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(54) **ELECTRIC VACUUM CLEANER**

(57) Provided is a vacuum cleaner (11) capable of indicating a remaining amount of a secondary battery (16) and other information at a position for a user to easily recognize, without the increased number of lines of wiring passing through a hose body (25).

A vacuum cleaner (11) includes an air path element (20) and a control unit (21). The air path element (20) includes a hose body (25), a connection part (26), a hand operation part (27), a wiring (30) and a lamp (29). The wiring (30) is disposed in the hose body (25) from the connection part (26) to at least the hand operation part (27). The lamp (29) is disposed on the hand operation

part (27), and is capable of performing indication in a plurality of types of indication modes. The control unit (21) controls the lamp (29) to perform indication in different indication modes according to previously-set conditions with respect to the vacuum cleaner (11). In the case where the remaining amount of the secondary battery (16) is lower than a predetermined level, the control unit (21) controls the lamp (29) in response to the remaining amount of the secondary battery (16) being lower than the predetermined level, even if other condition is satisfied.

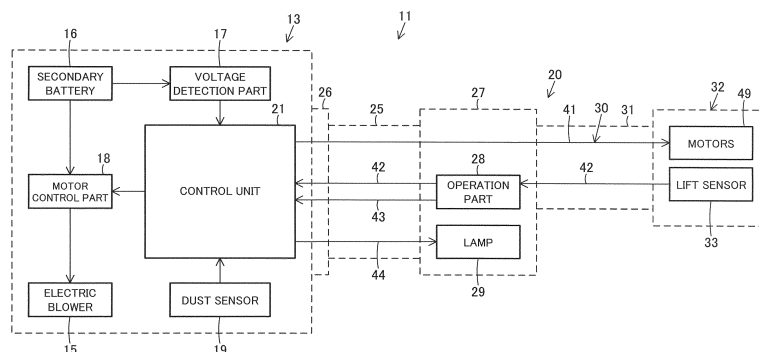


FIG. 1

Description

TECHNICAL FIELD

[0001] Embodiments described herein relate generally to a vacuum cleaner including a secondary battery disposed in a vacuum cleaner main body and an air path element to be connected to the vacuum cleaner main body.

BACKGROUND ART

[0002] In some conventional vacuum cleaners, a vacuum cleaner main body includes a rechargeable secondary battery, and is driven by the secondary battery serving as a power source.

[0003] A so-called stick type vacuum cleaner includes a vacuum cleaner main body having an extension pipe directly connected thereto, and a hand operation part to be gripped by a user to perform operation is disposed on the vacuum cleaner main body. In an example, in the case of such a stick type vacuum cleaner, some indication parts such as LEDs are disposed on the hand operation part, respectively indicating various types of information such as on a remaining amount of a secondary battery, suction of dust and dirt, and the amount of dust and dirt accumulated in a dust-collecting unit, whereby a user during cleaning is able to easily recognize the various types of information via the indication.

[0004] A so-called canister type vacuum cleaner includes a vacuum cleaner main body having a hose body connected thereto, and the vacuum cleaner main body performs cleaning while following traveling by being pulled via the hose body. In the case of such a canister type vacuum cleaner, a hand operation part to be gripped by a user to perform operation is disposed on the tip side of the hose body. Thus, the wiring to transmit the operation performed on the hand operation part to the control means disposed in the cleaning main body is to be disposed to pass through the hose body. In the case where an electric rotary brush is disposed to a floor brush connected to the tip side of the hose body, the wiring for power supply from the secondary battery is further to be disposed to pass through the hose body. As described above, in the case where wiring passes through the hose body, the number of lines of the wiring passing through the hose body should be limited, so as not to lower the cleaning performance due to the increased weight of the hose body with the wiring, and the impaired flexibility and stretchability of the hose body. Accordingly, unlike the stick type vacuum cleaner described above, in such a canister type vacuum cleaner, it is difficult to dispose a plurality of indication parts on the hand operation part, and thus the indication parts are disposed on the vacuum cleaner main body in general. However, in the case of a canister type vacuum cleaner, a user hardly realizes indication because the vacuum cleaner main body is positioned behind the user during cleaning.

[0005] In another configuration, the indication part receiving power supply from another secondary battery additionally disposed inside the floor brush is disposed on the floor brush, and configured to indicate the remaining amount of the secondary battery for the cleaning main body. However, the configuration is more complicated, and additionally the operability thereof is impaired due to the heavier floor brush.

[0006] Another configuration may be considered, in which a user is informed of various types of information by voice. However, such a configuration requires voice generation means, resulting in increasing cost. Additionally, a user may hardly listen to the voice due to relatively large noise in the case of a vacuum cleaner.

CITATION LIST

Patent Literature

[0007]

PTL 1: Japanese Laid-Open Patent Publication No. 2002-34873

PTL 2: Japanese Laid-Open Patent Publication No. 2002-34874

SUMMARY OF INVENTION

Technical Problem

[0008] The purpose of the present invention is to provide a vacuum cleaner capable of indicating information on a remaining amount of a secondary battery and other information at a position for a user to easily recognize, without the increased number of lines of wiring passing through a hose body.

Solution to Problem

[0009] A vacuum cleaner in an embodiment includes a vacuum cleaner main body, and operates by using a secondary battery disposed in the vacuum cleaner main body, as a power source. The vacuum cleaner includes an air path element and indication control means. The air path element includes a hose body, a connection part, a hand operation part, wiring, and indication means. The connection part connects one end side of the hose body to the vacuum cleaner main body. The hand operation part is disposed on the other end side of the hose body. The wiring is disposed in the hose body from the connection part to at least the hand operation part. The indication means is disposed on the hand operation part so as to perform indication in a plurality of types of indication modes. The indication control means controls the indication means to perform indication in different indication modes according to previously-set conditions with respect to the vacuum cleaner. In the case where a remaining amount of the secondary battery is lower than a

predetermined level, the indication control means controls the indication means in response to one condition of the remaining amount of the secondary battery being lower than the predetermined level, even if other condition is satisfied.

BRIEF DESCRIPTION OF DRAWINGS

[0010]

[Fig. 1]

Fig. 1 is a block diagram illustrating the internal structure of a vacuum cleaner according to a first embodiment.

[Fig. 2]

Fig. 2 is an oblique view illustrating the above vacuum cleaner.

[Fig. 3]

Fig. 3 is a flowchart indicating the control of the above vacuum cleaner.

[Fig. 4]

Fig. 4(a) is an explanatory diagram illustrating an indication driving signal corresponding to a zero-th indication mode of indication means of the above vacuum cleaner; Fig. 4(b) is an explanatory diagram illustrating an indication driving signal corresponding to a first indication mode of the above indication means; Fig. 4(c) is an explanatory diagram illustrating an indication driving signal corresponding to a second indication mode of the above indication means; and Fig. 4(d) is an explanatory diagram illustrating an indication driving signal corresponding to a third indication mode of the above indication means.

[Fig. 5]

Fig. 5 is a flowchart indicating the control of a vacuum cleaner according to a second embodiment.

[Fig. 6]

Fig. 6(a) is an explanatory diagram illustrating an indication driving signal corresponding to a zero-th indication mode of indication means of the above vacuum cleaner; Fig. 6(b) is an explanatory diagram illustrating an indication driving signal corresponding to a first indication mode of the above indication means; Fig. 6(c) is an explanatory diagram illustrating an indication driving signal corresponding to a second indication mode of the above indication means; Fig. 6(d) is an explanatory diagram illustrating an indication driving signal corresponding to a third indication mode of the above indication means; and Fig. 6(e) is an explanatory diagram illustrating an indication driving signal corresponding to a fourth indication mode of the above indication means.

DESCRIPTION OF EMBODIMENT

[0011] The first embodiment is described below in terms of its configuration with reference to the drawings.

[0012] In Fig. 1 and Fig. 2, reference sign 11 denotes a vacuum cleaner. The vacuum cleaner 11 is a canister type vacuum cleaner. The vacuum cleaner 11 includes a vacuum cleaner main body 13 capable of traveling on a floor surface as a cleaning-object surface. The vacuum cleaner 11 also includes a dust-collecting unit 14. The vacuum cleaner 11 further includes an electric blower 15 which is a suction source. The vacuum cleaner 11 further includes a secondary battery 16. The vacuum cleaner 11 further includes a voltage detection part 17 serving as voltage detection means. The vacuum cleaner 11 further includes a motor control part (motor driver) 18 serving as electric blower control means. The vacuum cleaner 11 may further include a dust sensor 19 serving as dust-and-dirt detection means. The vacuum cleaner 11 further includes an air path element 20. The vacuum cleaner 11 further includes a control unit 21 serving as control means.

