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(54) **ELECTRIC VACUUM CLEANER**

(57) An electric vacuum cleaner with power consumption reduced in confirming whether or not a regular secondary battery is attached to a body. The electric vacuum cleaner 1 comprising: a body 2 on which a secondary battery 4 is detachably mountable; an electric blower 8 housed in the body 2, the electric blower 8 being driven by power supplied from the secondary battery 4 and generating negative pressure; a connection determinator 45 that only at a time of the secondary battery 4 being at-

tached to the body 2, transmits a confirmation signal to the secondary battery 4 and verifies if a reception signal received from the secondary battery 4 and verification information match with each other; and a control member 46 that, if the connection determinator 45 confirms a match between the reception signal and the verification information, permits driving of the electric blower 8, and if the connection determinator 45 confirms otherwise, prohibits driving of the electric blower 8.

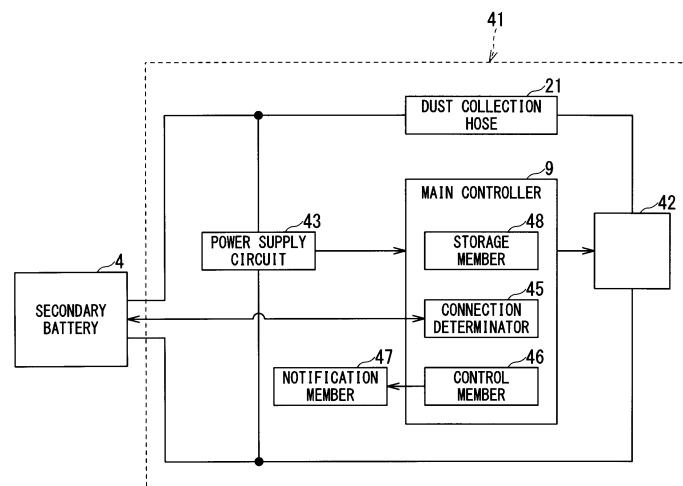


FIG. 2

Description**Advantage of the Invention****FIELD**

[0001] An embodiment described herein relates to an electric vacuum cleaner.

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[0008] The present invention enables provision of an electric vacuum cleaner with power consumption reduced in confirming whether or not a regular secondary battery is attached to a body.

BACKGROUND**BRIEF DESCRIPTION OF THE DRAWINGS**

[0002] Electric vacuum cleaners including a secondary battery as a power supply for a electric blower are known.

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[0009]**Prior Art Documents**

Fig. 1 is a perspective view of an outer appearance of an electric vacuum cleaner according to an embodiment of the present invention.

Patent Documents

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Fig. 2 is a block diagram illustrating the electric vacuum cleaner according to the embodiment of the present invention.

[0003] Patent Document 1: Japanese Patent Laid-Open No. 2005-13460

Fig. 3 is a flowchart illustrating secondary battery recognition control in an electric vacuum cleaner according to the present embodiment.

SUMMARY

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Problems to be Solved by the Invention**DETAILED DESCRIPTION**

[0004] In a conventional electric vacuum cleaner including a secondary battery that can be attached to on a body, a pulsed confirmation signal is continuously transmitted from the body to the secondary battery to verify whether or not a regular secondary battery is attached to the body.

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[0010] An embodiment of an electric vacuum cleaner according to the present invention will be described with reference to Figs. 1 to 3.

[0005] In this conventional electric vacuum cleaner, the pulsed confirmation signal is continuously transmitted, which results in waste power consumption in the secondary battery.

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[0011] Fig. 1 is a perspective view of an outer appearance of an electric vacuum cleaner according to an embodiment of the present invention.

[0006] Therefore, the present invention proposes an electric vacuum cleaner with power consumption reduced in confirming whether or not a regular secondary battery is attached to a body.

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[0012] As illustrated in Fig. 1, an electric vacuum cleaner 1 according to the present embodiment is what is called a canister-type electric vacuum cleaner. The electric vacuum cleaner 1 includes a body 2 that can be moved on a surface to be cleaned, a pipe section 3 detachably attached to the body 2, and a secondary battery 4, which is a power supply detachably attached to the body 2. The body 2 and the pipe section 3 are fluidically connected.

Means for Solving the Problems

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[0013] The secondary battery 4, which is a lithium ion battery, includes a protection circuit (not illustrated) for avoiding overcharge and overdischarge.

[0007] In order to solve the aforementioned problem, an electric vacuum cleaner according to an embodiment of the present invention comprises: a body on which a secondary battery is detachably mountable; an electric blower housed in the body, the electric blower being driven by power supplied from the secondary battery and generating negative pressure; a connection determinator that only at a time of the secondary battery being attached to the body, transmits a confirmation signal to the secondary battery and verifies if a reception signal received from the secondary battery and verification information match with each other; and a control member that, if the connection determinator confirms a match between the reception signal and the verification information, permits driving of the electric blower, and if the connection determinator confirms otherwise, prohibits driving of the electric blower.

