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(54) ELECTRIC CLEANER AND METHOD FOR ADJUSTING SAME

(57) An electric vacuum cleaner includes a cleaner main body housing electricblowers 15Aand 15B and having a dust collecting bag located on the suction side of the electric blowers 15A and 15B. The electric vacuum cleaner includes a display means 47. The electric vacuum cleaner includes a control means 16 capable of switching the electric blower 15 to be actuated according to a predetermined condition. The control means 16 makes the display means 47 display clogging of the dust collecting bag when the air amount during operation of the electric blower 15 is a first predetermined air amount or less. The control means 16 powers down the electric blower 15 when the air amount during operation of the electric blower 15 is a second predetermined air amount or less.

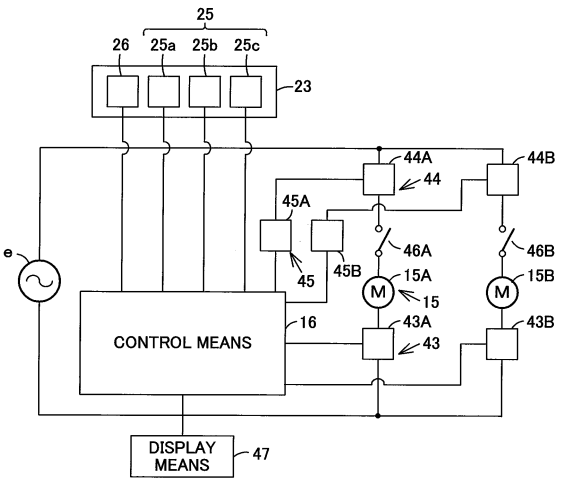

FIG. 1

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Description

FIELD

[0001] Embodiments described herein relate generally to an electric vacuum cleaner including a plurality of electric blowers and an adjusting method thereof.

BACKGROUND

[0002] Conventionally, an electric vacuum cleaner of this type houses, for example, a pair of electric blowers inside a cleaner main body. In this cleaner main body, a dust collecting chamber that is communicatively connected to the suction side of the electric blowers is formed. In the cleaner main body, a control means for controlling actuation of the electric blowers is disposed. In addition, this control means is arranged so as to switch actuation of the electric blower(s) according to an operation mode, etc., such as a weak mode, a medium mode, or a strong mode set by an operator (for example, refer to Patent documents 1 and 2).

CITATION LIST

Patent Literature

[0003]

PTL 1: Japanese Laid-Open Patent Publication No. 2007-20765 (pages 5 and 6, Figs. 1 and 2).
PTL 2: Japanese Laid-Open Patent Publication No. 2009-125399 (pages 3 to 8, Figs. 1 to 3).

SUMMARY OF INVENTION

Technical Problem

[0004] In the above-described electric vacuum cleaner, even when the operator attempts to operate the electric vacuum cleaner in the same operationmode, the control means sometimes switches the electric blower to be actuated as necessary in order to make the use lives of the electric blowers uniform by, for example, making the total operation times of the electric blowers substantially uniform. In some cases, for example, at the time of a predetermined condition such that the operator once stops the electric vacuum cleaner, and then attempts to again operate the electric vacuum cleaner in the same operation mode as that just before stopping, the control means performs control so as to actuate the electric blower that had been at a standstill just before stopping and stop the electric blower that had been actuated just before stopping.

[0005] However, in the case of performing such control, the respective electric blowers have input variations, so that the display timing of a display unit for informing the operator of the time for dust disposal or the power-down timing of the electric blower, etc., may be different despite being in the same operation mode, and with the same collected dust amount, etc.

[0006] The present invention has been made in view of these circumstances, and an object thereof is to provide an electric vacuum cleaner capable of making an operating unit perform a predetermined operation at the same timing without depending on an actuated electric blower and an adjusting method thereof.

Solution to Problem

[0007] An electric vacuum cleaner according to an embodiment includes a cleaner main body housing a plurality of electric blowers, and including a dust collecting part located on a suction side of these electric blowers, an operable operating unit, and a control means capable of switching the electric blower to be actuated according to a predetermined condition, for controlling operation of the operating unit so as to make the operating unit perform a predetermined operation when an air amount during operation of the electric blower is a predetermined air amount or less.

[0008] An adjusting method of an electric vacuum cleaner according to an embodiment is an adj usting method of an electric vacuum cleaner including a cleaner main body housing a plurality of electric blowers, and including a dust collecting part located on a suction side of these electric blowers, an operable operating unit, a current detecting means for detecting a current value of the actuated electric blower, an adjusting means capable of adjusting a current output value from the current detecting means, and a control means capable of switching the electric blower to be actuated according to a predetermined condition, for controlling operation of the electric blowers and the operation unit, respectively, according to a current output value from the current detecting means which has been adjusted by the adjusting means, wherein the electric blowers are actuated so as to reach predetermined air amounts, respectively, with the electric blowers fitted into the cleaner main body, and the adjusting means performs adjustment so that current output values corresponding to the electric blowers from the current detecting means become predetermined values set in advance.

BRIEF DESCRIPTION OF DRAWINGS

[0009]

Fig. 1 is a block diagram showing an electric vacuum cleaner according to a first embodiment.
Figs. 2 are plan views showing the same electric vacuum cleaner, in which Fig. 2 (a) shows a state where one electric blower is actuated, Fig. 2(b) shows a state where another electric blower is actuated, and Fig. 2 (c) shows a state where both electric blowers are actuated.

Fig. 3 is a perspective view showing the same electric vacuum cleaner.

Fig. 4 is a graph showing characteristics between the air amount and input of the same electric vacuum cleaner and control of electric blowers.

Fig. 5 is a block diagram showing an electric vacuum cleaner according to a second embodiment.

Fig. 6 is a block diagram showing an electric vacuum cleaner according to a third embodiment.

Fig. 7 is a block diagram showing an electric vacuum cleaner according to a fourth embodiment.

Fig. 8 is a block diagram showing an electric vacuum cleaner according to a fifth embodiment.

DETAILED DESCRIPTION

[0010] Hereinafter, a configuration of a first embodiment will be described with reference to Fig. 1 to Fig. 4.

[0011] In Fig. 1 to Fig. 3, the reference numeral 10 denotes a so-called canister type electric vacuum cleaner, and this electric vacuum cleaner 10 includes a cleaner main body 11. This cleaner main body 11 includes a hollow main body case 12, and the inside of the main body case 12 is partitioned by a partition part 18 into a dust collecting chamber 14 which is positioned at the front side and to which a dust collecting bag 13 that is a filter as a dust collecting part is detachably attached, and an electric blower chamber 17 which is positioned at the rear side and houses a plurality of, for example, two electric blowers 15A and 15B (hereinafter, at least any one or all of these electric blowers 15A and 15B may be simply referred to as an electric blower 15) as operating units, a control means 16, and a cord reel (not shown). In the front portion of the main body case 12, a main body suction port 21 which is communicatively connected to the dust collecting chamber 14 is opened, and to this main body suction port 21, a hose body 22 as a bendable narrow and long substantially cylindrical connecting tube is communicatively connected. Further, on the tip end of the hose body 22, a tubular hand operation part 23 is provided, and on this hand operation part 23, a grip part 24 to be gripped by an operator when cleaning is provided so as to project on the base end side, and on this grip part 24, a plurality of, for example, three setting buttons 25a, 25b, and 25c for setting an operation state, that is, an operation mode of the electric blower 15, etc., to a predetermined state, and an ON/OFF button 26 for turning the power supply ON/OFF, are provided respectively. Hereinafter, at least any one or all of the setting buttons 25a, 25b, and 25c may be simply referred to as a setting button 25. To the tip end of the hand operation part 23, an extensible narrow and long substantially cylindrical extension tube 27 is detachably communicatively connected. Further, to the tip end of the extension tube 27, a floor brush 28 as a suction port body which is set on, for example, a carpet, etc., on a floor surface as a surface to be cleaned in a room and suctions dust on the carpet, is detachably communicatively connected.

[0012] The main body case 12 includes a lower case 31 which is provided with a partition part 18 and opened upward, a lid body 32 which opens and closes an upper portion of the dust collecting chamber 14 that is the front side of the lower case 31, and an upper case 33 which closes the upper portion of the electric blower chamber 17 that is the rear side of the lower case 31. In the main body case 12, a large number of exhaust holes 34 are opened.

[0013] On both side portions of the electric blower chamber 17 on the rear side of the lower case 31, large diameter traveling wheels 35 for making the cleaner main body 11 travel on a floor surface are axially supported turnably, and on a bottom portion opposed to the floor surface of the dust collecting chamber 14 on the front side, a turning wheel (not shown) as a driven wheel is provided turnably.

