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Oh et al.(10) **Pub. No.: US 2006/0236496 A1**(43) **Pub. Date: Oct. 26, 2006**(54) **VACUUM CLEANER WITH STERILIZING
SYSTEM****Publication Classification**(51) **Int. Cl.****A47L 5/00** (2006.01)**A47L 9/00** (2006.01)**A47L 5/28** (2006.01)(52) **U.S. Cl.** **15/339; 15/351**

(57)

ABSTRACT

A vacuum cleaner with a sterilizing system including a safety device for a sterilizer thereof. The vacuum cleaner according to an embodiment of the present invention comprises a cleaner body and a suction brush. The suction brush comprises a sterilizer using an ultraviolet (UV) ray; and a safety device interrupting power supply to the sterilizer when the suction brush is moved apart from the surface being cleaned by a predetermined distance. Here, the safety device comprises a micro switch controlling power to the sterilizer, a micro switch operator released from contact with the micro switch as the suction brush is separated from the surface being cleaned by an amount at least equal to the predetermined distance, thereby turning off the micro switch, and a biasing member that biases the micro switch operator in a certain direction.

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ICS CO., LTD.**(21) Appl. No.: **11/269,632**(22) Filed: **Nov. 9, 2005**(30) **Foreign Application Priority Data**

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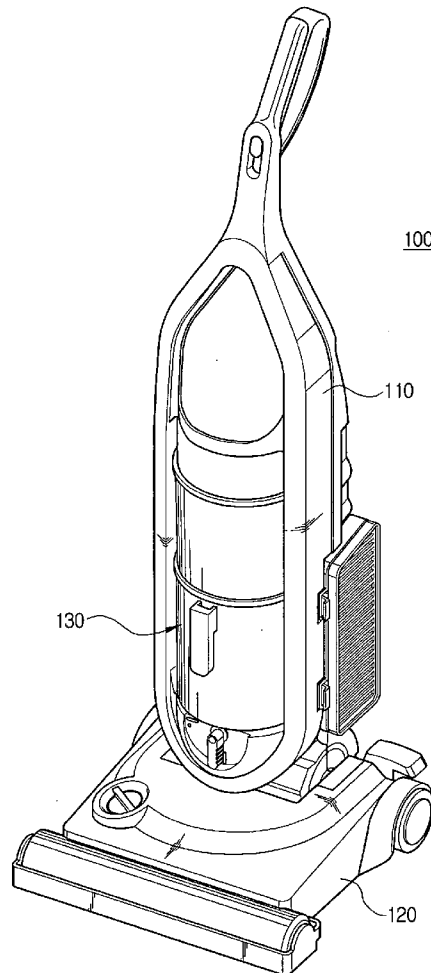


