **30** slides relative to the housing **20**. The opening/closing member **61** may include a chamber inlet **61***a* formed so that air introduced from the suction head **10** is introduced into the first dust collection chamber **81**. The chamber inlet **61***a* may be opened or closed by the opening/closing cover **62**.
(51) The opening/closing cover **62** may be configured to include an elastic material. The opening/closing cover **62** may open the chamber inlet **61***a* in a direction in which air is introduced into the first dust collection chamber **81**. On the other hand, the opening/closing cover **62** may be provided to not open the chamber inlet **61***a* in a direction opposite to the direction in which air is introduced into the first dust collection chamber **81**. That is, the opening/closing cover **62** may open the chamber inlet **61***a* while the cleaner **1** suctions rubbish from a surface to be cleaned but may not open the chamber inlet **61***a* in a direction in which dust is discharged from the first dust collection chamber **81**. Accordingly, scattering of rubbish can be prevented during separation of the housing **20** from the suction head **10**.
(52) The opening/closing cover **62** may include a cover hinge portion **62***a*. While the fan motor unit **40** generates suction force, the opening/closing cover **62** may be elastically deformed and open the chamber inlet **61***a* in a state in which the cover hinge portion **62***a* is fixed. While the fan motor unit **40** does not generate suction force, the opening/closing cover **62** may return to a position closing the chamber inlet **61***a* due to an elastic force.
(53) The opening/closing sealing member **63** may be provided to seal between the inner case **84** and the opening/closing member **61**. The opening/closing sealing member **63** may be disposed along an edge of the opening/closing member **61**. The opening/closing sealing member **63** may be configured to include an elastic material. The opening/closing sealing member **63** may be configured to include a material that is more flexible than the opening/closing member **61**. The opening/closing sealing member **63** may seal the first dust collection chamber **81** while in close contact with the inner side surface of the inner case **84**. Accordingly, the cleaner **1** according to one

embodiment of the present disclosure can prevent rubbish from spilling from the first dust collection chamber **81**.

(54) The main body **30** may include the first rubbish removal member **70** provided to discharge rubbish from the first dust collection chamber **81**. The first rubbish removal member **70** may be provided to slide in the first dust collection chamber **81**. The first rubbish removal member **70** may include a first mounting portion **71** and a first rubbish remover **72** mounted on the first mounting portion **71**.

(55) The first rubbish remover **72** may be configured to include an elastic material. The first rubbish remover **72** may be formed to come in close contact with an inner wall of the filtering device **86**. The first rubbish remover **72** may be provided to come in close contact with one surface of the filtering device **86** on which rubbish is filtered. While the main body **30** slides relative to the housing **20**, the first rubbish remover **72** may slide in close contact with an inner surface of the filtering device **86**. While the main body **30** slides into the housing **20**, the first rubbish remover **72** may scratch an inner side surface of the filtering device **86** and remove rubbish, such as tangled human hair, from the inner side surface of the filtering device **86**.

(56) The first rubbish removal member **70** may move from a first position between the filtering device **86** and the rubbish separation device **51** to a second position at which the first rubbish removal member **70** protrudes to an outside of the housing **20**. Accordingly, the first rubbish removal member **70** may discharge rubbish present in the first dust collection chamber **81** to the outside. Further, as the first rubbish removal member **70** protrudes to the outside of the housing **20**, dust collected in the second dust collection chamber **82** may also be discharged to the outside.

(57) The main body **30** may include a first connector **69** configured to connect the first rubbish removal member **70** and the opening/closing device **60**. The first connector **69** may be disposed in the first dust collection chamber **81**. The first rubbish removal member **70** and the opening/closing device **60** may operate in conjunction with each other by the first connector **69**.