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[0014] The body 2 includes a body case 5, a pair of wheels 6 provided on opposite right and left sides of the body case 5, a detachable dust separation/collection mechanism 7 disposed in a front half portion of the body case 5, an electric blower 8 housed in a rear half portion of the body case 5, a main controller 9 that controls mainly the electric blower 8, and a power supply cord 11 that conducts power to the secondary battery 4.

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[0015] The body 2 drives the electric blower 8 using power supplied from the secondary battery 4, and makes negative pressure generated as a result of the driving of the electric blower 8 be exerted in the pipe section 3. The electric vacuum cleaner 1 draws in air containing dust (hereinafter referred to as "dust-containing air") from a surface to be cleaned, through the pipe section 3, separates the dust from the dust-containing air, collects and accumulates the dust after the separation and lets out the air after the separation.

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[0016] At a front portion of the body case 5, a connection port 12 is provided. The connection port 12, which is an inlet of the body 2, fluidically interconnects the pipe section 3 and the dust separation/collection mechanism 7. In a back portion of the body case 5, a joint mechanism (not illustrated) to which the secondary battery 4 is mechanically connected is provided.

[0017] The wheels 6, which are large-diameter running wheels, support the body 2.

[0018] The dust separation/collection mechanism 7 separates dust from dust-containing air flowing into the body 2 and collects and accumulates the dust, and sends clean air with the dust removed to the electric blower 8. The dust separation/collection mechanism 7 may be of a centrifugal separation type or a filtration separation type.

[0019] The electric blower 8 is driven by power supplied from the secondary battery 4. The electric blower 8 draws air in from the dust separation/collection mechanism 7 and thereby generates negative pressure (suction negative pressure).

[0020] The main controller 9 includes a microprocessor (not illustrated) and a storage device (not illustrated) that, e.g., stores various calculation programs to be executed by the microprocessor, and parameters. In the storage device, a plurality of operation modes set in advance is stored. The operation modes set in advance are ones relating to magnitudes of a driving output of the electric blower 8, and correspond to instructions provided by a user operating the pipe section 3. For the respective operation modes, mutually-different input values (input values for the electric blower 8) are set. In response to an instruction provided by the user operating the pipe section 3, the main controller 9 selects a given operation mode corresponding to the instruction from among the plurality of operation modes set in advance, reads the operation mode from the storage device, and controls the electric blower 8 according to the read operation mode.

[0021] The power supply cord 11, which is detachably attached to the body 2, supplies power from a plug-in connector for electric distribution (a so-called receptacle outlet, which is not illustrated) to the secondary battery 4. A plug 14 is provided at a free end portion of the power supply cord 11. The secondary battery 4 is charged via the power supply cord 11.

[0022] The pipe section 3 draws in dust-containing air from a surface to be cleaned to the body 2 by means of the negative pressure exerted from the body 2 and guides the dust-containing air. The pipe section 3 includes a connection pipe 19, which serves as a joint, detachably connected to the body 2, a dust collection hose 21 fluidically connected to the connection pipe 19, a hand operation pipe 22 fluidically connected to the dust collection hose 21, a grip portion 23 projecting from the hand operation pipe 22, an operation section 24 provided at the grip portion 23, an extension pipe 25 detachably connected to the hand operation pipe 22, and a suction port

body 26 detachably connected to the extension pipe 25.

[0023] The connection pipe 19, which is a joint detachably connected to the connection port 12, is fluidically connected to the dust separation/collection mechanism 7 through the connection port 12.

[0024] The dust collection hose 21 is a long and flexible hose having a substantially cylindrical shape. One end portion (here, a rear end portion) of the dust collection hose 21 is fluidically connected to the connection pipe 19. The dust collection hose 21 is fluidically connected to the dust separation/collection mechanism 7 through the connection pipe 19.

[0025] The hand operation pipe 22 links the dust collection hose 21 and the extension pipe 25. One end portion (here, a rear end portion) of the hand operation pipe 22 is fluidically connected to another end portion (here, a front end portion) of the dust collection hose 21. The hand operation pipe 22 is fluidically connected to the dust separation/collection mechanism 7 through the dust collection hose 21 and the connection pipe 19.

[0026] The grip portion 23 is a part to be gripped by a user with his/her hand for operating the electric vacuum cleaner 1. The grip portion 23, which has a proper shape enabling the user to easily grip with his/her hand, projects from the hand operation pipe 22.

