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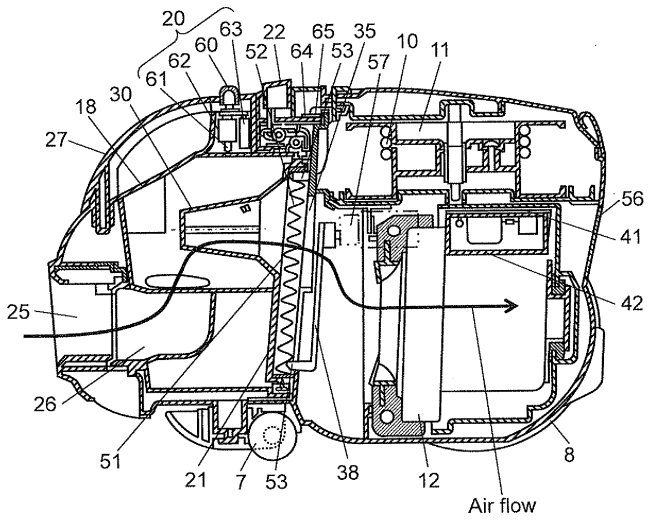
(54) ELECTRIC CLEANER

(57) An electric cleaner includes an electric cleaner body with electric blower, and a dust chamber detachably mounted on the electric cleaner body. The dust chamber includes an actuator for vibrating the dust chamber, a driver for driving the actuator, a storage for supplying electric power to the driver, and a dust removal switch for electrically connecting the driver and the storage. The electric cleaner body includes a charger for charging the storage. The charger continuously charges the storage for a first predetermined time after starting the operation of the electric blower, and then intermittently charges the storage at least while the electric blower is stopped.

FIG. 2



EP 2 586 350 A1

Description

TECHNICAL FIELD

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

BACKGROUND ART

[0002] A conventional electric cleaner removes fine dust attached to a dust filter face by an arm (dust remover) driven by a filter dust removal motor equipped with speed reducing mechanism. PTL 1 proposes this example. In PTL 1, the arm is moved by the filter dust removal 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 electric cleaner. In other words, the conventional structure is highly effective in removal of dust on the dust filter face.

[0003] Furthermore, to improve portability and/or user-friendliness of the electric cleaner, PTL 2, for example, proposes a rechargeable electric cleaner equipped with a rechargeable battery.

[0004] In the configuration of electric cleaner of PTL 1, dust removed from the dust filter face attaches to an inner wall and bottom face of a dust chamber. However, the conventional electric cleaner does not take into consideration releasability of dust attached to the dust chamber at disposing of waste.

[0005] In the configuration of electric cleaner of PTL 2, a complicated charge control circuit is needed for controlling charging of a rechargeable battery, including a charge detector for secondary battery and a connection detector for detecting connection of the secondary battery and charger.

[Citation List]

Patent Literature

[0006]

PTL1 Japanese Patent Unexamined Publication No. 2004-358032
PTL2 Japanese Patent Unexamined Publication No. 2006-75396

SUMMARY OF THE INVENTION

[0007] An electric cleaner of the present invention includes an electric cleaner body having an electric blower, and a dust chamber detachably mounted on the electric cleaner body. The dust chamber includes an actuator for vibrating the dust chamber, a driver for driving the actuator, a storage for supplying electric power to the driver, and a dust removal switch for electrically connecting the driver and the storage. The electric cleaner body includes a charger for charging the storage. After starting the operation of the electric blower, the storage is charged continuously for a first predetermined time, and then the storage is intermittently charged at least while the electric blower is stopped.

[0008] Accordingly, when the user starts cleaning, an electric double layer capacitor, which is the storage, provided in the dust chamber can be fully charged by continuous charging for the first predetermined time (e.g., 30 seconds). When the user disposes of waste collected in the dust chamber after cleaning, the dust chamber is removed from the electric cleaner body, and the dust removal switch is pressed to electrically connect the electric double layer capacitor and the driver. Then, the driver drives the actuator and vibrates an inner wall and components of the dust chamber so that dust attached to the inner wall and bottom face of the dust chamber can be removed at disposal.

BRIEF DESCRIPTION OF DRAWINGS

[0009]

Fig. 1 is an appearance perspective view of an electric cleaner in accordance with a first exemplary embodiment of the present invention.
Fig. 2 is a side sectional view of the electric cleaner in accordance with the first exemplary embodiment.
Fig. 3 illustrates the detachment operation of a dust chamber of the electric cleaner in accordance with the first exemplary embodiment.
Fig. 4 illustrates the disposal operation of dust from the dust chamber of the electric cleaner in accordance with the

first exemplary embodiment.

Fig. 5 is an appearance perspective view of the dust chamber and a dust filter of the electric cleaner in accordance with the first exemplary embodiment.

Fig. 6 is an appearance perspective view illustrating a state that the dust chamber is detached from the electric cleaner in accordance with the first exemplary embodiment.

Fig. 7 is a control block diagram of the electric cleaner in accordance with the first exemplary embodiment.

Fig. 8 is a timing chart illustrating a charge control of the electric cleaner in accordance with the first exemplary embodiment.

Fig. 9 is a timing chart illustrating the charge control of the electric cleaner in accordance with the first exemplary embodiment.

Fig. 10 is a timing chart illustrating the charge control of the electric cleaner in accordance with the first exemplary embodiment.

Fig. 11 is a control block diagram of an electric cleaner in accordance with a second exemplary embodiment of the present invention.

Fig. 12 is a timing chart illustrating a charge control of the electric cleaner in accordance with the second exemplary embodiment.

Fig. 13 is a control block diagram of an electric cleaner in accordance with a third exemplary embodiment of the present invention.

DESCRIPTION OF EMBODIMENTS

[0010] 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)

[0011] An electric cleaner in the first exemplary embodiment of the present invention is described below with reference to Figs. 1 to 10.

[0012] Fig. 1 is an appearance perspective view of an electric cleaner in accordance with the first exemplary embodiment of the present invention. Fig. 2 is a side sectional view of the electric cleaner.

[0013] As shown in Fig. 1, the electric cleaner in the exemplary embodiment includes suction tool 6 connected to one end of extension pipe 5 for vacuuming dust, hose 4 with hose connector 3 attached to the other end of extension pipe 5, and electric cleaner body 1 connected to hose connector 3. Extension pipe 5 has a handle control unit 2. Electric cleaner body 1 has, for example, one front caster wheel 7 and a pair of rear wheels 8 that are pivotably supported.

[0014] As shown in Fig. 2, electric cleaner body 1 includes electric blower 12 at a rear part (outlet 56), controller 41, and cord reel 11. Controller 41 is configured, for example, with a microprocessor and IC memory. The operation typically of suction tool 6 is controlled by operating handle control unit 2. Cord reel 11 is provided over electric blower 12, and winds up power cord 10 for supplying electric power from domestic commercial power source to the electric cleaner. Dust chamber 18 configured, for example, with a transparent dust collector is mounted in a housing at a front part (inlet 25) of electric cleaner body 1 so that inside dust chamber 18 can be visually confirmed.

[0015] Next is described a flow of dust and air vacuumed into electric cleaner. When electric blower 12 is operated, suction power is generated to vacuum up air and dust from inlet 25 of electric cleaner body 1 through suction tool 6 and hose 4. Vacuumed air and dust pass through passage 26 of dust chamber 18, and are introduced into dust chamber 18 with primary filter 30. In dust chamber 18, coarse dust is centrifugally-separated by swirling airflow centering on primary filter 30, and is accumulated in dust chamber 18. Fine dust passing through primary filter 30 is caught by next dust filter 51. Only air that has passed through dust filter 51 passes through intake part 35 at the back of dust filter 51 and flows to electric blower 12. Then, air passing through electric blower 12 is exhausted from outlet 56 provided at the back or side of electric cleaner body 1.

[0016] How dust accumulated in the dust chamber of the electric cleaner is disposed of is described with reference to Fig. 2 and also using Figs. 3 to 6.

[0017] Fig. 3 illustrates the detachment operation of the dust chamber of the electric cleaner. Fig. 4 illustrates the disposal operation of dust from the dust chamber of the electric cleaner. Fig. 5 is an appearance perspective view of the dust chamber and the dust filter of the electric cleaner. Fig. 6 is an appearance perspective view illustrating the state that the dust chamber is detached from the electric cleaner.

[0018] As shown in Fig. 3, for disposing of waste such as dust accumulated in dust chamber 18, the user first holds grip 27 of dust chamber 18, and detaches dust chamber 18 from housing 9 in electric cleaner body 1. Then, as shown in Fig. 4, the user presses lid open button 22 to open lid 21 of dust chamber 18 and discharges dust accumulated in dust chamber 18.

[0019] Dust chamber 18 is equipped with dust remover 20. As shown in Figs 2 and 6, dust remover 20 includes actuator 61, chamber dust removal motor 62, storage 63, and dust removal switch 60. Actuator 61 vibrates an inner wall of dust chamber 18. Chamber dust removal motor 62 is a driver for operating actuator 61. Storage 63 is configured, for example, with electric double layer capacitor 63, and supplies electric power to chamber dust removal motor 62. Dust removal switch 60 is provided on grip 27, and electrically connects chamber dust removal motor 62 and storage 63. In the description below, electric double layer capacitor 63 is described as an example of storage 63.

[0020] When dust removal switch 60 is pressed, actuator 61 starts a reciprocal motion by chamber dust removal motor 62, and thus the inner wall of dust chamber 18 vibrates. A vibration component (vibration method) of dust chamber 18 acts to separate dust attached the inner wall and/or bottom face of dust chamber 18 and that attached to primary filter 30 and/or dust filter 51.