[0014] The dust collecting bag 13 is, for example, a disposable paper pack, and has a mouth frame (not shown) to be fixed to the dust collecting chamber 14 and a bag-shaped bag body 38 attached to the mouth frame.

[0015] The dust collecting chamber 14 is formed common to the electric blowers 15A and 15B, and the suction side of each of the electric blowers 15A and 15B can be communicatively connected thereto.

[0016] The electric blowers 15A and 15B have suction ports 41A and 41B airtightly connectable to the dust collecting chamber 14 on their front ends, and a plurality of exhaust ports 42A and 42B in the outer peripheral surfaces on the rear end sides, and are disposed side by side to each other in the width direction in the electric blower chamber 17. Hereinafter, at least any one or all of the suction ports 41A and 41B may be simply referred to as a suction port 41, and at least any one or all of the exhaust ports 42A and 42B may be simply referred to as an exhaust port 42. In addition, these electric blowers 15A and 15B are connected in parallel with each other to a commercial AC power supply e.

[0017] The control means 16 is a circuit board including, for example, switching elements 43A and 43B (hereinafter, at least any one or all of the switching elements 43A and 43B may be simply referred to as a switching element 43) such as triacs corresponding to the electric blowers 15A and 15B, and is arranged so as to actuate the electric blowers 15A and 15B independently of each other by phase-angle control, etc., according to an operation mode input by the setting button 25. For example, the control means 16 performs automatic switching control so that, when an operation mode as a first mode in which the suctioning power is relatively small such as amediummode or a weakmode (an operationmode with suctioning power not more than half the full power) is selected by the setting button 25b or 25c, other remaining electric blowers than at least any one of the electric blowers 15 are actuated (either one of the electric blowers 15A and 15B is actuated and the other one of the electric blowers 15A and 15B is stopped), and when an operation mode as a second mode with relatively high suctioning

power such as a strong mode (an operation mode with suctioning power higher than half the full power) is selected by the setting button 25a, all of the electric blowers 15 are actuated (electric blowers 15A and 15B are actuated concurrently).

[0018] For example, in the strong mode (full power) with the highest suctioningpower among the operationmodes, the control means 16 actuates both electric blowers 15A and 15B with an input of 1000W, in the medium mode with suctioning power (power) smaller than that in the strong mode, the control means actuates either of the electric blowers 15A and 15B with an input of 1000W, and in the weakmode with suctioningpower (power) smaller than that in the strong mode and the medium mode, the control means actuates either of the electric blowers 15A and 15B with an input of 400W. Specifically, in the medium mode and the weak mode, either one of the electric blowers 15 is actuated alone.

[0019] The control means 16 increases and decreases the input values described above in an input range set in advance in each operation mode according to a dust amount, etc., trapped in the dust collecting bag 13. For example, the control means 16 includes a first control mode in which the input of the electric blower 15 (Figs. 2) is sequentially increased stepwise in accordance with a reduction in air amount Q due to clogging resulting from an increase, etc., in the collected dust amount of the dust collecting bag 13 (Figs. 2) as shown in Fig. 4, a second control mode in which, when in the first control mode a predetermined upper limit input value PU set in advance for each operation mode is reached, the input is controlled (not increased) to be substantially fixed regardless of the air amount Q, and a third control mode which is a power-down mode in which, when the air amount Q reaches a second predetermined air amount Q2 or less which is a predetermined air amount smaller than a first predetermined air amount Q1 which is a predetermined air amount in the second control mode, the input of the electric blower 15 (Figs. 2) is reduced to a predetermined reduced input value PL or less to protect the electric blower 15 (Figs. 2).

[0020] As shown in Fig. 1, to the control means 16, current detecting means 44A and 44B are electrically connected via adjusting resistors 45A and 45B as adjusting means. Further, this control means 16 is arranged so as to control opening and closing of switches 46A and 46B as current interrupting means capable of electrical interruption between the current detecting means 44A and 44B and the electric blowers 15A and 15B. Moreover, to this control means 16, a display means 47 as an operating unit is electrically connected. Hereinafter, at least any one or all of the current detecting means 44A and 44B may be simply referred to as a current detecting means 44, and at least any one or all of the adjusting resistors 45A and 45B may be simply referred to as an adjusting resistor 45.

[0021] The current detecting means 44A and 44B are formed by, for example, transformer-type or semiconductor-type current sensors, etc., and can detect the current values flowing in the electric blowers 15A and 15B and output the current values to the control means 16 side.

[0022] The adjusting resistors 45A and 45B are for adjusting current output values output from the current detecting means 44A and 44B to the control means 16, and are formed of, for example, variable resistors, etc. These adjusting resistors 45A and 45B can be operated externally to vary their resistance values via an adjusting hole 49 (Figs. 2) opened in the main body case 12.

[0023] The switches 46A and 46B are protection means for interrupting current based on detection of an abnormal temperature, etc., of the electric blowers 15A and 15B, and for example, thermostats, etc., are used for these.

[0024] The display means 47 is an informing means, when the collected dust amount of the dust collecting bag 13 (Figs. 2) has reached a predetermined amount or more or when the dust collecting bag 13 (Figs. 2) is clogged, etc., for informing the user to make replacement, etc., of the dust collecting bag 13, is formed by, for example, a lamp or a monitor, etc., and is disposed at a position visible to the operator when performing a cleaning operation, for example, an upper portion of the upper case 33 (Figs. 2).

[0025] Around the cord reel, a power cord (not shown) having a plug part to be connected to the commercial AC power supply e on the tip end portion is wound so as to be led out.

[0026] On the other hand, the electric blower chamber 17 shown in Figs. 2 is formed common to the electric blowers 15A and 15B, and is communicatively connected to the outside of the main body case 12 via the exhaust holes 34.

[0027] In the partition part 18, circular hole-shaped large diameter communication holes 51A and 51B which communicatively connect the dust collecting chamber 14 and the electric blower chamber 17 are opened at positions opposed to the front sides of the electric blowers 15A and 15B, and to the front portions that are the upstream sides of these communication holes 51A and 51B, filters 52A and 52B are attached respectively, and to the rear portions of the communication holes 51A and 51B, backflow preventing valve units 53A and 53B which are opening and closing means as backflow preventing means are attached between the suction ports 41A and 41B of the electric blowers 15A and 15B.

[0028] The front portions that are the upstream sides of the communication holes 51A and 51B are covered by filters 52A and 52B.

[0029] The filters 52A and 52B are for trapping dust which could not be trapped in the dust collecting bag 13.

[0030] The backflow preventing valve units 53A and 53B are arranged so that the backflow preventing valve unit 53A or 53B is opened by a negative pressure caused when the corresponding electric blower 15 is actuated, and is closed when the corresponding electric blower 15 is stopped, and is closed by a negative pressure caused

by actuation of the other electric blower 15 when the other electric blower 15 is actuated. Specifically, the backflow preventing valve units 53A and 53B can be opened and closed by a pressure difference (wind) between the upstream side and the downstream side.

[0031] Next, operations of the first embodiment mentioned above will be described.

[0032] First, description will be given of an adjusting method of the above-described electric vacuum cleaner 10. In, for example, an adjustment process of the electric vacuum cleaner 10 such as before factory shipment, with the electric blowers 15A and 15B respectively fitted inside the main body case 12, for example, the electric blower 15A is actuated so as to reach predetermined air amounts Q1 and Q2 (Fig. 4), for example, the air amounts when predetermined amounts of dust have accumulated in the dust collecting bag 13, a current output value output from the current detecting means 44A shown in Fig. 1 is measured, and the resistance value of the adjusting resistor 45A is variably operated via the adjusting hole 49 (Figs. 2) so that the current output value reaches a predetermined current value.

[0033] Then, after the electric blower 15A is stopped, the electric blower 15B is actuated so as to reach the above-described predetermined air amounts Q1 and Q2 (Fig. 4), a current output value output from the current detecting means 44B is measured, and in the same manner as with the above-described electric blower 15A, the resistance value of the adjusting resistor 45B is variably operated via the adjusting hole 49 (Figs. 2) so that the current output value reaches a predetermined current value.

[0034] The predetermined current value to be used for an adjustment of these electric blowers 15A and 15B is, in order to reduce individual differences in suctioning power, etc., among the electric vacuum cleaners 10, set in advance as a current output value or the like when the electric blower 15 having a standard input is actuated so as to reach the predetermined air amounts Q1 and Q2 (Fig. 4).

[0035] The resistance values of the adjusting resistors 45A and 45B once adjusted are basically fixed, and not varied afterward.

