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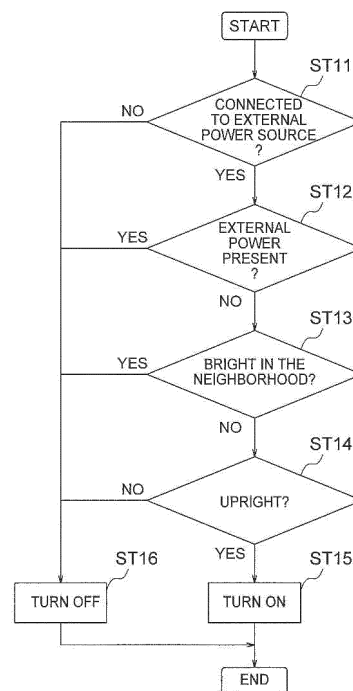
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VACUUM CLEANER

(57)

In an electric vacuum cleaner in which a secondary battery (204) in a cleaner main body (200) is charged at the time of storage and an electric fan (212) for sucking dust is rotated using the power of the secondary battery (204) at the time of use, an illuminating unit (250) is turned on using the power of the secondary battery (204) upon detection of a power outage. When the cleaner main body (200) is connected to an external power source (420), and no power is supplied from the external power source (420) to the cleaner main body (200), a power outage of the external power source (420) is found to have occurred. When a power outage occurs, the illuminating unit is automatically turned on, enabling the situation to be perceived promptly. Since the illuminating unit is provided on the electric vacuum cleaner, no separate outlet or separate secondary battery is required.

FIG. 5



Description

TECHNICAL FIELD

[0001] The present invention relates to an electric vacuum cleaner. In particular, the present invention relates to a rechargeable electric vacuum cleaner provided with an illuminating unit which serves as an emergency light automatically turning on at the time of a power outage.

BACKGROUND ART

[0002] An example of an electric vacuum cleaner provided with an illuminating unit is disclosed in Patent reference 1. The electric vacuum cleaner disclosed in Patent reference 1 is provided with an LED illuminating unit and a fluorescent-lamp illuminating unit, which can be selectively turned on or off by operation input. For instance, the LED illuminating unit is used to direct light into a narrow area like a spotlight, while the fluorescent-lamp illuminating unit is used to illuminate a wide area.

PRIOR ART REFERENCE

PATENT REFERENCE

[0003] Patent reference 1: Japanese Patent Application Publication No. 2011-206339

SUMMARY OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0004] However, the above-described conventional electric vacuum cleaner turns on responsive to operation by an operator, and does not turn on automatically upon occurrence of a power outage.

[0005] Also known is an illuminating appliance which automatically turns on upon occurrence of a power outage. However, it requires a dedicated outlet, and also requires a separate secondary battery for lighting at the time of a power outage.

[0006] Furthermore, special attention needs to be paid for keeping the illuminating appliance connected to the external power source in preparation for power outages which do not occur frequently. This is burdensome to the user.

[0007] The present invention has been made to solve the problems described above, and its object is to provide an electric vacuum cleaner having an illuminating unit which turns on automatically upon occurrence of a power outage.

MEANS FOR SOLVING THE PROBLEM

[0008] An electric vacuum cleaner according to the present invention comprises a cleaner main body provided with:

a secondary battery accommodating section for accommodating a secondary battery;
a charge controller for charging the secondary battery using electric power from an external power source; and
an electric fan driven by electric power from the secondary battery;
the electric vacuum cleaner further comprising:

an illuminating unit for illuminating a neighborhood of the cleaner main body; and
an illumination controller for turning on the illuminating unit when it detects a power outage of the external power source.

EFFECTS OF THE INVENTION

[0009] According to the present invention, when a power outage occurs, the illuminating unit automatically turns on, so that the situation can be perceived promptly. Moreover, since the illuminating unit is provided on the electric vacuum cleaner, no separate outlet or secondary battery is required.

[0010] Furthermore, since the electric vacuum cleaner is used relatively frequently for cleaning, it is often the case that the user has the cleaner connected to the power source for the purpose of charging, so that without paying special attention in preparation for power outages, lighting for emergency can be secured.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011]

Fig. 1 is an external view showing an electric vacuum cleaner of a first embodiment of the present invention in a stored state.

Fig. 2 is an external view showing the electric vacuum cleaner of the first embodiment in a use state.

Fig. 3 is a block diagram showing an electrical system of the electric vacuum cleaner of the first embodiment.

Fig. 4 is a schematic diagram showing a plug having a contact sensor of a connection detector of the electric vacuum cleaner of the first embodiment.

Fig. 5 is a flowchart showing the operation of the electric vacuum cleaner of the first embodiment, at the time of occurrence of a power outage, and at the time of restoration from a power outage.

Fig. 6 is an external view showing an electric vacuum cleaner of a second embodiment of the present invention in a stored state.

Fig. 7 is a schematic diagram showing a contact sensor provided on the electric vacuum cleaner of the second embodiment, and used to sense connection between power supplying terminals and power receiving terminals.

Fig. 8 is a block diagram showing the configuration

of a computer for implementing the functions of the illumination controller of the electric vacuum cleaner of the first or second embodiment.

MODE FOR CARRYING OUT THE INVENTION

First Embodiment

[0012] Fig. 1 and Fig. 2 show external views of an electric vacuum cleaner of a first embodiment of the present invention.

[0013] As shown in Fig. 1 and Fig. 2, the electric vacuum cleaner 100 has a cleaner main body 200, a plug 310, a power cord 320, a handle 330, a suction intake member 340, a connecting tube 342, and an operation input section 350.

[0014] Fig. 1 shows a state in which the electric vacuum cleaner 100 is supported by a storage mechanism which is an attachment of the electric vacuum cleaner 100. Fig. 2 shows a state in which the electric vacuum cleaner 100 is being used for cleaning.

[0015] The storage mechanism 400 shown in Fig. 1 is placed near an outlet 410. The outlet 410 is connected to an external power source 420. For example, the external power source 420 is a commercial power source.

[0016] At the time of storage, the cleaner main body 200 is supported by the storage mechanism 400, as shown in Fig. 1, and the plug 310 is inserted in the outlet 410 for charging.

[0017] At the time of use, the operator 450 typically holds the handle 330 as shown in Fig. 2, and applies the suction intake member 340 to the object to be cleaned, such as the floor surface, causing dust to be sucked.

[0018] Fig. 3 is a block diagram showing an electrical system of the electric vacuum cleaner of Fig. 1 and Fig. 2. Fig. 3 also shows flow of dust and air.

[0019] As shown in Fig. 3, the cleaner main body 200 has a battery accommodating section 202, a charge controller 206, an electric fan 210, a motor controller 216, a power input section 220, a posture detector 230, an illuminance detector 235, a connection detecting circuit 241, a power input detector 245, an illuminating unit 250, an illumination controller 260, and a dust separating/collecting section 344.

[0020] The electric fan 210 has a fan 212 and a fan motor 214.

[0021] A secondary battery 204 is removably inserted in the battery accommodating section 202. When inserted in the battery accommodating section 202, the secondary battery 204 is electrically connected to the charge controller 206.

[0022] The power input section 220 supplies the power input from the external power source 420, via the outlet 410, the plug 310, and the power cord 320, to the charge controller 206.

[0023] The charge controller 206 charges the secondary battery 204 using the power from the power input section 220.

[0024] The operation input section 350 is provided, for instance, on the handle 330, and is operated when the operator 450 uses the electric vacuum cleaner for cleaning.