FIG. 1

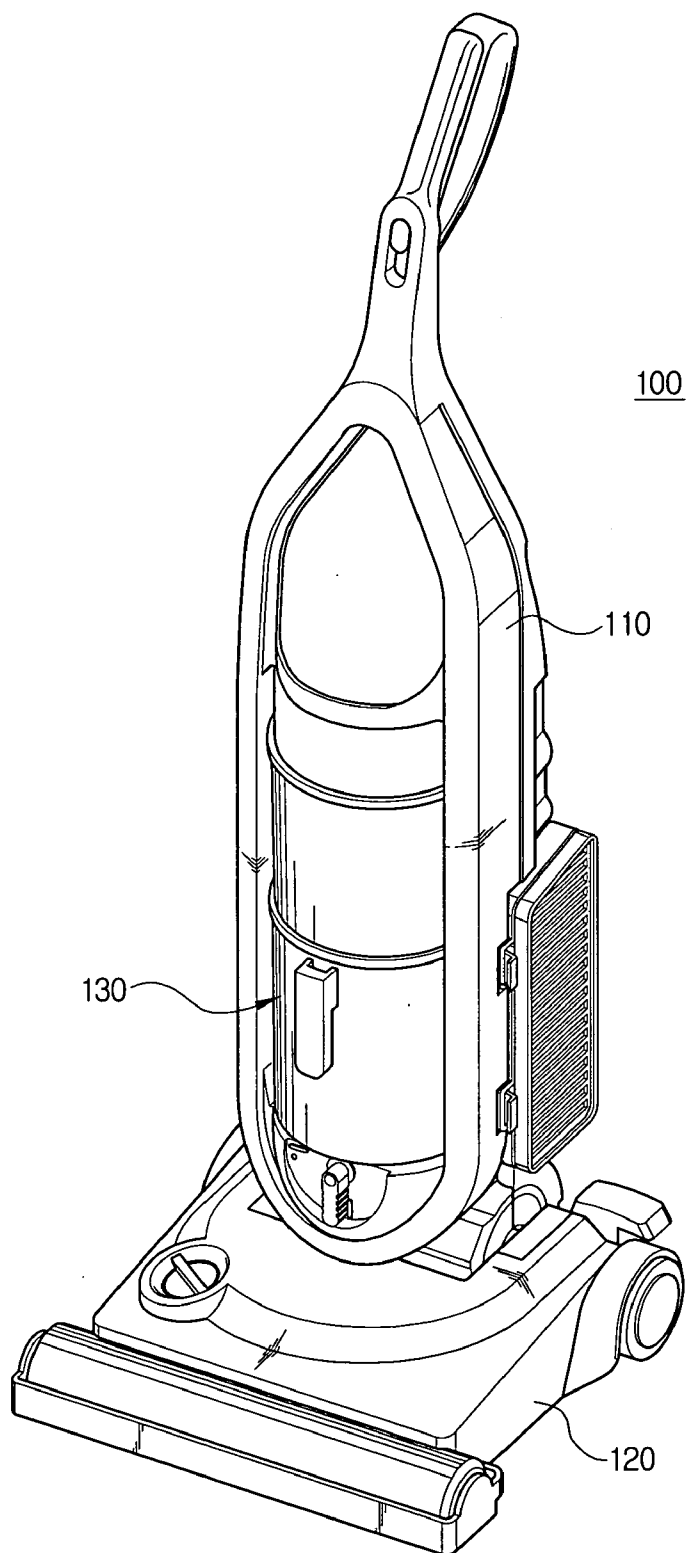


FIG. 2

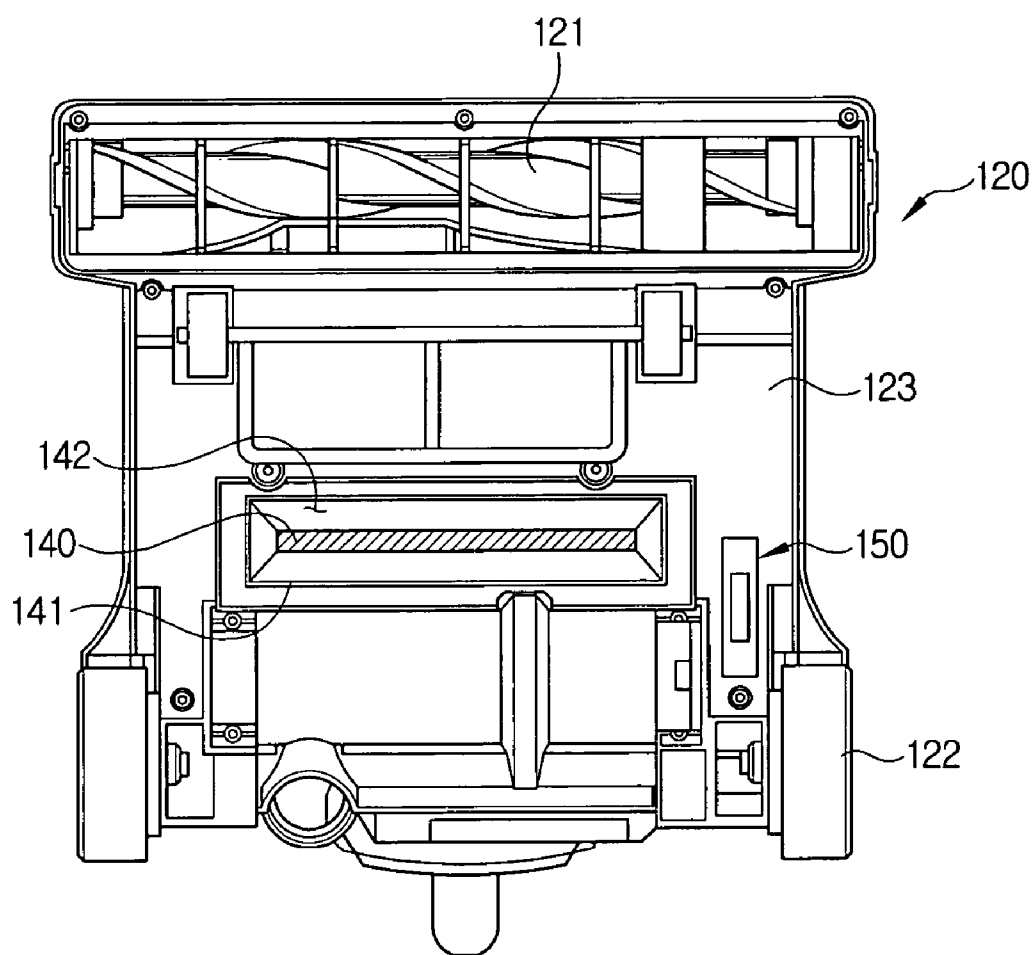


FIG. 3

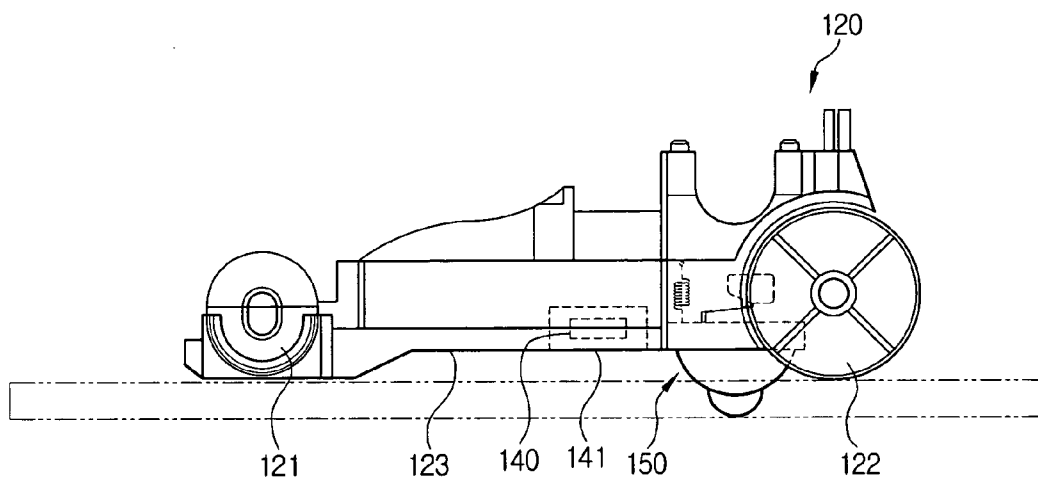


FIG. 4

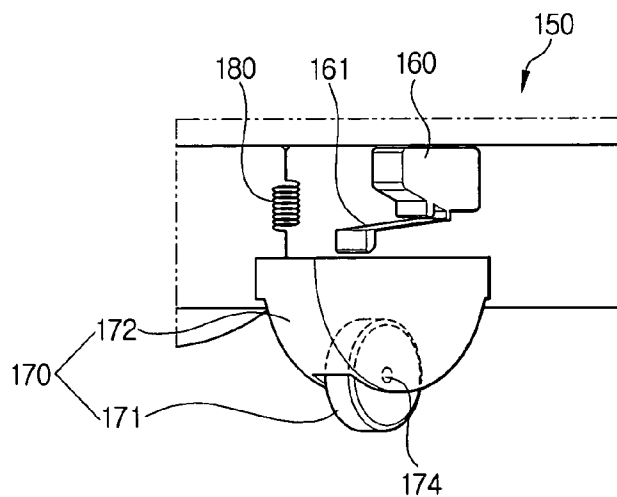


FIG. 5

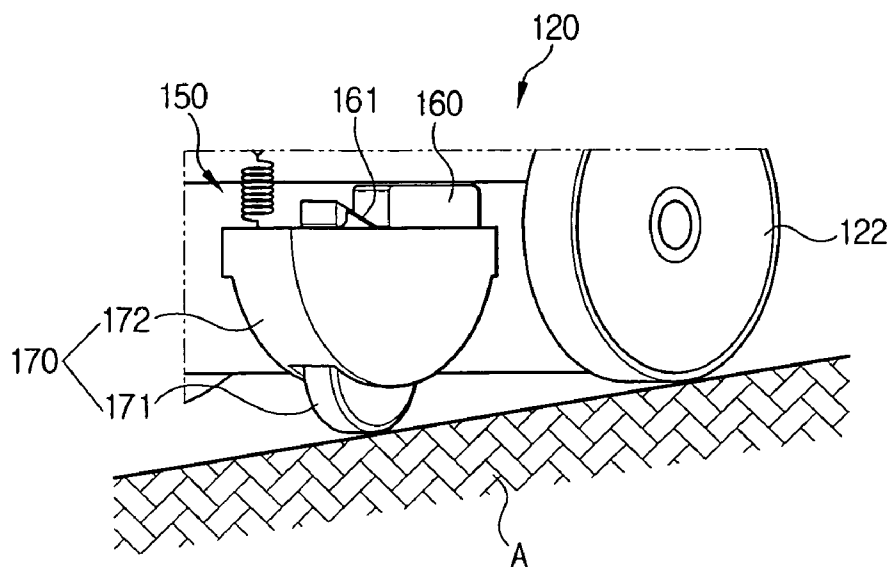


