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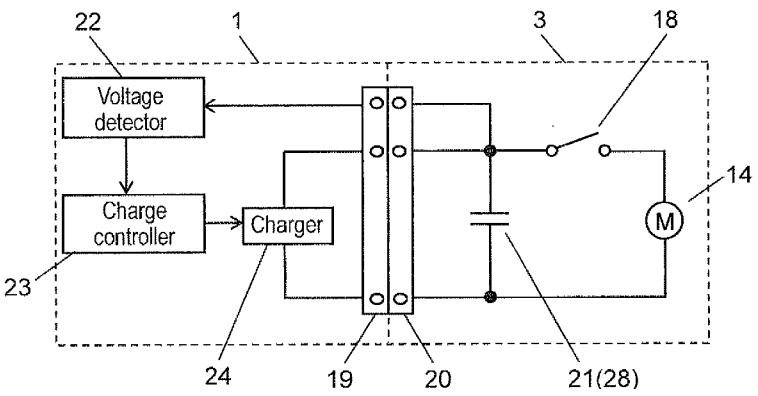
(54) **VACUUM CLEANER**

(57) A vacuum cleaner includes a dust collector mounted on a vacuum cleaner body for collecting dust, a dust remover for removing dust in the dust collector, a storage provided in the dust collector for storing electric energy, a charger for charging the storage with electric energy, and a dust removal mechanism for operating the dust remover by using the electric energy stored in the storage. This enables the dust removal operation of the independent dust collector.

FIG. 3



EP 2 578 130 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to vacuum cleaners that remove dust attached to an inner face of a dust chamber by vibrating the dust chamber.

BACKGROUND ART

[0002] A conventional vacuum cleaner removes fine dust attached to a dust filter face by an arm (dust remover) driven by a motor equipped with speed reducing mechanism. PTL 1 proposes this example. In PTL 1, the arm is moved by the motor. For example, the arm sequentially beats a pleated portion of a substantially-flat dust collector configured with a pleated dust filter. Fine dust attached to the dust filter face is shaken off by giving vibration to remove dust. This suppresses degradation of suction performance of the vacuum cleaner. In other words, the conventional structure is highly effective in removal of dust on the dust filter face.

[0003] However, although most of dust removed from the dust filter face can be disposed of, some dust attaches to an inner wall or bottom face of a dust chamber. The conventional vacuum cleaner does not take into consideration releasability of dust attached to the dust chamber at disposing of waste.

[Citation List]

Patent Literature

[0004] PTL1 Japanese Patent Unexamined Publication No. 2004-358032

SUMMARY OF THE INVENTION

[0005] A vacuum cleaner of the present invention includes a dust collector mounted on a vacuum cleaner body for catching dust, a dust remover for removing dust inside the dust collector, a storage in the dust collector for storing electric energy, a charger for charging the storage with electric energy, and dust removal mechanism for operating the dust remover by using the electric energy stored in the storage.

[0006] This structure enables the dust removal operation over a trash box at disposing of waste. Accordingly, dust attached to an inner wall and bottom face of a dust chamber can be removed in addition to dust on a filter face of the dust remover.

BRIEF DESCRIPTION OF DRAWINGS

[0007]

Fig. 1A is a perspective view of a state that a dust collector is mounted on a vacuum cleaner body in accordance with an exemplary embodiment of the present invention.

Fig. 1B is a perspective view seen from main body inlet A (front) of the vacuum cleaner body in a state that the dust collector is detached from the vacuum cleaner body in accordance with the same exemplary embodiment of the present invention.

Fig. 1C is a perspective view seen from the side opposite (back) to main body inlet A off the vacuum cleaner body in a state that the dust collector is detached from the vacuum cleaner body in accordance with the same exemplary embodiment of the present invention.

Fig. 2 is a partially cutaway perspective view of the dust collector in accordance with the same exemplary embodiment of the present invention.

Fig. 3 is a control block diagram of the vacuum cleaner in accordance with the same exemplary embodiment of the present invention.

Fig. 4 illustrates a state of the dust collector at disposing of waste in accordance with the same exemplary embodiment of the present invention.

Fig. 5 is a perspective view of a vacuum cleaner in accordance with a second exemplary embodiment of the present invention.

Fig. 6 is a control block diagram in accordance with the same exemplary embodiment of the present invention.

DESCRIPTION OF EMBODIMENTS

[0008] Exemplary embodiments of the present invention are described below with reference to drawings. However, a scope of the present invention is not restricted in any way by the exemplary embodiments.

(FIRST EXEMPLARY EMBODIMENT)

[0009] Fig. 1A is a perspective view of a state that a dust collector is mounted on a vacuum cleaner body in an exemplary embodiment of the present invention. Fig. 1B is a perspective view seen from main body inlet A (front) of the vacuum cleaner body in a state that the dust collector is detached from the vacuum cleaner body in the same exemplary embodiment. Fig. 1C is a perspective view seen from the side opposite (back) to main body inlet A of the vacuum cleaner body in a state that the dust collector is detached from the vacuum cleaner body in the same exemplary embodiment.