[0036] Further, in the case of cleaning, as shown in Figs. 2, first, when a new dust collecting bag 13 is used, the dust collecting bag 13 is attached to the dust collecting chamber 14 exposed by opening the lid body 32 (Fig. 3), and after the lid body 32 (Fig. 3) is closed, the power cord is pulled out and the plug part on the tip end portion is connected to an outlet (commercial AC power supply e (Fig. 1)) (plug-in). When the dust collecting bag 13 is not renewed, without opening and closing the lid body 32 (Fig. 3), the power cord is pulled out and the plug part is connected to the outlet (commercial AC power supply e (Fig. 1)).

[0037] Then, the grip part 24 on the hand operation part 23 of the hose body 22 connected to the main body suction port 21 shown in Fig. 3 is gripped, and by operating the ON/OFF button 26 from the stopped state of the electric blower 15, the control means 16 inside the cleaner main body 11 shown in Fig. 1 performs phase-angle control of the actuation of the electric blower 15 by the switching element 43 to generate a negative pressure.

[0038] At this time, the control means 16 actuates the electric blower 15 in the medium mode, for example. Here, for convenience of description, it is assumed that the electric blower 15A is actuated. In this state, the control means 16, when an operator operates the setting button 25c, varies the input of the electric blower 15A to switch the operation mode of the electric blower 15A to the weak mode. On the other hand, the control means 16, when the operator operates the setting button 25a, varies the inputs of the electric blowers 15A and 15B respectively to switch the operation mode to the strong mode in which both electric blowers 15A and 15B are actuated.

[0039] Then, for example, when the operator operates the ON/OFF button 26, the control means 16 stops the electric blower 15A.

[0040] Thereafter, for example, when the operator again operates the ON/OFF button 26, the control means 16 actuates the electric blower 15B in, for example, the medium mode. In this state, the control means 16, when the operator operates the setting button 25c, varies the input of the electric blower 15B to switch the operation mode of the electric blower 15B to the weak mode. Further, the control means 16, when the operator operates the setting button 25a, varies the inputs of the electric blowers 15A and 15B respectively to switch the operation mode to the strong mode in which both electric blowers 15A and 15B are actuated.

[0041] That is, the control means 16 switches the electric blower 15 to be actuated when the electric vacuum cleaner 10 (electric blower 15) is once stopped, and restarted, in other words, at the time of a predetermined condition such as every start (every time the ON/OFF button 26 is operated).

[0042] The predetermined condition for switching the electric blower 15 to be actuated can be arbitrarily set. For example, the control means 16 may switch the electric blower 15 to be actuated every predetermined time such as a plurality of times of starting, and may switch the electric blower 15 to be actuated when the operation mode is changed. Here, it is as a matter of course that the switching of the electric blower 15 to be actuated is not applied to an operation mode in which all electric blowers 15 are actuated at full power (maximum input), however, for example, when starting in an operation mode (for example, a strong mode) in which all electric blowers 15 are actuated at full power, and then switching into an operation mode (for example, a medium mode or a weak mode) in which at least any one of the electric blowers 15 is actuated without once stopping the electric blowers 15, this electric blower 15 to be actuated may be switched from the electric blower 15 actuated the last

time in an operation mode (last medium mode or weak mode) in which at least any one of the electric blowers 15 was actuated. Further, the switchingof the electric blower 15 to be actuated does not always mean switching actuation of all electric blowers 15. Specifically, in the case of a configuration having, for example, three electric blowers 15, it also includes control, etc., for switching every two of these sequentially. In any case, if the actuated electric blower 15 is different from the one at the time of the last actuation in terms of the electric blower 15 as a whole, this means that the electric blower 15 to be actuated has been switched.

[0043] Then, the backflow preventing valve units 53A and 53B shown in Figs. 2 are arranged so that both backflow preventing valve units 53A and 53B open in the strong mode in which both electric blowers 15A and 15B are actuated (Fig. 2(c)), only the backflow preventing valve unit 53A opens and the backflow preventing valve unit 53B closes when only the electric blower 15A is actuated (Fig. 2 (a)), and only the backflow preventing valve unit 53B opens and the backflow preventing valve unit 53A closes when only the electric blower 15B is actuated (Fig. 2(b)).

[0044] Thereafter, as shown in Fig. 3, when the operator makes the floor brush 28 connected to the tip end side of the hose body 22 via an extension tube 27 travel forward and backward on a floor surface, etc., by the grip part 24 that the operator grips, the air suctioned together with dust from the tip end of the floor brush 28 due to a negative pressure of the electric blower 15 becomes suctioning wind, and is suctioned together with dust into the dust collecting bag 13 shown in Figs. 2 via the extension tube 27, the hose body 22, and the main body suction port 21, and when passing through the bag body 38 of the dust collecting bag 13, dust contained in the suctioning wind is trapped.

[0045] The air that passed through the bag body 38 is suctioned into the suction port 41 of the electric blower 15 via the communication hole after passing through the filter, and passes through the inside of the electric blower 15 and is then exhausted as exhaust wind from the exhaust port 42, and exhausted to the outside of the main body case 12 from the electric blower chamber 17 via the exhaust holes 34.

[0046] The bag body 38 of the dust collecting bag 13 starts clogging in accordance with an increase in the collected dust amount, so that the air amount Q due to actuation of the electric blower 15, as shown in Fig. 4, is gradually reduced when the input of the electric blower 15 is fixed. As a result of such a reduction in air amount Q, the current value of the electric blower 15 gradually decreases. Therefore, the control means 16 shown in Fig. 1, by measuring the current value of the electric blower 15 via the adjusting resistor 45 by the current detecting means 44, indirectly measures the air amount Q due to actuation of each electric blower 15, compares the measured current value with a predetermined current threshold set in advance, sequentially increases the input of the electric blower 15 stepwise if it judges that the air amount Q has been reduced, thereby maintaining the air amount Q (first control mode).

[0047] Moreover, the control means 16, if judging that the input of the electric blower 15 has reached a predetermined upper limit input value or more set in advance for each operation mode, fixes the input without further increasing the input to protect the electric blower 15 (second control mode).

[0048] Further, the control means 16, if judging that the measured current value of the electric blower 15 has reached a predetermined first lower limit threshold or less set in advance for each operation mode, judges that the air amount Q is not more than the first predetermined air amount Q1, that is, dust of a predetermined amount or more has been collected in the dust collecting bag 13 (Figs. 2) (the bag body 38 (Figs. 2) is clogged to a predetermined extent or more), and makes the display means 47 perform a predetermined operation, that is, a display of clogging of the dust collecting bag 13 (Figs. 2) .

[0049] Then, the control means 16, if judging that the measured current value of the electric blower 15 has reached a predetermined second lower limit threshold or less set in advance for each operation mode, judges that the air amount Q is not more than the second predetermined air amount Q2, that is, the electric blower 15 is overloaded, and reduces the input of the electric blower 15 to a predetermined reduced input value PL (Fig. 4) set in advance to cause a predetermined operation, that is, to power down the electric blower 15 (third control mode).

[0050] Here, at these timings of display of the display means 47 and judgment of the control modes, the control means 16 uses the current value of the electric blower 15 detected by the current detecting means 44, so that when the input of the electric blower 15 is different (shown in the solid lines and imaginary lines of Fig. 4, for example), the timing of display by the display means 47 may be different from the timing of reaching the first predetermined air amount Q1 (Fig. 4), or the timing of judgment of switching into the third control mode may be different from that of the second predetermined air amount Q2 (Fig. 4) (air amounts Q1H, Q1L, Q2H, and Q2L in Fig. 4). Particularly, in the above-described first embodiment, the electric blower 15 to be actuated is switched at the time of a predetermined condition, so that when, in a state of the medium mode or the weak mode, etc., in which, for example, the electric blower 15A is actuated, the ON/OFF button 26 is operated to once stop operation of the electric vacuum cleaner 10, and then when the ON/OFF button 26 is again operated to operate the electric vacuum cleaner 10, the control means 16 may actuate the electric blower 15B to bring about the medium mode or the weak mode. At this time, if the input of the electric blower 15B is greater than the input of the electric blower 15A when clogging of the dust collecting bag 13 is displayed in the display means 47 while the electric blower 15A is actuated, and further the control mode has be-

come the third control mode, the display of the display means 47 may go out, or the control mode may become the second control mode in the case of switching to actuation of the electric blower 15B as a result of operation of the ON/OFF button 26, etc. Specifically, the mere operation of the ON/OFF button 26, etc., may change the operation of the display means 47 and the control mode of the electric blower 15 although there is no change in the state of the dust collecting bag 13.