FIG. 6

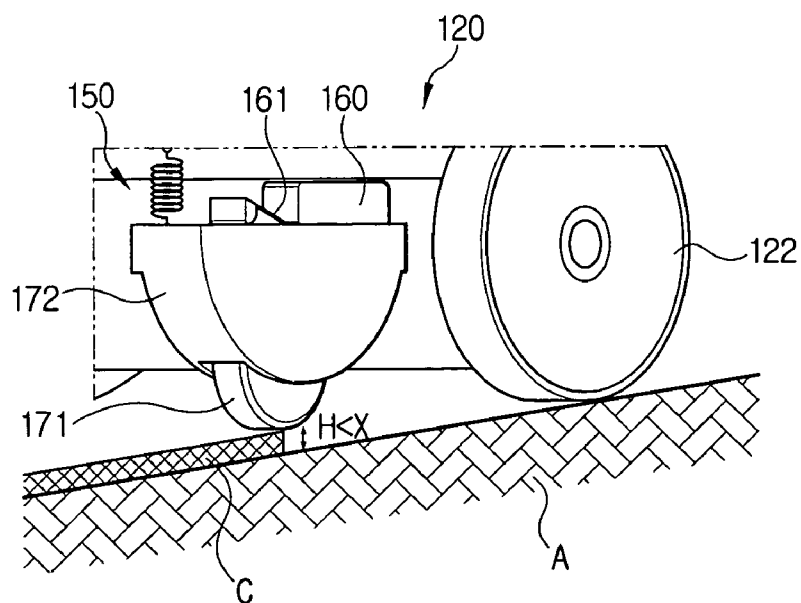


FIG. 7

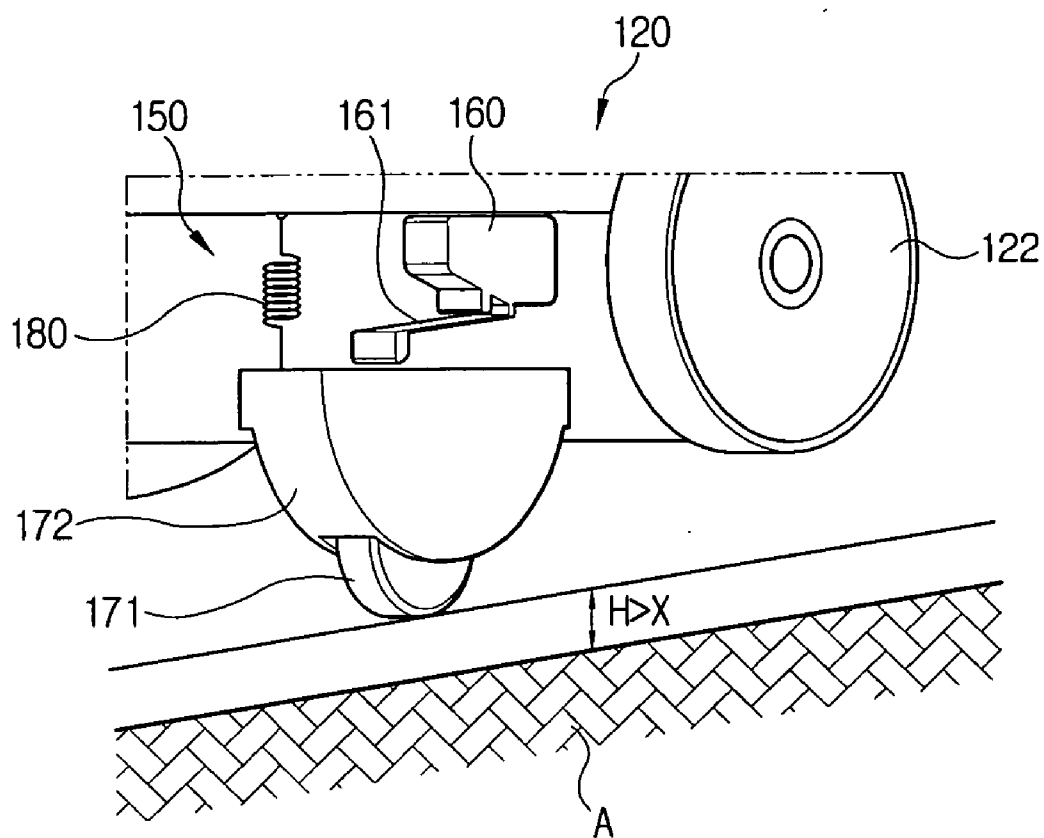


FIG. 8

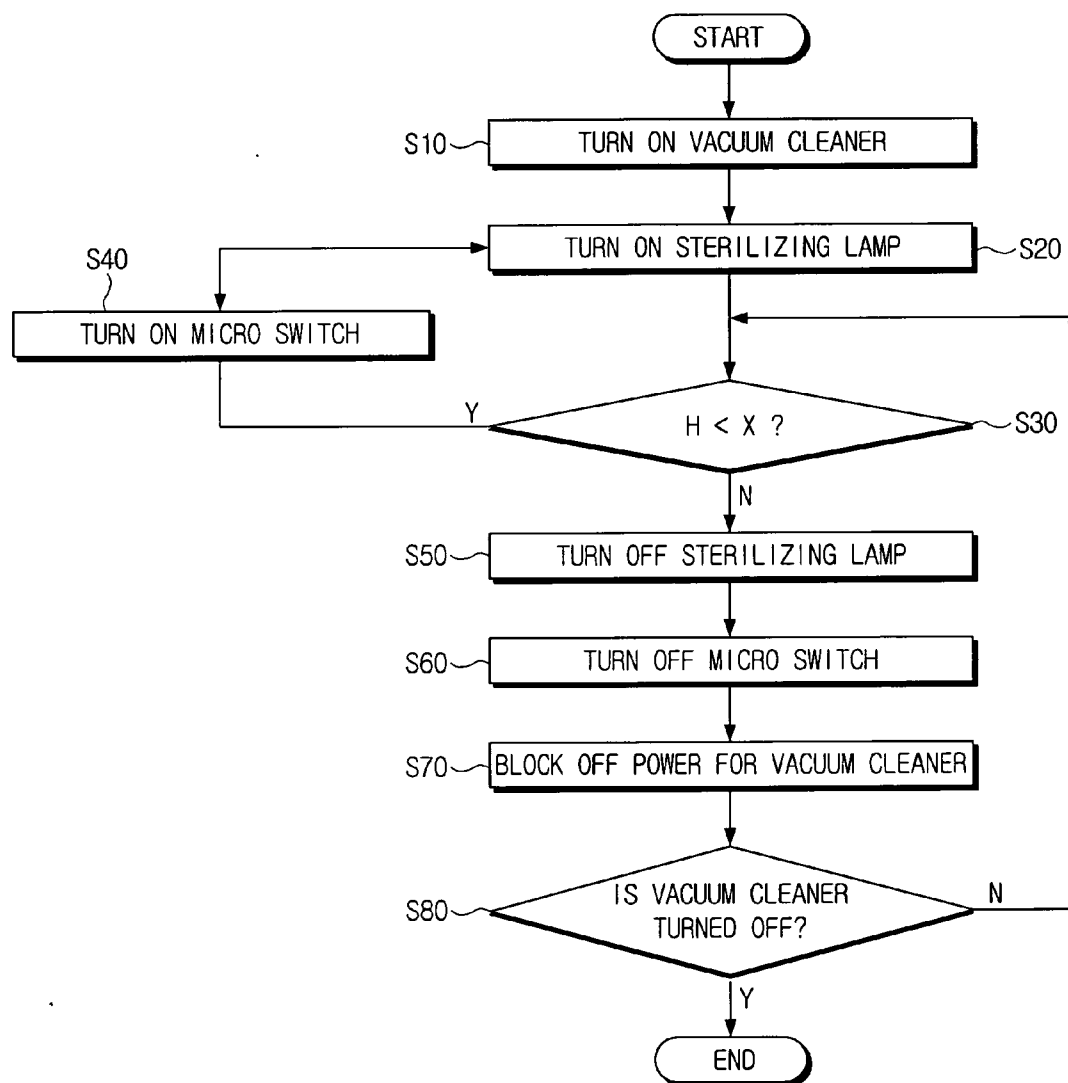
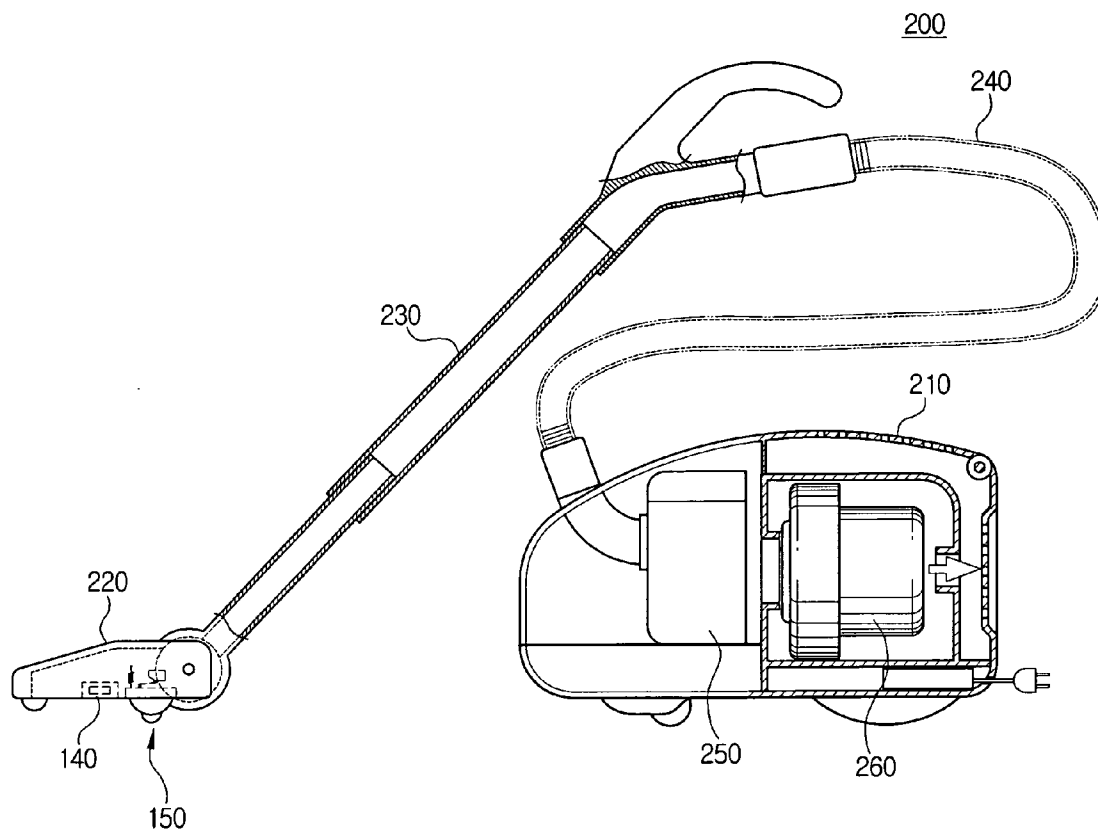


FIG. 9



VACUUM CLEANER WITH STERILIZING SYSTEM

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of priority under 35 U.S.C. § 119(a) from Korean Patent Application No. 2005-33713, filed Apr. 22, 2005, the entire contents of which are incorporated herein by reference.

FIELD OF THE INVENTION

[0002] The present invention relates to a vacuum cleaner. More particularly, the present invention relates to a vacuum cleaner having a sterilizer, such as an ultraviolet (UV) lamp, and a safety device.

BACKGROUND OF THE INVENTION

[0003] Vacuum cleaners are mainly divided into either an upright type or a canister type. Conventional vacuum cleaners comprise a cleaner body with a suction motor and a dust collecting chamber therein, and a suction brush for drawing in dust from a surface being cleaned.