[0010] As shown in Fig. 1A, vacuum cleaner body 1 includes built-in electric blower 2 at its rear part. Dust collector 3 that separates and collects dust vacuumed up is removably mounted at a front part of vacuum cleaner body 1. Dust collector 3 includes removably attached filter unit 5, i.e., a dust remover, and dust chamber 4 for accumulating dust. One end of hose (not illustrated) is connected to main body inlet A17 at the forefront of vacuum cleaner body 1. A suction nozzle (not illustrated) is

connected to the other end of the hose.

[0011] As shown in Fig. 1B, vacuum cleaner body 1 and dust collector 3 are separated by partition 15. Grid-like partition opening 16 is provided above partition 15, so that partition opening 16 is communicated with a suction part of electric blower 2. Main body inlet B32 is provided at the side of partition 15 so that main body inlet B32 is communicated with main body inlet A17 via a passage (not illustrated) inside vacuum cleaner body 1.

[0012] As shown in Fig 1C, dust collector 3 is communicated with main body inlet B32 of vacuum cleaner body 1 shown in Fig. 1B when dust collector 3 is mounted on vacuum cleaner body 1, and has dust chamber inlet 6 leading suction wind into dust chamber 4. In addition, dust removal switch 18 is provided at an upper part of dust collector 3. Dust removal mechanism 29 can be operated, which will be described with reference to Fig. 2, even in an independent state of dust collector 3 when the user operates dust removal switch 18.

[0013] Lid 7 is openably attached to the bottom of dust collector 3 shown in Fig. 1B. Dust accumulated inside dust chamber 4 of dust collector 3 can be discharged outside by opening lid 7.

[0014] Power supply terminal 19 is provided on partition 15 of vacuum cleaner body 1 shown in Fig. 1B so as to feed electricity to storage 28 provided inside dust collector 3 shown in Fig. 1C. Power receiving terminal 20, which is a counterpart of power supply terminal 19 of dust collector 3, is provided on dust collector 3. Accordingly, power supply terminal 19 and power receiving terminal 20 are connected at mounting dust collector 3 on vacuum cleaner body 1.

[0015] An internal structure of dust collector 3 in the exemplary embodiment is described below with reference to Fig. 2. Fig. 2 is a partially cutaway perspective view of the dust collector in the same exemplary embodiment of the present invention.

[0016] As shown in Fig. 2, filter unit 5 configuring dust remover 5 includes frame 8, pleated filter 9 provided on frame 8 with its pleats in the vertical direction, and dust removal mechanism 29.

[0017] Dust removal mechanism 29 includes beater 10, dust removal gear 11, dust removal connecting rod 12, fixed rod 13, and dust removal motor 14. Beater 10 is slidably provided in the horizontal direction along fixed rod 13. Dust removal gear 11 is rotatably provided relative to filter unit 5. Dust removal connecting rod 12 connects an outer periphery of dust removal gear 11 and a part of beater 10. A protrusion (not illustrated) is provided on beater 10 at a face opposing filter 9 so that the protrusion makes contact with each mountain fold of pleated filter 9.

[0018] Fixed rod 13 is fixed to frame 8. A rotating shaft of dust removal gear 11 is fixed onto fixed rod 13. This restricts the operation (movement) of beater 10 to the left-right horizontal direction (Arrow in Fig. 2).

[0019] Teeth that engage with dust removal gear 11 are formed on dust removal connecting rod 12 at a side facing dust removal gear 11. Dust removal connecting rod 12 slides as dust removal gear 11 rotates clockwise or counterclockwise, and thus beater 10 connected to dust removal connecting rod 12 moves in the left-right direction.

[0020] Dust removal motor 14 has a gear with a shape that engages with dust removal gear 11, and is connected to dust removal gear 11 via the gear of dust removal motor 14. Power is transmitted to dust removal gear 11 as dust removal motor 14 rotates.

[0021] The operation of filter unit 5 as configured above, which is the dust remover, is described below.

[0022] First, when dust removal motor 14 is rotated, dust removal gear 11 rotates, and beater 10 connected via dust removal connecting rod 12 starts reciprocal motion in the left-right direction. Here, the protrusion provided on beater 10 in reciprocal motion beats the mountain folds of filter 9. This vibrates filter 9. Vibration of filter 9 then propagates to entire dust collector 3. At this point, fine dust attached to the rear face of filter 9 (a face to the side of dust chamber 4) by suction of the vacuum cleaner is shaken off by vibration or impact propagated to dust collector 3, and is accumulated in dust chamber 4. This recovers filtration performance of filter 9. A control method of the vacuum cleaner in the exemplary embodiment is described below using Fig. 3, and also with reference to Figs. 1A to 1C. Fig. 3 is a control block diagram in the same exemplary embodiment of the present invention.

[0023] First, the control inside dust collector 3 is described.