(58) Referring to FIG. **6**, a discharge opening **68** may be formed between a plurality of first connectors **69**. The discharge opening **68** may be formed between the first rubbish removal member **70** and the opening/closing device **60**. In response to the opening/closing device **60** opening the first dust collection chamber **81** and the first rubbish removal member **70** discharging rubbish from the first dust collection chamber **81**, rubbish may be discharged to the outside through the discharge opening **68**.

(59) The main body **30** may include the rubbish separation device **51**. The rubbish separation device **51** may include a cyclone. The rubbish separation device **51** may centrifuge rubbish not filtered in the first dust collection chamber **81** from air. Since the rubbish separation device **51** uses a different method, as compared to the filtering device **86**, to separate rubbish from air which has passed through the filtering device **86**, cleaning efficiency of the cleaner **1** according to one embodiment of the present disclosure can be improved.

(60) The main body **30** may include the second rubbish removal member **75** provided to discharge rubbish from the second dust collection chamber **82**. The second rubbish removal member **75** may be provided to slide in the second dust collection chamber **82** and the first dust collection chamber **81**. The second dust collection chamber **82** may be formed between the first rubbish removal member **70** and the second rubbish removal member **75**. The second rubbish removal member **75** may include a second mounting portion **76** and a second rubbish remover **77** mounted on the second mounting portion **76**.

(61) The second rubbish remover **77** may be configured to include an elastic material. While the main body **30** slides relative to the housing **20**, the second rubbish remover **77** may slide in close contact with the inner side surface of the inner case **84** to discharge rubbish from the second dust collection chamber **82**. While the main body **30** slides relative to the housing **20**, the second rubbish remover **77** may slide in close contact with the inner side surface of the inner case **84** and completely empty the second dust collection chamber **82** of rubbish.

(62) The main body **30** may include a second connector **79** configured to connect the first rubbish removal member **70** and the second rubbish removal member **75**. The second connector **79** may be disposed in the second dust collection chamber **82**. The second rubbish removal member **75** and the first rubbish removal member **70** may operate in conjunction with each other by the second connector **79**.
(63) The motor filter **46** may be provided in the main body **30**. The motor filter **46** may be provided to filter rubbish one more time from air before the air is introduced into the fan motor unit **40**. The motor filter **46** may be disposed in front of the fan motor unit **40** in a direction in which air which has passed through the rubbish separation device **51** is discharged. The motor filter **46** may be disposed between the fan motor unit **40** and the rubbish separation device **51**. The motor filter **46** may filter rubbish from air which has passed through the rubbish separation device **51**. The motor filter **46** may be provided as a mesh member.
(64) The motor filter **46** may be detachably mounted in a filter case **47**. The motor filter **46** may be disposed inside the housing **20** while mounted in the filter case **47**. By the motor filter **46**, the cleaner **1** according to one embodiment of the present disclosure can prevent damage to the fan motor unit **40** due to rubbish or the like and can discharge relatively clean air.
(65) The main body **30** may include a shutter device **110** provided to open or close a flow path along which air which has passed through the motor filter **46** moves to the fan motor unit **40**. The shutter device **110** will be described below.
(66) The fan motor unit **40** may be provided to generate suction force in the first dust collection chamber **81** and the second dust collection chamber **82**. Air which has passed through the motor filter **46** may pass through the fan motor unit **40** and then be discharged from the housing **20**.
(67) Referring to FIG. **2**, the main body **30** of the cleaner **1** according to one embodiment of the present disclosure may include a first body **101** and a second body **102** detachably coupled to the first body **101**. The first body **101** may include the handle **90**, the extension **31**, the battery mounting portion **32**, and the fan motor unit **40**. The second body **102** may include the opening/closing device **60**, the first rubbish removal member **70**, the second rubbish removal member **75**, the rubbish separation device **51**, and the filter case **47**.
(68) In the cleaner **1** according to one embodiment of the present disclosure, since the fan motor unit **40** which is relatively heavier than the battery **33** is disposed below the battery **33**, the center of mass may be positioned relatively low. Accordingly, since the center of mass may be positioned relatively low, convenience of use of the cleaner **1** according to one embodiment of the present disclosure can be improved.
(69) In the cleaner **1** according to one embodiment of the present disclosure, one portion of the main body **30** where the fan motor unit **40** is disposed may be provided to be partitioned from the battery mounting portion **32**. That is, air flowing due to the fan motor unit **40** is immediately discharged through a motor exhaust port **41** and the exhaust ports **23** and **24** of the housing **20** without moving to the battery mounting portion **32** and the handle **90**. Accordingly, the cleaner **1** according to one embodiment of the present disclosure can minimize the amount of discharged air heading toward a user.
(70) A controller **36** may be disposed between the fan motor unit **40** and the battery mounting portion **32**. The controller **36** may be provided as a printed board assembly (PBA). The controller **36** may be provided to control the operation of the cleaner **1**.
(71) According to the above-described configuration, in a case in which the cleaner **1** according to one embodiment of the present disclosure performs a cleaning operation, air including rubbish introduced from the suction head **10** may be primarily filtered in the filtering device **86** of the first dust collection chamber **81**. Then, air which has moved to the rubbish separation device **51** through the case flow path **85** may be secondarily filtered. The air filtered in the rubbish separation device **51** may be collected in the second dust collection chamber **82**. Air which has passed through the rubbish separation device **51** may be tertiarily filtered while passing through the motor filter **46** and