[0004] Recently, in order to remove not only dust and dirt but also germs and ticks inhabiting the surface being cleaned, such as carpet and bedclothes, vacuum cleaners with a sterilizer, such as an ultraviolet (UV) sterilizing lamp in the suction brush have been developed.

[0005] However, the UV light of the sterilizer could hurt a person's skin and eyes if the UV ray is projected on the person accidentally. Therefore, various ideas have been suggested to solve such a problem. For example, commonly owned Korean Utility Model Laid-open No. 1997-50925 discloses a suction brush equipped with a switch member for operating the UV sterilizing lamp only when the suction brush is in contact with the surface being cleaned. However, the suction brush introduced in the above Utility Model is not appropriate for the upright-type vacuum cleaner because the upright-type vacuum cleaner usually cleans a wide hall or a carpet spread on a wide hall and is often lifted by a predetermined height when being moved from a hall floor up to the carpet. The frequent lift caused as the vacuum moves up from the hall floor to the carpet causes the UV sterilizing lamp to turn off frequently and lose power. Therefore, the user has to monitor the vacuum cleaner constantly.

[0006] Korean Utility Model Registration No. 342660 discloses a suction brush having a floor sensor which interrupts power supply to the UV sterilizing lamp when a bottom portion of the suction brush is apart from the surface being cleaned by a predetermined distance. However, the sensor considerably increases the manufacturing cost and requires a complicated circuit structure. If the sensor does not properly function, the vacuum cleaner may not operate.

[0007] Furthermore, although a tilt switch and a mercury switch can also interrupt the power supply to a UV sterilizing lamp when the suction brush is tilted by a predetermined angle, those switches are not effective when having to clean a slant surface. Those switches are also ineffective when the suction brush is vertically lifted with respect to the floor, instead of being tilted, because the operation of the UV sterilizing lamp will continue.

SUMMARY OF THE INVENTION

[0008] An aspect of the present invention is to solve at least the above problems and/or disadvantages and to provide at least the advantages described below. Accordingly, an aspect of the present invention is to provide a vacuum cleaner equipped with a safety device capable of stopping operation of a sterilizer when a suction brush is moved apart from a surface being cleaned by a predetermined distance.

[0009] Another aspect of the present invention is to provide a vacuum cleaner with simpler construction and stabler operation by mechanically controlling the operation of the sterilizer.

[0010] In order to achieve the above-described aspects of the present invention, there is provided a vacuum cleaner comprising a cleaner body and a suction brush drawing in dust-laden air from a surface being cleaned and discharging the dust-laden air into the cleaner body. The suction brush comprises a sterilizer; and a safety device that interrupts a power supply to the sterilizer when the suction brush is moved apart from the surface being cleaned by a predetermined distance.

[0011] The safety device comprises a micro switch that controls the electrical power supplied to the sterilizer; a micro switch operator that, when released from contact with the micro switch as the suction brush is separated from the surface being cleaned by an amount equal to at least a predetermined distance, operates the micro switch; and a biasing member that biases the micro switch operator in a certain direction.

[0012] The micro switch operator comprises a wheel rotated by friction with the surface being cleaned; and a wheel guide supporting the wheel that selectively contacts an actuator of the micro switch. The wheel guide travels substantially perpendicular to the bottom surface of the suction brush. The safety device is disposed at a rear portion of the suction brush not to be exposed to the outside. The sterilizer comprises at least one means of emitting UV light for sterilizing the surface being cleaned.

[0013] The vacuum cleaner according to an embodiment of the present invention is capable of controlling electrical power supply to at least one other component of the vacuum cleaner, depending on the position of the micro switch, in coordination with controlling electric power to the sterilizer.

BRIEF DESCRIPTION OF THE DRAWING FIGURES

[0014] The above aspect and other features of the present invention will become more apparent by describing in detail exemplary embodiments thereof with reference to the attached drawing figures, wherein:

[0015] **FIG. 1** is a perspective view of an upright-type vacuum cleaner according to an embodiment of the present invention;

[0016] **FIG. 2** is a bottom plan view of a suction brush of **FIG. 1**;

[0017] **FIG. 3** is a side elevational view of a suction brush of **FIG. 1**;

[0018] **FIG. 4** is a partial perspective view of the structure of a safety device in accordance with the present invention;

[0019] FIGS. 5 to 7 are partial perspective views of the suction brush, showing the operation of the vacuum cleaner having the safety device of FIG. 4;

[0020] FIG. 8 is a simplified flowchart illustrating the operation processes of the vacuum cleaner according to an embodiment of the present invention; and

[0021] FIG. 9 is a sectional view of a canister-type vacuum cleaner according to another embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0022] Hereinafter, certain embodiments of the present invention will be described in detail with reference to the accompanying drawing figures.