[0024] As shown in Fig. 3, an electric double layer capacitor 21 configuring storage 28 is connected to, for example, power receiving terminal 20. Electric double layer capacitor 21 stores electric energy supplied via power receiving terminal 20. Dust removal switch 18 is connected between electric double layer capacitor 21 and dust removal motor 14. By turning on dust removal switch 18, electric double layer capacitor 3 and dust removal motor 14 are electrically connected. Dust removal motor 14 rotates by electric energy stored in electric double layer capacitor 21, and the dust removal operation starts.

[0025] Next is described the control inside vacuum cleaner body 1.

[0026] As shown in Fig. 3, voltage detector 22 in vacuum cleaner body 1 monitors voltage of electric double layer capacitor 21 via power supply terminal 19 and power receiving terminal 20. Here, if the voltage detected by voltage detector 22 is below a predetermined threshold (e.g., 2.1 V in this exemplary embodiment), an operation signal is sent to charge controller 23. Charge controller 23 is configured with a semiconductor switch such as a transistor.

[0027] In response to the operation signal from voltage detector 22, ON and OFF of charger 24 is controlled. Charger 24 is DC power source obtained by switching commercial power, and is the power source for charging electric double layer capacitor 21 via power supply terminal 19 and power receiving terminal 20. (In this exemplary embodiment, output voltage is, for example, 2.1 V).

[0028] The operation of the vacuum cleaner as configured above is described with reference to Fig. 3.

[0029] First, when a power cord of the vacuum cleaner is connected to the commercial power via a receptacle outlet and power is supplied to the vacuum cleaner, voltage detector 22 confirms the voltage of electric double layer capacitor 21. If the voltage of electric double layer capacitor 21 is less than 2.1V, charge controller 23 operates charger 24 to charge electric double layer capacitor 21 until the voltage of electric double layer capacitor 21 becomes 2.1 V or higher. By this charge control of charge controller 23, voltage of electric double layer capacitor 21 is maintained at 2.1 V or higher when the commercial power is applied. On the other hand, if the vacuum cleaner is disconnected from the commercial power, voltage of electric double layer capacitor 21 gradually drops by natural discharge. However, the voltage is maintained around 2V for a while.

[0030] Next, when the user starts to operate the vacuum cleaner, dust sucked in from a suction nozzle is accumulated in dust chamber 4.

[0031] The operation for disposing of dust accumulated in dust chamber 4 is described below with reference to Fig. 4. Fig. 4 illustrates the state of dust collector at disposing of waste in the same exemplary embodiment of the present invention.

[0032] As shown in Fig. 4, the user detaches dust collector 3 from vacuum cleaner body 1. Then, the user carries detached dust collector 3 to, for example, over a trash box.

[0033] Next, when lid 7 provided at the bottom of dust chamber 4 of dust collector 3 is opened, most of dust accumulated in dust chamber 4 is discharged into the trash box. However, some dust attached to the inner wall of dust chamber 4 and lid 7 remains in dust chamber 4.

[0034] At this point, if the user turns on dust removal switch 18 shown in Fig. 1C, dust removal motor 14 rotates by electric energy stored in electric double layer capacitor 1, which is storage 28. Beater 10 then starts reciprocal motion in line with the rotation of dust removal motor 14. This makes entire dust collector 3 vibrates, centering on filter 9. As shown in Fig. 4, vibration propagates to the inner wall of dust chamber 4 and lid 7, in addition to filter 9, as shown in Fig. 4. As a result, dust attached to the inner wall of dust chamber 4 and lid 7 is removed by vibration.

[0035] As described above, in the exemplary embodiment, independent dust collector 3 detached from vacuum cleaner body 1 can be carried over the trash box to execute the dust removal operation at disposing of waste. As a result, the dust removal operation facilitates removal of dust attached to the inner wall of dust chamber 4 and lid 7, in addition to filter 9.

[0036] Furthermore, in the exemplary embodiment, voltage detector 22 monitors voltage of electric double layer capacitor 21 used as storage 28, and stops the charging operation by charger 24 if sufficient electric energy for the dust removal operation is stored. This avoids unrequired power consumption, and thus a vacuum cleaner with good energy conservation can be achieved.

(SECOND EXEMPLARY EMBODIMENT)

[0037] A vacuum cleaner in the second exemplary embodiment of the present invention is described with reference to Figs. 5 and 6. Same reference marks are given to components same as that in the first exemplary embodiment to omit duplicate description.

[0038] Fig. 5 is a perspective view of the vacuum cleaner in the second exemplary embodiment of the present invention. Fig. 5 is the perspective view seen from main body inlet A17 (front) of vacuum cleaner body 1 in the state that dust collector 3 is detached from vacuum cleaner body 1.

[0039] As shown in Fig. 5, the vacuum cleaner in the exemplary embodiment has attachment switch 26 on partition 15 of vacuum cleaner body 1. Attachment switch 26 is configured to turn on when dust collector 3 is mounted on vacuum cleaner body 1.

[0040] The operation of the vacuum cleaner as configured above is described with reference to Fig.6. Fig. 6 is a control block diagram in the same exemplary embodiment of the present invention.