then pass through the fan motor unit **40**. The air which has passed through the fan motor unit **40** may be discharged through the motor exhaust port **41** and the exhaust ports **23** and **24** of the housing **20**.

(72) Referring to FIG. **6**, when it is attempted to empty the rubbish collected in the dust collection chambers **81** and **82** after a cleaning task has ended, the user may slide the main body **30** relative to the housing **20**. Here, the user may operate the button device **26** to move the main body **30**.

(73) While the main body **30** slides inside the housing **20**, the opening/closing device **60** disposed on one end portion of the main body **30** opens the first dust collection chamber **81**, the first rubbish removal member **70** slides on one surface of the filtering device **86** on which rubbish is present, and the second rubbish removal member **75** slides on an inner surface of the second dust collection chamber **82** and the one surface of the filtering device **86** on which rubbish is present. The first rubbish removal member **70** may separate the rubbish present on the filtering device **86** and discharge the separated rubbish to an outside of the first dust collection chamber **81**. The second rubbish removal member **75** may, while discharging rubbish in the second dust collection chamber **82** to the outside, secondarily separate the rubbish present on the filtering device **86** and discharge the separated rubbish to the outside of the first dust collection chamber **81**.

(74) To this end, the first rubbish removal member **70** and the second rubbish removal member **75** may move to positions at which the first rubbish removal member **70** and the second rubbish removal member **75** protrude to the outside of the housing **20**. On the other hand, the main body **30** may move so that only the opening/closing device **60** is exposed to the outside of the housing **20** and the first rubbish removal member **70** and the second rubbish removal member **75** are not exposed to the outside of the housing **20**. Also, the main body **30** may move so that only the opening/closing device **60** and the first rubbish removal member **70** are exposed to the outside of the housing **20** and the second rubbish removal member **75** is not exposed to the outside of the housing **20**.

(75) Then, upon completion of discharge of dust from the dust collection chambers **81** and **82**, the user may move the handle **90** of the main body **30** in a direction moving away from the housing **20**, and accordingly, the opening/closing device **60** moves to a position closing the first dust collection chamber **81**. Further, the button device **26** may fix the position of the main body **30** relative to the housing **20**.

(76) According to such a configuration, the cleaner **1** according to one embodiment of the present disclosure may easily empty rubbish from the dust collection chambers **81** and **82** by a relatively simple operation. Further, since the opening/closing device **60** is provided to open or close the dust collection chambers **81** and **82** only while rubbish is discharged from the dust collection chambers **81** and **82**, scattering of rubbish can be prevented even when the housing **20** is separated from the suction head **10**.