[0027] The operation section 24 includes switches associated with respective operation modes. More specifically, the operation section 24 includes a stop switch 24a associated with an instruction to stop operation of the electric blower 8, a start switch 24b associated with an instruction to start operation of the electric blower 8, and a brush switch 24c associated with an instruction to supply power to the suction port body 26. The stop switch 24a and the start switch 24b are electrically connected to the main controller 9. The user of the electric vacuum cleaner 1 can select one of the operation modes of the electric blower 8 by operating the operation section 24. The start switch 24b functions also as an operation mode selection switch during the electric blower 8 operating. In this case, each time the main controller 9 receives an instruction signal from the start switch 24b, switches operation modes in the order of strong, middle, weak, strong, middle, weak.... Here, the operation section 24 may include a strong operation switch (not illustrated), a middle operation switch (not illustrated) and a weak operation switch (not illustrated) individually, instead of the start switch 24b.

[0028] The extension pipe 25, which has a telescopic structure in which a plurality of tubular bodies are put on one another, is an extensible pipe having a substantially cylindrical elongated tube. A joint mechanism detachably attached to another end portion (here, a front end portion) of the hand operation pipe 22 is provided at one end portion (here, a rear portion) of the extension pipe 25. The extension pipe 25 is fluidically connected to the dust separation/collection mechanism 7 through the hand operation pipe 22, the dust collection hose 21 and the connection pipe 19.

[0029] The suction port body 26 can run or glide on a surface to be cleaned such as a wood floor or a carpet, and includes a suction port 28 in a bottom surface facing the surface to be cleaned in a running or gliding state. Also, the suction port body 26 includes a rotational sweeping body 29, which is rotatable, disposed in the suction port 28, and an electric motor 31 that drives the rotational sweeping body 29. A joint mechanism detachably attached to another end portion (here, a front end portion) of the extension pipe 25 is provided at one end portion (here, a rear end portion) of the suction port body 26. The suction port body 26 is fluidically connected to the dust separation/collection mechanism 7 through the extension pipe 25, the hand operation pipe 22, the dust collection hose 21 and the connection pipe 19. In other words, the suction port body 26, the extension pipe 25, the hand operation pipe 22, the dust collection hose 21, the connection pipe 19 and the dust separation/collection mechanism 7 form a suction air passageway leading to the suction port 28 from the electric blower 8. The electric motor 31 alternately starts and stops operating each time the electric motor 31 receives an instruction signal from the brush switch 24c.

[0030] Upon receipt of an instruction provided by the user operating the start switch 24b, the electric vacuum cleaner 1 starts the electric blower 8. For example, upon receipt of an instruction provided by the start switch 24b being operated in a state in which the electric blower 8 is stopped, the electric vacuum cleaner 1 first makes the electric blower 8 operate in a strong operation mode. Then, upon receipt of an instruction provided by the start switch 24b being operated again, the electric vacuum cleaner 1 makes the electric blower 8 operate in a middle operation mode, and upon receipt of an instruction, which is the third, provided by the start switch 24b being operated, the electric vacuum cleaner 1 makes the electric blower 8 operate in a weak operation mode, and the above is repeated subsequently. The strong operation mode, the middle operation mode and the weak operation mode are included in the plurality of operation modes set in advance, and a value input to the electric blower 8 is smaller in the order of the strong operation mode, the middle operation mode and the weak operation mode. The started electric blower 8 draws air out from the dust separation/collection mechanism 7 to produce negative pressure inside the dust separation/collection mechanism 7.

[0031] The negative pressure inside the dust separation/collection mechanism 7 sequentially passes through the connection port 12, the connection pipe 19, the dust collection hose 21, the hand operation pipe 22, the extension pipe 25 and the suction port body 26, and is then exerted in the suction port 28. The electric vacuum cleaner 1 draws in dust on the surface to be cleaned together with air, by means of the negative pressure exerted in the suction port 28 and thereby cleans the surface to be cleaned. The dust separation/collection mechanism 7 separates and accumulates the dust-containing air

drawn into the electric vacuum cleaner 1, and also sends air separated from the dust-containing air to the electric blower 8. The electric blower 8 lets the air drawn in from the dust separation/collection mechanism 7 out to the outside of the body 2.

[0032] Fig. 2 is a block diagram of the electric vacuum cleaner according to the embodiment of the present invention.

[0033] As illustrated in Fig. 2, the electric vacuum cleaner 1 according to the present embodiment includes a control circuit 41 electrically connected to the secondary battery 4.