[0041] First, a power cord of the vacuum cleaner is connected to commercial power via a receptacle outlet. After power is supplied to the vacuum cleaner and attachment switch 26 is turned on, attachment detector 25 receives detection information, such as ON information. On receiving the detection information, attachment detector 25 sends an operation signal to timer 27, and starts counting predetermined time (e.g., 30 seconds in the exemplary embodiment). Then, charge controller 23 is operated to start charging electric double layer capacitor 21, which is storage 28, via charger 24.

[0042] After 30 seconds pass, attachment detector 25 receives a signal from timer 27. Attachment detector 25 stops sending the operation signal to timer 27. Charge controller 23 then stops the operation of charger 24 to stop charging electric double layer capacitor 21. In this exemplary embodiment, the predetermined time is set to 30 seconds because charging of electric double layer capacitor 21 completes in about 25 seconds.

[0043] By this charging for 30 seconds, voltage of electric double layer capacitor 21 becomes 2.1 V, which is output voltage of charger 24.

[0044] If attachment switch 26 detects detachment and attachment of dust chamber 3, possibility is assumed that the user has executed the dust removal operation using electric energy of electric double layer capacitor 21. Therefore, attachment detector 25 implements the charging operation for 30 seconds again by charger 24 via timer 27 and charge controller 23.

[0045] As described above, in the exemplary embodiment, the use of attachment detector 25 eliminates the need for continuously charging electric double layer capacitor 21 by operating charger 24. Therefore, the oper-

ation of charger 24 can be stopped when charging is not necessary. As a result, a vacuum cleaner with good energy conservation can be achieved.

[0046] Compared to the voltage detector in the first exemplary embodiment, this exemplary embodiment can configure a simple circuit using attachment switch 26, attachment detector 25, and timer 27. This realizes cost reduction of the circuit. In other words, if a low-voltage and low-current signal line is used via a contact, such as power supply terminal 19 and power receiving terminal 20, for monitoring the voltage of electric double layer capacitor 21, the signal line is easily affected by contact resistance at the contact. Accordingly, a complicated circuit becomes necessary for accurately detecting the voltage of electric double layer capacitor 21 in the first exemplary embodiment. It is apparent that voltage detector 22 in the first exemplary embodiment may be combined with attachment detector 25 in the second exemplary embodiment for controlling charging of electric double layer capacitor 21, which is storage 28. This further improves energy conservation.

[0047] The first exemplary embodiment and the second exemplary embodiment refer to an example of the dust removal operation by independent dust collector 3 when the user operates dust removal switch 18. However, the present invention is not limited to this operation. For example, the same effect is achieved when dust removal of independent dust collector 3 is added to a vacuum cleaner with dust removal operation for a filter while power is turned on or when the operation of a vacuum cleaner is stopped, which is the current mainstream model. In other words, the dust removal operation over the trash box enables removal of dust attached to the inner wall of dust chamber 4 and lid 7 that was not conventionally possible to remove.

[0048] As described above, the vacuum cleaner of the present invention includes the dust collector mounted on the vacuum cleaner body for collecting dust, the dust remover for removing dust in the dust collector, the storage provided in the dust collector for storing electric energy, the charger for charging the storage with electric energy, and the dust removal mechanism for operating the dust remover by using the electric energy stored in the storage.

[0049] This configuration enables removal of dust attached to the inner wall and the bottom face of the dust chamber in addition to the filter face of the dust remover.

[0050] Still more, the vacuum cleaner of the present invention includes the charge controller for controlling the charger, and the voltage detector for detecting charging voltage of the storage. The charge controller controls the charger based on detection information from the voltage detector.

[0051] This configuration enables charging of the storage by operating the charger only when charging of the storage is necessary. When charging is not required, the operation of the charger is stopped and the storage is not charged. As a result, the vacuum cleaner with good energy conservation can be achieved.

[0052] Furthermore, the vacuum cleaner of the present invention includes the attachment detector for detecting attachment and detachment of the vacuum cleaner. The charge controller controls the charger based on the detection information from the attachment detector.

[0053] This configuration enables detection of the dust collector when it is detached from and attached again to the vacuum cleaner body. When the attachment detector detects re-attachment of the dust collector, the charge controller operates the charger again. Accordingly, the charger does not need to be operated continuously. When charging is not required, the operation of the charger is stopped and the storage is not charged. As a result, the vacuum cleaner with good energy conservation can be achieved.

[0054] In the vacuum cleaner of the present invention, the storage comprises the electric double layer capacitor. This configuration enables rapid charging by large current, and thus charging can be completed in a shorter period even if power is supplied to an apparatus for a short period, such as the case of vacuum cleaner. In addition, compared to a secondary battery, a charge/discharge circuit can be simplified, which in turn reduces costs.

INDUSTRIAL APPLICABILITY

[0055] The vacuum cleaner of the present invention can remove dust attached to the inner wall and bottom face of the dust chamber in addition to the filter face of the dust remover. Accordingly, the present invention is applicable to a range of vacuum cleaners for home use, industrial use, and shop use.