[0013] The vacuum cleaner main body 13 includes traveling wheels 23. In an example, the traveling wheels 23 are rotatably disposed on the both sides of the vacuum cleaner main body 13. The vacuum cleaner main body 13 is capable of traveling on a floor surface by use of the traveling wheels 23. It is noted that the back-and-forth direction and the both sides direction or the width direction in the following description are based on the direction in which the vacuum cleaner main body 13 travels, wherein the side of the air path element 20 corresponds to the front side and the side opposite to the air path element 20 corresponds to the back side.

[0014] The dust-collecting unit 14 catches and collects the dust and dirt which have been sucked together with air by use of the negative pressure generated by the driving of the electric blower 15, from the air. The dust-collecting unit 14 may be integrally incorporated in the vacuum cleaner main body 13, or may be detachably disposed in the vacuum cleaner main body 13.

[0015] In the electric blower 15, an electric motor rotates a fan, and thus generates negative pressure, thereby sucking dust and dirt together with air into the dust-collecting unit 14. The electric blower 15 is housed in the vacuum cleaner main body 13.

[0016] The secondary battery 16 supplies electric power to the electric blower 15, the motor control part 18, the voltage detection part 17, the control unit 21 and the like. The secondary battery 16 may further supply electric power to other parts via a voltage conversion part. The secondary battery 16 is housed in the vacuum cleaner main body 13.

[0017] The voltage detection part 17 outputs the voltage of the secondary battery 16 to the control unit 21. The voltage detection part 17 is, for example, a voltage dividing part including a voltage dividing resistor. The voltage detection part 17 is configured to convert the voltage of the secondary battery 16 to the input level of the control unit 21.

[0018] The motor control part 18 controls the operation of the electric blower 15 or the like, in response to the

signal from the control unit 21. The motor control part 18 according to the present embodiment controls the amount of the power supply from the secondary battery 16 to the electric blower 15 or the like, thereby controlling the operation status such as turning on/off, or operation power of the electric blower 15 or the like. The motor control part 18 is housed in the vacuum cleaner main body 13.

[0019] The dust sensor 19 detects dust and dirt at any point in the air path through which the dust and dirt sucked from a cleaning-object surface by the operation of the electric blower 15 pass to the dust-collecting unit 14. In an example, the dust sensor 19 has a known configuration, in which an optical sensor having a light emitting part and a light receiving part are disposed to face each other so as to sandwich the air path through which dust and dirt pass. The dust sensor 19 is disposed in the upstream side of the dust-collecting unit 14. In an example, the dust sensor 19 is disposed in the vacuum cleaner main body 13 or the air path element 20.

[0020] The air path element 20 applies the negative pressure generated by the driving of the electric blower 15 to a floor surface and the like. The air path element 20 according to the present embodiment is connected to the suction side of the electric blower 15 via the dust-collecting unit 14. The air path element 20 allows a user to pull the vacuum cleaner main body 13 and thereby make the vacuum cleaner main body 13 following travel. In an example, the air path element 20 is detachably disposed to the vacuum cleaner main body 13. The air path element 20 includes a hose body 25. The air path element 20 further includes a connection part 26. The air path element 20 further includes a hand operation part 27. The air path element 20 further includes an operation part 28 serving as setting means. The air path element 20 further includes a lamp 29 which is lighting means serving as indication means. The air path element 20 further includes a wiring 30. The air path element 20 may further include an extension pipe 31. The air path element 20 may further include a suction port body 32. The air path element 20 may further include a lift sensor 33 serving as detection means (a detection part).

[0021] The hose body 25 is formed in a long cylindrical shape having flexibility. In an example, the hose body 25 is formed in a bellow shape. The hose body 25 sectionally has the air path through which dust and dirt pass.

[0022] The connection part 26 connects the air path element 20 to the vacuum cleaner main body 13. The connection part 26 according to the present embodiment connects the base end side which is the downstream end side of the hose body 25 to the vacuum cleaner main body 13.

[0023] The hand operation part 27 is also called a grip pipe or the like. The hand operation part 27 is disposed in the tip side which is the upstream end side of the hose body 25. The hand operation part 27 connects the tip side of the hose body 25 and the base end side which is the downstream end side (one end side) of the extension

pipe 31. Also, the hand operation part 27 is to be gripped by a user at the time of cleaning. The operation part 28 is disposed on the hand operation part 27. The lamp 29 is disposed on the hand operation part 27. A gripping part 35 for gripping and operation of the air path element 20 may be disposed so as to protrude from the upper part of the hand operation part 27. The gripping part 35 is not an essential component. A user may directly grip the hand operation part 27.

[0024] The operation part 28 is configured so that a user sets the operation of the electric blower 15 or the like. The operation part 28 is, for example, a switch or a button. The operation part 28 is disposed on the upper part of the hand operation part 27. The operation part 28 may be disposed on, for example, the gripping part 35.

[0025] The lamp 29 is capable of indicating, to a user, at least two types of information including the information on the remaining amount of the secondary battery 16 and other information, in mutually-different indication modes, that is, in mutually-different light emitting modes. In an example, the lamp 29 lights as a first indication mode, flicks as a second indication mode, and flicks in a longer cycle compared to the cycle of the second indication mode as a third indication mode. It is noted that the flickering is the state where lighting-on and lighting-off are switched alternately in a cycle allowing a person to recognize the lighting-on/off. The lamp 29 lights by the electric power supplied from the secondary battery 16. In the present embodiment, for example, an LED light serves as the lamp 29. The lamp 29 is disposed on the hand operation part 27. In an example, the lamp 29 is disposed in front of the gripping part 35. The lamp 29 is disposed in front of the operation part 28. In an example, the lamp 29 is disposed in the front vicinity of the operation part 28. The lamp 29 is disposed so as to emit light in a longitudinal shape along the longitudinal direction of the hand operation part 27. Accordingly, the lamp 29 is positioned in front of the hand of the user gripping the gripping part 35 or the hand operation part 27. The lamp 29 according to the present embodiment is positioned at a position not allowing the lamp 29 to be covered by the hand of the user gripping the gripping part 35 or the hand operation part 27.

[0026] The wiring 30 is disposed in the hose body 25 from the connection part 26 to at least the hand operation part 27. The wiring 30 according to the present embodiment is disposed to be embedded spirally inside the outer wall surrounding the air path of the hose body 25, so as to follow the bellow shape of the hose body 25. The wiring 30 is disposed outside the air path of the hose body 25. In the present embodiment, the wiring 30 includes, for example, four signal lines of a driving signal line 41, a state signal line 42, an operation signal line 43 and an indication signal line 44. One end part of the wiring 30 is electrically connected to the control unit 21.

[0027] The driving signal line 41 is the signal line for driving the suction port body 32 to be described below. The driving signal line 41 is disposed from the connection

part 26 through the hose body 25, the hand operation part 27 and the extension pipe 31 to the suction port body 32. The driving signal line 41 is disposed to partially pass through the hose body 25.

[0028] The state signal line 42 is the signal line for transmitting information on the lift state of the suction port body 32 to be described below. The state signal line 42 is disposed from the connection part 26 through the hose body 25, the hand operation part 27 and the extension pipe 31 to the suction port body 32. The state signal line 42 is disposed to partially pass through the hose body 25.

[0029] It is noted that the driving signal line 41 and the state signal line 42 may not be disposed, depending on the form of the suction port body 32. That is, the driving signal line 41 and the state signal line 42 are not essential components.

[0030] The operation signal line 43 is the signal line for the operation setting of the electric blower 15 performed by the operation part 28. The operation signal line 43 is disposed from the connection part 26 through the hose body 25 to the hand operation part 27. The operation signal line 43 electrically connects the operation part 28 and the control unit 21.