(77) FIG. **7** is a view illustrating a state in which a shutter device illustrated in FIG. **5** is separated from a first body. FIG. **8** is a view illustrating a state in which a second body having a motor filter illustrated in FIG. **5** mounted therein is coupled to the first body. FIG. **9** is a view illustrating an operation of the shutter device when the second body illustrated in FIG. **8** is coupled to the first body. FIG. **10** is a view illustrating a state of the shutter device while the motor filter illustrated in FIG. **5** is not mounted in the main body.

(78) Referring to FIGS. **7** and **8**, the shutter device **110** may be provided in the fan motor unit **40**. The shutter device **110** may be provided to open or close a flow path between the motor filter **46** and the fan motor unit **40**.

(79) The shutter device **110** may be disposed on a coupling portion **43** coupled to the second body **102** of the fan motor unit **40**. The second body **102** may be coupled to the coupling portion **43** of the fan motor unit **40** of the first body **101**. The shutter device **110** may include a shutter body **111** and a shutter door **114** rotatably coupled to the shutter body **111**.

(80) The shutter body **111** may be mounted in the fan motor unit **40**. The fan motor unit **40** may

include a shutter opening **112**. Air which has passed through the motor filter **46** through the shutter opening **112** may be introduced into the fan motor unit **40**. The shutter opening **112** is provided to be opened or closed by the shutter door **114**.

(81) The shutter body **111** may include a door coupling portion **113** to which the shutter door **114** is rotatably coupled. The door coupling portion **113** may be provided to rotatably support the shutter door **114**.

(82) The shutter door **114** may be rotatably coupled to the shutter body **111**. The shutter door **114** may be provided to open or close the shutter opening **112**. The shutter door **114** may be provided as a pair of shutter doors **114**.

(83) The shutter door **114** may include a lever **115** protruding to be pressed by the motor filter **46**. The lever **115** may be pressed when the second body **102** in which the motor filter **46** is mounted is mounted on the first body **101**.

(84) The shutter door **114** may include a door shaft **116** coupled to the door coupling portion **113**. Since the door shaft **116** is rotatably coupled to the door coupling portion **113**, the shutter door **114** may rotate relative to the shutter body **111** and open or close the shutter opening **112**.

(85) The shutter device **110** may include an elastic body **117** provided to support the shutter door **114** in a direction in which the shutter door **114** closes the shutter opening **112**. The elastic body **117** may be provided as a torsion spring. Due to the elastic body **117**, the shutter door **114** can keep the shutter opening **112** closed while the motor filter **46** does not press the lever **115**.

(86) Referring to FIGS. **8** and **9**, according to such a configuration, in the cleaner **1** according to one embodiment of the present disclosure, the shutter door **114** may open the shutter opening **112** as the second body **102** in which the motor filter **46** is mounted is coupled to the first body **101**. Specifically, a presser **46***a* provided on one end portion of the motor filter **46** that faces the fan motor unit **40** may press the lever **115** of the shutter door **114** when the second body **102** is coupled to the first body **101**. As the lever **115** is pressed, the shutter door **114** may rotate in a direction in which the shutter door **114** opens the shutter opening **112**. The user may apply a force greater than an elastic force of the elastic body **117** when coupling the second body **102** to the first body **101**.

(87) Accordingly, the second body **102** and the first body **101** may communicate.

(88) On the other hand, referring to FIG. **10**, in the cleaner **1** according to one embodiment of the present disclosure, in a case in which the second body **102** is coupled to the first body **101** while the motor filter **46** is not mounted in the second body **102**, the shutter device **110** may keep the shutter opening **112** closed. That is, the shutter device **110** does not rotate in a direction in which the shutter device **110** opens the shutter opening **112**, and accordingly, air including rubbish can be prevented from being introduced into the fan motor unit **40**, and damage to the fan motor unit **40** can be prevented.