REFERENCE MARKS IN THE DRAWINGS

[0056]

1	Vacuum cleaner body
2	Electric blower
3	Dust collector
4	Dust chamber
5	Filter unit (dust remover)
6	Dust chamber inlet
7	Lid
8	Frame
9	Filter
10	Beater
11	Dust removal gear
12	Dust removal connecting rod
13	Fixed rod
14	Dust removal motor
15	Partition
16	Partition opening
17	Main body inlet A
18	Dust removal switch
19	Power supply terminal

20 Power receiving terminal
21 Electric double layer capacitor
22 Voltage detector
23 Charge controller
24 Charger
25 Attachment detector
26 Attachment switch
27 Timer
28 Storage
29 Dust removal mechanism
32 Main body inlet B

Claims

1. vacuum cleaner comprising:

a dust collector mounted on a vacuum cleaner body for collecting dust;
a dust remover for removing dust inside the dust collector;
a storage provided in the dust collector for storing electric energy;
a charger for charging the storage with electric energy; and
a dust removal mechanism for operating the dust remover by using the electric energy stored in the storage.

2. The vacuum cleaner of claim 1, comprising a charge controller for controlling the charger, and a voltage detector for detecting charging voltage of the storage,
wherein the charge controller controls the charger based on the voltage detected by the voltage detector.

3. The vacuum cleaner of claim 1, comprising an attachment detector for detecting attachment and detachment of the vacuum cleaner body,
wherein the charge controller controls the charger based on detection information from the attachment detector.