[0031] The indication signal line 44 is the signal line for driving the lamp 29. The indication signal line 44 is disposed from the connection part 26 through the hose body 25 to the hand operation part 27. The indication signal line 44 electrically connects the lamp 29 and the control unit 21.

[0032] The extension pipe 31 is made of, for example, hard synthetic resin and formed in a straight pipe shape. The base end side of the extension pipe 31 is connected to the tip side of the hose body 25, for example, in the present embodiment, connected to the hand operation part 27 and the tip side of the extension pipe 31 is connected to the suction port body 32. It is noted that the extension pipe 31 is not an essential component.

[0033] The suction port body 32 sucks dust and dirt from a floor surface by the negative pressure generated by the driving of the electric blower 15. In the present embodiment, the suction port body 32 is, for example, a floor brush which is to be placed on a floor surface and moved on the floor surface. The suction port body 32 includes a casing body 46. The suction port body 32 further includes a connection pipe 47 to be connected to the tip side of the extension pipe 31. The suction port body 32 may include a rotary brush 48 serving as a rotary cleaner. The suction port body 32 may further include motors 49 which are electric motors. It is noted that the suction port body 32 is not an essential component.

[0034] The casing body 46 includes a suction port in the lower portion facing a floor surface, allowing to suck dust and dirt together with air by the negative pressure generated by the driving of the electric blower 15.

[0035] The rotary brush 48 rotates to rake up dust and dirt from a floor surface. The rotary brush 48 is rotatably disposed on the lower portion of the casing body 46. In an example, the rotary brush 48 is rotatably attached to

the suction port.

[0036] The motors 49 rotationally drive the rotary brush 48. The motors 49, which are housed in the casing body 46, transmits the rotating force thereof via a transmitting member such as a timing belt and a gear to the rotary brush 48. The motors 49 are driven by the electric power supplied by the secondary battery 16. The motors 49 are electrically connected to the control unit 21 via the driving signal line 41. The motors 49 are driven or stopped in response to the signal of driving or stopping, which is set in the control unit 21 through the operation part 28 and is output by the control unit 21 via the driving signal line 41. As described above, the control unit 21 has the function of a rotary cleaner driving control part serving as rotary cleaner driving control means configured to control the driving of the rotary brush 48.

[0037] The lift sensor 33 detects the lift of the suction port body 32 from a floor surface. The lift sensor 33 is disposed, for example, on the lower portion of the casing body 46. A switch such as a micro switch serves as the lift sensor 33, which is switched on or off depending on the state where the suction port body 32 is placed on a floor surface or the state where the suction port body 32 is lifted up from a floor surface. The lift sensor 33 is electrically connected to the control unit 21 via the state signal line 42. In an example, in the present embodiment, the lift sensor 33 is electrically connected to the control unit 21 via the state signal line 42 and the operation part 28. The information on the on/off of the lift sensor 33 is transmitted to the control unit 21 via the state signal line 42 as the signal indicating whether the suction port body 32 is placed on or lifted up from a floor surface. It is noted that the lift sensor 33 is not an essential component.

[0038] The control unit 21 has the function of the indication control means (an indication control part) configured to control the operation of the lamp 29. That is, the control unit 21 outputs the indication driving signal to drive the lamp 29 to the lamp 29 via the indication signal line 44. The control unit 21 is electrically connected to the voltage detection part 17, the motor control part 18 and the dust sensor 19. The control unit 21 is further electrically connected via the wiring 30 to the operation part 28, the lamp 29, the lift sensor 33 and the motors 49, respectively. In the control unit 21 according to the present embodiment, the input side thereof is connected to the voltage detection part 17, the dust sensor 19, the operation part 28 and the lift sensor 33, and the output side thereof is connected to the motor control part 18, the lamp 29 and the motors 49. The control unit 21 calculates the voltage of the secondary battery 16 on the basis of the output of the voltage detection part 17. The control unit 21 then generates the driving signal of the electric blower 15 on the basis of the output of the voltage detection part 17, the operation signal input by the operation part 28 via the operation signal line 43, and the detection output with respect to presence or absence of the lift of the suction port body 32 input by the lift sensor 33 via the state signal line 42, and thereafter outputs the

signal to the motor control part 18 to drive or stop the electric blower 15. The control unit 21 further generates the indication driving signal of the lamp 29, on the basis of the output of the voltage detection part 17, the operation signal input by the operation part 28 via the operation signal line 43, the detection output with respect to presence or absence of the lift of the suction port body 32 input by the lift sensor 33 via the state signal line 42, and the output of the dust sensor 19, and thereafter outputs the signal to the lamp 29 via the indication signal line 44. The control unit 21 then controls the lamp 29 to indicate information in different indication modes according to the conditions set in advance with respect to the vacuum cleaner 11. Herein, the examples of the conditions set in advance with respect to the vacuum cleaner 11 include whether or not the remaining amount of the secondary battery 16 is lower than a predetermined level, whether or not dust and dirt have been sucked into the dust-collecting unit 14, and whether or not the suction port body 32 has been lifted up. For example, a microcomputer serves as the control unit 21. The control unit 21 is housed in the vacuum cleaner main body 13.

[0039] The cleaning operation according to the above-described first embodiment is described next.

[0040] Under the state where the extension pipe 31 and the suction port body 32 are connected to the tip part of the hose body 25 connected to the vacuum cleaner main body 13 via the connection part 26, a user places the suction port body 32 on a floor surface, and grips the gripping part 35 and operates the operation part 28, thereby driving the electric blower 15.

[0041] The control unit 21 refers to the operation performed on the operation part 28 via the operation signal line 43, and outputs, to the motor control part 18, the driving signal to make the electric blower 15 operate with the power set by the operation. The motor control part 18 makes the electric blower 15 operate or stop on the basis of the driving signal. In the case where the control unit 21 refers to the output of the voltage detection part 17, and where the voltage of the secondary battery 16 is lowered, as an example, the control unit 21 is able to perform control such as to make the electric blower 15 operate with reduced power, or not to allow the electric blower 15 to operate. In the case where the control unit 21 refers to the output of the lift sensor 33 via the state signal line 42, and where the suction port body 32 is lifted from a floor surface, as an example, the control unit 21 is able to perform control such as to reduce the power of the electric blower 15.

[0042] A user pulls the air path element 20 and moves the vacuum cleaner main body 13 to an appropriate position, and makes the suction port body 32 reciprocate in the back-and-forth direction on a floor surface, whereby dust and dirt together with air are sucked from the floor surface through the suction port of the suction port body 32 by use of the negative pressure generated by the driving of the electric blower 15. A user operates the operation part 28 to rotationally drive the rotary brush 48,

as needed, whereby entered dust and dirt are raked up from a floor surface.

[0043] That is, in the case where the control unit 21 refers to the operation performed on the operation part 28 via the operation signal line 43, and the operation is to set the rotary brush 48 to drive under the state where the rotary brush 48 stops, the control unit 21 outputs the driving signal to drive the motors 49 via the driving signal line 41. In the case where the control unit 21 refers to the output of the voltage detection part 17, and where the voltage of the secondary battery 16 is lowered, as an example, the control unit 21 may perform control such as not to allow the operation of the motors 49. In the case where the control unit 21 refers to the output of the lift sensor 33 via the state signal line 42, and where the suction port body 32 is lifted from a floor surface, as an example, the control unit 21 may perform control such as not to allow the operation of the motors 49, or to temporarily stop the motors 49 under a driving state. In the case where the control unit 21 refers to the operation performed on the operation part 28 via the operation signal line 43, and where the operation is to set the rotary brush 48 to stop under the state where the motors 49 are driving or temporarily stops, the control unit 21 outputs the driving signal to stop the motors 49 via the driving signal line 41.

[0044] It is noted that the air containing dust sucked through the suction port of the suction port body 32 passes from the connection pipe 47 through the air path inside the extension pipe 31 and the hose body 25, and is sucked into the dust-collecting unit 14. In the dust-collecting unit 14, the dust and dirt in the air containing dust are separated and collected. The air after dust and dirt are separated is sucked into the electric blower 15 and cools the electric blower 15, and thereafter is exhausted from the vacuum cleaner main body 13.