(89) Further, conventionally, in order to check whether a filter is mounted, a separate sensor such as an infrared sensor or a Hall sensor has been applied, causing an increase in manufacturing costs and an increase in a product size due to a space occupied by the sensor. Also, in the case of a structure in which a main body **30** is provided to be movable relative to a housing **20** as in the cleaner **1** according to one embodiment of the present disclosure, there is a limit to the space for installing the separate sensor.

(90) In the cleaner **1** according to one embodiment of the present disclosure, whether the motor filter **46** is mounted may be detected using the shutter device **110** having a relatively simple structure, without a separate sensor. Thus, manufacturing costs can be reduced, and a product size can be reduced by reducing a space occupied by a separate sensor.

(91) FIG. **11** is a control block diagram of the cleaner illustrated in FIG. **1**. FIG. **12** is a flowchart illustrating a process in which the cleaner illustrated in FIG. **1** is selectively operated according to whether the motor filter is present which is detected by measuring a revolutions per minute of a fan motor. FIG. **13** is a flowchart illustrating a process in which the cleaner illustrated in FIG. **1** is selectively operated according to whether the motor filter is present which is detected by measuring

a flow rate of air passing through a fan motor unit. FIG. **14** is a flowchart illustrating a process in which the cleaner illustrated in FIG. **1** is selectively operated according to whether the motor filter is present which is detected by measuring a vacuum level inside the fan motor unit.

(92) Referring to FIG. **11**, the cleaner **1** according to one embodiment of the present disclosure may include a sensor **120**. The sensor **120** may be provided to detect whether the flow path between the motor filter **46** and the fan motor unit **40** is blocked.

(93) Specifically, the sensor **120** may be provided to measure a revolutions per minute (RPM) of the fan motor **42** of the fan motor unit **40**. In this case, the sensor **120** sends the measured RPM of the fan motor **42** to the controller **36**. The controller **36** may control the operation of the fan motor unit **40** on the basis of information received from the sensor **120**. Specifically, in a case in which the RPM of the fan motor **42** is higher than a reference RPM, the controller **36** may determine that the motor filter **46** is not mounted and stop the operation of the cleaner **1**.

(94) The sensor **120** may be provided to measure a flow rate of air passing through the fan motor unit **40**. In this case, the sensor **120** sends the measured flow rate of air passing through the fan motor unit **40** to the controller **36**. The controller **36** may control the operation of the fan motor unit **40** on the basis of information received from the sensor **120**. Specifically, in a case in which the flow rate of air passing through the fan motor unit **40** is lower than a reference flow rate, the controller **36** may determine that the motor filter **46** is not mounted and stop the operation of the cleaner **1**.

(95) The sensor **120** may be provided to measure a vacuum level inside the fan motor unit **40**. In this case, the sensor **120** sends the measured vacuum level inside the fan motor unit **40** to the controller **36**. The controller **36** may control the operation of the fan motor unit **40** on the basis of information received from the sensor **120**. Specifically, in a case in which the vacuum level inside the fan motor unit **40** is higher than a reference vacuum level, the controller **36** may determine that the motor filter **46** is not mounted and stop the operation of the cleaner **1**.

(96) The sensor **120** may be electrically connected to the controller **36**. The controller **36** may be disposed on the other end of the fan motor unit **40** that is opposite to one end of the fan motor unit **40** where the shutter device **110** is disposed. The controller **36** may receive information from the sensor **120** and control the fan motor unit **40**.

(97) The operation of the cleaner **1** in a case in which the sensor **120** is provided to measure the RPM of the fan motor unit **40** will be described with reference to FIG. **12**.

(98) A user mounts the second body **102** on the first body **101** to clean a surface to be cleaned (**131**). The first body **101** is coupled to the housing **20**, and specifically, the second body **102** is coupled to the first body **101** coupled to the housing **20**.

(99) The user operates the assembled cleaner **1**. That is, the user may turn on the power of the fan motor unit **40** and operate the cleaner **1** (**132**).