[0051] Therefore, in the above-described first embodiment, the control means 16 makes the display means 47 display clogging of the dust collecting bag 13 when the air amount Q during operation of the electric blower 15 is the first predetermined air amount Q1 (Fig. 4) or less, and the control means 16 powers down the electric blower 15 when the air amount Q during operation of the electric blower 15 is the second predetermined air amount Q2 (Fig. 4) or less, whereby even when the control means 16 switches the electric blower 15 to be actuated according to a predetermined condition, a display of the display means 47 or power-down of the electric blower 15, etc., can be performed at the same timing without depending on the actuated electric blower 15.

[0052] In detail, the current output values from the current detecting means 44 are adjusted by the adjusting resistor 45 so that these current output values become a predetermined value set in advance when the air amount Q during operation of each of the electric blowers 15 is the predetermined air amounts Q1 and Q2 (Fig. 4) or less, and the control means 16 controls the operation of the electric blower 15 and the display means 47, respectively, based on the adjusted current output values from the current detecting means 44, so that a display of the display means 47 or power-down of the electric blower 15, etc., can be reliably performed at the same timing regardless of variation in characteristics of the electric blower 15.

[0053] In the case of adjustment by the adjusting resistor 45, performing adjustment, with the electric blowers 15 fitted into the cleaner main body 11 and actuated so as to reach the predetermined air amounts Q1 and Q2 (Fig. 4), respectively, by varying the resistance values of the adjusting resistors 45 respectively so that the current output values corresponding to the electric blowers 15 from the current detecting means 44 become a predetermined value set in advance, makes it easily possible, when the control means 16 controls the operation of the electric blower 15 and the control means 47 according to the adjusted current output values, to make the display means 47 perform a display when the air amount Q during operation of the electric blower 15 is the first predetermined air amount Q1 (Fig. 4) or less and power down the electric blower 15 when the air amount Q during operation of the electric blower 15 is the second predetermined air amount Q2 (Fig. 4) or less.

[0054] Further, providing the predetermined air amounts Q1 and Q2 to make the display means 47 perform a display and power down the electric blower 15 as air amounts when set predetermined amounts of dust have accumulated in the dust collecting bag 13 makes it possible to appropriately notify the operator of the time for replacement of the dust collecting bag 13.

[0055] Next, a second embodiment will be described with reference to Fig. 5. The same components and operations as those in the first embodiment described above are provided with the same reference numerals, and description thereof will be omitted.

[0056] According to this second embodiment, in the above-described first embodiment, a common current detecting means 55 is disposed for the electric blowers 15A and 15B in place of the current detecting means 44A and 44B, and between this current detecting means 55 and the control means 16, a wiring 56 and a wiring 58 having an adjusting resistor 57 as an adjusting means are connected respectively.

[0057] The current detecting means 55 is, similar to the above-described current detecting means 44, formed by, for example, a transformer-type or semiconductor-type current sensor, etc., and can detect the current values flowing in the electric blowers 15A and 15B and output the current values to the control means 16 side.

[0058] The adjusting resistor 57 is, similar to the above-described adjusting resistor 45, for adjusting a current output value output from the current detecting means 55 to the control means 16, and is formed of, for example, a variable resistor. Here, a current output value output from the current detecting means 55 to the control means 16 when, for example, the electric blower 15B is actuated is adjusted. This adjusting resistor 57 can be operated externally to vary its resistance value via the adjusting hole 49 (Figs. 2).

[0059] Further, the control means 16, when actuating only the electric blower 15A, makes the current output value input from the wiring 56 effective, and when actuating only the electric blower 15B, makes the current output value input from the wiring 58 (via the adjusting resistor 57) effective. These can be easily judged by judging which electric blowers 15A and 15B is actuated by the control means 16.

[0060] In, for example, an adjustment process of the electric vacuum cleaner 10 such as before factory shipment, with the electric blowers 15A and 15B respectively fitted inside the main body case 12, for example, the electric blower 15A is actuated so as to reach predetermined air amounts Q1 and Q2 (Fig. 4), for example, the air amounts when predetermined amounts of dust have accumulated in the dust collecting bag 13, and a current output value output from the current detecting means 55 shown in Fig. 1 is measured via the wiring 56. Thereafter, the electric blower 15A is stopped, and the electric blower 15B is actuated so as to reach the above-described predetermined air amounts Q1 and Q2 (Fig. 4), a current output value output from the current detecting means 55 is measured via the wiring 58, and the resistance value of the adjusting resistor 57 is variably operated via the adjusting hole 49 (Figs. 2) so that this current output value

becomes equal to the current output value when the above-described electric blower 15A is actuated with the predetermined air amounts Q1 and Q2 (Fig. 4).

[0061] The resistance value of the adjusting resistor 57 once adjusted is basically fixed, and not varied afterward.

[0062] Thus, by adjusting the current output value by the adjusting resistor 57 so that the control means 16 makes the display means 47 display clogging of the dust collecting bag 13 when the air amount Q during operation of the electric blower 15 is the first predetermined air amount Q1 (Fig. 4) or less, and the control means 16 powers down the electric blower 15 when the air amount Q during operation of the electric blower 15 is the second predetermined air amount Q2 (Fig. 4) or less, the same operation and effect as of the first embodiment described above can be obtained such that, even when the control means 16 switches the electric blower 15 to be actuated according to a predetermined condition, a display of the display means 47 or power-down of the electric blower 15, etc., can be performed at the same timing without depending on the actuated electric blower 15.

[0063] Moreover, by performing adjustment by the adjusting resistor 57 so as to match, to a current output value from the current detecting means 55 when either one of the electric blowers 15 is actuated, a current output value from the current detectingmeans 55 when the other electric blower 15 is actuated, as compared with the case where current output values corresponding to the respective electric blowers 15 are adjusted, this adjustment operation can be reduced (lessened), and it is not necessary to dispose the current detecting means 55 and the adjusting resistor 57 corresponding to all electric blowers 15 respectively, the configuration can be simplified, and the electric vacuum cleaner 10 can be provided at a lower cost.

[0064] Next, a third embodiment will be described with reference to Fig. 6. The same components and operations as those in the embodiments described above will be provided with the same reference numerals, and description thereof will be omitted.

[0065] According to this third embodiment, in the first embodiment described above, the control means 16 has different threshold tables for respective current output values from the current detectingmeans 44Aand 44B in place of the adjusting resistor 45.

[0066] Specifically, the control means 16 is arranged so that threshold values for a display in the display means 47 and switching of the control modes are, according to respective inputs of the electric blowers 15A and 15B, set in advance for each of these electric blowers 15A and 15B, and even with either of the electric blowers 15A and 15B actuated, the same control can be performed at the time of the same air amount by the control means 16.

[0067] For example, when the input of the electric blower 15A is greater than the input of the electric blower 15B, the threshold table for the electric blower 15A set in the control means 16 contains thresholds set greater than those in the threshold table for the electric blower 15B, respectively.

[0068] These threshold tables are, by, for example, actuating the electric blowers 15A and 15B so as to reach the predetermined air amounts Q1 and Q2 (Fig. 4), respectively, in an adjustment process of the electric vacuum cleaner 10 such as before factory shipment, with the electric blowers 15A and 15B respectively fitted inside the main body case 12, set respectively according to variations, etc., in current output values output from the current detecting means 44A and 44B with respect to a current value of the electric blower 15 having a standard input.

[0069] Then, by setting the threshold tables in the control means 16 so that the control means 16 makes the display means 47 display clogging of the dust collecting bag 13 when the air amount Q during operation of the electric blower 15 is the first predetermined air amount Q1 (Fig. 4) or less, and the control means 16 powers down the electric blower 15 when the air amount Q during operation of the electric blower 15 is the second predetermined air amount Q2 (Fig. 4) or less, the same operation and effect as of the first embodiment described above can be obtained such that, even when the control means 16 switches the electric blower 15 to be actuated according to a predetermined condition, a display of the display means 47 or power-down of the electric blower 15, etc., can be performed at the same timing without depending on the actuated electric blower 15.

[0070] Moreover, an adjusting means for adjusting a current output value from the current detecting means 44 is no longer necessary, so that the number of components can be reduced, and the electric vacuum cleaner 10 can be provided at a lower cost.

[0071] Next, a fourth embodiment will be described with reference to Fig. 7. The same components and operations as those in the embodiments described above will be provided with the same reference numerals, and description thereof will be omitted.

[0072] According to this fourth embodiment, a non-volatile storage means 59 is provided in place of the adjusting resistor 45 of the first embodiment and the threshold tables of the third embodiment described above.

[0073] The storage means 59 is electrically connected to the control means 16. This storage means 59 stores correction values for correcting current output values from the current detecting means 44A and 44B, respectively.