[0021] As shown in Figs. 2 and 3, power receiving terminal 64 is provided in dust chamber 18 for charging electric double layer capacitor 63. When dust chamber 18 is housed in housing 9 in electric cleaner body 1, power supply terminal 65 provided in electric cleaner body 1 and power receiving terminal 64 of dust chamber 18 are electrically connected.

[0022] As shown in Fig. 5, dust filter 51, which is a dust collector, is approximately flat (including a flat face), and is configured with accordion pleats 52 made typically of non-woven fabric or filter paper. Dust filter 51 is provided approximately parallel (including parallel) to the direction of taking out dust chamber 18 from electric cleaner body 1.

[0023] As shown in Fig. 6, friction body 53 is provided on the outer peripheral side of intake part 35 of electric cleaner body 1. Friction body 53 is provided protruding from guide groove 55 of front wall 54 of electric cleaner body 1, so as to remove dust by beating and applying vibration to pleats 52 of dust filter 51. Friction body 53 is connected, via arm 38 that is a drive transmission part, to a rotating shaft of filter dust removal motor 57 equipped with speed reducing mechanism that is driven on receiving electric power. Accordingly, when filter dust removal motor 57 rotates, arm 38 rotates and friction body 53 moves along guide groove 55. Friction body 53 thus sequentially beats and vibrates pleats 52 of dust filter 51.

[0024] Next is described a control method of the electric cleaner in the exemplary embodiment with reference to Fig. 7. Fig. 7 is a control block diagram of the electric cleaner.

[0025] First is described the control inside dust chamber 18 detached from the electrical cleaner.

[0026] As shown in Fig. 7, electric double layer capacitor 63, which is the storage, in dust chamber 18 is connected to power receiving terminal 64 and stores electric energy supplied from power supply terminal 65 in electric cleaner body 1. Dust removal switch 60 is connected between electric double layer capacitor 63 and chamber dust removal motor 62. By turning on dust removal switch 60, electric double layer capacitor 63 is electrically connected to chamber dust removal motor 62. Accordingly, chamber dust removal motor 62 is driven by electric energy charged to electric double layer capacitor 63.

[0027] Next is described the control inside electric cleaner body 1 of the electric cleaner.

[0028] As shown in Fig. 7, controller 41 of electric cleaner body 1 is connected to charger 45 to control ON and OFF of charger 45. Charger 45 is DC power source obtained typically from switching power source of commercial power source 46. Charger 45 functions as a power source for charging electric double layer capacitor 63 via power supply terminal 65 and power receiving terminal 64.

[0029] The operation and effect of the electric cleaner as configured above are described below with reference to Fig. 7 and using Fig. 8. Fig. 8 is a timing chart illustrating the charge control of the electric cleaner.

[0030] To start cleaning, the user first pulls out power cord 10 that is wound around a cord reel from electric cleaner body 1, and plugs in a plug at a tip of power cord 10 to a receptacle outlet. At this point, the user operates handle control unit 2 by using operation buttons such as high, mid, low, and stop. For example, if the user selects the operation button 'high', controller 41 sends a predetermined signal to driver 44 based on information from handle control unit 2. This drives and rotates electric blower 12. By the rotation of electric blower 12, a suction force is generated, and cleaning starts.

[0031] By the above suction force, dust on a cleaning face is vacuumed up through a horizontally-long opening (not illustrated) on a bottom face of suction tool 6 shown in Fig. 1. Dust passes through extension pipe 5 and hose 4, and is vacuumed up and collected in dust chamber 18 in electric cleaner body 1. Here, air passing through dust chamber 18, which does not contain dust, goes through electric blower 12 and is discharged into the air from outlet 56 of electric cleaner body 1. In this way, the user performs cleaning.

[0032] In the above operation of the electric cleaner, controller 41 turns on charger 45 at the same time as starting the operation of electric blower 12, as shown in Fig. 8, so as to start continuous charging (Ta1) at typically DC5V/2A for a first predetermined time. Continuous charging means charging on a steady basis. The first predetermined time is a charging time needed to fully charge electric double layer capacitor 63 (Ta1 to Ta2), and this is set to about 30 seconds as an example in this exemplary embodiment. However, the present invention is not limited to this time.

[0033] Next, controller 41 stops charging electric double layer capacitor 63 via charger 45 when 30 seconds of charging time passes from starting the operation of electric blower 12 (Ta2).

[0034] Then, when completing the cleaning, the user operates handle control unit 2, and presses the 'stop' button. Controller 41 then sends a stop signal to driver 44 of electric blower 12 to stop driving electric blower 12 (Ta4). Controller

41 drives filter dust removal motor 57 at the same time as stopping electric blower 12. This makes friction body 53 connected to arm 38 start the reciprocal motion along guide groove 55 shown in Fig. 6 for a predetermined time (e.g., about 10 seconds). Pleats 52 of dust filter 51 shown in Fig. 5 are sequentially beaten and vibrated by this reciprocal motion. Fine dust attached to a dust collecting face of dust filter 51 is thus shaken off.

[0035] Then, when dust removal of dust filter 51 is completed, controller 41 starts intermittent charging at typically DC5V/2A in a cycle such as ON time for 0.5 second and OFF time for 0.5 second. The reason for shifting to intermittent charging is that continuous charging does not need to be carried on to fully-charged electric double layer capacitor 63 from the viewpoint of energy conservation. Therefore, intermittent charging is adopted to compensate for self-discharge of electric double layer capacitor 63, and always keep the full charge state.

[0036] After finishing the cleaning for about 6 minutes, for example, the user first holds grip 27 of dust chamber 18 and detaches dust chamber 18 from housing 9 in electric cleaner body 1 (Ta6), as shown in Fig. 3, for disposing of waste such as dust accumulated in dust chamber 18. Detached dust chamber 18 is moved typically over a trash box. Then, as shown in Fig. 4, the user discharges and disposes of dust accumulated in dust chamber 18 to the trash box by pressing lid open button 22 to open lid 21 of dust chamber 18. At this point, collected dust is discharged to the trash box to some extent, but some dust remains attached to the inner wall and bottom face of dust chamber 18 and lid 21. The user thus turns on dust removal switch 60 of detached dust chamber 18 to drive chamber dust removal motor 62 by electric energy stored in electric double layer capacitor 63. This starts the reciprocal motion of actuator 61 of dust chamber 18, and the inner wall of dust chamber 18 vibrates. A vibration component generated by actuator 61 propagates to entire dust chamber 18, and dust attached to the inner wall and bottom face of dust chamber 18 and lid 21 is further peeled off and removed.

[0037] After disposing of waste inside dust chamber 18, dust chamber 18 is housed back to housing 9 in electric cleaner body 1. At this point, charging capacity (electric energy) stored in electric double layer capacitor 63 is almost zero, typically empty, by driving chamber dust removal motor 62 (Ta7).

[0038] Controller 41 in the exemplary embodiment does not neither have an attachment detector for dust chamber 18, a connection detector for connecting the connection of electric double layer capacitor 63 and charger 45, nor a charging voltage detector for detecting the charge state of electric double layer capacitor 63. Therefore, when the user detaches or returns dust chamber 18 to and from electric cleaner body 1 cannot be detected.

[0039] However, controller 41 in the exemplary embodiment always executes intermittent charging while electric blower 12 is stopped in the state the plug of the electric cleaner is connected to the receptacle outlet. Therefore, intermittent charging starts at any time immediately after dust chamber 18 is put back to electric cleaner body 1 (Ta8). In addition, new dust will not be vacuumed up to dust chamber 18 while electric blower 12 is stopped. Therefore, intermittent charging can also achieve the full charge state over time (Ta9).

[0040] Still more, an insulation, such as an oxide film, formed on a contact of the power receiving terminal and power supply terminal when dust chamber 18 is detached from electric cleaner body 1 can be destroyed by ON/OFF intermittent charging at, for example, DC 5V/2A, so as to prevent failure in electrical connection. This is the operation generally called contact refreshing.

[0041] Still more, if the user restarts cleaning and the operation of the electric blower starts during intermittent charging, continuous charging for 30 seconds, which is the first predetermined time, is executed again (the control starts from Ta1 again). This enables to achieve the full charge state of electric double layer capacitor 63 rapidly so that dust chamber 18 can start the dust removal operation at any time.

[0042] As described above, the dust removal operation can be implemented over the trash box at disposing of waste by detaching dust chamber 18 from electrical cleaner body 1 in the exemplary embodiment. Therefore, dust attached to the inner wall and bottom face of dust chamber 18 and lid 21 can be removed in addition to that attached to dust falter 51. As a result, degradation of suction performance of the electric cleaner can be prevented, and thus the electric cleaner can demonstrate sufficient cleaning performance.

[0043] Still more, the exemplary embodiment employs electric double layer capacitor 63 as the storage. There is thus almost no limitation at charging and discharging, compared to that of a secondary battery. Accordingly, charging of large current such as 3.0A is feasible. Furthermore, electric double layer capacitor 63 can charge in a short charging time and has long charge-discharge cycle life. Therefore, the charge control becomes feasible without using the charge state detector and detachment detector. As a result, the exemplary embodiment offers an electric cleaner with good usability and operability that enables reliable charge control with a simple configuration at low cost.

[0044] Next is described another example of the charge control of the electric double layer capacitor of the electric cleaner in the exemplary embodiment with reference to Fig. 9. Fig. 9 is a timing chart illustrating the charge control of the electric cleaner.

[0045] More specifically, no one knows when the user unplugs the plug of power cord 10 of the electric cleaner from the receptacle outlet of commercial power source 46. In addition, no one knows when dust chamber 18 is detached from electric cleaner body 1. In this case, it is difficult to retain the full-charge state of electric double layer capacitor 63.