[0025] The motor controller 216 performs control over starting, stopping, the rotary speed, and the like of the fan motor 214 responsive to operation input by means of the operation input section 350. The motor controller 216 operates on the power from the secondary battery 204, and drives the fan motor 214 using the power from the secondary battery 204.

[0026] When the fan motor 214 rotates, the fan 212 rotates, and a negative pressure is created in the suction intake member 340 and the connecting tube 342. As indicated by dotted lines in Fig. 3, air containing dust is sucked by the suction intake member 340, and is sent via the connecting tube 342 to the dust separating/collecting section 344, where the dust is collected. The air having passed the dust separating/collecting section 344 is exhausted to the outside of the cleaner main body 200.

[0027] When the electric vacuum cleaner 100 is not being used for cleaning, it is desirably stored in a state in which the cleaner main body 200 is standing upright. This is to reduce the area of the floor required for storage. It is also desirable that the secondary battery 204 be charged during storage.

[0028] As an example, as shown in Fig. 1, the electric vacuum cleaner 100 is supported by the storage mechanism 400 in an upright posture with respect to the floor surface, is stored in this state, and the plug 310 is inserted in the outlet 410.

[0029] When the plug 310 is inserted in the outlet 410, the power from the external power source 420 is supplied via the plug 310 and the power cord 320 to the cleaner main body 200, and is supplied via the power input section 220 and the charge controller 206 to the secondary battery 204, whereby the secondary battery 204 is charged. The control of the charging is performed by the charge controller 206.

[0030] When cleaning is carried out, the electric vacuum cleaner 100 is typically used in a state in which the plug 310 is removed from the outlet 410. However, in the range in which cleaning is possible with the plug 310 being inserted in the outlet 410, the plug 310 may be kept inserted in the outlet 410.

[0031] At the time of cleaning, the motor controller 216 responds to operation input by means of the operation input section 350 to cause rotation of the fan motor 214 using power from the secondary battery 204, and the fan 212 driven by the fan motor 214 causes dust on the floor surface or the like to be sent from the suction intake member 340, via the connecting tube 342, to the dust separating/collection section 344.

[0032] As described above, at the time of storage, the electric vacuum cleaner 100 is supported by the storage mechanism 400, in an upright state. In the present embodiment, the storage mechanism 400 is a mechanism for causing the electric vacuum cleaner 100 to stand up-

right, and is a stand against which the electric vacuum cleaner 100 may be leaned.

[0033] Here, it is assumed that the electric vacuum cleaner 100 is of a generally elongated shape, and an "upright state" means a state in which the handle 330 of the electric vacuum cleaner 100 is above the suction intake member 340, and the longitudinal direction of the elongated electric vacuum cleaner 100 is in a direction close to the vertical direction. The direction close to the vertical direction is a direction which differs from the vertical direction by, for example, 30 degrees or less.

[0034] In the example shown in Fig. 1, the storage mechanism 400 is a structure for supporting the electric vacuum cleaner 100, and with the connecting tube 342 and the suction intake member 340 being fixed to the cleaner main body 200, the suction intake member 340 is made to abut the floor surface, and the cleaner main body 200 is inclined, so that a side surface 208 of a casing 207 (the surface of the side wall part of the casing) is rested against and supported by a supporting surface 402 of the storage mechanism 400.

[0035] The posture detector 230 detects a posture of the electric vacuum cleaner 100, and outputs the result of the detection to the illumination controller 260. For example, the posture detector 230 detects the posture of the electric vacuum cleaner 100 as a whole, by detecting the posture of the cleaner main body 200. For example, the posture detector 230 is formed of a sensor (acceleration sensor, or the like) for detecting the posture. For example, the inclination with respect to the vertical direction is detected as the posture.

[0036] The illuminance detector 235 detects illuminance in the neighborhood of the cleaner main body 200, and outputs the result of the detection to the illumination controller 260. For example, the illuminance detector 235 comprises a sensor (illuminance sensor) capable of measuring illuminance on the surface of the casing 207 of the cleaner main body 200.

[0037] The connection detection circuit 241 forms a part of the connection detector 240. The connection detector 240 detects connection of the power input section 220 to the external power source 420 (hence connection of the cleaner main body 200 to the external power source 420), and outputs the result of the detection to the illumination controller 260. For example, the connection detector 240 determines whether the plug 310 is connected to the outlet 410.

[0038] In addition to the connection detection circuit 241, the connection detector 240 is provided with a contact sensor, for example.

[0039] An example of the contact sensor is shown in Fig. 4. In the illustrated example, a contactor 242 is provided at a part of the plug 310. When the plug 310 is inserted in the outlet 410, the contactor 242 senses the insertion by abutment with the surface of the outlet 410. A signal indicating the result of the detection is transmitted via a signal line 243 to the connection detection circuit 241. The signal is then transmitted from the connection

detection circuit 241 to the illumination controller 260.

[0040] The power input detector 245 detects the supply of power from the external power source 420 to the power input section 220 (hence the supply of power from the external power source 420 to the cleaner main body 200), and outputs the result of the detection to the illumination controller 260. The power input detector 245 may, for example, include a sensor which can determine whether the power is input by sensing the current flowing from the power cord 320 to the power input section 220. The sensor is formed, for example, of a current sensor.

[0041] The posture detector 230, the illuminance detector 235, the connection detector 240, and the power input detector 245 operate on the power from the secondary battery 204.

[0042] The illumination controller 260 controls turn-on and turn-off of the illuminating unit 250, responsive to the results of the detection by the posture detector 230, the illuminance detector 235, the connection detector 240, and the power input detector 245. The illumination controller 260 causes the illuminating unit 250 to be powered by the secondary battery 204 when it is turned on.

[0043] The illuminating unit 250 is provided to illuminate upward when it is turned on, in a state in which the electric vacuum cleaner 100 is standing upright. For example, it is desirable that the illuminating unit 250 be so provided as to be positioned on the upper side of the electric vacuum cleaner 100, e.g., on the upper side of the cleaner main body 200, and is so configured as to illuminate a wide area of the ceiling situated above, in a state in which the electric vacuum cleaner 100 is standing upright. This is because such an arrangement is advantageous in that the surrounding situation can be observed at the time of occurrence of a power outage.

[0044] When the electric vacuum cleaner 100 is in a use state, the illuminating unit 250 is kept in a turn-off state.

[0045] When the electric vacuum cleaner 100 is in a non-use state, operation in a power outage monitoring mode is started. In this power outage monitoring mode, the illumination controller 260 performs detection of occurrence of a power outage, and control over turn-on and turn-off of the illuminating unit 250.

[0046] Whether the electric vacuum cleaner 100 is in a non-use state is determined based, for example, on the operation by means of the operation input section 350. For example, it is determined that the non-use state has begun when a predetermined time has elapsed after the fan 212 is turned off by the operation input section 350, and it is determined that the non-use state has ended at the moment when the fan 212 is turned on by the operation input section 350.

[0047] In the power outage monitoring mode, the illumination controller 260 monitors the outputs of (indicating the results of the detection by) the posture detector 230, the illuminance detector 235, the connection detector 240, and the power input detector 245, and performs control over turn-on and turn-off of the illuminating unit 250

based on these outputs. The process for this control is explained with reference to Fig. 5.

[0048] The process of Fig. 5 is initiated at a predetermined time interval.

[0049] At first, in step ST11, whether the cleaner main body 200 is connected to the external power source 420 is determined based on the output of the connection detector 240. When it is "connected", the process proceeds to step ST12.