[0045] During cleaning, the control unit 21 refers to the output of the voltage detection part 17, the output of the dust sensor 19, and the output of the lift sensor 33 via the state signal line 42, generates an indication driving signal on the basis of these outputs and outputs the signal to the lamp 29 via the indication signal line 44, thereby making the lamp 29 indicate various types of information with respect to the vacuum cleaner 11 in mutually-different indication modes. In the present embodiment, the control unit 21 makes the lamp 29 indicate the information on the remaining amount of the secondary battery 16, for example, the information that the remaining amount or the voltage of the secondary battery 16 is lower than a predetermined level. The control unit 21 also makes the lamp 29 indicate the information that the dust sensor 19 has detected dust and dirt, or the information that dust and dirt have been sucked into the dust-collecting unit 14. The control unit 21 further makes the lamp 29 indicate the information that the suction port body 32 has been lifted from a floor surface. The control unit 21 sets priorities to the types of information to be indicated by the lamp 29. In the present embodiment, according to the

set priorities, the lamp 29 is made to indicate the information that the remaining amount of the secondary battery 16 is lower than a predetermined level, with the highest priority, and then made to indicate the information that the dust sensor 19 has detected dust and dirt, and the information that the suction port body 32 has been lifted from a floor surface, in this order. In the case where the remaining amount of the secondary battery 16 is lower than a predetermined level, the control unit 21 according to the present embodiment performs control to make the lamp 29 indicate the information in response to the remaining amount of the secondary battery 16 being lower than the predetermined level, even if other condition is satisfied such as the condition that the dust sensor 19 has detected dust and dirt, or that the suction port body 32 has been lifted from a floor surface.

[0046] After the cleaning is finished, a user operates the operation part 28 to make the electric blower 15 stop. The dust and dirt collected in the dust-collecting unit 14 are disposed of as appropriate.

[0047] The control of the indication by the above-described lamp 29 is described next with reference to Fig. 3 as well.

[0048] In step S1, the control unit 21 first refers to the output of the voltage detection part 17, and determines whether or not the voltage of the secondary battery 16 is lower than a predetermined threshold. In the case of, in step S1, determining that the voltage of the secondary battery 16 is lower than a predetermined threshold, then in step S2, the control unit 21 generates the indication driving signal to make the lamp 29 indicate the information in the second indication mode or a second indication pattern, and outputs the signal to the lamp 29 via the indication signal line 44, and thereafter finishes the control.

[0049] On the other hand, in the case of, in step S1, determining that the voltage of the secondary battery 16 is not lower than a predetermined threshold, then in step S3, the control unit 21 refers to the output of the dust sensor 19, and determines whether or not the dust sensor 19 has detected dust and dirt, that is, whether or not the vacuum cleaner 11 has sucked dust and dirt into the dust-collecting unit 14. In the case of, in step S3, determining that the dust sensor 19 has detected dust and dirt, that is, determining that the vacuum cleaner 11 has sucked dust and dirt into the dust-collecting unit 14, then in step S4, the control unit 21 generates the indication driving signal to make the lamp 29 indicate the information in the first indication mode or a first indication pattern, and outputs the signal to the lamp 29 via the indication signal line 44, and thereafter finishes the control.

[0050] In the case of, further in step S3, determining that the dust sensor 19 has not detected dust or dirt, or that the electric blower 15 has not sucked dust or dirt into the dust-collecting unit 14, then in step S5, the control unit 21 refers to the output of the lift sensor 33 via the state signal line 42, and determines whether or not the suction port body 32 has been lifted from a floor surface.

In the case of, in step S5, determining that the suction port body 32 has been lifted from a floor surface, then in step S6, the control unit 21 generates the indication driving signal to make the lamp 29 indicate the information in the third indication mode or a third indication pattern, and outputs the signal to the lamp 29 via the indication signal line 44, and thereafter finishes the control.

[0051] On the other hand, in the case of, in step S5, determining that the suction port body 32 has not been lifted from a floor surface, then in step S7, the control unit 21 generates the indication driving signal to make the lamp 29 indicate the information in a zero-th indication mode or a zero-th indication pattern, and outputs the signal to the lamp 29 via the indication signal line 44, and thereafter finishes the control.

[0052] It is noted that the indication may be controlled periodically in a predetermined interval, or may be controlled all the times. The indication may be controlled during cleaning, that is, during the operation of the electric blower 15, or may be controlled regardless of the operation or stop of the electric blower 15.

[0053] Herein, with respect to the zero-th to third indication modes, in an example, the zero-th indication mode indicates lighting-off; the first indication mode indicates lighting-on; the second indication mode indicates flickering; and the third indication mode indicates flickering in a longer cycle and a longer lighting-on period than those in the second indication mode. Fig. 4 shows one example set of the indication driving signals. In the indication driving signals of these indication modes, an L level corresponds to lighting-off of the lamp 29, and an H level corresponds to lighting-on of the lamp 29. In the present embodiment, in an example, the third indication mode indicates flickering in a cycle and a period twice as long as those of the second indication mode.

[0054] A user during cleaning is able to see directly the suction port body 32, and thus easily to grasp the information that the suction port body 32 has been lifted from a floor surface, and accordingly the information is less important. In the case of the vacuum cleaner 11 driven by the secondary battery 16, the information on the remaining amount of the secondary battery 16 which directly relates to the remaining operating time of the vacuum cleaner 11 is more important than the information on dust detection.

[0055] In the first embodiment described above, in the case where the remaining amount of the secondary battery 16 is lower than a predetermined level, the control unit 21 makes the lamp 29 indicate the information in the second indication mode. In the case where the remaining amount of the secondary battery 16 is not lower than a predetermined level, and where the dust sensor 19 has detected dust and dirt, the control unit 21 makes the lamp 29 indicate the information in the first indication mode. In the case where the remaining amount of the secondary battery 16 is not lower than a predetermined level, where the dust sensor 19 has not detected dust or dirt, and where the lift sensor 33 has detected the lift of the suction

port body 32 from a floor surface, the control unit 21 makes the lamp 29 indicate the information in the third indication mode.

[0056] Accordingly, in the case where three types of information to be indicated by the lamp 29 coexist with regard to the dust detection, the remaining amount of the secondary battery 16, and the lift of the suction port body 32, the control unit 21 makes the lamp 29 indicate such information, by giving priorities to the information in order of the importance to a user, whereby the one lamp 29 is able to individually indicate different types of information. Thus, a plurality of lamps or the like are not required, and the indication by the lamp 29 is able to be controlled by use of just one line of the wiring 30, in the present embodiment, the indication signal line 44, resulting in preventing the increased number of lines of the wiring 30 from passing through the hose body 25.

[0057] The second embodiment is described next with reference to Fig. 5 and Fig. 6. It is noted that the same configurations and operations as those of the first embodiment described above are denoted by the same reference numerals, and the descriptions thereof are omitted.

[0058] In the second embodiment, the information to be indicated by the lamp 29 includes not only the information in the first embodiment described above, but also the information of the case where the lift sensor 33 has detected the lift of the suction port body 32 from a floor surface under the state where the dust sensor 19 has detected dust and dirt.

[0059] In the present embodiment, the control unit 21 additionally determines whether or not the suction port body 32 has been lifted from a floor surface under the state where the dust sensor 19 has detected dust and dirt, thereby making the lamp 29 indicate the abnormal state of the vacuum cleaner 11.

[0060] In the present embodiment, in order that the control unit 21 controls the lamp 29 to indicate information in different indication modes according to the conditions set in advance with respect to the vacuum cleaner 11, the conditions above include, for example, whether or not the remaining amount of the secondary battery 16 is lower than a predetermined level, whether or not dust and dirt have been sucked into the dust-collecting unit 14, whether or not the suction port body 32 has been lifted under the state where the dust sensor 19 has detected dust and dirt, and whether or not the suction port body 32 has been lifted under the state where the dust sensor 19 has not detected dust or dirt.

[0061] As shown in Fig. 5, the second embodiment includes step S8 and step S9, in addition to the steps in the above-described first embodiment. That is, in the case of, in step S3, determining that the dust sensor 19 has detected dust and dirt, or that the vacuum cleaner 11 has sucked dust and dirt into the dust-collecting unit 14, then in step S8, the control unit 21 refers to the output of the lift sensor 33 via the state signal line 42, and determines whether or not the suction port body 32 has

been lifted from a floor surface. In the case of, in step S8, determining that the suction port body 32 has been lifted from a floor surface, then in step S9, the control unit 21 generates the indication driving signal to make the lamp 29 indicate the information in a fourth indication mode or a fourth indication pattern, and outputs the signal to the lamp 29 via the indication signal line 44, and thereafter finishes the control. In the case of, in step S8, determining that the suction port body 32 has not been lifted from a floor surface, the processing proceeds to step S4.