[0034] The control circuit 41 control operation of the electric blower 8. The control circuit 41 includes: the electric blower 8 serially connected to the secondary battery 4; a switching element 42 that opens/closes an electric circuit connecting the secondary battery 4 and the electric blower 8; a power supply circuit 43 for control, the power supply circuit 43 converting a battery voltage from the secondary battery 4 and thereby outputting power for control; a connection determinator 45 that only at the time of the secondary battery 4 being attached to the body 2, transmits a confirmation signal to the secondary battery 4 and verifies if a reception signal received from the secondary battery 4 and body-side verification information match with each other; a control member 46 that if the connection determinator 45 confirms a match between the reception signal and the body-side verification information, permits driving of the electric blower 8, and if the connection determinator 45 confirms otherwise, prohibits driving of the electric blower 8; and a notification member 47 that provides notification of a mismatch between the reception signal and the body-side verification information based on a result of the confirmation by the connection determinator 45. Here, "only at the time of the secondary battery 4 being mounted on the body 2" means a period of time immediately after the secondary battery 4 being mounted on the body 2, and is a limited period of time, for example, around 10 seconds.

[0035] The switching element 42 is, for example, a field-effect transistor (FET), and includes a gate connected to the main controller 9. The switching element 42 varies an input to the electric blower 8 according to variation in gate current.

[0036] The power supply circuit 43 converts a voltage of power supplied from the secondary battery 4 to the control circuit 41 into a power supply voltage for control and supplies the power supply voltage to the main controller 9.

[0037] The connection determinator 45 and the control member 46 are programs to be executed by the main controller 9. The main controller 9 is formed of a micro-computer, and includes a central processing unit (not illustrated), a storage member 48, an I/O member (not illustrated) and a timer (not illustrated).

[0038] The storage member 48 is a non-volatile memory, for example, an EEPROM. The storage member 48 stores, e.g., a control program to be executed by the cen-

tral processing unit and data such as constants necessary for execution of the control program, in advance. The data include constants indicating input values for each of the operation modes set in advance. Also, the storage member 48 serves as a data storage area and a work area that temporarily stores, e.g., calculation data from the central processing unit. Furthermore, the storage member 48 stores a mismatch between a reception signal and the body-side verification information, from a result of confirmation by the connection determinator 45.

[0039] The main controller 9 and the secondary battery 4 are connected via an interactive communication line. The main controller 9 performs secondary battery recognition control for determining whether the secondary battery 4 is a regular product or an irregular product while performing interactive communication with the secondary battery 4.

[0040] Also, the main controller 9 periodically reads an instruction signal output by the operation section 24, and performs switching control of the switching element 42 according to the selected operation mode to vary the input to the electric blower 8.

[0041] Furthermore, the main controller 9 varies the input to the electric blower 8 according to, for example, three operation modes, which are weak, middle and strong. The main controller 9 switches operation modes each time the main controller 9 receives an instruction signal from the start switch 24b and performs switching control of the switching element 42.

[0042] The notification member 47 includes a display device such as a lamp or a liquid-crystal monitor that provides notification in the form of visual information to the user of the electric vacuum cleaner 1, and for example, a speaker that provides notification in the form of audio information to the user of the electric vacuum cleaner 1. The notification member 47 provides notification of connection of a secondary battery 4 that is an irregular product to the body 2, according to an instruction from the main controller 9.

[0043] The secondary battery recognition control performed by the main controller 9 will be described.

[0044] Fig. 3 is a flowchart of secondary battery recognition control in the electric vacuum cleaner according to the present embodiment.

[0045] As illustrated in Fig. 3, in the electric vacuum cleaner 1 according to the present embodiment, upon a voltage being applied from the secondary battery 4 to the power supply circuit 43 as a result of the secondary battery 4 being attached to the body 2, power is supplied from the power supply circuit 43 to the main controller 9 to start the main controller 9 (step S1). Upon the start of the main controller 9, the connection determinator 45 of the main controller 9 transmits a confirmation signal to the secondary battery 4 (step S2). The confirmation signal is arbitrary information stored in advance in the storage member 48 of the main controller 9.

[0046] Upon receipt of the confirmation signal from the main controller 9 on the body 2 side (step S3), the sec-

ondary battery 4 verifies if the confirmation signal and battery-side verification information match with each other (step S4). The battery-side verification information is stored in advance in the protection circuit in the secondary battery 4. If the secondary battery 4 confirms that the confirmation signal and the battery-side verification information matches with each other (step S4: match), the secondary battery 4 transmits a confirmation response signal including information indicating the confirmation of the match (match information) back to the connection determinator 45 (step S5). On the other hand, if the secondary battery 4 confirms a mismatch between the confirmation signal and the battery-side verification information (step S4; mismatch), the secondary battery 4 transmits a confirmation response signal including information indicating the confirmation of the mismatch (mismatch information) back to the connection determinator 45 (step S6).