[0050] In step ST12, whether the power is supplied from the external power source 420 to the cleaner main body 200 is determined based on the output of the power input detector 245.

[0051] If it is determined that the power is "not supplied" (NO in step ST12), the process proceeds to step ST13.

[0052] In step ST13, whether the illuminance in the neighborhood of the cleaner main body 200 is equal to or more than a threshold value is determined based on the output of the illuminance detector 235.

[0053] If it is less than the threshold value (NO in the ST13), the process proceeds to step ST14.

[0054] In step ST14, it is determined whether the electric vacuum cleaner 100 is in the upright state based on the output of the posture detector 230.

[0055] If it is in the upright state (YES in step ST14), the process proceeds to step ST15.

[0056] In step ST15, the illuminating unit 250 is turned on. That is, if it has been in the on-state, the on-state is continued. If it has been in the off-state, it is changed to the on-state.

[0057] In the case of NO in step ST11 (it is not connected to the power source), YES in step ST12 (the power is supplied), YES in step ST13 (the illuminance is equal to or more than the threshold value), or NO in step ST14 (it is not in the upright state), the process proceeds to step ST16.

[0058] In step ST16, the illuminating unit 250 is turned off. That is, if it has been in the off-state, the off-state is continued. If it has been in the on-state, it is changed to the off-state.

[0059] By following the process shown in Fig. 5, the illumination controller 260 exercises the following control.

[0060] That is, the illumination controller 260 turns on the illuminating unit 250 when all of the four conditions (a) to (d) noted below are satisfied.

(a) It is determined from the result of the detection by the connection detector 240 that the cleaner main body 200 is connected to the external power source 420.

(b) It is determined from the result of the detection by the power input detector 245 that no power is supplied from the external power source 420 to the cleaner main body 200.

(c) It is determined from the result of the detection by the illuminance detector 235 that the illuminance in the neighborhood of the cleaner main body 200 is less than the threshold value.

(d) It is determined from the result of the detection by the posture detector 230 that the electric vacuum cleaner 100 is in the upright state.

[0061] When, on the other hand, any of the four conditions (a), (b), (c) and (d) noted above is not satisfied, the illuminating unit 250 is turned off.

[0062] The conditions (a) and (b) noted above are satisfied when a power outage occurs. It is so arranged that the illumination controller 260 turns on the illuminating unit 250 only in such a situation.

[0063] Even if the above condition (b) is satisfied, the illuminating unit 250 is not turned on when the above condition (a) is not satisfied. This is because it is possible that the power is not supplied from the external power source 420 due to non-insertion of the plug 310 in the outlet 410, rather than a power outage.

[0064] Also, even if the above conditions (a) and (b) are satisfied, the illumination controller 260 does not turn on the illuminating unit 250 when the above condition (c) is not satisfied. This is because in such a case it can be determined that the ambient light is bright (when sunlight is received, or some other illuminating light is on), and in such a case, it is not necessary to turn on the illuminating unit 250 because it is bright in the neighborhood even if a power outage occurs.

[0065] Furthermore, even if the above conditions (a), (b) and (c) are satisfied, the illumination controller 260 does not turn off the illuminating unit 250 when the above condition (d) is not satisfied. This is to prevent the illuminating light of the illuminating unit 250 from directly entering the eyes of people, even in the event of a power outage.

Variation 1.

[0066] In the embodiment described above, the illuminating unit 250 is turned on when all of the above conditions (a), (b), (c) and (d) are satisfied. Alternatively, it may be so arranged

(α) that the illuminating unit 250 is turned on when the conditions (a) and (b) are satisfied (even if the conditions (c) and (d) are not satisfied);

(β) that the illuminating unit 250 is turned on when the conditions (a), (b) and (c) are satisfied (even if the condition (d) is not satisfied); or

(γ) that the illuminating unit 250 is turned on when the conditions (a), (b) and (d) are satisfied (even if the condition (c) is not satisfied).

Variation 2.

[0067] In the embodiment described above, the power input detector 245 is a sensor capable of sensing a current flowing from the power cord 320 to the power input section 220, and is formed, for example, of a current sensor, and the sensor operates on the power from the sec-

ondary battery 204.

[0068] However, the present invention is not limited to such a configuration.

[0069] For example, the configuration may be such that when a current from the external power source 420 flows, a signal due to this current indicating the input of power is output, and otherwise the signal is not output.

Variation 3.

[0070] In the first embodiment described above, the storage mechanism 400 is provided as an attachment to the electric vacuum cleaner 100. However, an existing structure which can serve as a supporting member, for example a wall of the room for storing the electric vacuum cleaner, may be used as the storage mechanism 400.

[0071] Also, the electric vacuum cleaner 100 may be so configured as to be capable of standing by itself.

Variation 4.

[0072] In the first embodiment, it is assumed that the electric vacuum cleaner is of a stick-type. However, the present invention is also applicable where the electric vacuum cleaner is of a handy-type. The present invention is also applicable where the electric vacuum cleaner is of a canister type. The present invention is also applicable where the electric vacuum cleaner is an electric vacuum cleaner which autonomously performs cleaning (robot-type electric vacuum cleaner).

Variation 5.

[0073] In connection with the first embodiment, it is explained that the illuminating unit 250 is provided to illuminate upward when the electric vacuum cleaner 100 is in an upright state.

[0074] Such a configuration is advantageous because when the electric vacuum cleaner 100 is elongated as shown in Fig. 1, and if the upper end of the electric vacuum cleaner 100 in its stored state, where the illuminating unit 250 is positioned, is above the eyes of an average person, then the illuminating light from the illuminating unit 250 is prevented from directly entering the eyes of the person.

[0075] However, this is not indispensable, and the illuminating unit may be provided to illuminate in a predetermined direction other than the upward direction.

Variation 6.

[0076] In connection with the first embodiment, it is explained that "upright" means that the longitudinal direction of the elongated electric vacuum cleaner 100 is in a direction close to the vertical direction. However, the present invention is not limited to the cases where the electric vacuum cleaner 100 is elongated. What is essential is that, at the time of storage, the electric vacuum

cleaner 100 is placed in a state of a predetermined posture, i.e., a state in which it is oriented in a predetermined direction, and that, in such a state, the illuminating unit 250 illuminates in a predetermined direction e.g., the upward direction.

[0077] In such a case, in place of the above-mentioned condition (d), the following condition (d') which is a generalization of the condition (d) is used.

(d') It is determined that from the result of the detection by the posture detector 230, the electric vacuum cleaner 100 is in a state in which it is oriented in a predetermined direction.

[0078] For instance, if the illuminating unit 250 is positioned below the eyes of people, the illuminating unit 250 may be provided to illuminate downward, thereby to prevent direct entry of the illuminating light into the eyes of people.

Variation 7.

[0079] The present invention is also applicable where the cleaner main body 200 is separable from at least one of the suction intake member 340, the connecting tube 342 and the handle 330. In such a case, the arrangement will be such that the posture detector 230 detects the posture of the cleaner main body 200, and the illumination controller 260 determines, from the result of the detection by the posture detector 230, whether the cleaner main body 200 is in a state in which it is oriented in a predetermined direction.

[0080] In this case, the cleaner main body 200 may be configured to maintain a predetermined posture even if it is not supported by the storage mechanism 400, that is, it may be configured to stand by itself. For instance, the cleaner main body 200 may be provided, at its bottom, with a protruding structure which abuts the floor surface and forms a three-point support for the cleaner main body 200.