[0062] Fig. 6 shows one example set of the indication driving signals. In the indication driving signals of these indication modes, an L level corresponds to lighting-off of the lamp 29, and an H level corresponds to lighting-on of the lamp 29. In the present embodiment, in an example, the fourth indication mode indicates the lighting pattern of high-speed flickering twice followed by a long lighting-off period. The fourth indication mode is referred to as special flickering, as an example.

[0063] As described above, in the second embodiment, in the case where the remaining amount of the secondary battery 16 is lower than a predetermined level, the control unit 21 makes the lamp 29 indicate the information in the second indication mode. In the case where the remaining amount of the secondary battery 16 is not lower than a predetermined level, the dust sensor 19 has detected dust and dirt, and the lift sensor 33 has detected the lift of the suction port body 32 from a floor surface, the control unit 21 makes the lamp 29 indicate the information in the fourth indication mode. In the case where the remaining amount of the secondary battery 16 is not lower than a predetermined level, the dust sensor 19 has detected dust and dirt, and the lift sensor 33 has not detected the lift of the suction port body 32 from a floor surface, the control unit 21 makes the lamp 29 indicate the information in the first indication mode. In the case where the remaining amount of the secondary battery 16 is not lower than a predetermined level, the dust sensor 19 has not detected dust or dirt, and the lift sensor 33 has detected the lift of the suction port body 32 from a floor surface, the control unit 21 makes the lamp 29 indicate the information in the third indication mode.

[0064] Under the state where the suction port body 32 is lifted from a floor surface, the vacuum cleaner 11 in a normal state does not suck dust or dirt, and thus the dust sensor 19 does not detect dust or dirt. Therefore, in the case where the suction port body 32 is lifted from a floor surface under the state where the dust sensor 19 has detected dust and dirt as described above, the vacuum cleaner 11 is assumed to be in an abnormal state. Accordingly, in the present embodiment, the control unit 21 additionally determines whether or not the suction port body 32 is lifted from a floor surface under the state where the dust sensor 19 has detected dust and dirt, and makes the lamp 29 indicate the information in a corresponding indication mode, thereby enabling to inform a user of whether or not the vacuum cleaner 11 is in abnormal state, for example, whether or not dust and dirt are at-

tached to the dust sensor 19 resulting in fouling, or whether or not dust and dirt are stacked in the vicinity of the dust sensor 19, by the indication by the lamp 29. This enables to urge a user to perform maintenance of the dust sensor 19 or in the vicinity thereof.

[0065] Especially, the dust sensor 19 is disposed, for example, inside the vacuum cleaner main body 13 or inside the suction port body 32, so that the air path allowing to suck dust and dirt is sandwiched, and thus a user is not able to directly see the dust sensor 19 from the outside in a general use state. Accordingly, the information of whether or not the vacuum cleaner 11 is in an abnormal state caused by fouling or the like of the dust sensor 19 is relatively highly important to a user during cleaning. Therefore, the lamp 29 is made to indicate the information on the abnormal state of the vacuum cleaner 11 with a higher priority than those of the dust detection and merely the lift of the suction port body 32 from a floor surface, thereby enabling to inform a user of information highly important to a user in order.

[0066] In the case where the four types of information to be indicated by the lamp 29 coexist with regard to the dust detection, the remaining amount of the secondary battery 16, the lift of the suction port body 32, and the abnormal state of the vacuum cleaner 11, the control unit 21 makes the lamp 29 indicate such information, by giving priorities to the information in order of the importance to a user, whereby the one lamp 29 is able to individually indicate different types of information. Thus, a plurality of lamps or the like are not required, and the indication by the lamp 29 is able to be controlled by use of just one line of the wiring 30, in the present embodiment, the indication signal line 44, resulting in preventing the increased number of lines of the wiring 30 from passing through the hose body 25.

[0067] It is noted that, in each of the embodiments described above, only the case where the remaining amount of the secondary battery 16 is lower than a predetermined level is indicated as the information on the remaining amount of the secondary battery 16. Alternatively, a plurality of threshold values may be set with respect to the remaining amount (voltage) of the secondary battery 16, and the remaining amount of the secondary battery 16 may be compared with these threshold values, and thereby on the basis of the comparison, the lamp 29 may be made to indicate information in a plurality of mutually-different types of indication modes with respect to the remaining amount of the secondary battery 16.

[0068] Additionally, the examples of the information to be indicated by the lamp 29 other than the information on the remaining amount of the secondary battery 16 may include the amount of dust and dirt accumulated in the dust-collecting unit 14, and the clogging of a filter and the closing of a suction port detected by a clogging sensor which is clogging detection means such as of a rotational speed detection part serving as rotational speed detection means configured to detect rotational speed of the electric blower 15. That is, arbitrary information on the

operation status and/or cleaning status of the vacuum cleaner 11 acquirable by use of a sensor or the like may serve as the information other than the information on the remaining amount of the secondary battery 16 to be indicated by the lamp 29.

[0069] In the description above, the control unit 21 integrally includes the function of the rotary cleaner driving control part serving as rotary cleaner driving control means and the function of the indication control part serving as indication control means, and further includes the function to control the motor control part 18. Alternatively, these functions may be configured respectively as individual control parts which are control means.

[0070] In at least one of the embodiments described above, the lamp 29 disposed on the hand operation part 27 is capable of indicating information in various types of indication modes. In the case where the remaining battery of the secondary battery 16 is lower than a predetermined level, the control unit 21 controls the lamp 29 in response to the remaining battery of the secondary battery 16 being lower than the predetermined level, even if other condition is satisfied. That is, the control unit 21 makes the lamp 29 indicate one type of information with priority, and makes the lamp 29 indicate at least remaining one type of information other than the indicated one type of information, in the period in which the one type of information is not indicated. This enables to individually indicate various different types of information by giving priorities in indicating by use of the one lamp 29, according to the importance of information. Thus, since a plurality of lamps or the like are not required, and the indication by the lamp 29 is able to be controlled by use of just one line of the wiring 30, for example, the indication signal line 44, without the usage of the increased number of lines of the wiring 30 passing through the hose body 25. Accordingly, the remaining amount of the secondary battery 16 and other types of information are able to be indicated at a position for a user to easily recognize, without being impaired in flexibility of the hose body 25 or in operability at the time when the vacuum cleaner main body 13 is made to following travel.

[0071] In the case where at least two types of conditions for indicating information are satisfied simultaneously, the information on the remaining amount of the secondary battery 16 with a higher priority is indicated, and other types of information with lower priorities are not indicated, whereby the one lamp 29 is available as means for indicating a plurality of types of information.

[0072] The indication by the lamp 29 informs a user of the remaining amount of the secondary battery 16, and the user is thus able to estimate the remaining operating time of the vacuum cleaner 11. Accordingly, the user is able to operate the vacuum cleaner 11 depending on an expected cleaning status, by, for example, performing cleaning in a hurry, or lowering the power of the electric blower 15 to lengthen the operating time as much as possible.

[0073] The control unit 21 makes the lamp 29 indicate

the information that the dust sensor 19 has detected dust and dirt, in the first indication mode, and makes the lamp 29 indicate the information that the remaining amount of the secondary battery 16 is lower than a predetermined level, in the second indication mode, thereby enabling to inform a user of the two types of information of the dust detection and the remaining amount of the secondary battery 16 respectively by the common lamp 29.

[0074] In the case where the dust sensor 19 has detected dust and dirt and the remaining amount of the secondary battery 16 is lower than a predetermined level, the control unit 21 makes the lamp 29 indicate the information that the remaining amount of the secondary battery 16 is lower than a predetermined level with priority in the second indication mode, thereby enabling to inform a user of the information more important to the user with priority, even in the case where the two types of information coexist with regard to the dust detection and the remaining amount of the secondary battery 16.