[0047] Upon receipt of the confirmation response signal from the secondary battery 4 (step S7), the connection determinator 45 verifies if the confirmation response signal and the body-side verification information match with each other (step S8). If the connection determinator 45 confirms a match between the confirmation response signal and the body-side verification information (step S8: match), the connection determinator 45 determines that the match is confirmed (step S9). On the other hand, if the connection determinator 45 confirms a mismatch between the confirmation response signal and the body-side verification information (step S8: mismatch), the connection determinator 45 determines that the mismatch is confirmed (step S10). Here, the secondary battery 4 that is an irregular product may have no function that transmits a confirmation response signal back to the connection determinator 45, irrespective of match information or mismatch information. In this case, the connection determinator 45 can receive no confirmation response signal, and thus naturally cannot perform verification between the confirmation response signal and the body-side verification information, and recognizes a mismatch between the confirmation response signal and the body-side verification information (step S8: mismatch) and determines that the mismatch is confirmed (step S10).

[0048] The confirmation response signal is a signal generated by the secondary battery 4 based on a result of verification between the confirmation signal and the battery-side verification information, which is different from the confirmation signal transmitted by the connection determinator 45 to the secondary battery 4. In other words, the connection determinator 45 stores the confirmation signal and the body-side verification information that are different from each other. Also, in the verification between the confirmation response signal and the body-side verification information in the connection determinator 45, the confirmation response signal may be a digital signal including a plurality of bit string, a single-bit digital signal, a single analog signal or a plurality of analog

signals having an arbitrary form such as a sinusoidal form, a semi-sinusoidal form, an impulse form or a stepped form.

[0049] If the connection determinator 45 determines that the match is confirmed, the control member 46 permits operation of the electric blower 8 and ends the secondary battery recognition control (step S11). Subsequently, the control member 46 makes the electric blower 8 operate according to the operation mode selected via the operation section 24.

[0050] On the other hand, if the connection determinator 45 determines that the mismatch is confirmed, the control member 46 prohibits operation of the electric blower 8 and ends the secondary battery recognition control (step S12). Subsequently, the control member 46 shuts off the power supply to the electric blower 8 irrespective of the operation mode selected via the operation section 24. Also, the control member 46 provides notification of the secondary battery 4 being an irregular product, to the user via the notification member 47. Furthermore, the control member 46 makes the storage member 48 store information that the secondary battery 4 is an irregular product.

[0051] As described above, the electric vacuum cleaner 1 according to the present embodiment transmits the confirmation signal to the secondary battery 4 only at the time of the secondary battery 4 being attached to the body 2, and verifies if a reception signal received from the secondary battery 4 and verification information match with each other, enabling substantial power consumption reduction in confirming whether or not the secondary battery 4 is a regular product, compared to the conventional electric vacuum cleaners. In other words, as opposed to the conventional electric vacuum cleaners, the electric vacuum cleaner 1 according to the present embodiment does not continuously transmit the confirmation signal, but verifies if a secondary battery 4 that is a regular product is mounted on the body 2 only at the time of the secondary battery 4 being mounted on the body 2, whereby power consumption is substantially reduced.

[0052] Also, the electric vacuum cleaner 1 according to the present embodiment stores the confirmation signal and the body-side verification information that are different from each other, enabling the cleaner body 2 and the secondary battery 4 to mutually confirm whether or not the product on the opposite side is a regular product.

[0053] Furthermore, the electric vacuum cleaner 1 according to the present embodiment includes the notification member 47, and thus, even if the electric blower 8 is not driven and the electric vacuum cleaner 1 is suspected of having a failure as a result of a user attaching a secondary battery 4 that is an irregular product to the body 2 without knowing that the secondary battery 4 is an irregular product, notification of a cause of the electric blower 8 being not driven is reliably provided to the user, enabling urging the user to take a proper countermeasure.

[0054] Also, the electric vacuum cleaner 1 according to the present embodiment includes the storage member 48, and thus, e.g., if there is a fear of failure of the body 2 as a result of a secondary battery 4 that is an irregular product being attached to the body 2, prohibits subsequent driving of the electric blower 8 and urges a manufacturer's inspection, and when identifying a cause of a failure of the failed body 2, checks a history of use of the irregular secondary battery 4 to promptly identify the cause of the failure, enabling convenience enhancement in maintenance and post-sales support.

[0055] Therefore, the electric vacuum cleaner 1 according to the present invention enables power consumption reduction in confirming whether or not a regular secondary battery 4 is connected to the body 2.

[0056] The electric vacuum cleaner 1 according to the present embodiment is not limited to a canister-type one, and may be of, e.g., an upright type, a stick type or a handheld type. Also, the electric vacuum cleaner 1 may be of a cordless type in which a secondary battery is provided in addition to a commercial alternating-current power supply E.

[0057] While certain the embodiment has been described, this embodiment has been presented by way of example only, and is not intended to limit the scope of the invention. Indeed, the novel apparatuses and units described herein may be embodied in a variety of other forms; furthermore, various omissions, substitutions and changes in the form of the apparatuses and units described herein may be made without departing from the spirit of the invention. The accompanying claims and their equivalents are intended to cover such forms or modifications as would fall within the scope and spirit of the invention.