[0074] These correction values are, by, for example, actuating the electric blowers 15A and 15B so as to reach the predetermined air amounts Q1 and Q2 (Fig. 4), respectively, in an adjustment process of the electric vacuum cleaner 10 such as before factory shipment, with the electric blowers 15A and 15B respectively fitted inside the main body case 12, set respectively according to variations, etc., in current output values output from the current detecting means 44A and 44B with respect to a current value when the electric blower 15 having a standard

input is actuated.

[0075] Then, by correcting the current output values from the current detecting means 44 by the correction values stored in the storage means 59, respectively, so that the control means 16 makes the display means 47 display clogging of the dust collecting bag 13 when the air amount Q during operation of the electric blower 15 is the first predetermined air amount Q1 (Fig. 4) or less, and the control means 16 powers down the electric blower 15 when the air amount Q during operation of the electric blower 15 is the second predetermined air amount Q2 (Fig. 4) or less, the same operation and effect as of the first embodiment described above can be obtained such that, even when the control means 16 switches the electric blower 15 to be actuated according to a predetermined condition, a display of the display means 47 or power-down of the electric blower 15, etc., can be performed at the same timing without depending on the actuated electric blower 15.

[0076] Moreover, by setting the correction values to be stored in the storage means 59 based on a current value when the electric blower 15 having a standard input is actuated, individual differences in suctioning power, etc., among the electric blowers 15 can be reduced.

[0077] Further, as a result of correcting the current output values from the current detecting means 44 based on the correction values stored in the storage means 59, respectively, an adjusting means for adjusting a current output value from the current detecting means 44 is no longer necessary, so that the number of components can be reduced, the electric vacuum cleaner 10 can be provided at a lower cost, and more detailed control can be performed according to the input of the electric blower 15.

[0078] Next, a fifth embodiment will be described with reference to Fig. 8. The same components and operations as those in the embodiments described above will be provided with the same reference numerals, and description thereof will be omitted.

[0079] According to this fifth embodiment, in the second embodiment described above, the storage means 59 of the fourth embodiment described above is electrically connected to the control means 16 in place of the adjusting resistor 57.

[0080] The correction values to be stored in this storage means 59 are, in an adjustment process of the electric vacuum cleaner 10 such as before factory shipment, with the electric blowers 15A and 15B respectively fitted inside the main body case 12, set so that, for example, a current output value from the current detecting means 55 measured by actuating the electric blower 15A so as to reach the predetermined air amounts Q1 and Q2 (Fig. 4) and a current output value from the current detecting means 55 measured by actuating the electric blower 15B so as to reach the predetermined air amounts Q1 and Q2 (Fig. 4) become equal to each other.

[0081] Then, by correcting the current output values from the current detecting means 44 by the correction values stored in the storage means 59, respectively, so that the control means 16 makes the display means 47 display clogging of the dust collecting bag 13 when the air amount Q during operation of the electric blower 15 is the first predetermined air amount Q1 (Fig. 4) or less, and the control means 16 powers down the electric blower 15 when the air amount Q during operation of the electric blower 15 is the second predetermined air amount Q2 (Fig. 4) or less, the same operation and effect as of the fourth embodiment described above can be obtained such that, even when the control means 16 switches the electric blower 15 to be actuated according to a predetermined condition, a display of the display means 47 or power-down of the electric blower 15, etc., can be performed at the same timing without depending on the actuated electric blower 15.

[0082] By setting the correction values to be stored in the storage means 59 based on a current output value from the current detecting means 55 when either one of the electric blowers 15 is actuated, the calculation operation of the correction values can be lessened, and the electric vacuum cleaner 10 can be provided at a lower cost as such because the amount of data to be stored in the storage means 59 can be reduced, and as the storage means 59, a lower cost one can be used.

[0083] In the embodiments described above, as the control modes of the electric blower 15 by the control means 16, even control modes other than those described above may be arbitrarily set.

[0084] Further, the operating unit to be operated when the air amount Q during operation of the electric blower 15 is the predetermined air amounts Q1 and Q2 or less can be arbitrarily set, and the predetermined operation of the operating unit can also be arbitrarily set.

[0085] In addition, as the dust collecting part, a dust collecting cup, a filter, or the like may be used.

[0086] The power cord may not be used as long as, for example, a secondary battery, etc., installed inside the cleaner main body 11 can supply the electric blower 15 and the control means 16 with electric power.

[0087] Further, as the adjusting means, not only the adjusting resistor 45 but also an arbitrary impedance element, etc., whose impedance is variable can be used.

[0088] The electric vacuum cleaner 10 is not limited to a canister type, and for example, an upright type having a floor brush 28 connected to a lower portion of the cleaner main body 11 or a handy type having a floor brush 28 connected to a front portion of the cleaner main body 11 can also be used.

[0089] While certain embodiments have been described, these embodiments have been presented by way of example only, and are not intended to limit the scope of the inventions. Indeed, the novel embodiments described herein may be embodied in a variety of other forms; furthermore, various omissions, substitutions and changes in the form of the embodiments described herein may be made without departing from the spirit of the inventions. The accompanying claims and their equivalents are intended to cover such forms or modifications

as would fall within the scope and spirit of the inventions.

Claims

1. An electric vacuum cleaner comprising:

   a cleaner main body housing a plurality of electric blowers, and including a dust collecting part located on a suction side of these electric blowers;
   an operable operating unit; and
   a control means capable of switching the electric blower to be actuated according to a predetermined condition, for controlling operation of the operating unit so as to make the operating unit perform a predetermined operation when an air amount during operation of the electric blower is a predetermined air amount or less.

2. The electric vacuum cleaner according to Claim 1, comprising:

   a current detecting means for detecting and outputting a current value of an actuated electric blower; and
   an adjusting means for adjusting at least any one of the current output values from the current detecting means so that these current output values are equalized when the air amount during operation of each of the electric blowers is a predetermined air amount, wherein
   the control means controls operation of the electric blower and operation unit, respectively, based on a current output value from the current detecting means which has been adjusted by the adjusting means.

3. The electric vacuum cleaner according to Claim 1, wherein
   the control means includes a threshold table set for each electric blower so that the operating unit performs a predetermined operation when the air amount during operation of each of the electric blowers is a predetermined air amount or less.

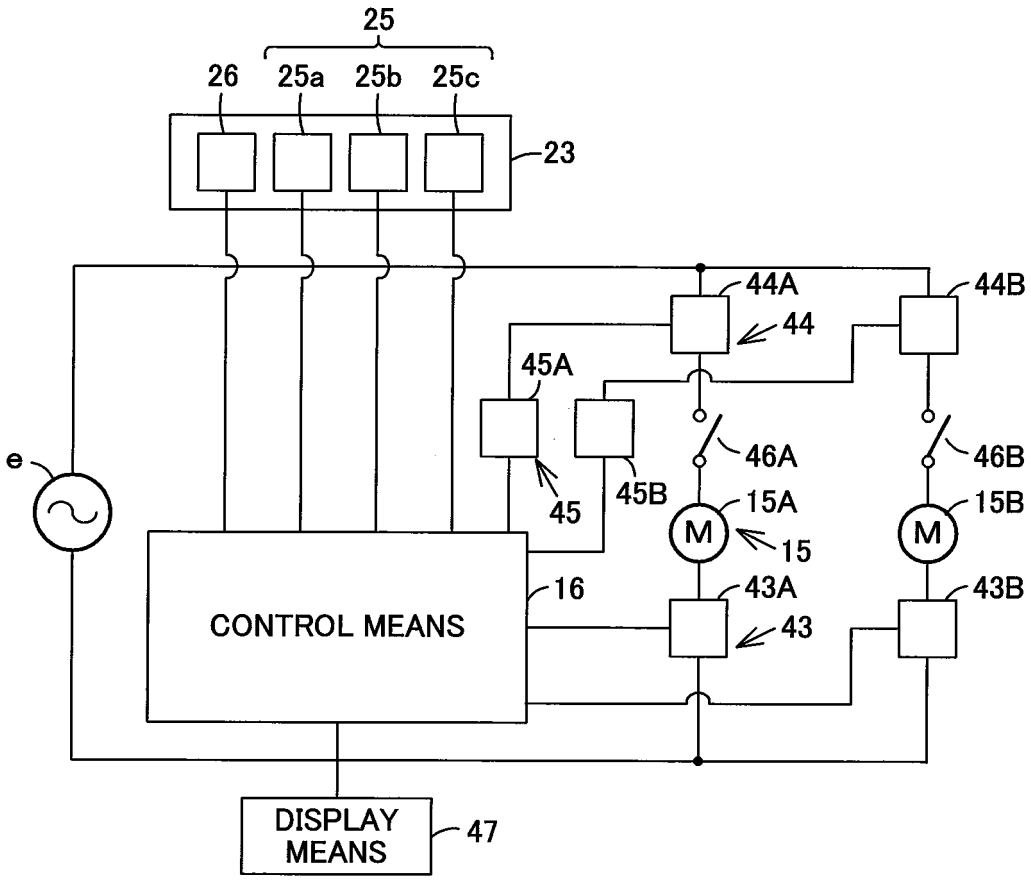
4. The electric vacuum cleaner according to Claim 1, comprising:

   a current detecting means for detecting and outputting a current value of an actuated electric blower; and
   a storage means capable of storing correction values, respectively, calculated based on differences between a predetermined reference value set in advance and current output values of the electric blowers from the current detecting means, wherein
   the control means corrects a current output value of the current detecting means by a correction value stored in the storage means corresponding to each of the actuated electric blowers, and controls operation of the electric blower and operation unit, respectively, based on the corrected current output value.