[0046] Therefore, as shown in Fig. 9, controller 41 immediately turns on charger 45 when the electric cleaner is

connected to commercial power source 46 and the electric power is supplied from the power source to controller 41 (Tb1). Here, continuous charging starts for a second predetermined time (e.g., 30 seconds) in electric double layer capacitor 63 disposed in dust chamber 18 (Tb2).

[0047] More specifically, the above charge control is the control for full-charging of electric double layer capacitor 63 using the preparation time for cleaning (e.g., adjustment of extension pipe length, connection of a suction tool, and selection of the operation mode (high, mid, low) of electric blower) after the plug of power cord 10 is connected to the receptacle outlet of commercial power source 46 (30 seconds until full charge).

[0048] This enables completion of charging of electric double layer capacitor 63 during the preparation time for cleaning. Therefore, even if the user detaches dust chamber 18 from electric cleaner body 1 and disposes of waste in dust chamber 18 without starting the operation of electric blower 12, the dust removal operation can be easily operated because electric double layer capacitor 63 is already fully charged. As a result, the electric cleaner with good usability that allows the dust removal operation of dust chamber 18 at any time can be achieved.

[0049] Next is described still another example of the charge control of the electric double layer capacitor of the electric cleaner in the exemplary embodiment with reference to Fig. 10. Fig. 10 is a timing chart illustrating the charge control of the electric cleaner.

[0050] More specifically, controller 41 executes the charge control of electric double layer capacitor 63 by changing an intermittent charging cycle according to an elapse of time after stopping electric blower 12 (length of stop time).

[0051] As shown in Fig. 10, for example, if one hour has passed after stopping the operation of electric blower 12 (Tc0), it can be estimated that the cleaning by the user is already completed (left plugged to the receptacle outlet). Therefore, the cycle of ON time for 0.5 second and OFF time for 0.5 second, which is regular intermittent charging, is extended to, for example, a cycle of ON time for 0.5 second (Tc2) and OFF time for 10 seconds (Tc3).

[0052] The charge control of electric double layer capacitor 63 by extending the cycle of intermittent charging (compensation for self-discharge and contact refreshing) eliminates consumption of wasteful electric energy. Accordingly, the electric cleaner with good usability and energy conservation can be achieved.

(SECOND EXEMPLARY EMBODIMENT)

[0053] An electric cleaner in the second exemplary embodiment of the present invention is described with reference to Figs. 11 and 12. Components same as those in the first exemplary embodiment are given same reference marks to omit duplicate description. Fig. 11 is a control block diagram of the electric cleaner in the second exemplary embodiment of the present invention. Fig. 12 is a timing chart for illustrating the charge control of the electric cleaner.

[0054] Normally, when dust accumulates in dust chamber 18, suction power generated by electric blower 12 degrades because dust blocks the flow of suction wind.

[0055] In the electric cleaner in this exemplary embodiment, air volume detector 47, such as an air volume sensor, detects reduction of suction wind, and controller 41 controls, for example, the number of revolution of electric blower 12 or charging of electric double layer capacitor 63. In this case, dust volume in dust chamber 18 can be indirectly grasped based on reduction of suction wind. Therefore, air volume detector 47 may be replaced with dust volume detector 47.

[0056] More specifically, controller 41 determines the dust volume in dust chamber 18 based on an input signal detected by air volume detector 47 during the operation of electric blower 12. If controller 41 judges that the dust volume in dust chamber 18 is large, the control described below, as shown in Fig. 12, is executed upon estimation that the user disposes of waste in dust chamber 18 when electric blower 12 stops next time. Fig. 12 is a timing chart illustrating the charge control of the electric cleaner. The following description defines that a timing that electric blower 12 stops is Ua1, a timing that dust filter 51 stops is Ua2, a third predetermined time is from Ua1 to Ua3, and a fourth predetermined time is from Ua3 to Ua4.

[0057] As shown in Fig. 12, after electric blower 12 stops (Ua1), controller 41 drives filter dust removal motor 57 and a dust removal of dust filter 51 performs. Then, controller 41 starts intermittent charging of electric double layer capacitor 63 via charger 45 in the same way as the first exemplary embodiment after filter dust removal motor 57 stops (Ua2).

[0058] Then, continuous charging is executed after the third predetermined time passes from stopping electric blower 12, e.g. after 5 minutes (from Ua1 to Ua3), until the fourth predetermined time, e.g., 4 minutes (from Ua3 to Ua4).

[0059] A reason for controlling charging of electric double layer capacitor 63 in the above way is described below.

[0060] First, after stopping electric blower 12, the user is assumed to detach dust chamber 18 from electric cleaner body 1, dispose of waste, and return dust chamber 18 to housing 9 of electric cleaner body 1 again within 5 minutes, which is the third predetermined time (between Ua1 and Ua3). In other words, dust chamber 18 may be detached from electric cleaner body 1 at any time within 5 minutes, which is the third predetermined time (Ua3). Therefore, electric double layer capacitor 63 is intermittently charged within 5 minutes, which is the third predetermined time (Ua3). Accordingly, controller 41 implements the charge control to retain the full-charge state of electric double layer capacitor 63.

[0061] Next, after 5 minutes, which is the third predetermined time (Ua3), dust chamber 18 is assumed to be returned to electric cleaner body 1 in a state that electric double layer capacitor 63 is discharged by the dust removal operation

at disposing of waste in dust chamber 18. Controller 41 thus controls charger 45 to continuously charge electric double layer capacitor 63 so that electric double layer capacitor 63 recovers the full-charge state in a short time (between Ua5 and Ua4).

[0062] During continuous charging from Ua5 to Ua4, waste may be disposed of for the second time and the dust removal operation shown in Fig. 12 may be executed (between Ua6 and Ua7) if particularly large volume of dust is collected in dust chamber 18. In other words, electric double layer capacitor 63 can be recovered to the full-charge state by the charge control again during 9 minutes (Ua4) that is a range between a stoppage of electric blower 12 to the third predetermined time and the fourth predetermined time (Ua8).

[0063] The exemplary embodiment charges electric double layer capacitor 63 by the estimated charge control based on prediction of a behavior of the user. This eliminates the need for the charge state detector and detachment detector for the control. Accordingly, the charge control of electric double layer capacitor 63 becomes feasible just by intermittent charging and continuous charging. As a result, configuration of controller 41 can be simplified, and the exemplary embodiment offers the electric cleaner with good usability that achieves reliable charge control at low cost.

(THIRD EXEMPLARY EMBODIMENT)

[0064] An electric cleaner in the third exemplary embodiment is described below with reference to Fig. 13. Components same as those in the first exemplary embodiment and the second exemplary embodiment are given same reference marks to omit duplicate description. Fig. 13 is a control block diagram of the electric cleaner in the third exemplary embodiment of the present invention.

[0065] The exemplary embodiment is an electric cleaner equipped with a charge switch (not illustrated) operated by the user in electric cleaner body 1 in the first exemplary embodiment and the second exemplary embodiment.

[0066] More specifically, as shown in Fig. 13, controller 41 controls electric double layer capacitor 63 and executes continuous charging for a fifth predetermined time, e.g., 30 seconds, based on an input from charge switch 48. This is a rapid charging function used when the user wants to charge electric double layer capacitor 63 in a short time.

[0067] The use of the rapid charging function in the exemplary embodiment is described below.

[0068] For example, if dust chamber 18 is detached from electric cleaner body 1 and the dust removal operation in dust chamber 18 is executed many times in the state that electric blower 12 is stopped, controller 41 executes intermittent charging of electric double layer capacitor 63 every time dust chamber 18 is mounted on housing 9 in electric cleaner body 1. This results in taking longer time for charging electric double layer capacitor 63, compared to continuous charging.

[0069] Accordingly, controller 41 forcibly executes continuous charging of double electric layer capacitor for the fifth predetermined time, e.g., 30 seconds, when the user presses charge switch 48. This enables electric double layer capacitor 63 reach the full-charge state in 30 seconds, which is the fifth predetermined time. As a result, the dust removal operation of dust chamber 18 can be implemented by chamber dust removal motor 62 in the shortest time. The electric cleaner with good usability can thus be achieved.

[0070] The above exemplary embodiments refer to the electric double layer capacitor as the storage in their description. However, it is apparent that a secondary battery can be used if a charge control circuit exists.

INDUSTRIAL APPLICABILITY

[0071] The electric cleaner of the present invention can remove dust attached to the inner wall and bottom face of the dust chamber in addition to the dust filter face of the dust chamber. Accordingly, the present invention is applicable to a range of electric cleaners for home use, industrial use, and shop use.

REFERENCE MARKS IN THE DRAWINGS

[0072]

1	Electric cleaner body
2	Handle control unit
3	Hose connector
4	Hose
5	Extension pipe
6	Suction tool
7	Front caster wheel
8	Rear wheel
9	Housing

(continued)

10	Power cord
11	Cord reel
12	Electric blower
18	Dust chamber
20	Dust remover
21	Lid
22	Lid open button
25	Inlet
26	Passage
27	Grip
30	Primary filter
35	Intake part
38	Arm
41	Controller
44	Driver
45	Charger
46	Commercial power source
47	Dust volume detector (air volume detector)
48	Charge switch
51	Dust filter
52	Pleats
53	Friction body
54	Front wall
55	Guide groove
56	Outlet
57	Filter dust removal motor
60	Dust removal switch
61	Actuator
62	Chamber dust removal motor
63	Electric double layer capacitor (storage)
64	Power receiving terminal
65	Power supply terminal

Claims

1. An electric cleaner comprising:

an electric cleaner body including an electric blower; and
a dust chamber detachably mounted on the electric cleaner body;
wherein
the dust chamber includes an actuator for vibrating the dust chamber, a driver for driving the actuator, a storage for supplying electric power to the driver, and a dust removal switch for electrically connecting the driver and the storage;
the electric cleaner body includes a charger for charging the storage; and
the storage is continuously charged for a first predetermined time after starting an operation of the electric blower, and then intermittently charged at least while the electric blower is stopped.