Reference Signs List

[0058]

1	electric vacuum cleaner
2	body
3	pipe section
4	secondary battery
5	body case
6	wheel
7	dust separation/collection mechanism
8	electric blower
9	main controller
11	power supply cord
12	connection port
14	plug
19	connection pipe
21	dust collection hose
22	hand operation pipe
23	grip portion
24	operation section
24a	stop switch
24b	start switch

24c	brush switch	
25	extension pipe	
26	suction port body	
28	suction port	
29	rotational sweeping body	5
31	electric motor	
41	control circuit	
42	switching element	
43	power supply circuit for control	
45	connection determinator	10
46	control member	
47	notification member	
48	storage member	

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Claims

1. An electric vacuum cleaner comprising:

a body on which a secondary battery is detach- 20
ably mountable;
an electric blower housed in the body, the elec-
tric blower being driven by power supplied from
the secondary battery and generating negative
pressure; 25
a connection determinator that only at a time of
the secondary battery being attached to the
body, transmits a confirmation signal to the sec-
ondary battery and verifies if a reception signal
received from the secondary battery and verifi- 30
cation information match with each other; and
a control member that, if the connection deter-
minator confirms a match between the reception
signal and the verification information, permits
driving of the electric blower, and if the connec- 35
tion determinator confirms otherwise, prohibits
driving of the electric blower.

2. The electric vacuum cleaner according to claim 1, 40
wherein the connection determinator stores the con-
firmation signal and the verification information that
are different from each other.

3. The electric vacuum cleaner according to claim 1 or 45
2, comprising a notification member that provides
notification of a mismatch between the reception sig-
nal and the verification information, based on a result
of the confirmation by the connection determinator.

4. The electric vacuum cleaner according to any one 50
of claims 1 to 3, comprising a storage member that
stores a mismatch between the reception signal and
the verification information, based on a result of the
confirmation by the connection determinator.

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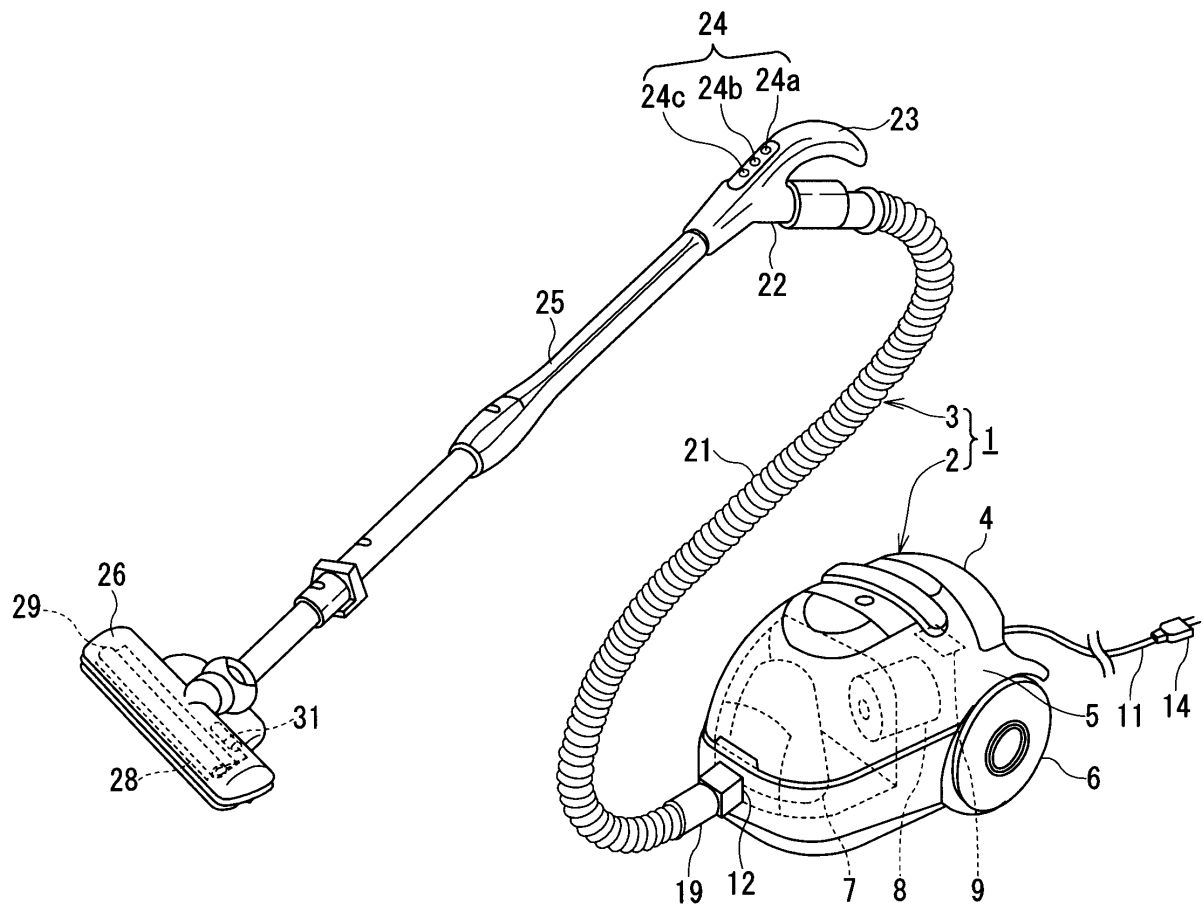