(100) While the fan motor unit **40** is operated, the sensor **120** measures the RPM of the fan motor **42**. The sensor **120** sends a measured value to the controller **36**.

(101) The controller **36** which has received the RPM of the fan motor **42** compares the received value with a reference RPM of a motor (**133**).

(102) In a case in which the measured RPM of the fan motor **42** is lower than the reference RPM, the cleaner **1** continues to operate (**134**).

(103) Conversely, in a case in which the measured RPM of the fan motor **42** is higher than the reference RPM, the controller **36** stops the operation of the fan motor **42** of the cleaner **1** (**135**). That is, in the case in which the measured RPM of the fan motor **42** is higher than the reference RPM, the controller **36** may recognize a state in which the motor filter **46** is not mounted and stop the operation of the cleaner **1**.

(104) The operation of the cleaner **1** in a case in which the sensor **120** is provided to measure a flow rate of air passing through the fan motor unit **40** will be described with reference to FIG. **13**.

(105) A user mounts the second body **102** on the first body **101** to clean a surface to be cleaned

(**231**). The first body **101** is coupled to the housing **20**, and specifically, the second body **102** is coupled to the first body **101** coupled to the housing **20**.
(106) The user operates the assembled cleaner **1**. That is, the user may turn on the power of the fan motor unit **40** and operate the cleaner **1** (**232**).
(107) While the fan motor unit **40** is operated, the sensor **120** measures the flow rate of air passing through the fan motor unit **40**. The sensor **120** sends a measured value to the controller **36**.
(108) The controller **36** which has received the flow rate of air passing through the fan motor unit **40** compares the received value with a reference flow rate of air passing through the fan motor unit **40** (**233**).
(109) In a case in which the measured flow rate of air passing through the fan motor unit **40** is higher than the reference flow rate, the cleaner **1** continues to operate (**234**).
(110) Conversely, in a case in which the measured flow rate of air passing through the fan motor unit **40** is lower than the reference flow rate, the controller **36** stops the operation of the fan motor unit **40** of the cleaner **1** (**235**). That is, in the case in which the measured flow rate of air passing through the fan motor unit **40** is lower than the reference flow rate, the controller **36** may recognize a state in which the motor filter **46** is not mounted and stop the operation of the cleaner **1**.
(111) The operation of the cleaner **1** in a case in which the sensor **120** is provided to measure a vacuum level of the fan motor unit **40** will be described with reference to FIG. **14**.
(112) A user mounts the second body **102** on the first body **101** to clean a surface to be cleaned (**331**). The first body **101** is coupled to the housing **20**, and specifically, the second body **102** is coupled to the first body **101** coupled to the housing **20**.
(113) The user operates the assembled cleaner **1**. That is, the user may turn on the power of the fan motor unit **40** and operate the cleaner **1** (**332**).
(114) While the fan motor unit **40** is operated, the sensor **120** measures the vacuum level of the fan motor unit **40**. The sensor **120** sends a measured value to the controller **36**.
(115) The controller **36** which has received the vacuum level of the fan motor unit **40** compares the received value with a reference vacuum level of the fan motor unit **40** (**333**).
(116) In a case in which the measured vacuum level of the fan motor unit **40** is lower than the reference vacuum level, the cleaner **1** continues to operate (**334**).
(117) Conversely, in a case in which the measured vacuum level of the fan motor unit **40** is higher than the reference vacuum level, the controller **36** stops the operation of the fan motor unit **40** of the cleaner **1** (**335**). That is, in the case in which the measured vacuum level of the fan motor unit **40** is higher than the reference vacuum level, the controller **36** may recognize a state in which the motor filter **46** is not mounted and stop the operation of the cleaner **1**.
(118) According to such configurations, the cleaner **1** according to one embodiment of the present disclosure allows whether the motor filter **46** is mounted to be checked with a relatively simple configuration. Further, in a case in which the motor filter **46** is not mounted, the operation of the cleaner **1** may be stopped to prevent damage to the cleaner **1**.
(119) Specific embodiments illustrated in the drawings have been described above. However, the present disclosure is not limited to the embodiments described above, and those of ordinary skill in the art to which the disclosure pertains may make various changes thereto without departing from the gist of the technical spirit of the disclosure defined in the claims below.