2. The electric cleaner of claim 1, wherein the storage is continuously charged for a second predetermined time after starting electric power supply to the electric cleaner.

3. The electric cleaner of claim 1, wherein a cycle of intermittent charging of the storage is changed according to a time elapsed after the electric blower is stopped.

4. The electric cleaner of claim 1, comprising a dust volume detector for detecting a dust volume in the dust chamber, and a controller,
wherein
when the controller determines that the dust volume in the dust chamber exceeds a predetermined volume, continuous charging is executed for a fourth predetermined time after a third predetermined time from stopping of the electric blower.

5. The electric cleaner of claim 1, the electric cleaner body further comprising a charge switch,
wherein
the controller executes continuous charging for a fifth predetermined time based on an input of the charge switch.

6. The electric cleaner of one of claims 1 to 3, wherein the storage is configured with an electric double layer capacitor.

FIG. 1

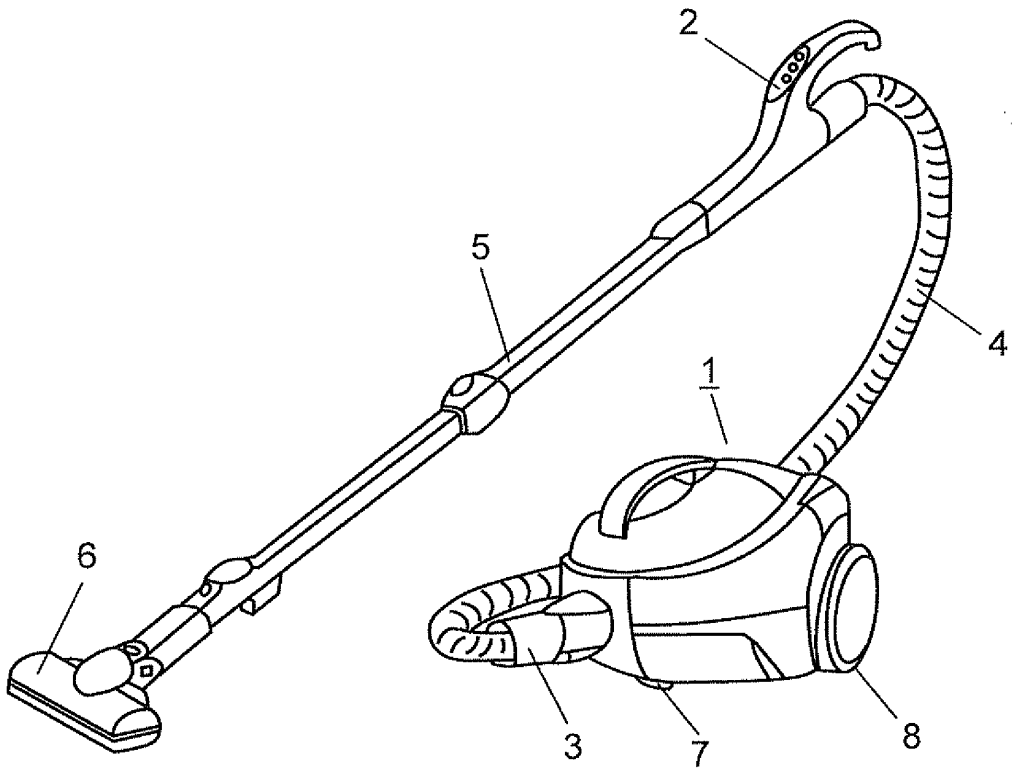
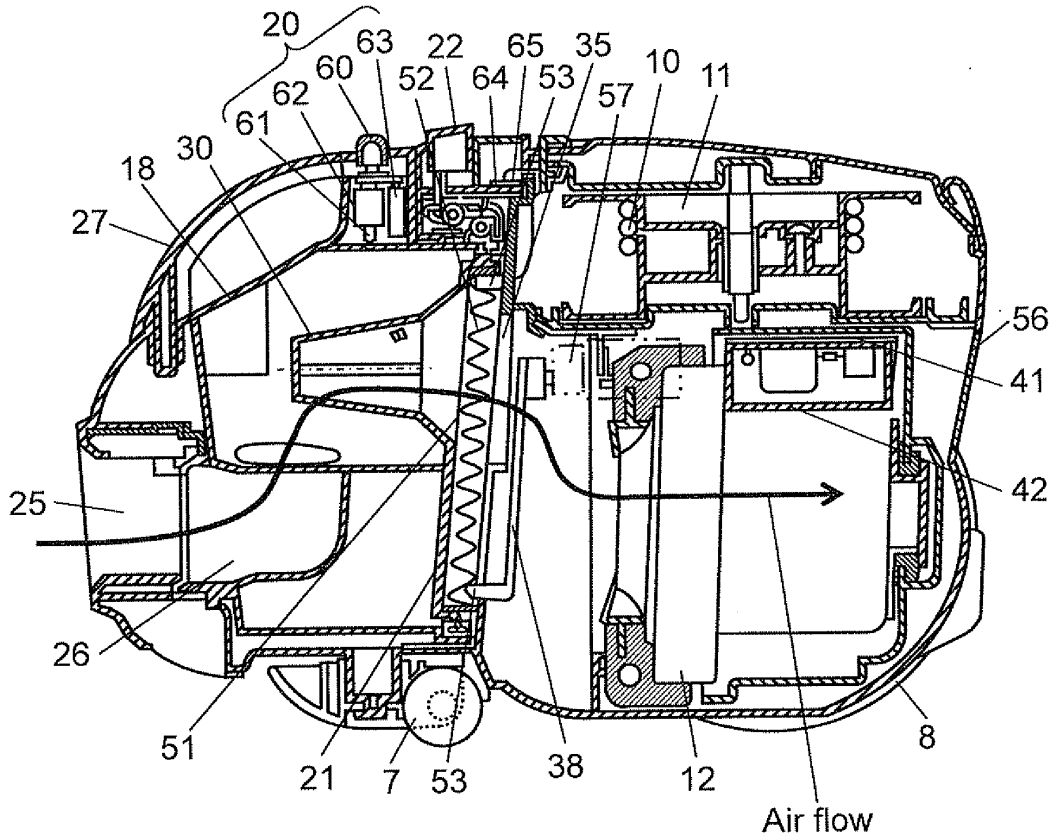


FIG. 2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51
21
7
53
38
12
8
Air flow