[0075] Moreover, since people have a characteristic of being more likely to recognize a moving object compared to a non-moving object, the control unit 21 makes, by using such a characteristic, the lamp 29 indicate the information on the remaining amount of the secondary battery 16 by flickering which is the second indication mode, and makes the lamp 29 indicate at least one type of other information, for example, the information that the dust sensor 19 has detected dust and dirt in a lighting-on state which is the first indication mode, thereby enabling to inform a user of information more important to the user in an easily-recognizable indication mode.

[0076] Moreover, the control unit 21 makes the lamp 29 indicate the information that the lift sensor 33 has detected the lift of the suction port body 32 from a floor surface, in the third indication mode, thereby enabling to inform a user of the three types of information of the dust detection, the remaining amount of the secondary battery 16, and the lift of the suction port body 32, respectively.

[0077] Especially, the control unit 21 makes the lamp 29 light as the first indication mode, flick as the second indication mode, and flick in a longer cycle than the cycle of the second indication mode as the third indication mode, thereby enabling to inform a user of the information most important to the user in an easily-recognizable indication mode.

[0078] 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. A vacuum cleaner comprising a vacuum cleaner main body, the vacuum cleaner configured to operate by using a secondary battery disposed in the vacuum cleaner main body, as a power source, the vacuum cleaner comprising:

an air path element including:

a hose body;
a connection part connecting one end side of the hose body to the vacuum cleaner main body;
a hand operation part disposed on the other end side of the hose body;
a wiring disposed in the hose body from the connection part to at least the hand operation part; and
indication means disposed on the hand operation part so as to perform indication in a plurality of types of indication modes; and

indication control means configured to control the indication means to perform indication in different indication modes according to previously-set conditions with respect to the vacuum cleaner, wherein

when a remaining amount of the secondary battery is lower than a predetermined level, the indication control means controls the indication means in response to one condition of the remaining amount of the secondary battery being lower than the predetermined level, even if other condition is satisfied.

2. The vacuum cleaner according to claim 1, the vacuum cleaner comprising:

an electric blower;
a dust-collecting unit configured to catch and collect dust and dirt sucked by operation of the electric blower; and
dust-and-dirt detection means configured to detect the dust and dirt sucked from a cleaning-object surface before the dust and dirt reaching the dust-collecting unit, wherein
the indication control means makes the indication means indicate information on detection of dust and dirt by the dust-and-dirt detection means, in a first indication mode, and the indication control means makes the indication means perform indication in a second indication mode when the remaining amount of the secondary battery is lower than a predetermined level.

3. The vacuum cleaner according to claim 2, wherein

when the dust-and-dirt detection means detects dust and dirt, and the remaining amount of the secondary battery is lower than a predetermined level, the indication control means makes the indication means indicate information on the remaining amount of the secondary battery being lower than a predetermined level, in the second indication mode.

4. The vacuum cleaner according to any one of claims 1 to 3, wherein
the indication means is lighting means, and
the indication control means makes the indication means indicate information on the remaining amount of the secondary battery by flickering as the second indication mode, and makes the indication means indicate at least one of other information in a lighting-on state as the first indication mode.

5. The vacuum cleaner according to claim 2 or 3, the vacuum cleaner comprising:

detection means configured to detect lift of a suction port body from the cleaning-object surface, the suction port body included in the air path element, the suction port body connected to the other end side of the hose body, wherein the indication control means makes the indication means indicate the lift of the suction port body from the cleaning-object surface detected by the detection means as other information, in a third indication mode.

6. The vacuum cleaner according to claim 5, wherein
when the remaining amount of the secondary battery is lower than a predetermined level, the indication control means makes the indication means perform indication in the second indication mode,
when the remaining amount of the secondary battery is not lower than a predetermined level and the dust-and-dirt detection means detects dust and dirt, the indication control means makes the indication means perform indication in the first indication mode, and
when the remaining amount of the secondary battery is not lower than a predetermined level, the dust-and-dirt detection means does not detect dust or dirt, and the detection means detects the lift of the suction port body from the cleaning-object surface, the indication control means makes the indication means perform indication in the third indication mode.
7. The vacuum cleaner according to claim 5, wherein
when the remaining amount of the secondary battery is lower than a predetermined level, the indication control means makes the indication means perform indication in the second indication mode,
when the remaining amount of the secondary battery is not lower than a predetermined level, the dust-

and-dirt detection means detects dust and dirt, and the detection means detects the lift of the suction port body from the cleaning-object surface, the indication control means makes the indication means perform indication in a fourth indication mode,
when the remaining amount of the secondary battery is not lower than a predetermined level, the dust-and-dirt detection means detects dust and dirt, and the detection means does not detect the lift of the suction port body from the cleaning-object surface, the indication control means makes the indication means perform indication in the first indication mode, and
when the remaining amount of the secondary battery is not lower than a predetermined level, the dust-and-dirt detection means does not detect dust or dirt, and the detection means detects the lift of the suction port body from the cleaning-object surface, the indication control means makes the indication means perform indication in the third indication mode.

8. The vacuum cleaner according to any one of claim 5 to 7, wherein
the indication means is lighting means, and
the indication control means makes the indication means light as the first indication mode, flick as the second indication mode, and flick in a longer cycle than a cycle of the second indication mode as the third indication mode.