5. The electric vacuum cleaner according to Claim 4, comprising a current detecting means for detecting and outputting a current value of an actuated electric blower, wherein
   the control means uses as a reference value a current output value of any one of the electric blowers from the current detecting means and corrects current output values of other electric blowers from the current detecting means and controls operation of the electric blowers and operation unit, respectively, based on these current output values.

6. The electric vacuum cleaner according to any one of Claims 1 to 5, wherein the predetermined air amount is an air amount when a predetermined amount of dust has accumulated in the dust collecting part.

7. An adjusting method of an electric vacuum cleaner comprising a cleaner main body housing a plurality of electric blowers, and including a dust collecting part located on a suction side of these electric blowers, an operable operating unit, a current detecting means for detecting a current value of the actuated electric blower, an adjusting means capable of adjusting a current output value from the current detecting means, and a control means capable of switching the electric blower to be actuated according to a predetermined condition, for controlling operation of the electric blowers and the operation unit, respectively, according to a current output value from the current detecting means which has been adjusted by the adjusting means, wherein
   the electric blowers are actuated so as to reach predetermined air amounts, respectively, with the electric blowers fitted into the cleaner main body, and the adjusting means performs adjustment so that current output values corresponding to the electric blowers from the current detecting means become predetermined values set in advance.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CONTROL MEANS
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DISPLAY MEANS
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FIG. 1

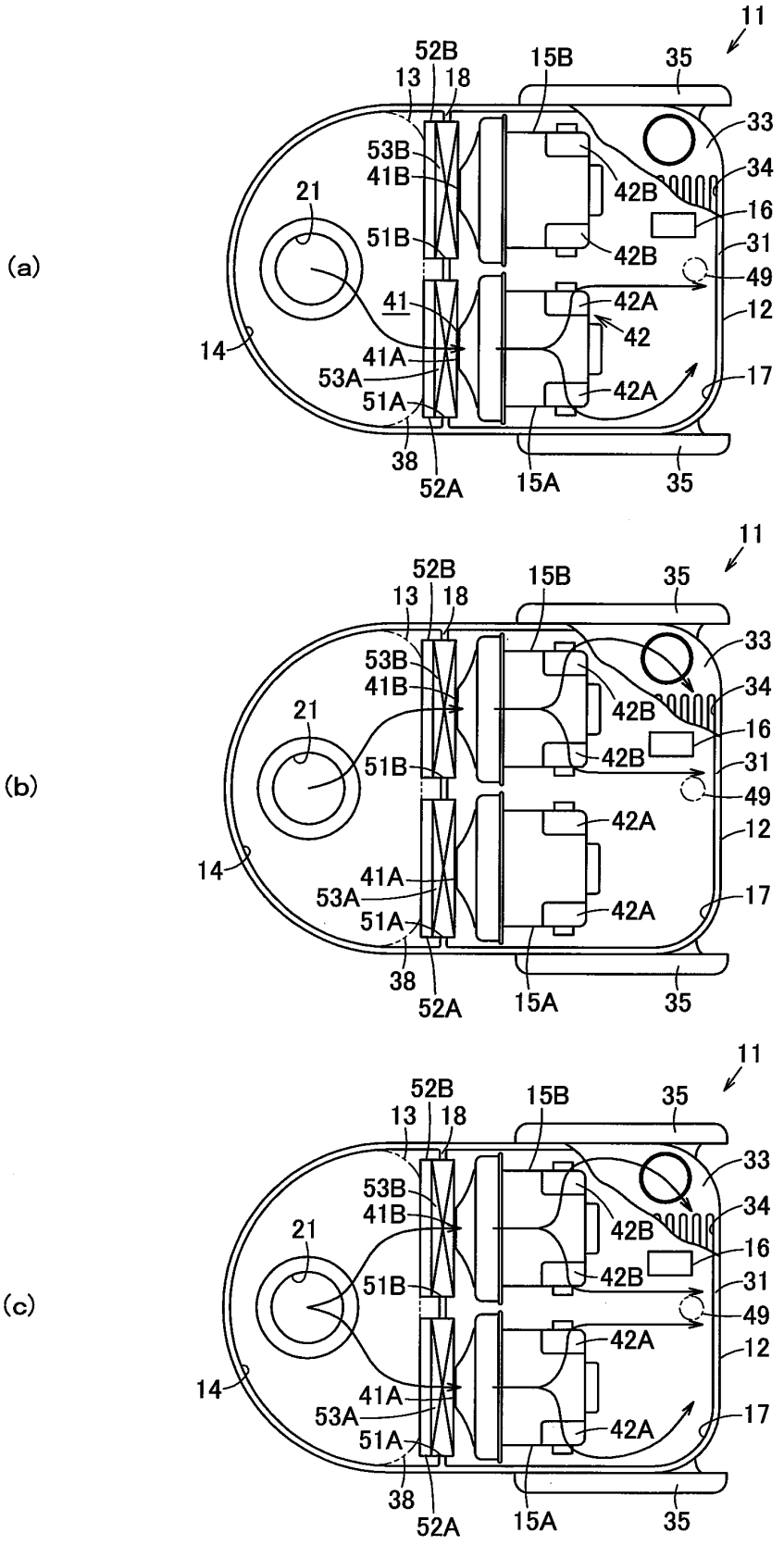
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FIG. 2