FIG. 3

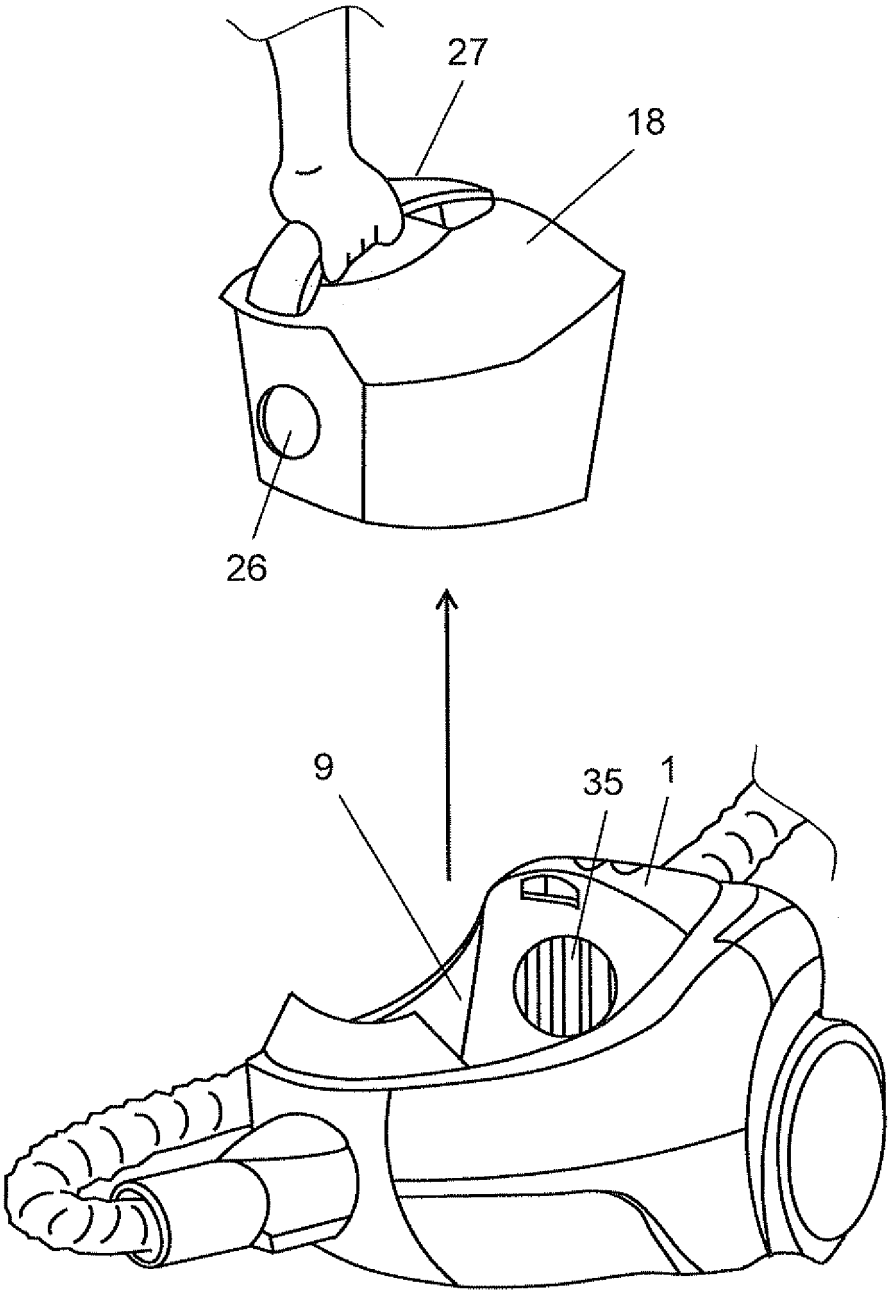


FIG. 4

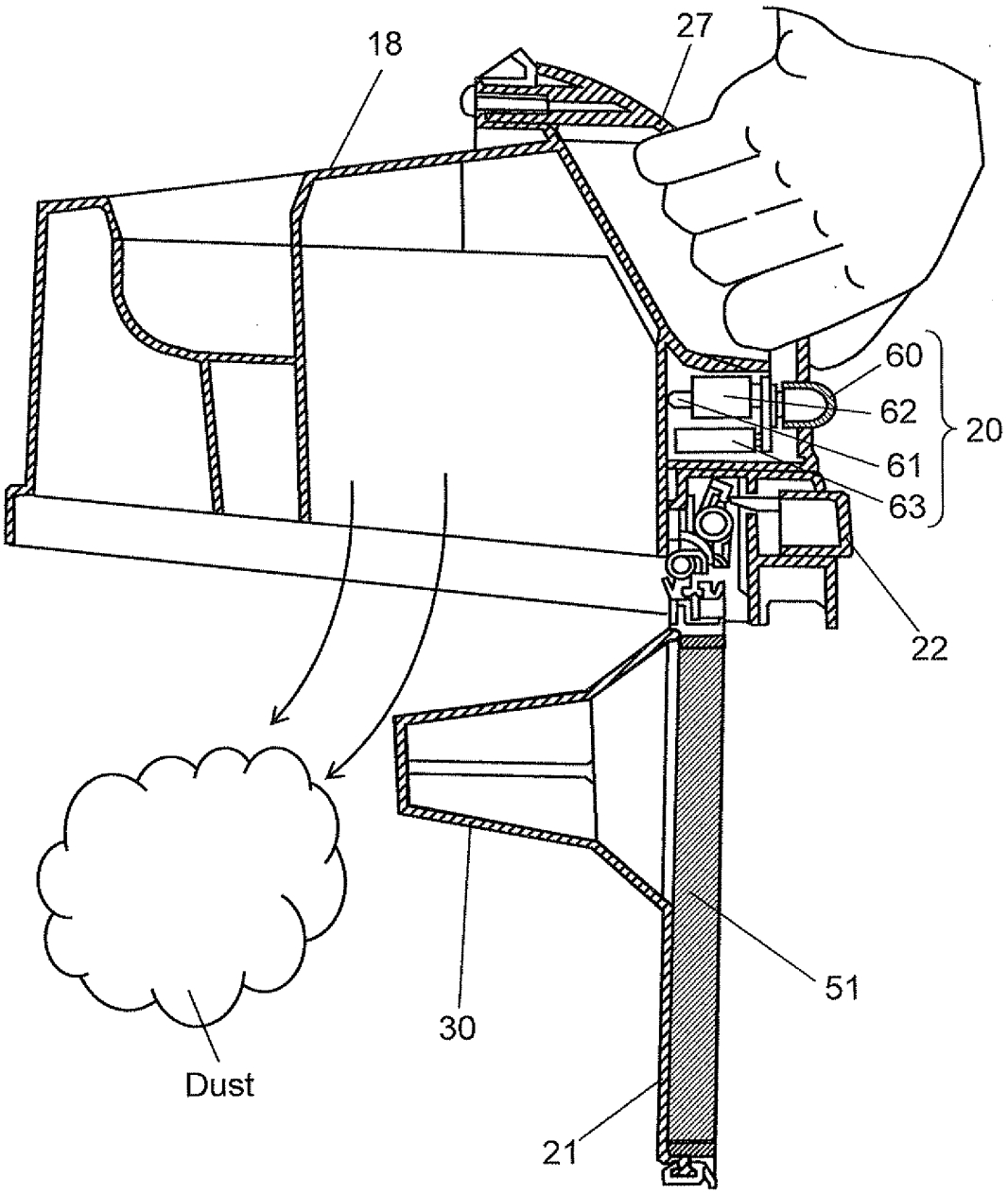


FIG. 5

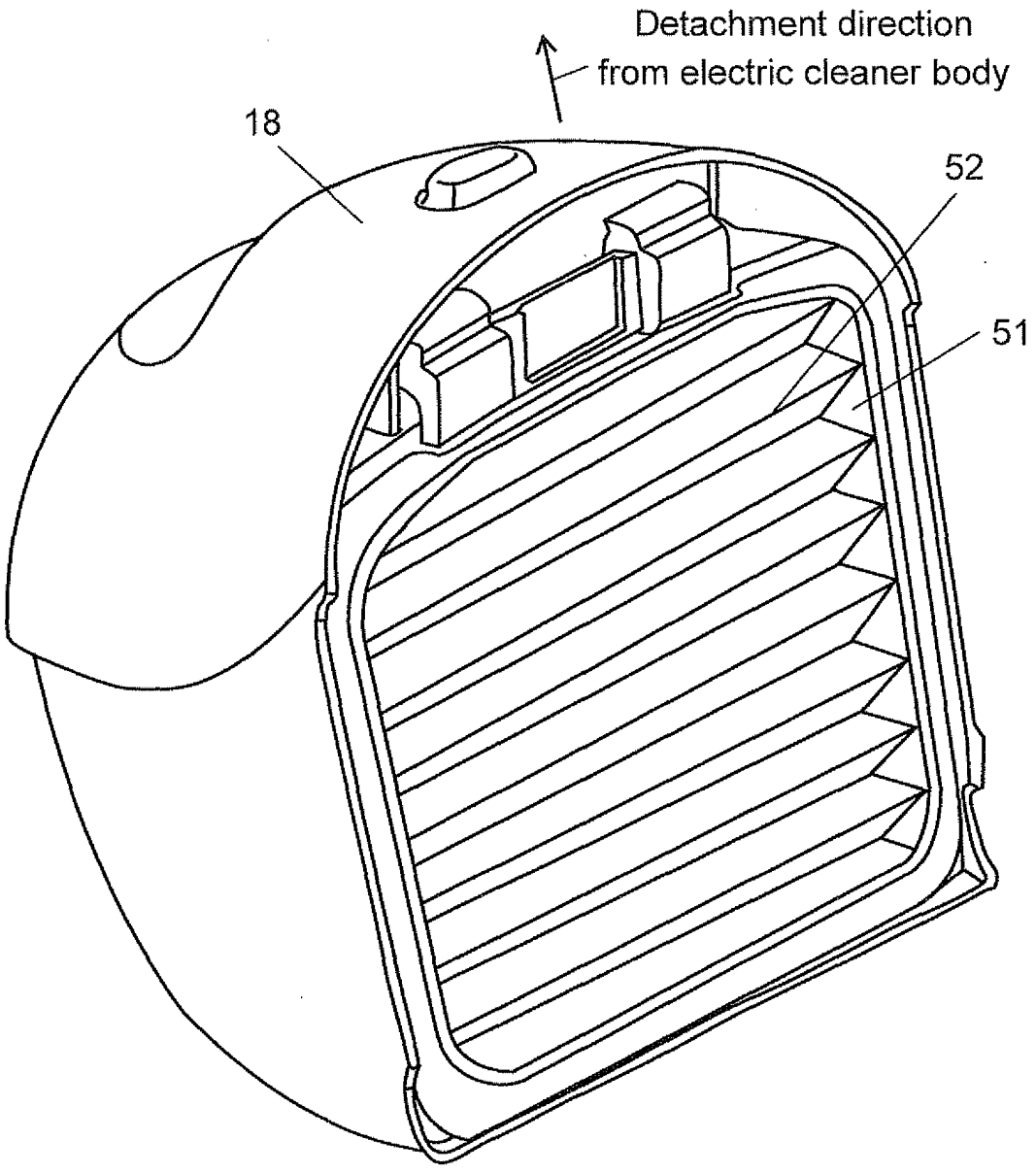


FIG. 6

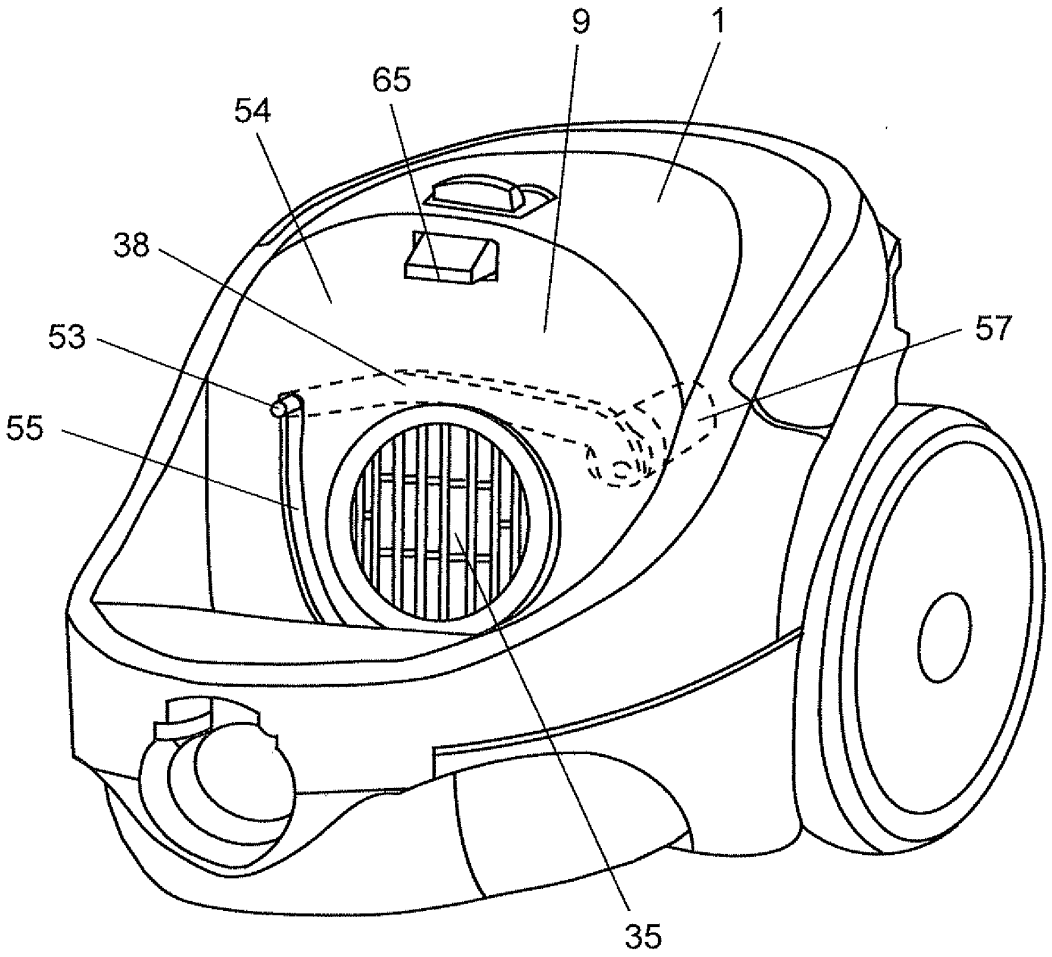


FIG. 7

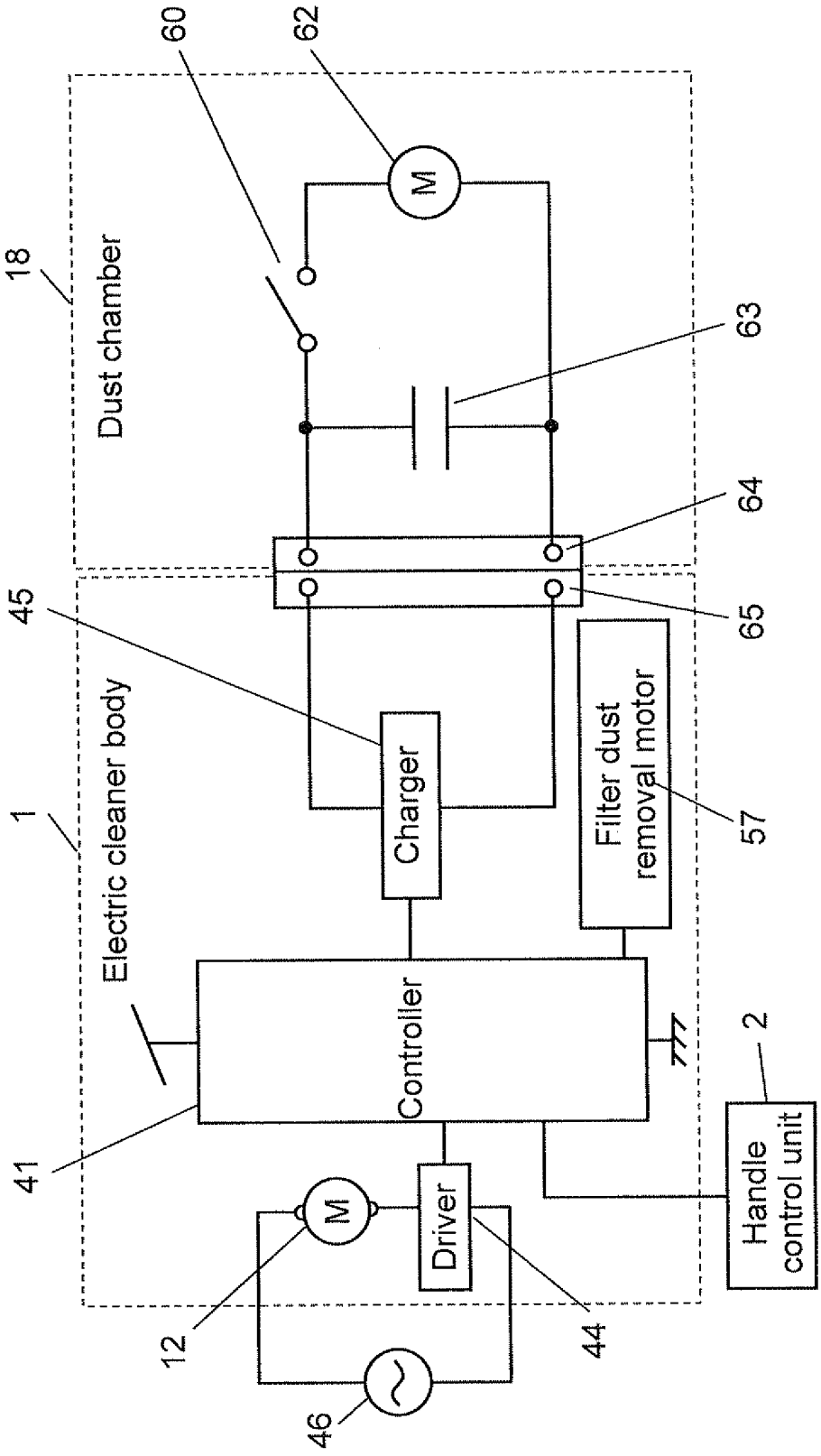

60
62
M
18
Dust chamber
63
64
65
45
Charger
Filter dust removal motor