4. The vacuum cleaner of one of claims 1 to 3,
wherein the storage comprises an electric double layer capacitor.

FIG. 1A

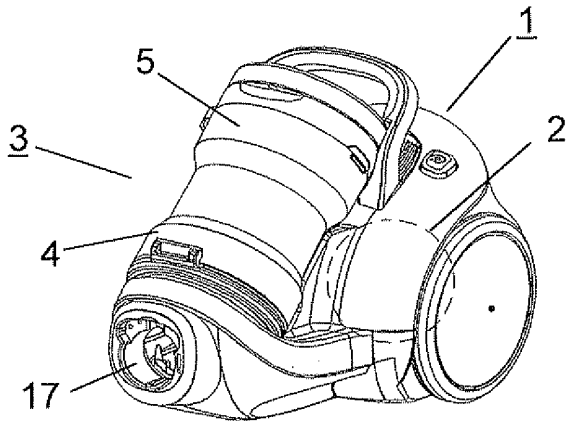


FIG. 1B

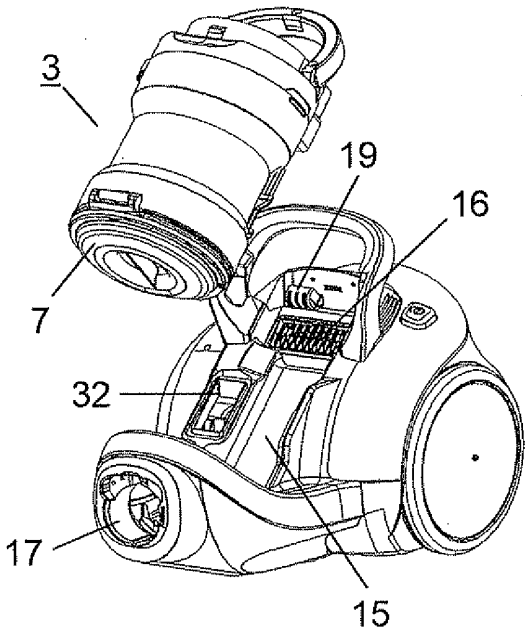


FIG. 1C

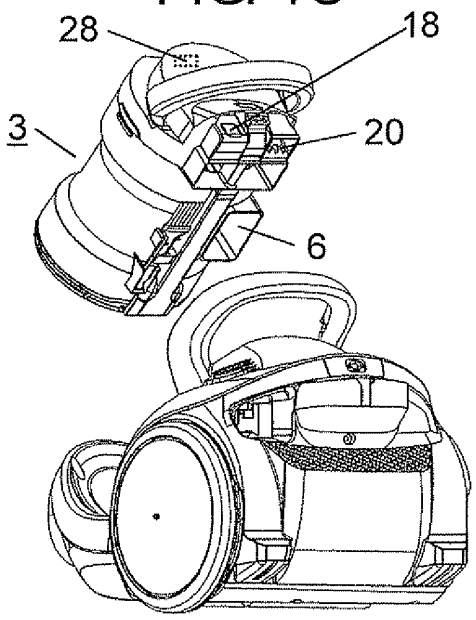


FIG. 2

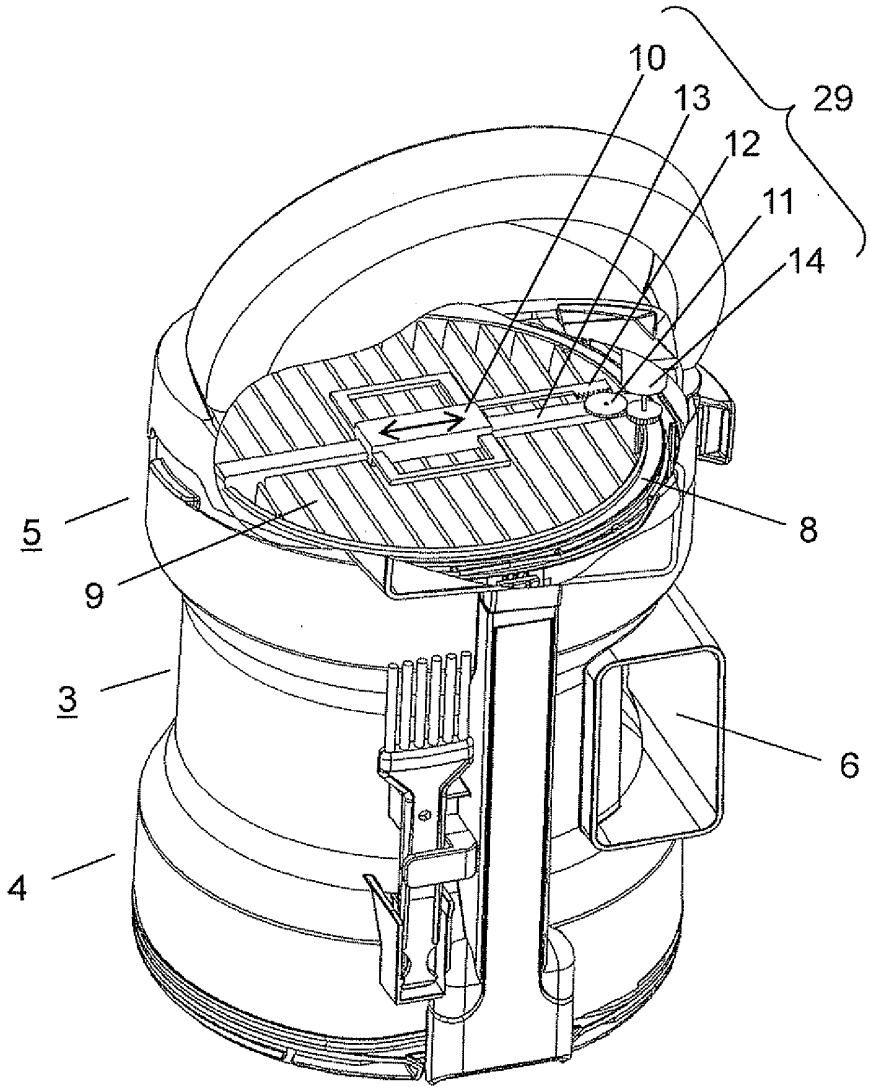


FIG. 3

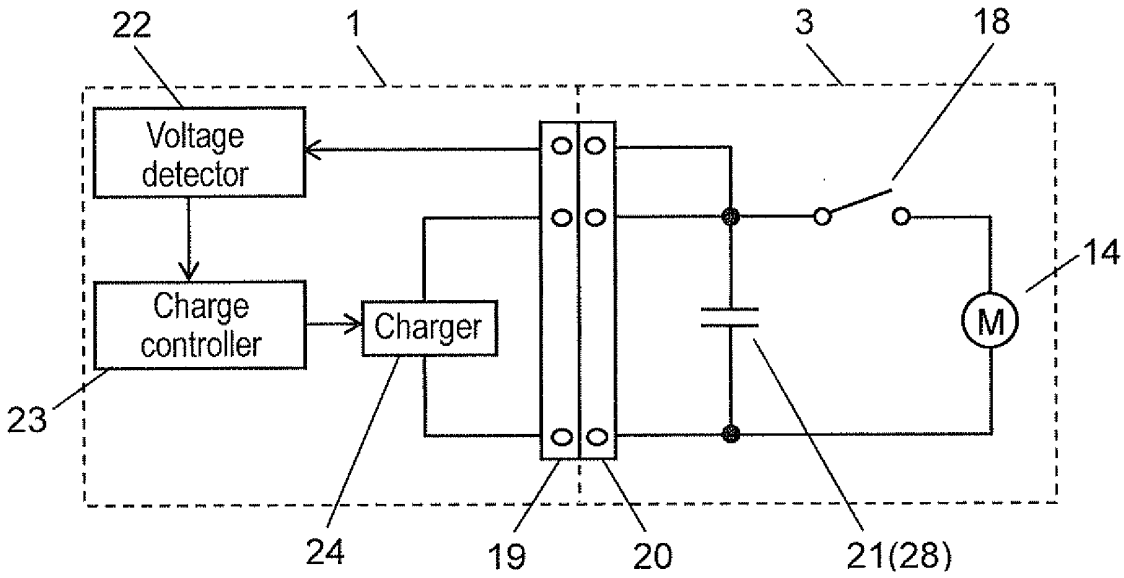

22
1
3
18
Voltage detector
Charge controller
Charger
M
14
23
24
19
20
21(28)