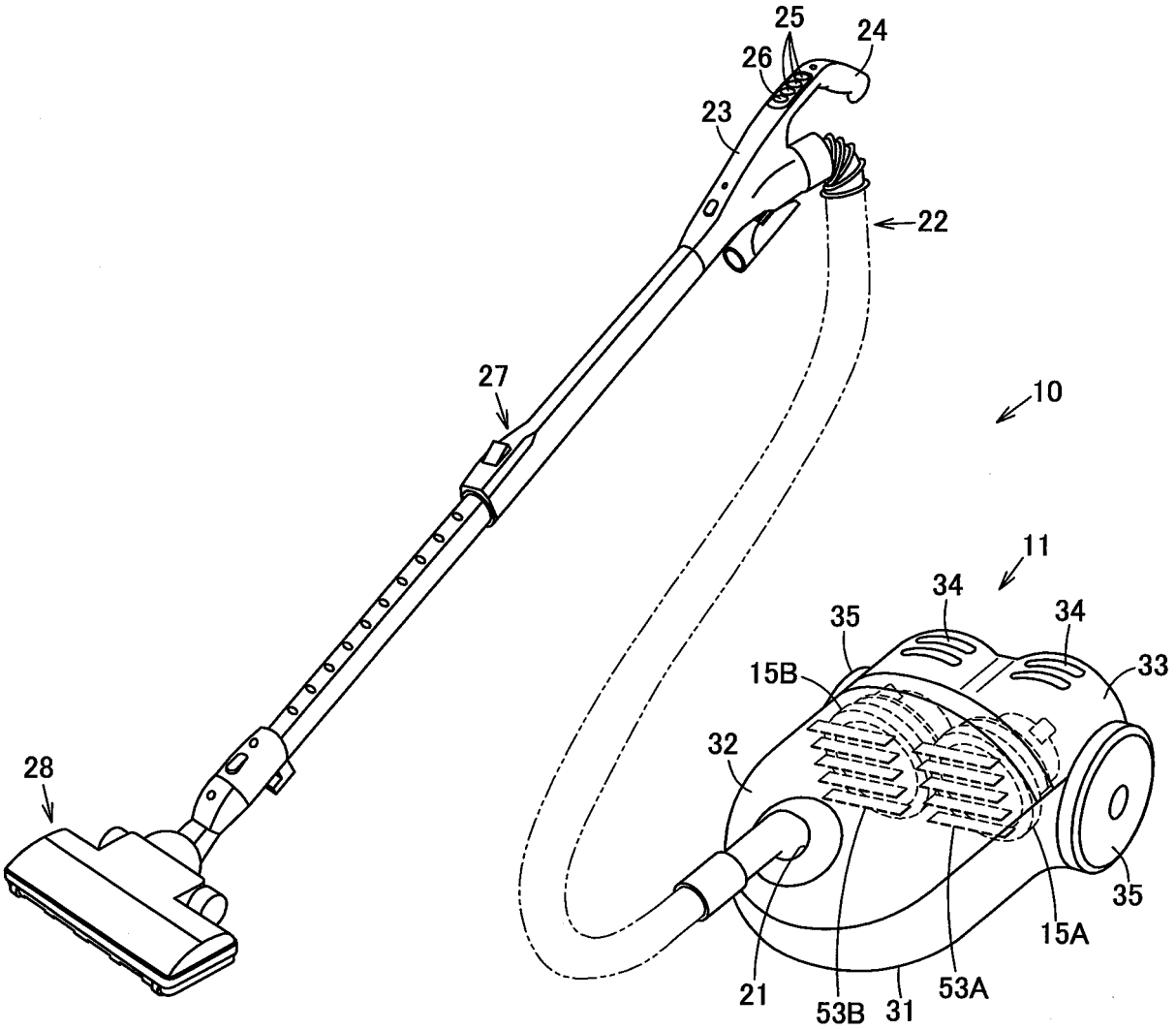


FIG. 3

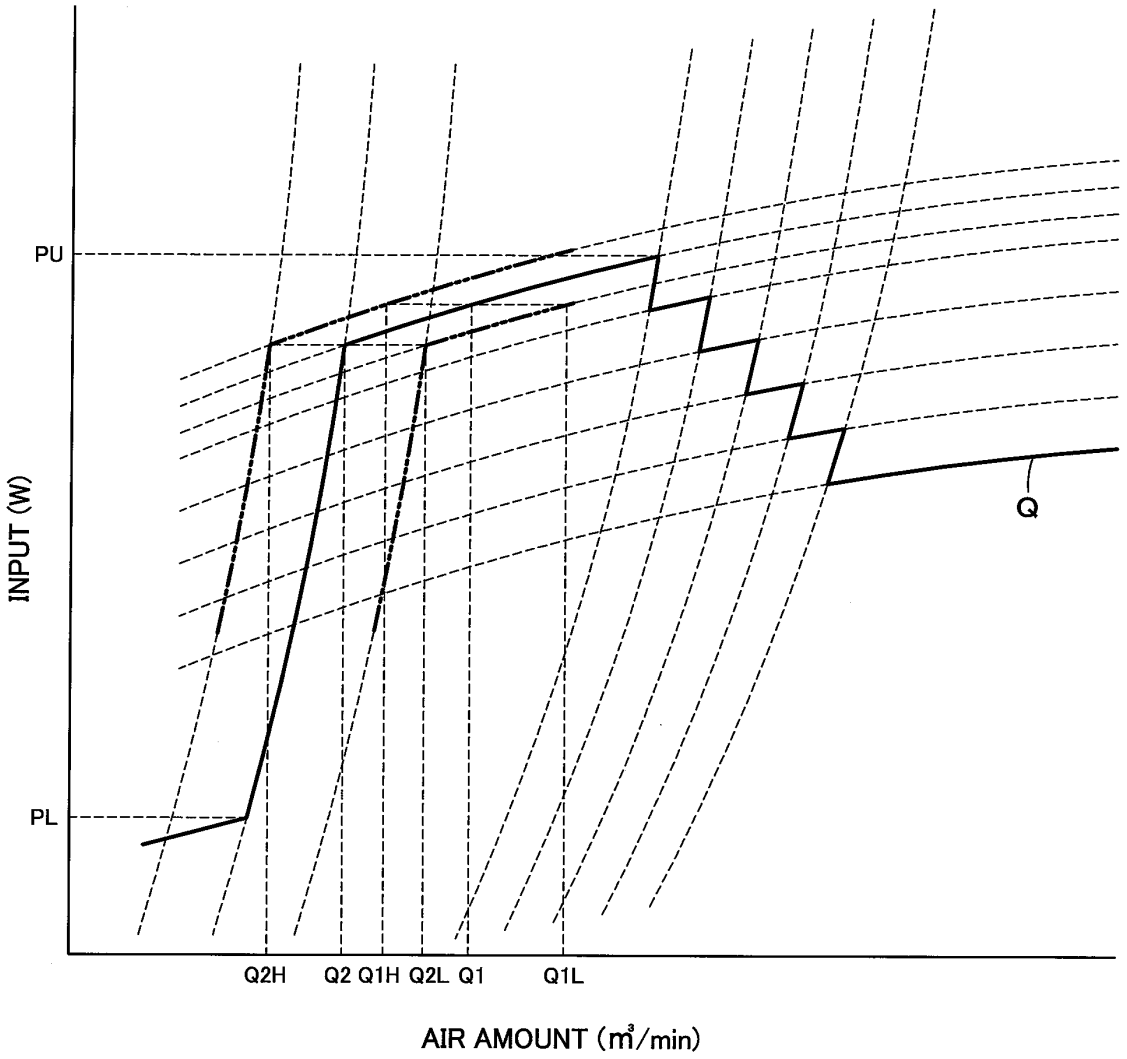
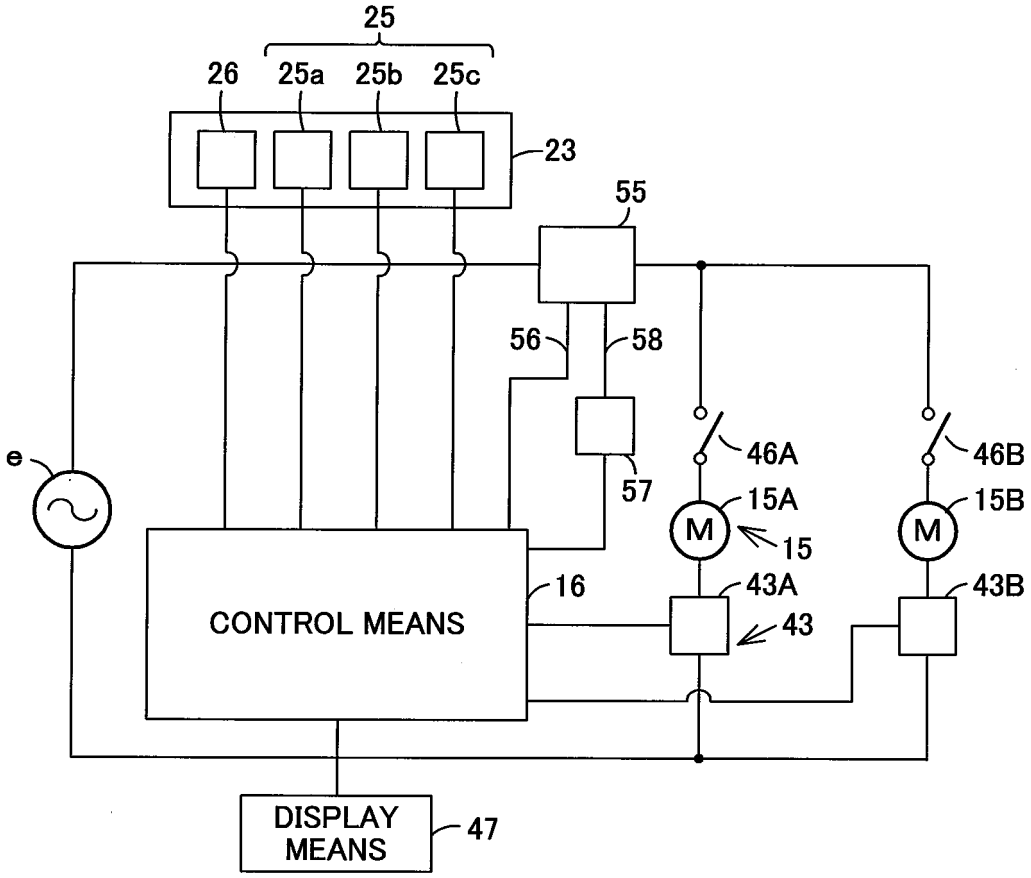