57
1
Electric cleaner body
Controller
2
41
Handle control unit
M
Driver
12
44
46

FIG. 8

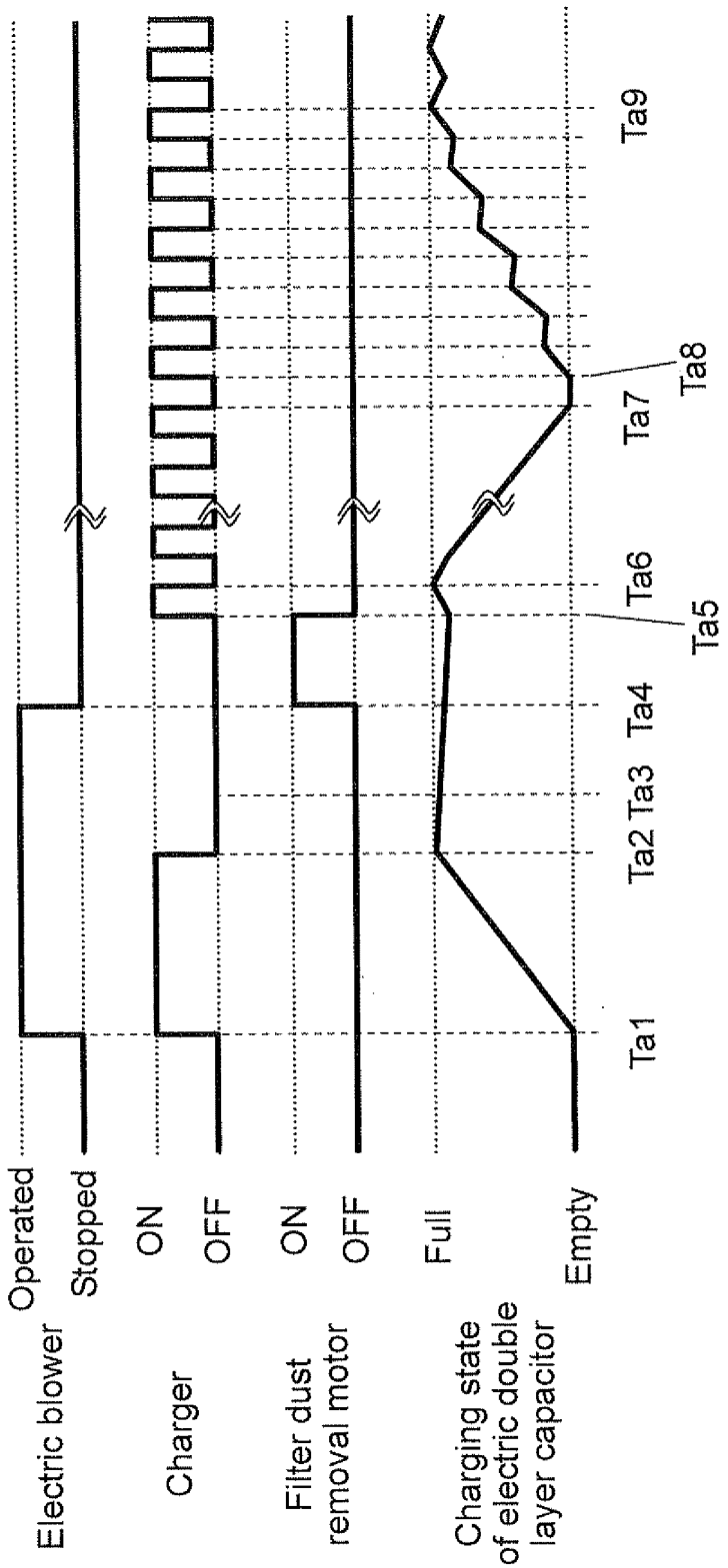

Electric blower
Operated
Stopped
Charger
ON
OFF
Filter dust removal motor
ON
OFF
Charging state of electric double layer capacitor
Full
Empty
Ta1
Ta2
Ta3
Ta4
Ta5
Ta6
Ta7
Ta8
Ta9