Second Embodiment

[0081] In the first embodiment described above, the storage mechanism 400 functions only as a support of the electric vacuum cleaner 100. The storage mechanism 400 may also serve as a charging table or charging stand, as shown in Fig. 6.

[0082] In this case, it is configured so that in a state in which the cleaner main body 200 is supported by the storage mechanism 400, power supplying terminals 404, 405 of the storage mechanism 400 and power receiving terminals 224, 225 of the cleaner main body 200 are electrically in contact with each other. The storage mechanism 400 has the power cord 320 and the plug 310, and the plug 310 is inserted in the outlet 410.

[0083] Also, as the connection detector 240, one which senses connection between the outlet 410 and the plug

310, and also senses connection between the power supplying terminals 404, 405 and the power receiving terminals 224, 225 is used.

[0084] And, if the connection is sensed for both, it is determined that the cleaner main body 200 is connected to the external power source.

[0085] For the sensing of the connection between the outlet 410 and the plug 310, the contact sensor described with reference to Fig. 4 in connection with the first embodiment can be used.

[0086] Fig. 7 shows a contact sensor which can be used to sense the connection between the power supplying terminals 404, 405 and the power receiving terminals 224, 225.

[0087] In the example shown in Fig. 7, a contactor 221 is provided adjacent to the power receiving terminals 224, 225, so as to protrude from the side surface 208 of the casing 207 (the surface of the side wall part of the casing) of the cleaner main body 200. When the power receiving terminals 224, 225 are pressed against the power supplying terminals 404, 405, the contactor 221 abuts the supporting surface 402 of the storage mechanism 400, thereby sensing the electrical connection between the power receiving terminals 224, 225 and the power supplying terminals 404, 405.

[0088] A signal indicating the result of the sensing is transmitted via a signal line 223 to the connection detection circuit 241.

[0089] From the result of the detection communicated via the signal line 243, and the result of the detection communicated via the signal line 223, the connection detection circuit 241 determines that the cleaner main body 200 is connected to the external power source 420 when

(a1) it is determined that the plug 310 is connected to the outlet 410, and

(a2) it is determined that the power receiving terminals 224, 225 are connected to the power supplying terminals 404, 405.

[0090] That is, the connection detection circuit 241 determines that the above condition (a) is satisfied when the condition (a1) that the plug 310 is determined to be connected to the outlet 410, from the output of the contact sensor similar to that in Fig. 4, and the condition (a2) that the power receiving terminals 224, 225 are determined to be connected to the power supplying terminals 404, 405 from the output of the contact sensor in Fig. 7 are both satisfied.

[0091] When at least one of the above conditions (a1) and (a2) is not satisfied, the connection detection circuit 241 determines that the above condition (a) is not satisfied.

[0092] The result of the determination by the connection detection circuit 241 is communicated, as the result of the detection by the connection detector 240, to the illumination controller 260.

[0093] The variations which are applicable to the first

embodiment are also applicable to the second embodiment.

[0094] According to the present invention, when a power outage occurs, the illuminating unit is automatically turned on, enabling the situation to be perceived promptly. Also, the illuminating unit is provided on the electric vacuum cleaner, so that no separate outlet or separate secondary battery is required.

[0095] Furthermore, the electric vacuum cleaner is used relatively frequently for cleaning, and the user often has it connected to the power supply for charging, so that lighting for emergency can be secured without paying special attention in preparation for power outages.

[0096] Also, if it is so arranged that the illuminating unit 250 is turned on when the above condition (c) is satisfied, it is possible to omit the turn-on when it is bright in the neighborhood of the cleaner main body 200, and waste of power can be avoided.

[0097] Also, if it is so arranged that the illuminating unit 250 is turned on when the above condition (d), or, more generally, the above condition (d') is satisfied, it is possible to prevent the illuminating light from the illuminating unit 250 from directly entering the eyes of people.

[0098] In the above embodiments, at least part of the illumination controller 260, the posture detector 230, the illuminance detector 235, the connection detector 240 and the power input detector 245 may be in the form of a processing circuit. The processing circuit may be dedicated hardware, or a CPU which executes programs stored in a memory.

[0099] When the processing circuit is a CPU, the functions of the illumination controller 260, the posture detector 230, the illuminance detector 235, the connection detector 240 and the power input detector 245 are implemented by software, firmware, or a combination of software and hardware. The software or the firmware is described as programs and stored in a memory. The processing circuit reads and executes the programs stored in the memory, to implement the functions of the illumination controller 260, the posture detector 230, the illuminance detector 235, the connection detector 240 and the power input detector 245. That is, the memory is provided to store the programs by which, when executed by the processing circuit, the functions of the illumination controller 260, the posture detector 230, the illuminance detector 235, the connection detector 240 and the power input detector 245 are implemented. These programs can be said to cause a computer to execute the processes, or their procedure, in the illumination control method performed by the illumination controller 260.

[0100] Also, part of the functions of the illumination controller 260, the posture detector 230, the illuminance detector 235, the connection detector 240 and the power input detector 245 may be implemented by dedicated hardware, and part thereof may be implemented by software or firmware.

[0101] In this way, the processing circuit can implement the functions by hardware, software, firmware, or

their combination.

[0102] Fig. 8 shows an example of a configuration in which a computer (indicated by reference characters 500) including a single CPU constituting the above processing circuit implements the functions of the illumination controller 260.

[0103] The computer 500 shown in Fig. 8 is provided with a CPU 510, a memory 520, input interfaces 531 to 534, and an output interface 540, which are interconnected by a bus 550.

[0104] Input to the input interfaces 531 to 534, respectively, are signals (the results of the detection) from the posture detector 230, the illuminance detector 235, the connection detector 240, and the power input detector 245 in Fig. 3.

[0105] The CPU 510 operates according to programs stored in the memory 520, performs the determination of the illumination controller 260 described above, based on the signals (the results of the detection) input via the input interfaces 531 to 534, and performs control for turning on or off the illuminating unit 250 based on the result of the determination. That is, a control signal generated based on the result of the determination is supplied via the output interface 540 to the illuminating unit 250 for turning-on or turning-off the illuminating unit 250.

[0106] The content of the processes executed by the CPU 510 is similar to that described with reference to Fig. 5 in connection with the first embodiment. The data generated during the process execution is stored in the memory 520.

[0107] By the use of the programs causing a computer to execute the processes in the illumination control method performed by the illumination controller 260, it is possible to obtain effects similar to those described with reference to the illumination controller 260.

[0108] The same is true for the cases where the functions of the posture detector 230, the illuminance detector 235, the connection detector 240 and the power input detector 245 are implemented by the processing circuit.

REFERENCE CHARACTERS

[0109] 100: electric vacuum cleaner; 200: cleaner main body; 202: battery accommodating section; 204: secondary battery; 206: charge controller; 207: casing; 208: side surface; 210: electric fan; 212: fan; 214: fan motor; 216: motor controller; 220: power input section; 224, 225: power receiving terminal; 230: posture detector; 235: illuminance detector; 240: connection detector; 241: connection detection circuit; 242: contactor; 243: signal line; 245: power input detector; 250: illuminating unit; 260: illumination controller; 310: plug; 320: power cord; 330: handle; 340: suction intake member; 342: connecting tube; 344: dust separating/collecting section; 350: operation input section; 400: storage mechanism; 402: supporting surface; 404, 405: power supplying terminal; 410: outlet; 420: external power source; 500: computer; 510: CPU; 520: memory; 531 to 534: input interface; 540: output

interface; 550: bus.