Claims

1. A cleaner comprising: a housing having a dust collection chamber formed in the housing and configured to open and close; a main body movable relative to the housing between a first position whereby the main body closes the dust collection chamber and a second position whereby the main body opens the dust collection chamber; and a motor filter mountable to and demountable from the main body, wherein the main body includes: a fan motor unit to generate a suction force and a

shutter device mountable into the main body and configured to open or close a flow path between the motor filter and the fan motor unit.
2. The cleaner of claim 1, wherein the shutter device is configured to: open the flow path between the motor filter and the fan motor unit while the motor filter is mounted into the main body and close the flow path between the motor filter and the fan motor unit while the motor filter is demounted from the main body.
3. The cleaner of claim 1, wherein the shutter device includes: a shutter door; and an elastic body to support the shutter door at a position at which the shutter door closes the flow path between the motor filter and the fan motor unit.
4. The cleaner of claim 3, wherein the shutter door includes a lever to be pressed by the motor filter.
5. The cleaner of claim 1, wherein the main body includes a filter case couplable to and decouplable from the fan motor unit and the motor filter is mountable to and demountable from the filter case.
6. The cleaner of claim 1, further comprising: a sensor to detect whether the flow path between the motor filter and the fan motor unit is blocked; and a controller provided to receive information from the sensor and control the fan motor unit.
7. The cleaner of claim 6, wherein: the fan motor unit includes a fan motor; the sensor measures revolutions per minute of the fan motor; and the controller is configured to stop the fan motor in response to the revolutions per minute of the fan motor measured by the sensor being higher than a predetermined revolutions per minute.
8. The cleaner of claim 6, wherein: the sensor measures a flow rate of air passing through the fan motor unit; and the controller is provided to stop the fan motor unit in response to the flow rate of the air measured by the sensor being lower than a predetermined flow rate.
9. The cleaner of claim 6, wherein: the sensor measures a vacuum level inside the fan motor unit; and the controller is configured to stop the fan motor unit in response to the vacuum level of the fan motor unit measured by the sensor being higher than a predetermined vacuum level.
10. The cleaner of claim 6, wherein the controller is disposed on one end of the fan motor unit that is opposite to another end of the fan motor unit where the shutter device is disposed.
11. The cleaner of claim 1, wherein the main body includes: a rubbish removal member movable in the dust collection chamber; and an opening/closing device to open or close the dust collection chamber and configured to operate in conjunction with the rubbish removal member.
12. The cleaner of claim 11, wherein: the dust collection chamber is a first dust collection chamber; the main body includes a rubbish separation device provided to remove rubbish from air which has passed through the first dust collection chamber; and a second dust collection chamber in which rubbish separated from the rubbish separation device is collected inside the housing.
13. The cleaner of claim 12, wherein: the rubbish removal member is a first rubbish removal member; and the main body includes a second rubbish removal member to slide in the second dust collection chamber and the first dust collection chamber to discharge rubbish from the second dust collection chamber while the main body moves from the first position to the second position.
14. The cleaner of claim 12, wherein: the rubbish separation device is disposed on one side of the motor filter; and the fan motor unit is disposed on another side of the motor filter that is opposite to the one side.
15. The cleaner of claim 14, wherein: the second dust collection chamber is disposed on a side of the rubbish separation device that is opposite to one side of the rubbish separation device where the motor filter is disposed; and the first dust collection chamber is disposed on another side of the second dust collection chamber that is opposite to one side of the second dust collection chamber where the rubbish separation device is disposed.