FIG. 1

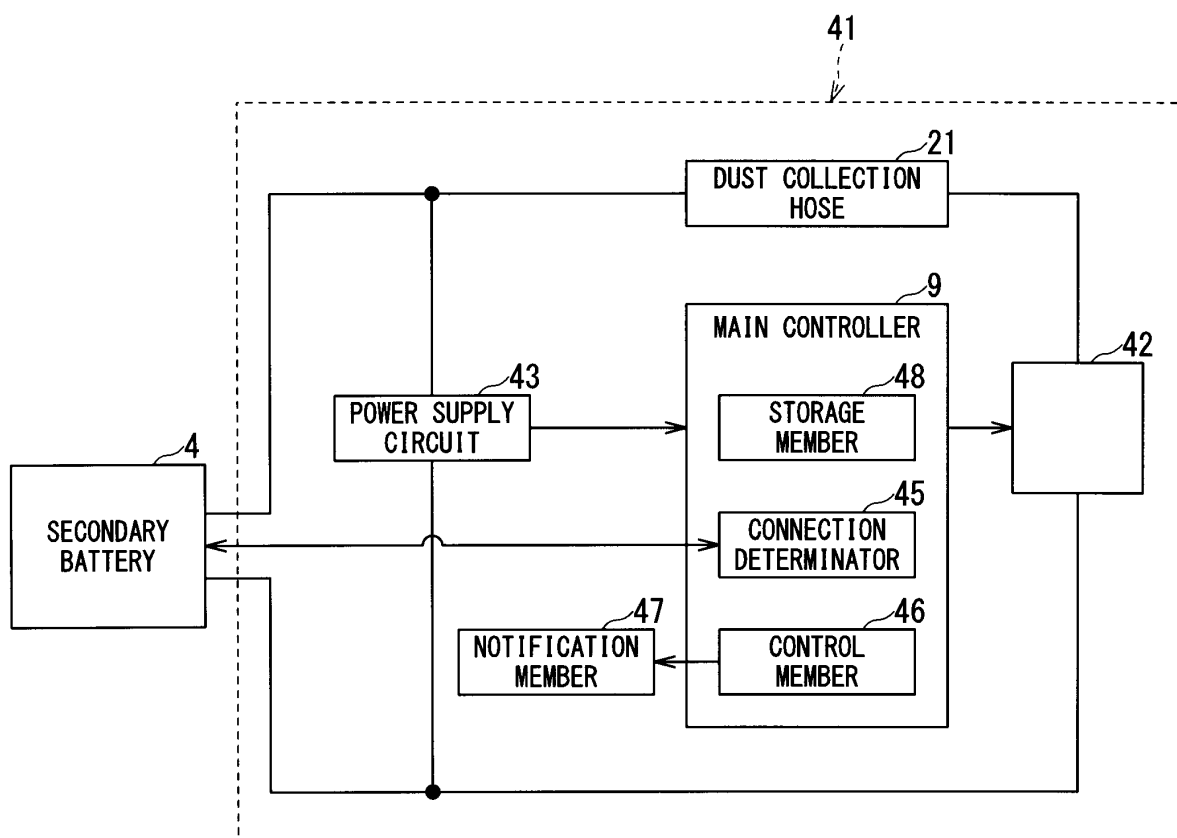


FIG. 2

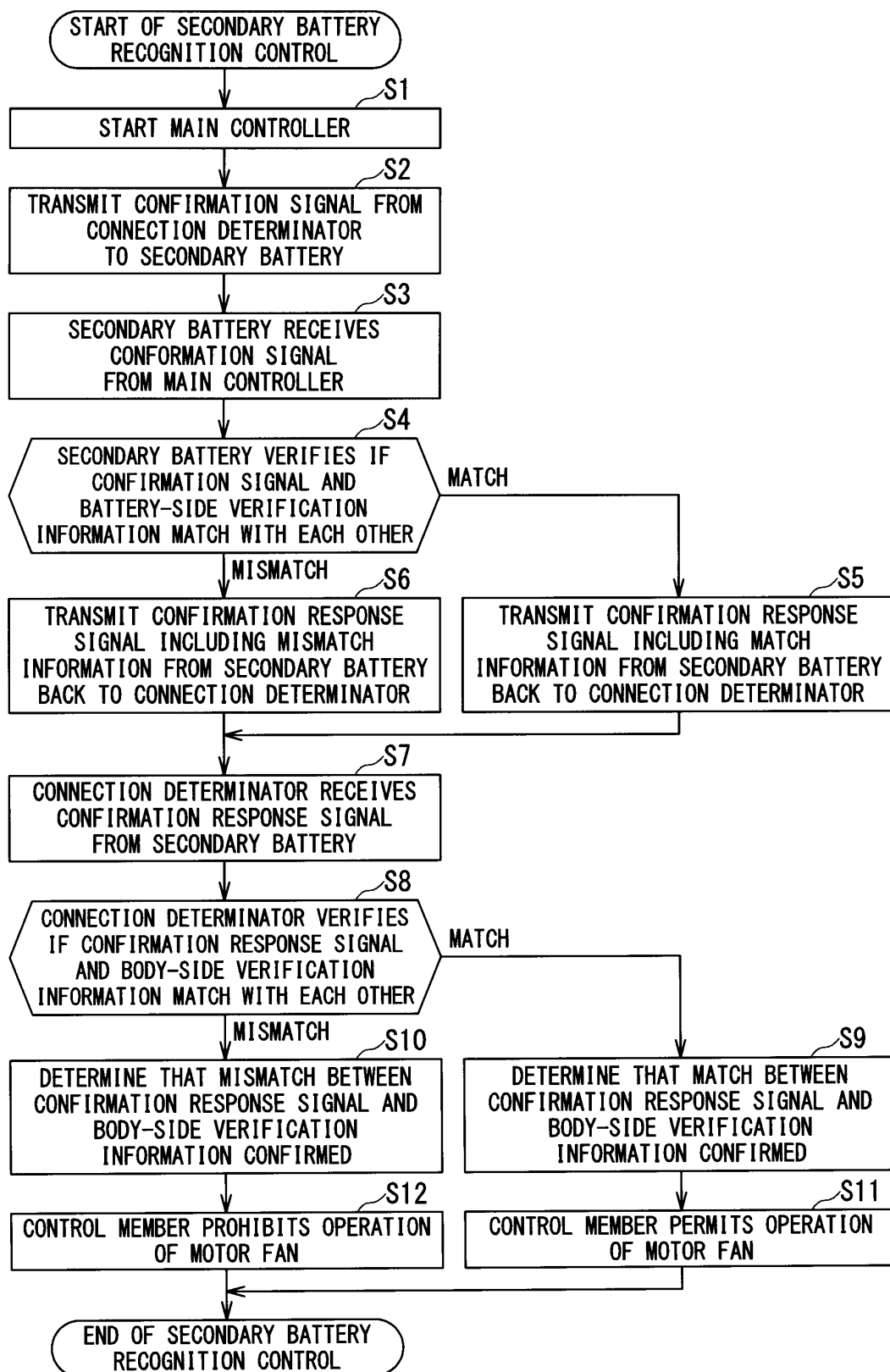


FIG. 3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2014/082031

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 1996-2015
Kokai Jitsuyo Shinan Koho 1971-2015 Toroku Jitsuyo Shinan Koho 1994-2015

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 2006-236806 A (Matsushita Electric Industrial Co., Ltd.), 07 September 2006 (07.09.2006), claim 9; paragraphs [0037] to [0038] (Family: none)	1-4
Y	JP 1-209929 A (Matsushita Electric Industrial Co., Ltd.), 23 August 1989 (23.08.1989), page 2, lines 11 to 15 (Family: none)	1-4
Y	JP 2005-140913 A (Seiko Epson Corp.), 02 June 2005 (02.06.2005), paragraphs [0028] to [0037], [0041] (Family: none)	2-4



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

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Date of the actual completion of the international search
02 March 2015 (02.03.15)

Date of mailing of the international search report
10 March 2015 (10.03.15)

Name and mailing address of the ISA/
Japan Patent Office
3-4-3, Kasumigaseki, Chiyoda-ku,
Tokyo 100-8915, Japan

Authorized officer

Telephone No

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2014/082031

C (Continuation).	DOCUMENTS CONSIDERED TO BE RELEVANT	
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2007-282471 A (Seiko Epson Corp.), 25 October 2007 (25.10.2007), paragraphs [0038] to [0042], [0062] & US 2007/0214296 A1 & CN 101056000 A	4

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

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2005013460 A [0003]