FIG. 4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CONTROL MEANS
DISPLAY MEANS
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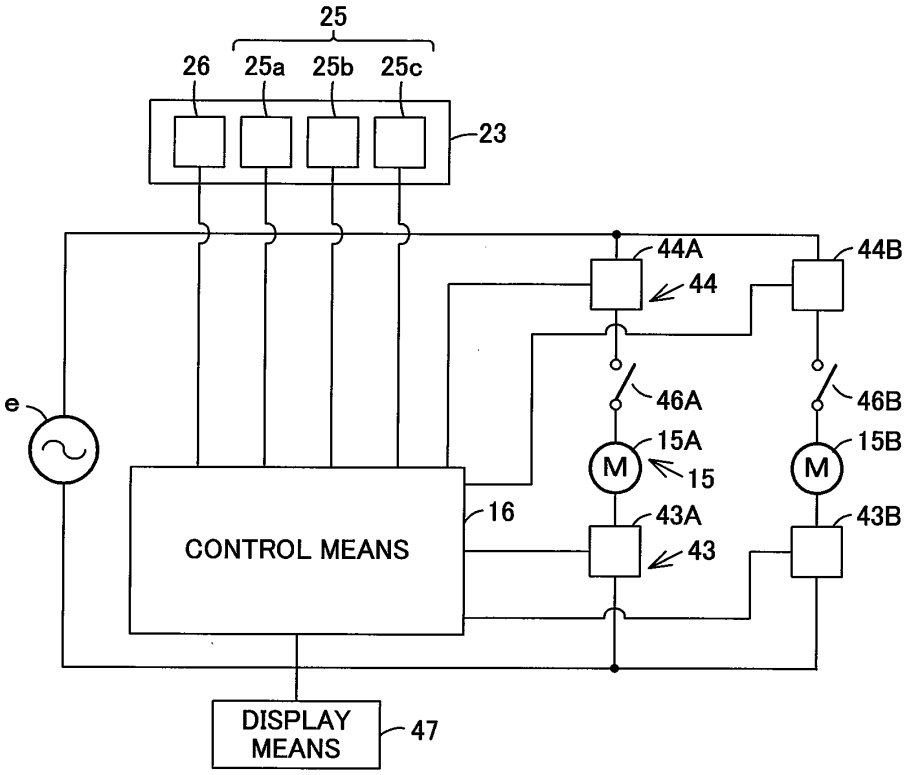
FIG.5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CONTROL MEANS
DISPLAY MEANS
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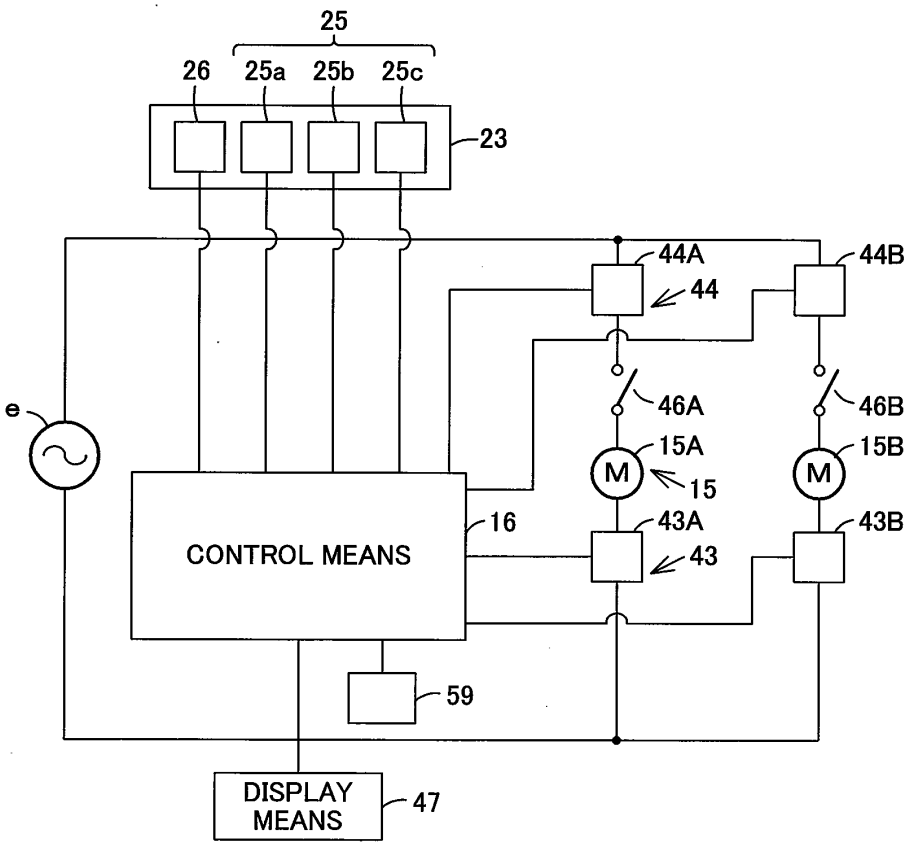
FIG. 6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CONTROL MEANS
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DISPLAY MEANS
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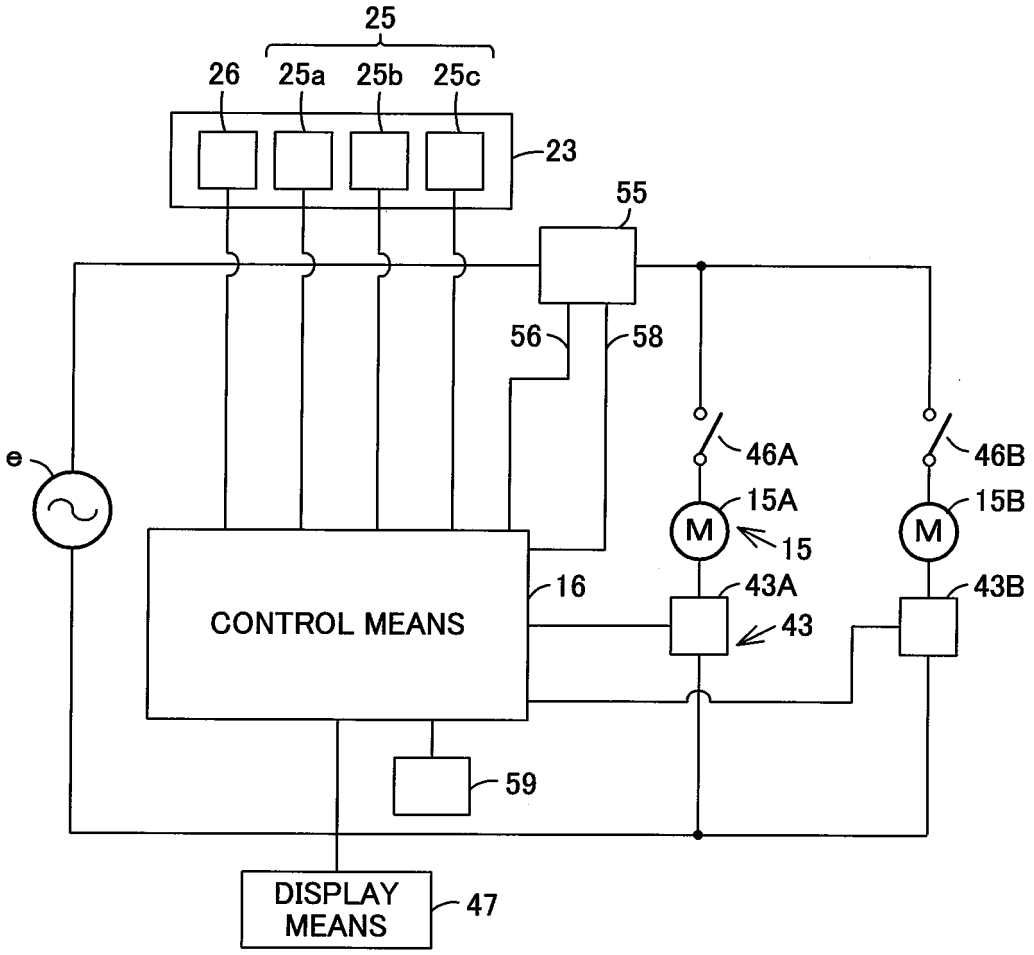
FIG. 7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CONTROL MEANS
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DISPLAY MEANS
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FIG. 8

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2010/062496

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 1996-2010
Kokai Jitsuyo Shinan Koho 1971-2010 Toroku Jitsuyo Shinan Koho 1994-2010

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 2007-20765 A (Matsushita Electric Industrial Co., Ltd.), 01 February 2007 (01.02.2007), paragraphs [0025], [0028] to [0032]; fig. 1, 2, 4 & EP 1743563 A2 & CN 1895142 A	1-7
Y	JP 11-47053 A (Mitsubishi Electric Corp.), 23 February 1999 (23.02.1999), entire text; all drawings (Family: none)	1-7
Y	JP 2006-167239 A (Hitachi Home & Life Solution, Inc.), 29 June 2006 (29.06.2006), paragraphs [0016] to [0029]; fig. 4 (Family: none)	3-6

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

* Special categories of cited documents:
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"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
31 August, 2010 (31.08.10)	07 September, 2010 (07.09.10)
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

- JP 2007020765 A **[0003]**
- JP 2009125399 A **[0003]**