FIG. 9

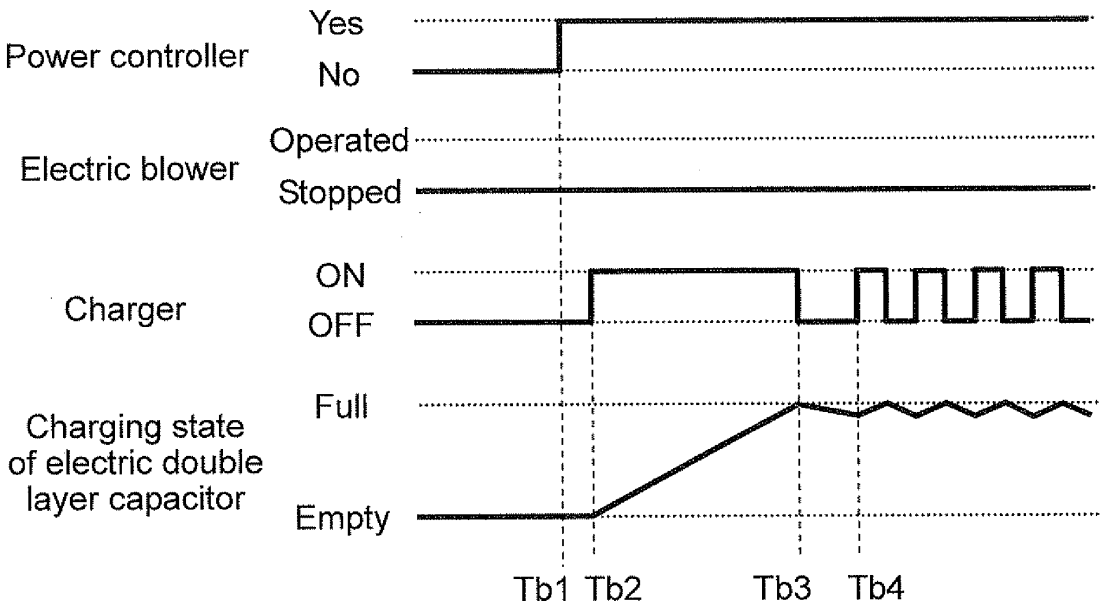

Power controller
Yes
No
Electric blower
Operated
Stopped
Charger
ON
OFF
Charging state of electric double layer capacitor
Full
Empty
Tb1
Tb2
Tb3
Tb4

FIG. 10

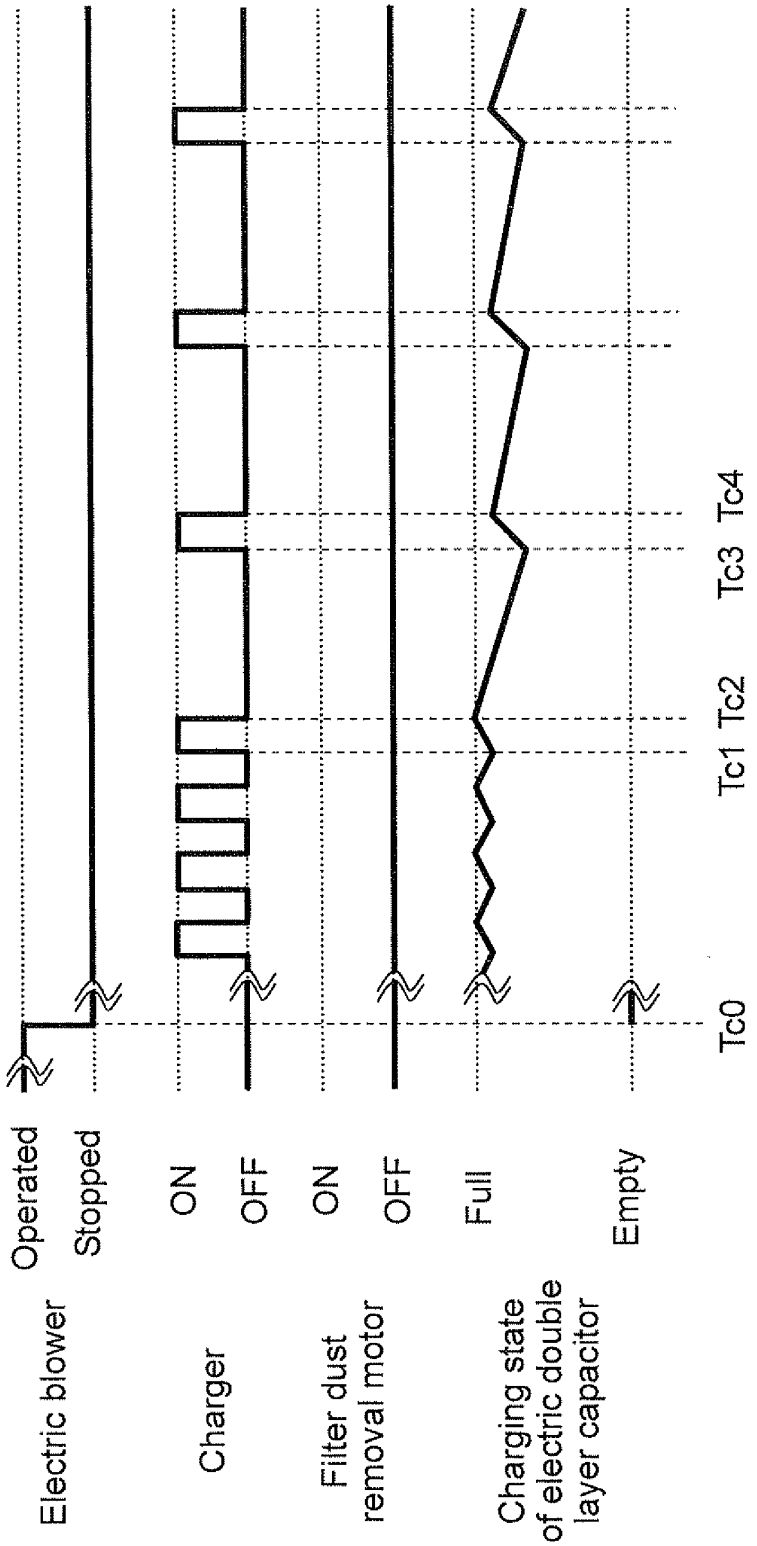

Electric blower
Operated
Stopped
Charger
ON
OFF
Filter dust removal motor
ON
OFF
Charging state of electric double layer capacitor
Full
Empty
Tc0
Tc1
Tc2
Tc3
Tc4

FIG. 11

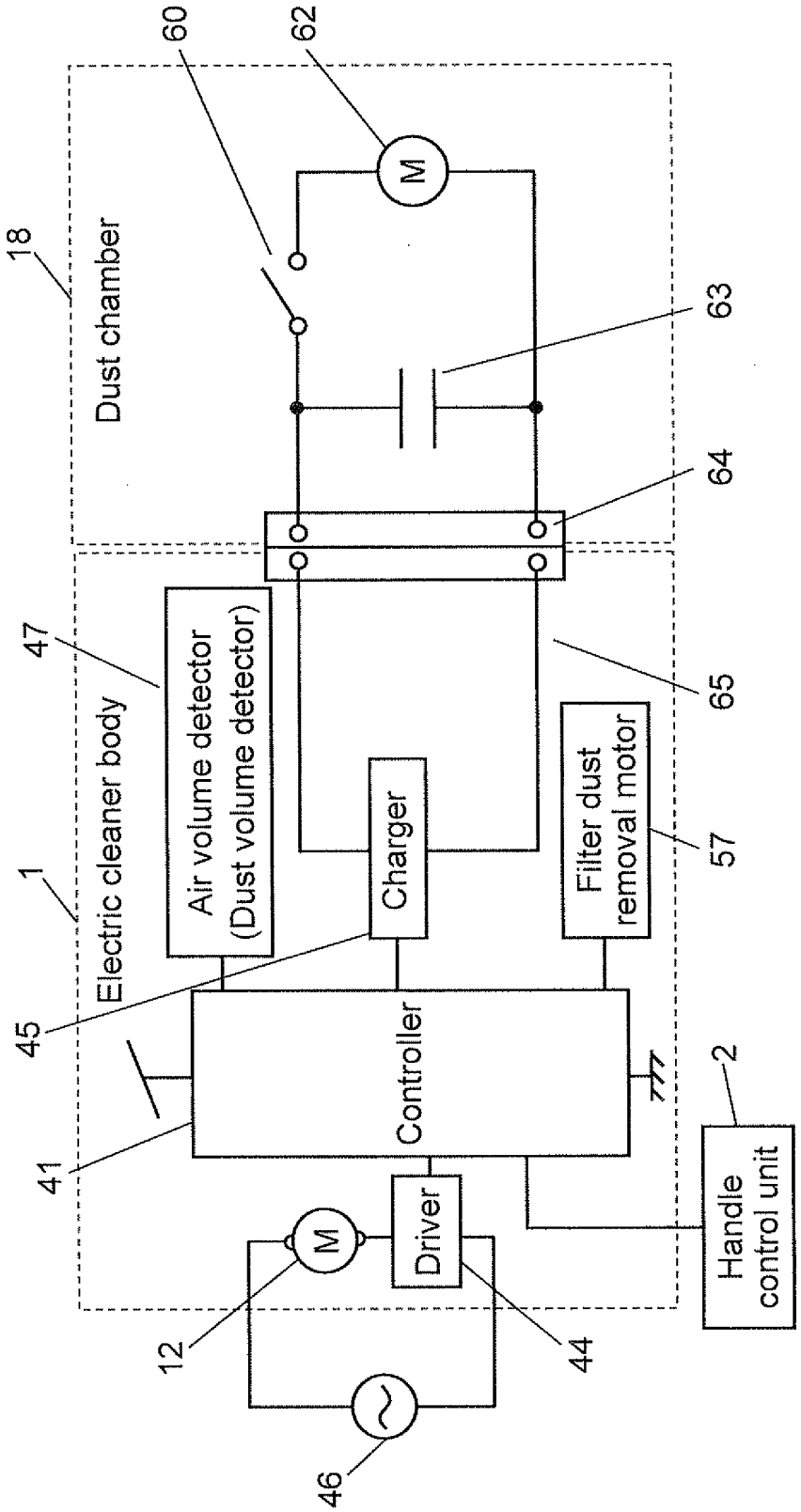

60
62
M
18
Dust chamber
63
64
47
Air volume detector
(Dust volume detector)
65
Charger
Filter dust
removal motor
57
1
Electric cleaner body
45
Controller
2
41
Handle
control unit
M
Driver
12
44
46