Claims

1. An electric vacuum cleaner comprising a cleaner main body (200) provided with:

a secondary battery accommodating section (202) for accommodating a secondary battery (204);

a charge controller (206) for charging the secondary battery (204) using electric power from an external power source (420); and
an electric fan (210) driven by electric power from the secondary battery (204);

the electric vacuum cleaner further comprising:

an illuminating unit (250) for illuminating a neighborhood of the cleaner main body (200); and

an illumination controller (260) for turning on the illuminating unit (250) when it detects a power outage of the external power source (420).

2. The electric vacuum cleaner as set forth in claim 1, further comprising:

a connection detector (240) for detecting connection of the cleaner main body (200) to the external power source (420); and

a power input detector (245) for detecting supply of electric power from the external power source (420) to the cleaner main body (200); wherein the illumination controller (260) detects a power outage of the external power source (420) based on a result of the detection by the connection detector (240) and a result of the detection by the power input detector (245) .

3. The electric vacuum cleaner as set forth in claim 2, wherein

the illumination controller (260) monitors the result of the detection by the connection detector (240), and the result of the detection by the power input detector (245); and turns on the illuminating unit (250) when

a condition (a) that the cleaner main body (200) is determined to be connected to the external power source (420), from the result of the detection by the connection detector (240); and

a condition (b) that no electric power is determined to be supplied from the external power source (420) to the cleaner main body (200), from the result of the detection by the power input detector (245) are both satisfied.

4. The electric vacuum cleaner as set forth in claim 3, wherein the illumination controller (260) turns off the illuminating unit (250) when at least one of the conditions (a) and (b) is not satisfied.

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5. The electric vacuum cleaner as set forth in claim 3, further comprising:

an illuminance detector (235) for detecting illuminance in a neighborhood of the cleaner main body (200); wherein

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the illumination controller (260) monitors a result of the detection by the illuminance detector (235), and turns on the illuminating unit (250) when, in addition to the conditions (a) and (b), a condition (c) that the illuminance in the neighborhood of the cleaner main body (200) is determined to be less than the threshold value, from the result of the detection by the illuminance detector (235)

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is satisfied.

6. The electric vacuum cleaner as set forth in claim 5, wherein the illumination controller (260) turns off the illuminating unit (250) when at least one of the conditions (a), (b) and (c) is not satisfied.

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7. The electric vacuum cleaner as set forth in claim 3, further comprising:

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a posture detector (230) for detecting a posture of the electric vacuum cleaner; wherein the illumination controller (260) monitors a result of the detection by the posture detector (230), and turns on the illuminating unit (250) when, in addition to the conditions (a) and (b), a condition (d') that the electric vacuum cleaner is determined to be in a state in which it is oriented in a predetermined direction, from the result of the detection by the posture detector (230)

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is satisfied.

8. The electric vacuum cleaner as set forth in claim 7, wherein the illumination controller (260) turns off the illuminating unit (250) when at least one of the conditions (a), (b) and (d') is not satisfied.

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9. The electric vacuum cleaner as set forth in claim 7 or 8, wherein the electric vacuum cleaner is of an elongated shape, and the state in which the electric vacuum cleaner is oriented in a predetermined direction is an upright state.

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10. The electric vacuum cleaner as set forth in claim 9,

wherein

the illuminating unit (250) is provided to illuminate upward, when the electric vacuum cleaner is in the upright state.