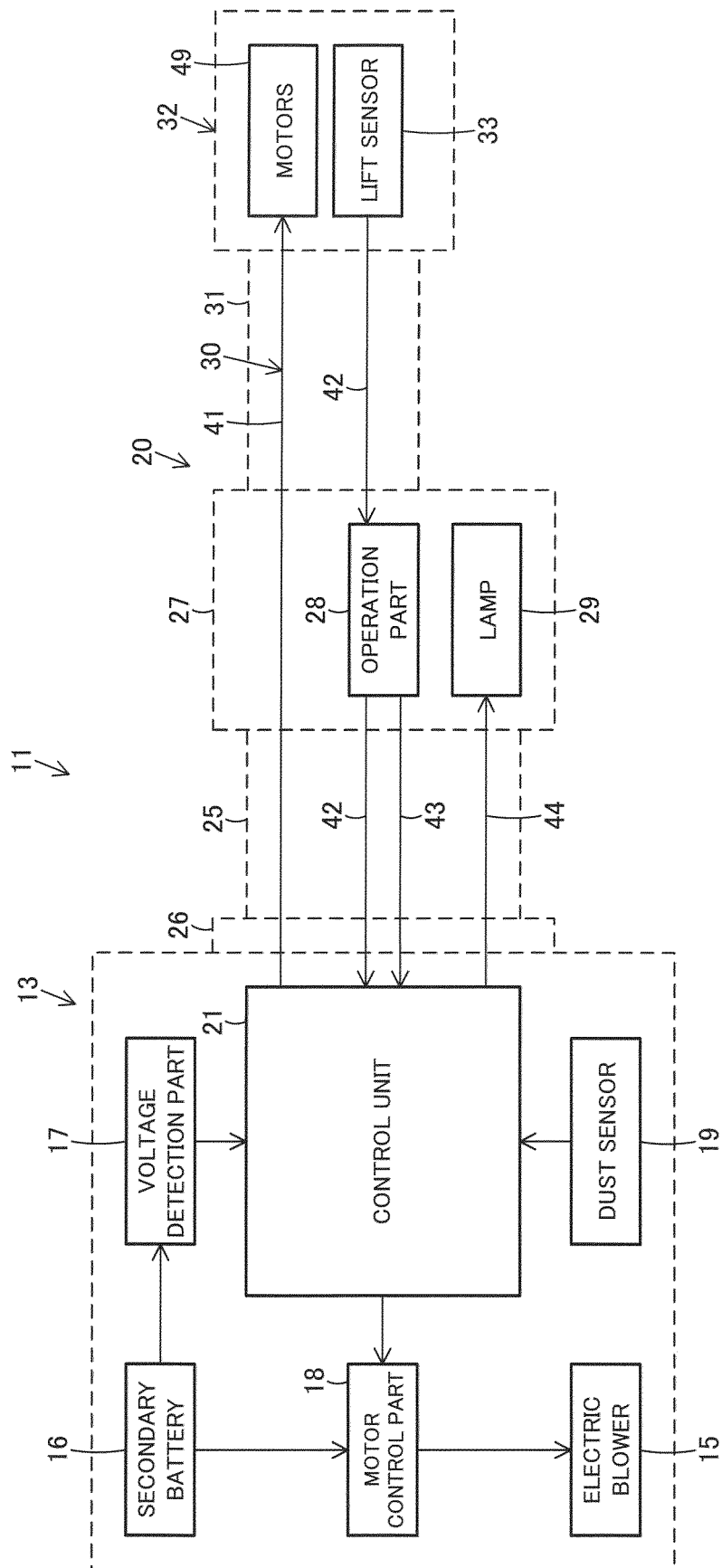


FIG. 1

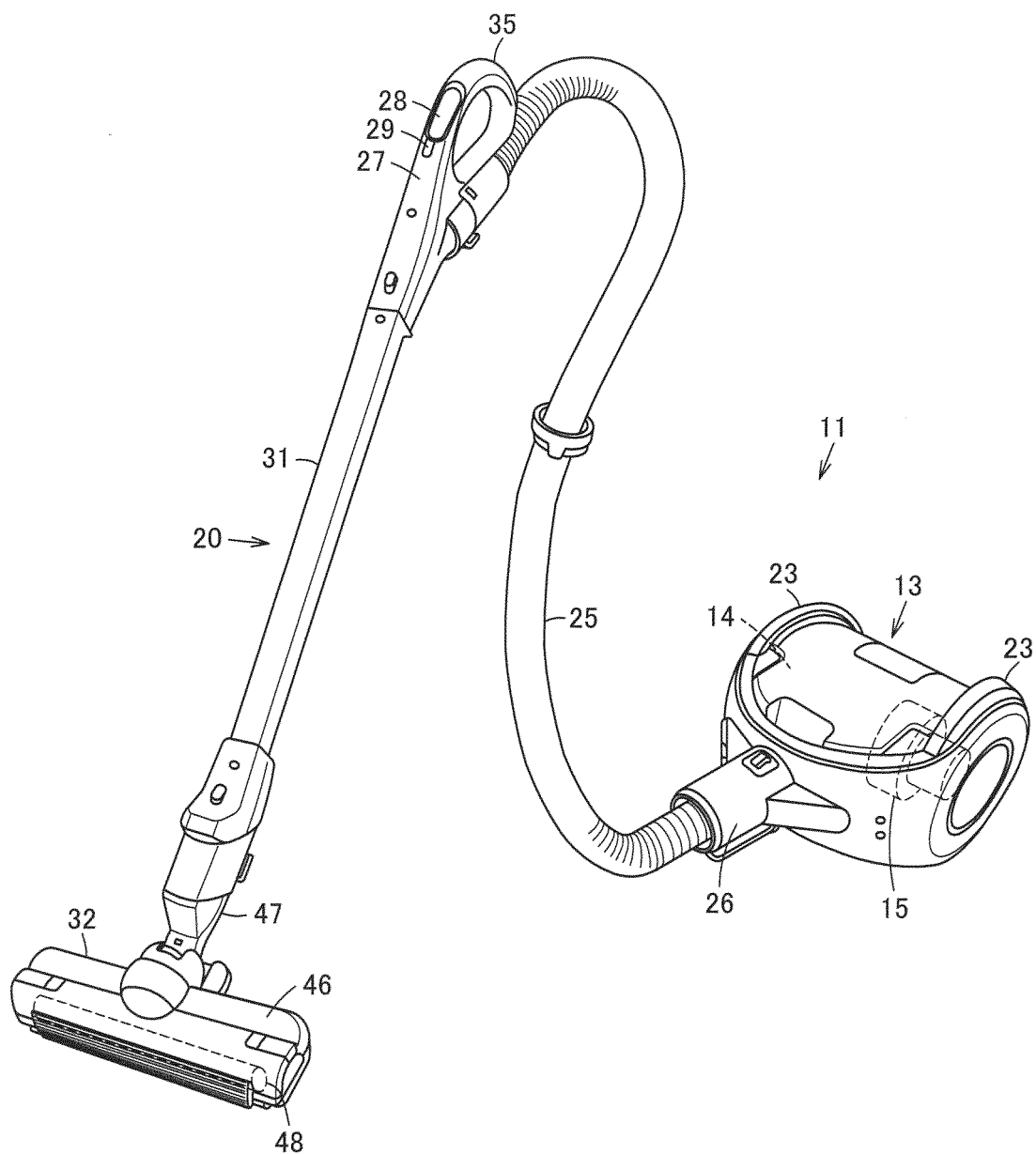


FIG. 2

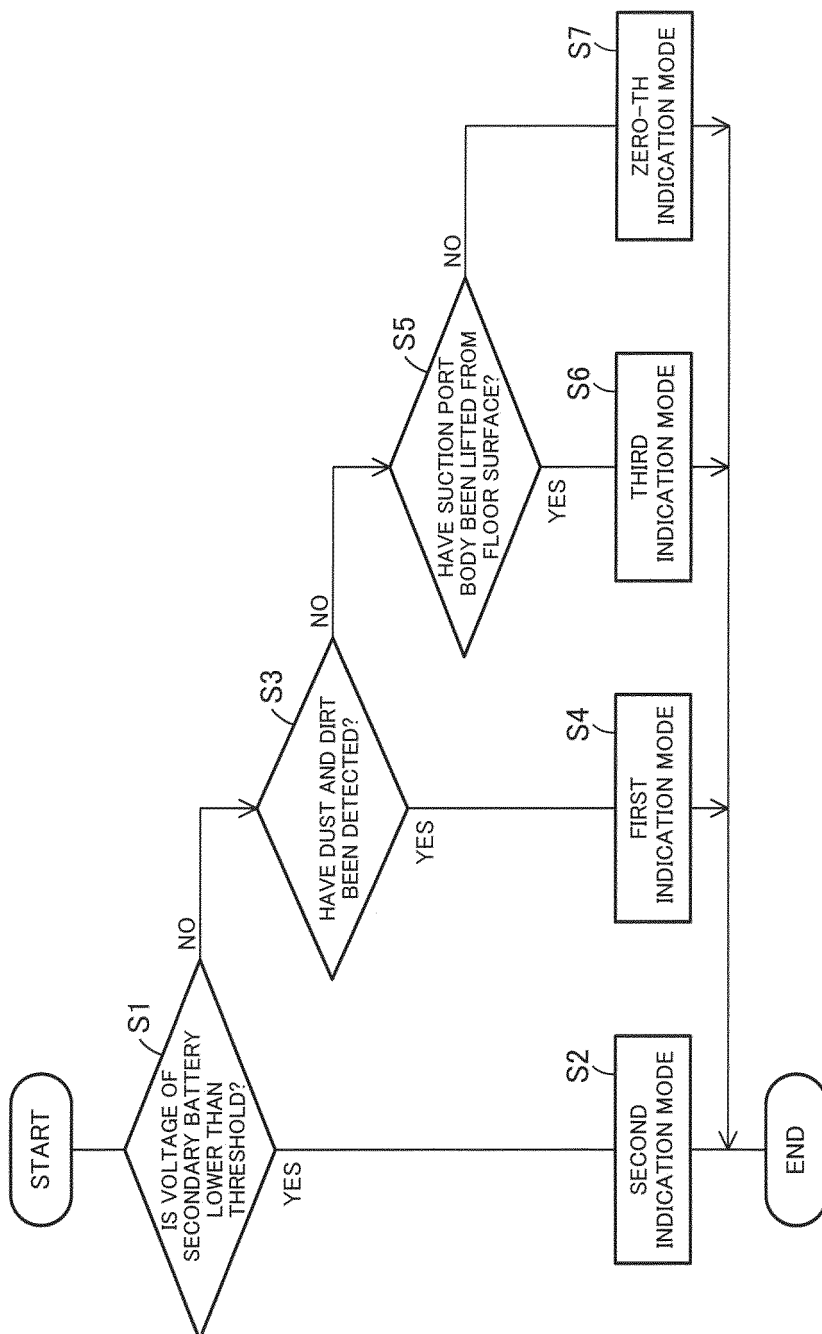


FIG. 3

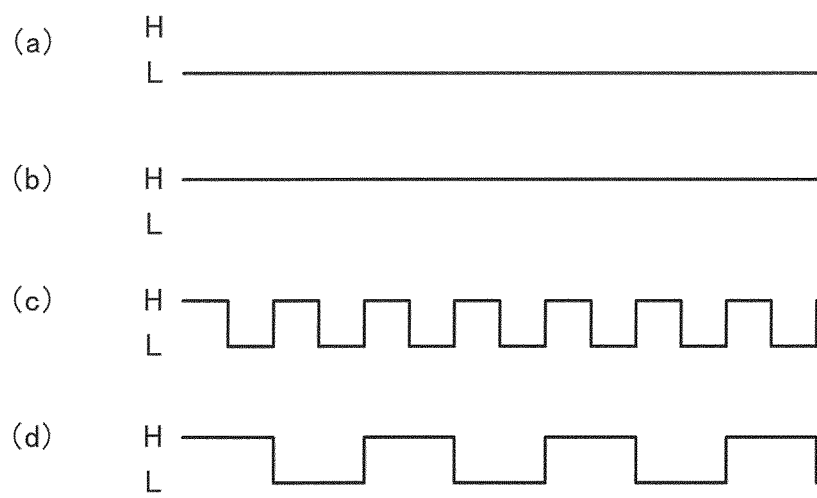


FIG. 4

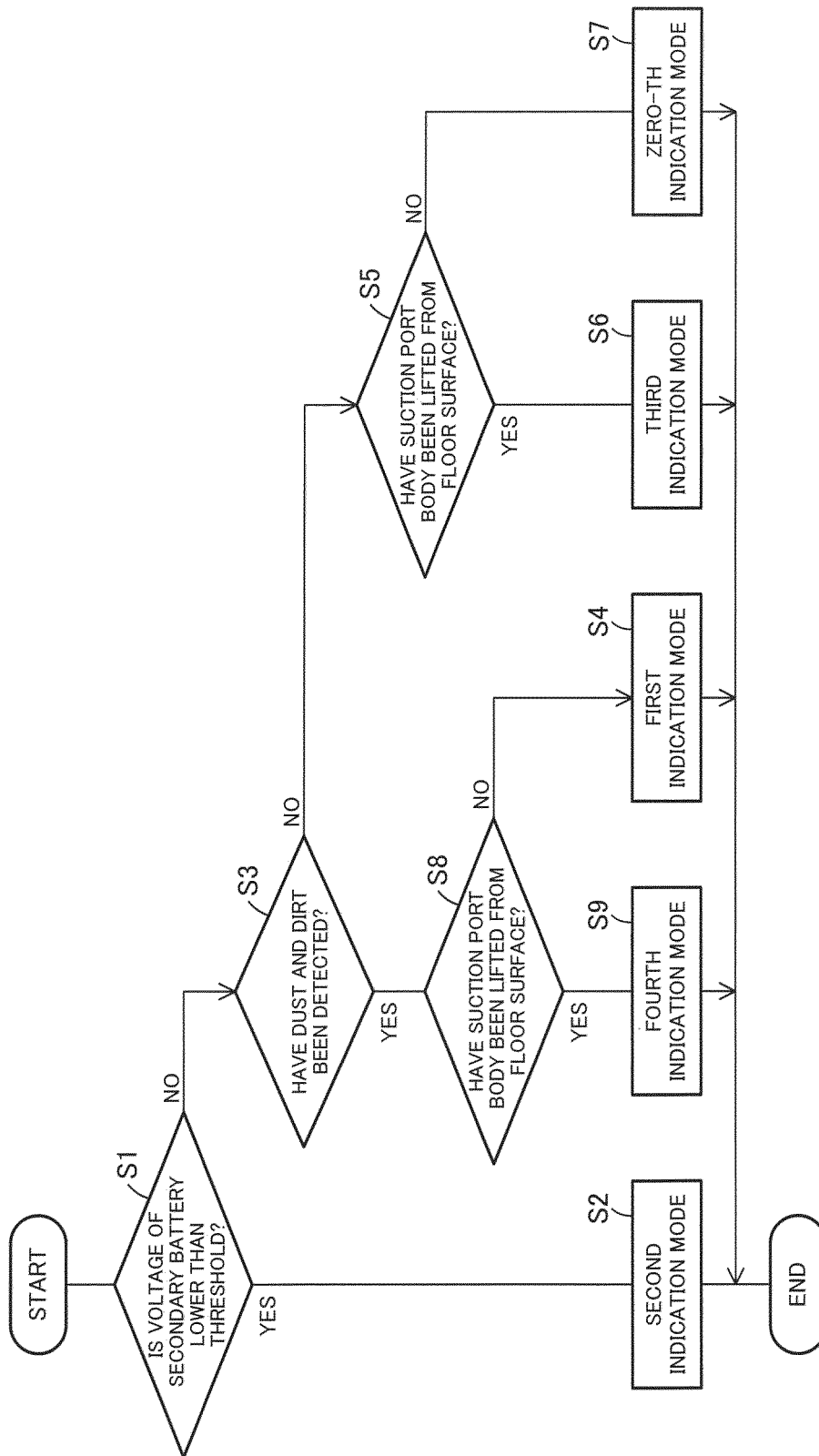


FIG. 5

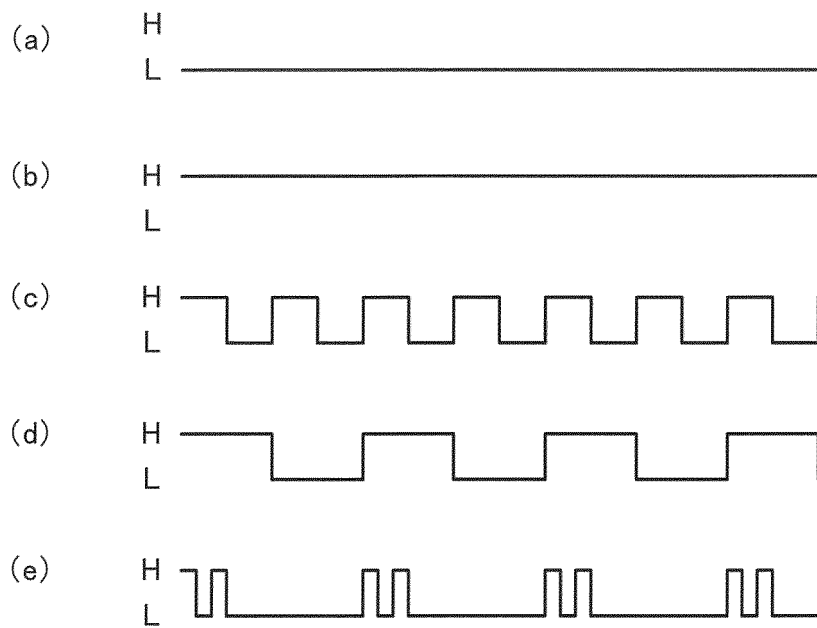


FIG. 6

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2018/032127

A. CLASSIFICATION OF SUBJECT MATTER

Int.Cl. A47L9/28 (2006.01) i, A47L9/24 (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)

Int.Cl. A47L9/28, A47L9/24

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

Published examined utility model applications of Japan 1922-1996

Published unexamined utility model applications of Japan 1971-2018

Registered utility model specifications of Japan 1996-2018

Published registered utility model applications of Japan 1994-2018

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 2005-52680 A (MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD.) 03 March 2005, paragraphs [0019], [0072]-[0074], [0084]-[0088], fig. 2, 18-20, 26 (Family: none)	1-8
Y	JP 2017-29409 A (IRIS OHYAMA INC.) 09 February 2017, paragraphs [0009], [0074], [0079], fig. 1, 5 (Family: none)	1-4
A		5-8
Y	JP 4-336021 A (TOKYO DENKI KABUSHIKI KAISHA) 24 November 1992, paragraphs [0015]-[0016], [0030]-[0033], fig. 1-3 (Family: none)	1-8
Y	JP 2012-61115 A (SHARP CORP.) 29 March 2012, paragraphs [0022]-[0031], fig. 1-4 (Family: none)	5-8
A		1-4



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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"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
12 November 2018 (12.11.2018)Date of mailing of the international search report
20 November 2018 (20.11.2018)Name and mailing address of the ISA/
Japan Patent Office
3-4-3, Kasumigaseki, Chiyoda-ku,
Tokyo 100-8915, Japan

Authorized officer

Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2002034873 A [0007]
- JP 2002034874 A [0007]