FIG. 4

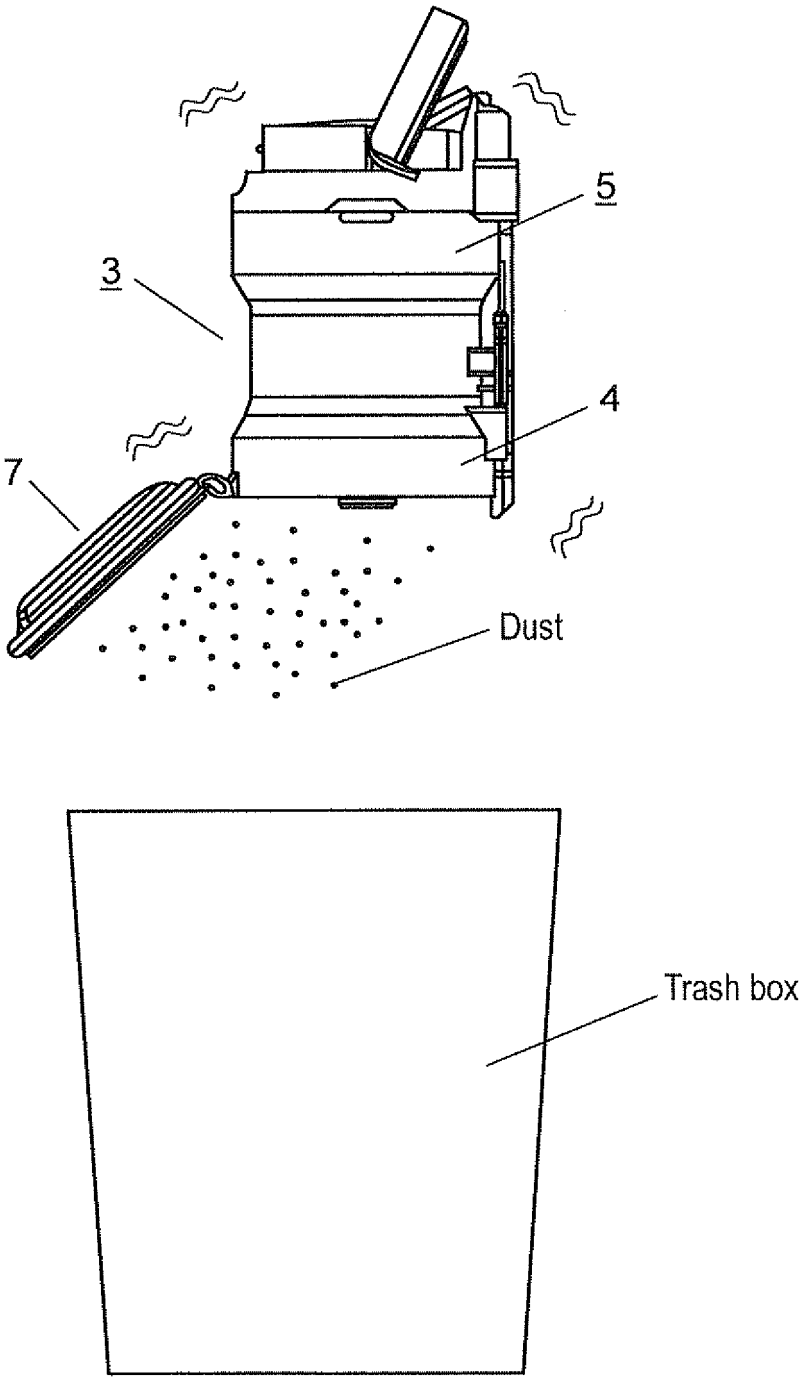


FIG. 5

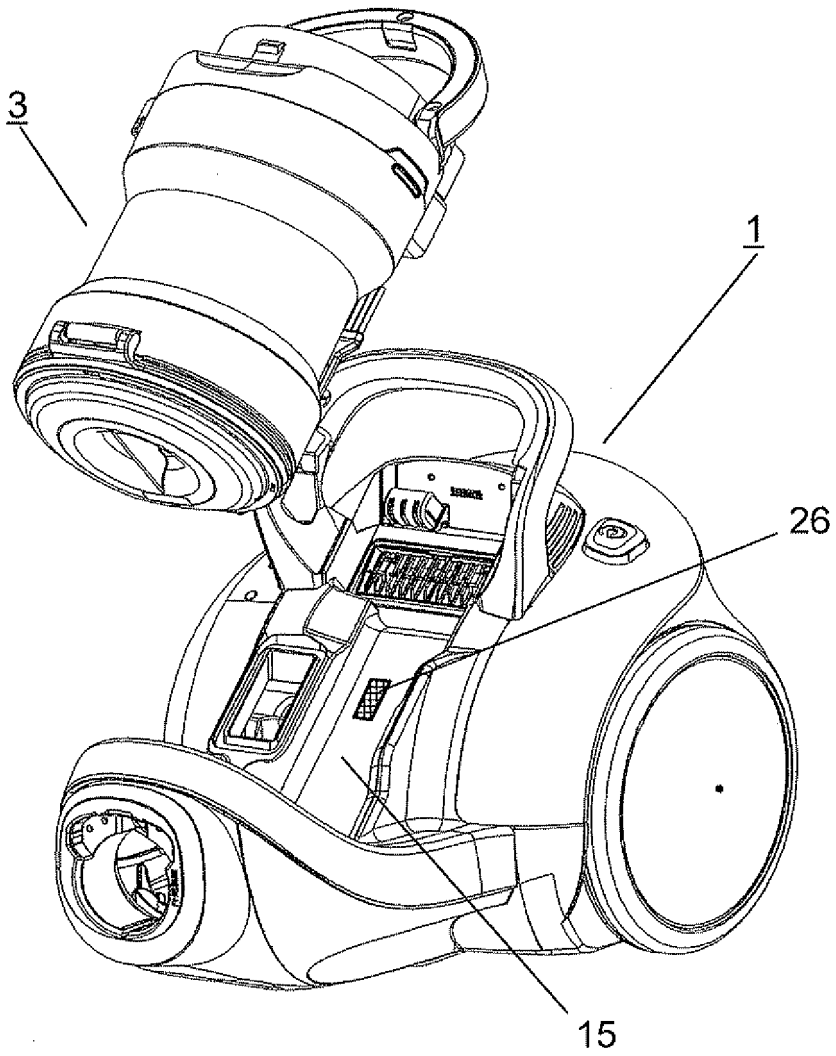
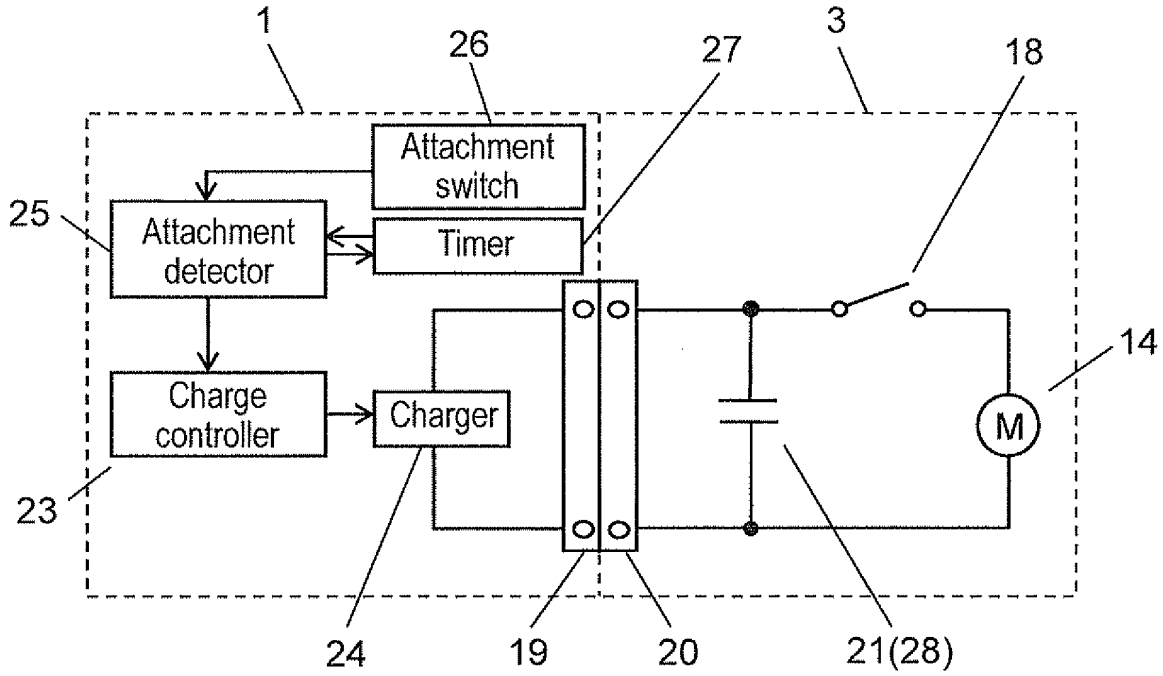


FIG. 6


1
26
27
3
18
Attachment switch
25
Attachment detector
Timer
14
Charge controller
Charger
M
23
24
19
20
21(28)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2011/002695

A. CLASSIFICATION OF SUBJECT MATTER
A47L9/28(2006.01)i, *A47L9/20*(2006.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A47L9/28, A47L9/20

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2011
Kokai Jitsuyo Shinan Koho	1971-2011	Toroku Jitsuyo Shinan Koho	1994-2011

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2010-81962 A (Sharp Corp.), 15 April 2010 (15.04.2010), entire text; all drawings & CN 101712015 A	1-4
Y	JP 2004-215897 A (Toshiba Tec Corp.), 05 August 2004 (05.08.2004), paragraphs [0015] to [0027]; fig. 2 to 4 (Family: none)	1-4
A	JP 2010-94438 A (Sharp Corp.), 30 April 2010 (30.04.2010), entire text; all drawings & CN 101721176 A	1-4

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Date of the actual completion of the international search 28 July, 2011 (28.07.11)	Date of mailing of the international search report 09 August, 2011 (09.08.11)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

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

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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