FIG. 12

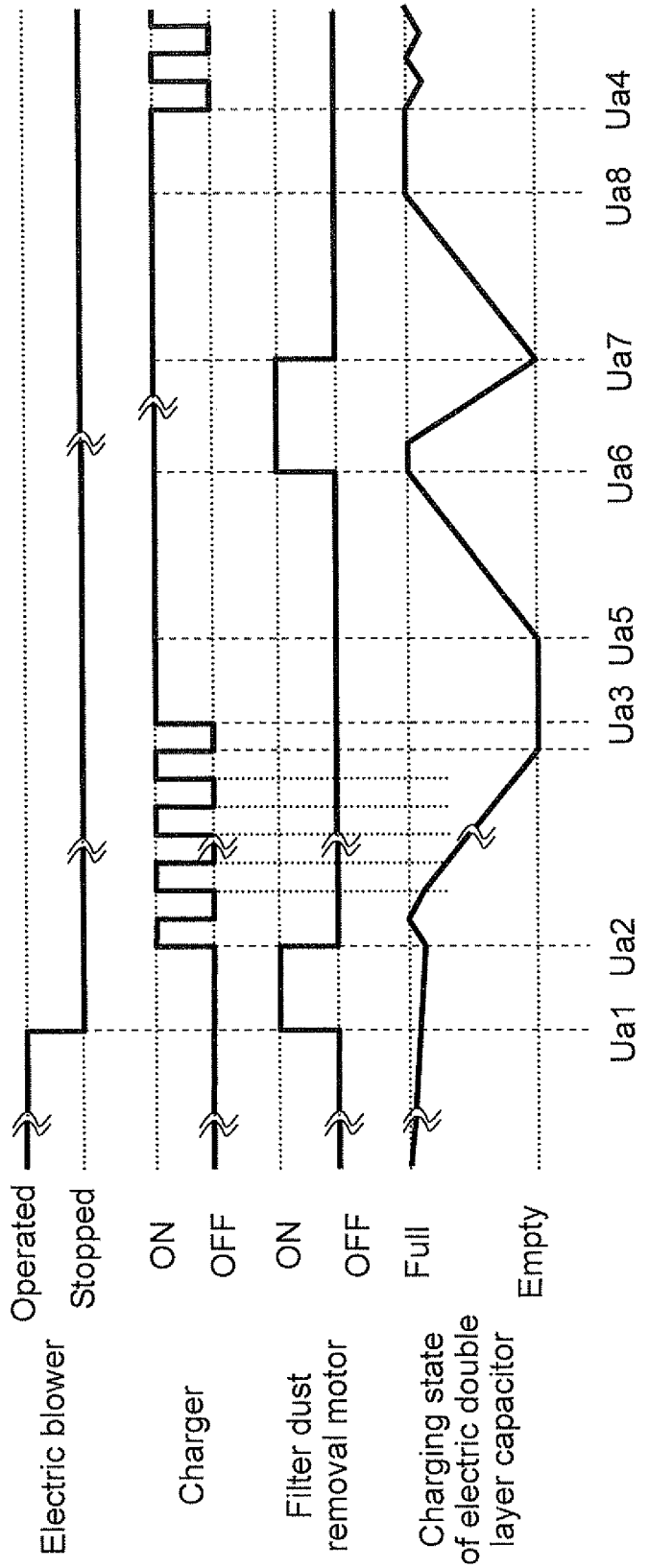
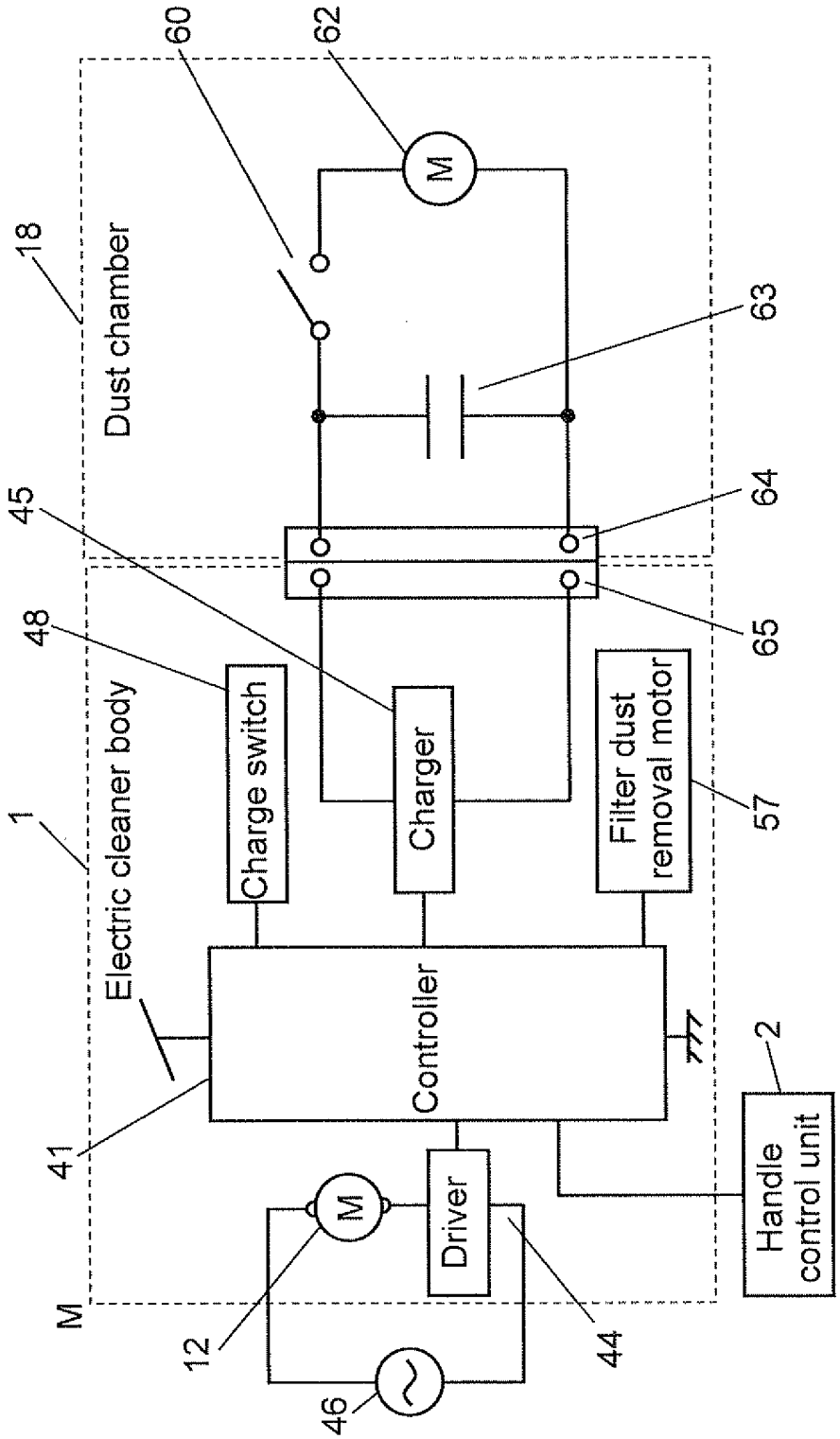

Electric blower
Operated
Stopped
Charger
ON
OFF
Filter dust removal motor
ON
OFF
Charging state of electric double layer capacitor
Full
Empty
Ua1
Ua2
Ua3
Ua5
Ua6
Ua7
Ua8
Ua4

FIG. 13


60
62
M
18
Dust chamber
63
45
64
48
65
Charge switch
Charger
Filter dust removal motor
57
1
Electric cleaner body
Controller
2
41
Handle control unit
M
Driver
12
44
46

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2011/002696

A. CLASSIFICATION OF SUBJECT MATTER
A47L9/28(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

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.
A	JP 2010-069331 A (Panasonic Corp.), 02 April 2010 (02.04.2010), entire text; all drawings (Family: none)	1-6
A	JP 2007-330360 A (Sanyo Electric Co., Ltd.), 27 December 2007 (27.12.2007), paragraphs [0049] to [0051]; fig. 4 (Family: none)	1-6

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

* Special categories of cited documents:
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
02 August, 2011 (02.08.11)	16 August, 2011 (16.08.11)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

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Patent documents cited in the description

- JP 2004358032 A **[0006]**
- JP 2006075396 A **[0006]**