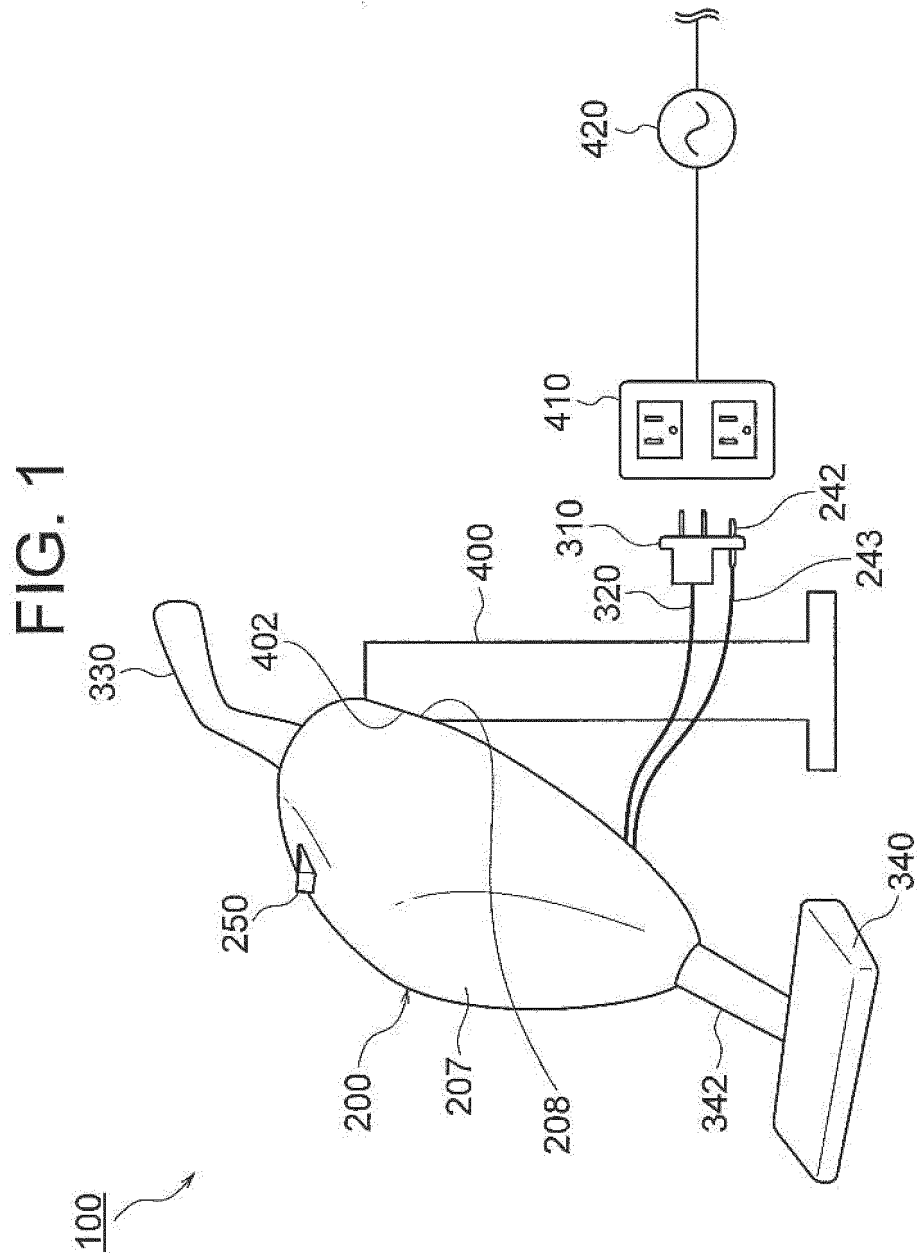


FIG. 2

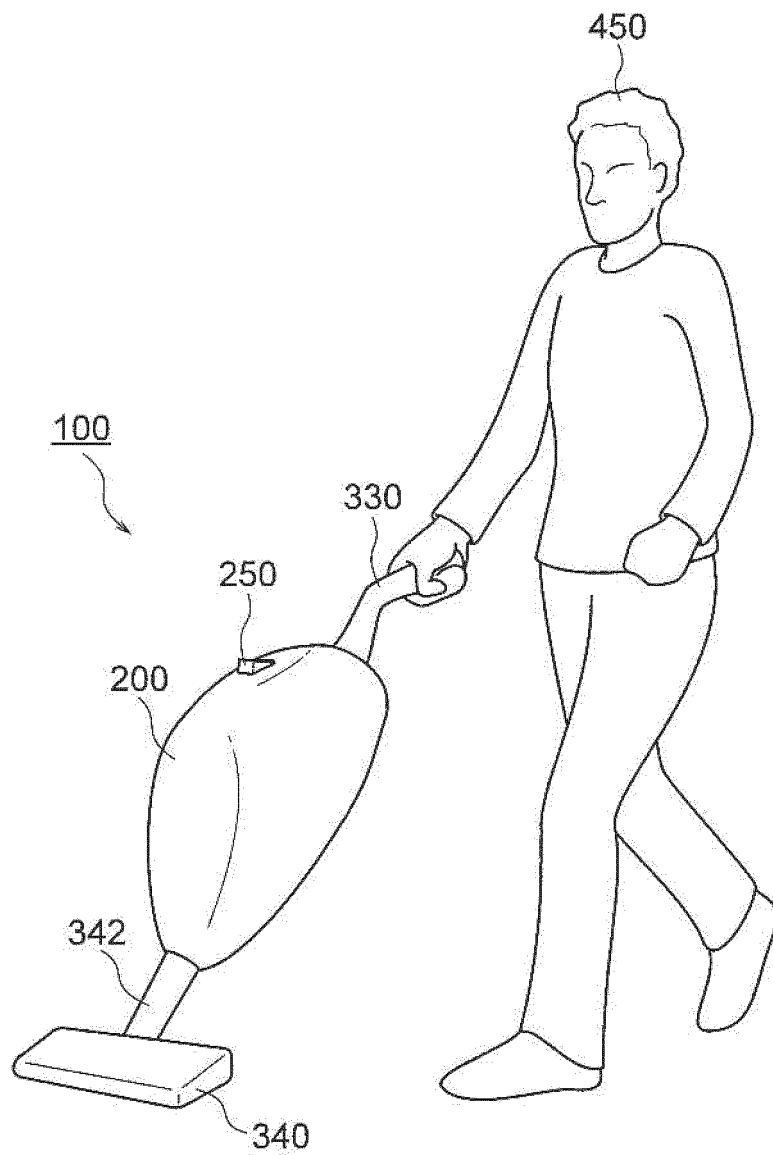


FIG. 3

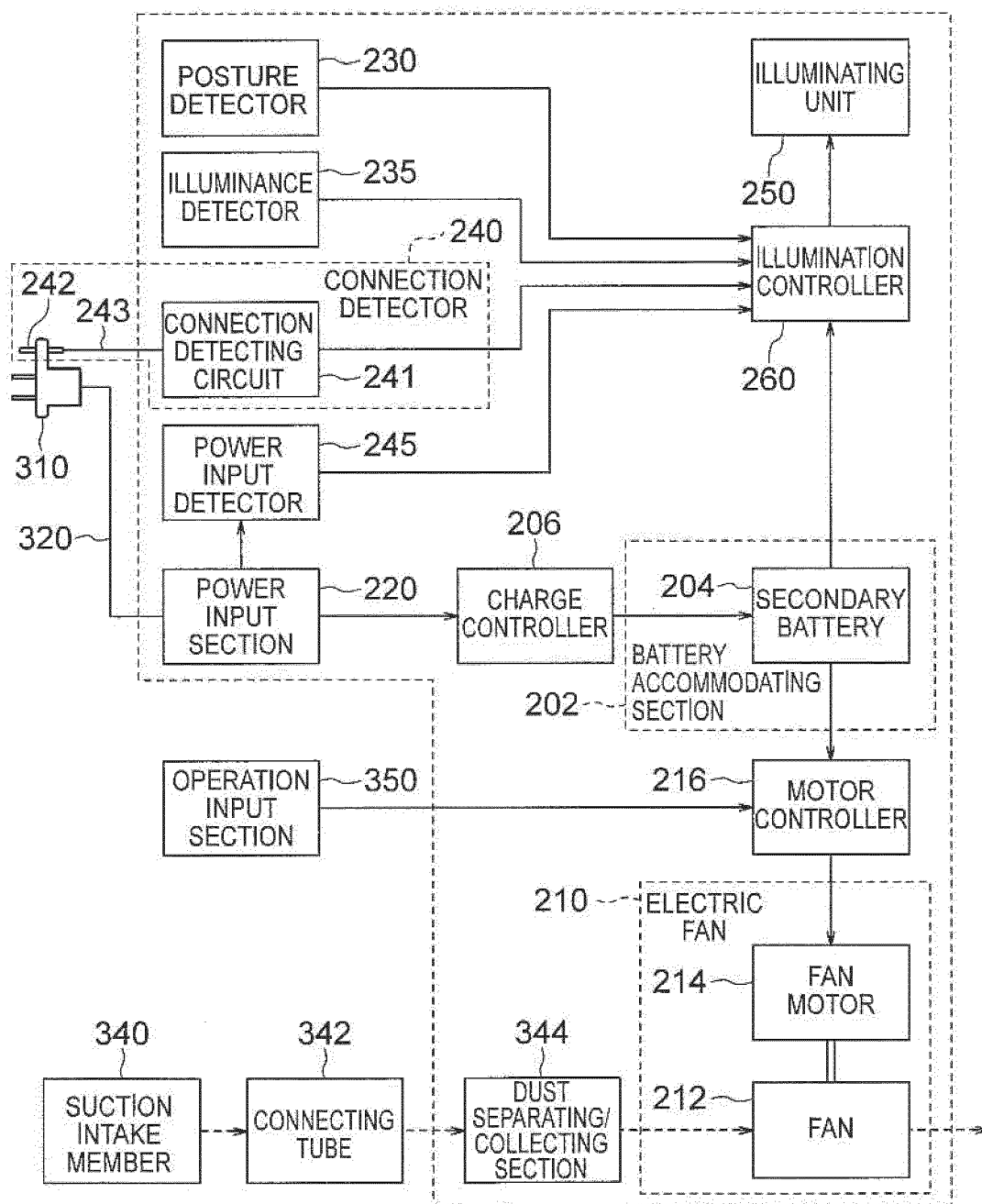


FIG. 4

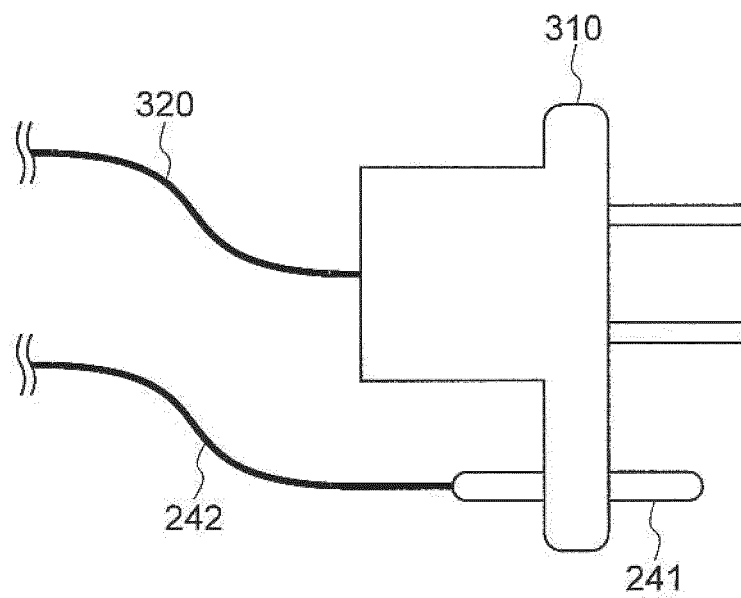


FIG. 5

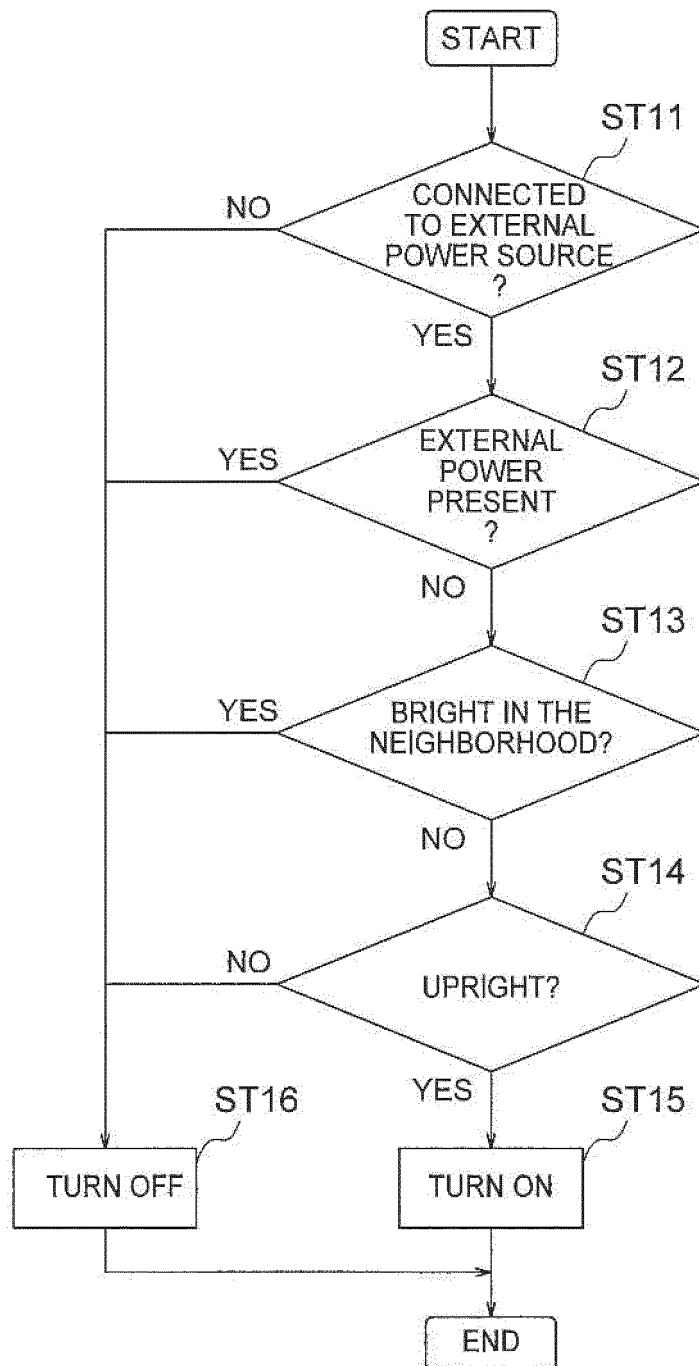


FIG. 6

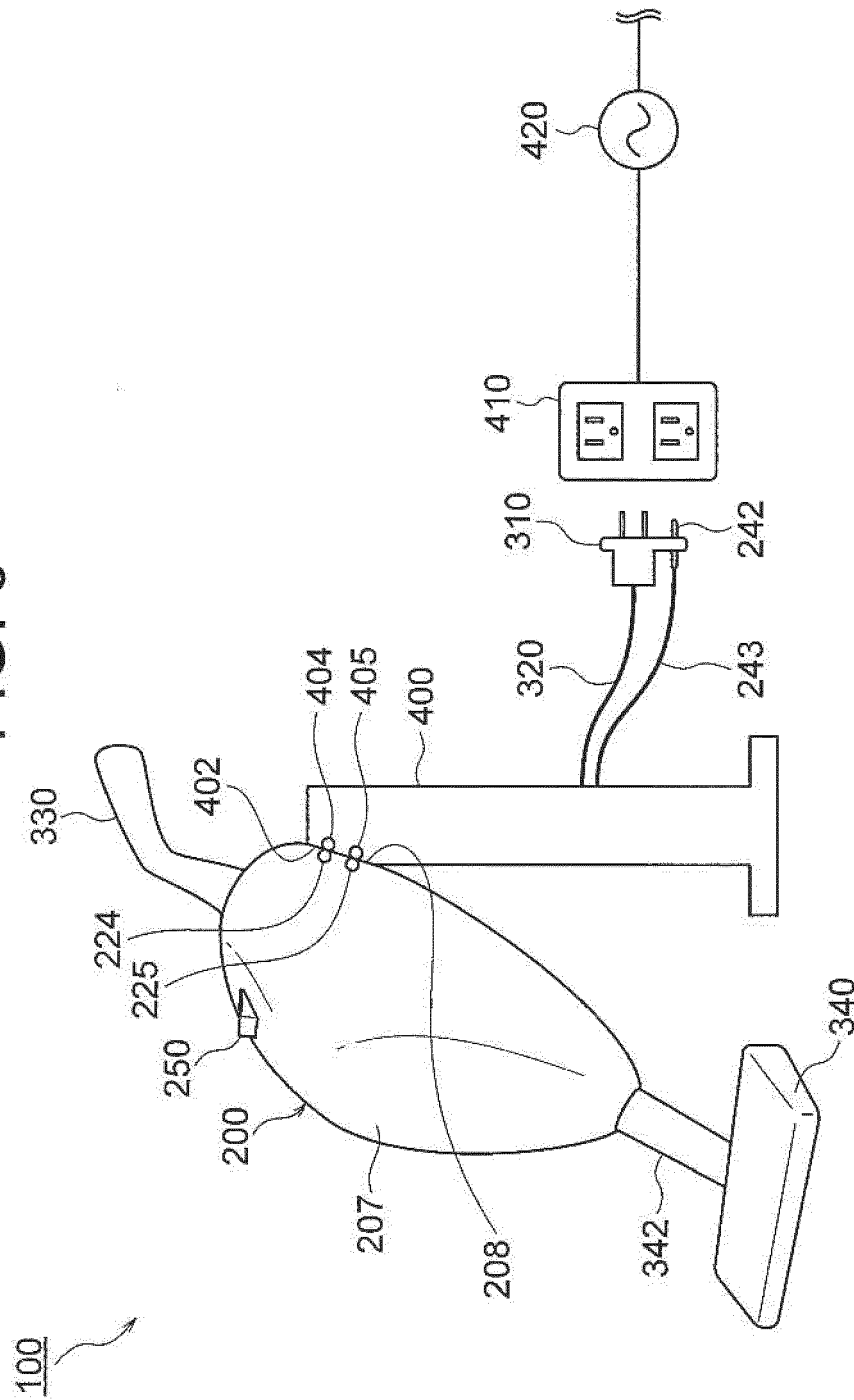


FIG. 7

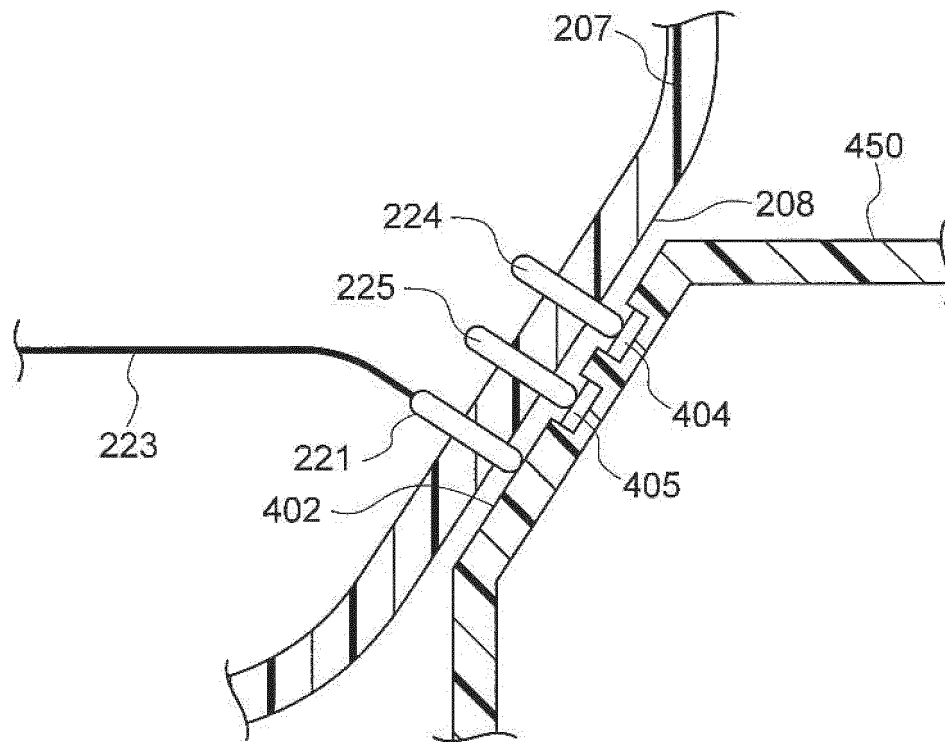
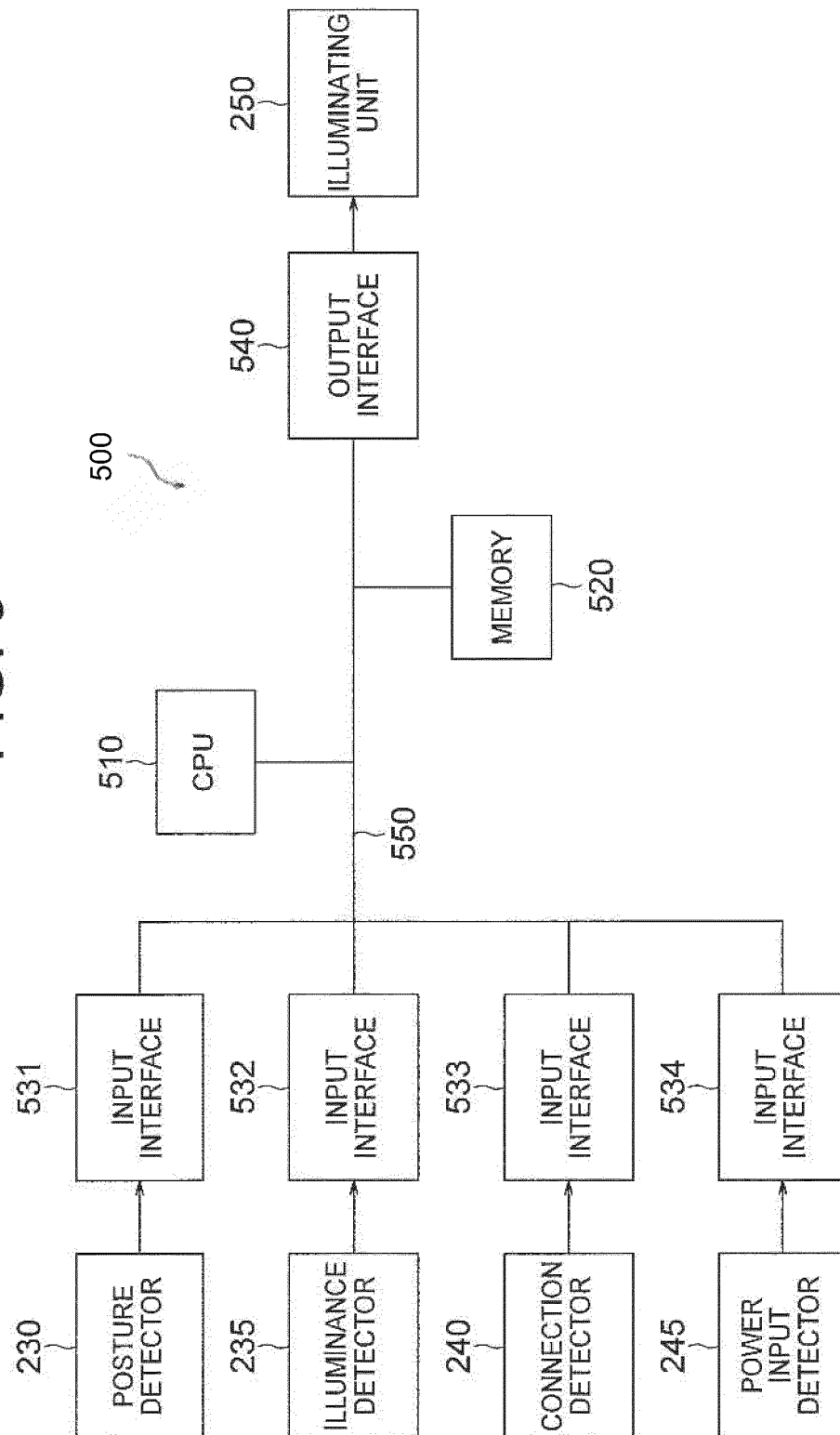


FIG. 8



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2015/080949

A. CLASSIFICATION OF SUBJECT MATTER

A47L9/30(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)

A47L9/30

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 1996-2016

Kokai Jitsuyo Shinan Koho 1971-2016 Toroku Jitsuyo Shinan Koho 1994-2016

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2015-154869 A (Hitachi Appliances, Inc.), 27 August 2015 (27.08.2015), entire text; all drawings (Family: none)	1-10
A	JP 2013-78656 A (Kazuo HANNO), 02 May 2013 (02.05.2013), entire text; all drawings (Family: none)	1-10
A	JP 2009-229000 A (Mitsubishi Electric Corp.), 08 October 2009 (08.10.2009), entire text; all drawings (Family: none)	1-10

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

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Date of the actual completion of the international search
04 January 2016 (04.01.16)Date of mailing of the international search report
19 January 2016 (19.01.16)Name and mailing address of the ISA/
Japan Patent Office
3-4-3, Kasumigaseki, Chiyoda-ku,
Tokyo 100-8915, Japan

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2015/080949

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 3014106 U (Kabushiki Kaisha Asahi Sangyo), 01 August 1995 (01.08.1995), entire text; all drawings (Family: none)	1-10

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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