[0023] In the following description, same drawing reference numerals are used for the same elements even in different drawings. The matters defined in the description, such as a detailed construction and elements, are provided only to assist in a comprehensive understanding of the invention. Thus, it is apparent that the present invention can be carried out without those defined matters. Also, well-known functions or constructions are not described in detail since they would obscure the invention in unnecessary detail.

[0024] Referring to FIG. 1, an upright-type vacuum cleaner 100 comprises a cleaner body 110 and a suction brush 120 formed at a lower portion of the cleaner body 110 to draw in dust-laden air, moving along a surface being cleaned. A dust separator 130, being removably mounted to the cleaner body 110, separates and collects dust from the dust-laden air drawn in through the suction brush 120. In the cleaner body 110, a suction motor (not shown) functioning as a driving source is mounted to generate a suction force for drawing in the dust-laden air through the suction brush 120.

[0025] Referring to FIGS. 2 and 3, the suction brush 120 has a rotary drum 121 at a front portion and a pair of driving wheels 122 at a rear portion thereof. A bottom frame 123 of the suction brush 120 has a transmission window 141 opened toward the surface being cleaned. A sterilizer 140 comprises a UV sterilizing lamp for sterilizing the surface being cleaned and is mounted in an inner space 142 of the transmission window 141. The UV ray generated by the sterilizer 140 is projected to the surface being cleaned such as a carpet, thereby removing germs and ticks.

[0026] A safety device 150 is mounted at the rear portion of the suction brush 120, that is, near the driving wheels 122. When the suction brush 120 is separated from the surface being cleaned by a predetermined distance, the safety device 150 turns off the sterilizer 140. The reason for disposing the safety device 150 at the rear portion of the suction brush 120 is to reduce the possibility that the vacuum cleaner 100 may be damaged by external obstacles during operation.

[0027] Referring to FIG. 4, the safety device 150 comprises a micro switch 160, a micro switch operator 170 and a biasing member 180.

[0028] The micro switch 160 controls power supplied to the sterilizer 140. More specifically, the micro switch 160 comprises a micro contact separation and a snap action device (actuator, 161) to mechanically turn on and off a

certain apparatus by a predetermined operation and a predetermined power. Since the principle of the micro switch 160 is generally known, detailed description thereof will be omitted.

[0029] The micro switch operator 170 turns on the micro switch 160 to operate the sterilizer 140 when the suction brush 120 is within a predetermined distance of the surface being cleaned. When the suction brush 120 is moved apart from the surface being cleaned by an amount at least equal to the predetermined distance, the switch operation part 170 turns off the micro switch 160 to stop operation of the sterilizer 140.

[0030] The micro switch operator 170 comprises a wheel 171 and a wheel guide 172 that supports the wheel 171 and contacts the actuator 161 of the micro switch 160. The wheel guide 172 is mounted to move substantially up and down through an opening (not shown) formed on the bottom frame 123 (FIG. 2) of the suction brush 120. The wheel guide 172 has a substantially semicircular shape and mounts the wheel 171 at a lower portion thereof by an axis 174. An upper portion of the wheel guide 172 is contacted with the actuator 161 of the micro switch 160. When ascending by the predetermined distance, the wheel guide 172 presses the actuator 161, thereby turning on the micro switch 160. When descending by more than the predetermined distance, the wheel guide 172 is separated from the actuator 161, thereby turning off the micro switch 160.

[0031] The biasing member 180, being connected to the upper portion of the wheel guide 172 by one end and supported by the suction brush 120 by the other end, resiliently biases the wheel guide 172 in a certain direction that is away from the micro switch 160. While the vacuum cleaner 100 (FIG. 1) is normally working, the suction brush 120 is contacted with the surface being cleaned and accordingly, the wheel 171 is brought into contact with the surface being cleaned. Therefore, the wheel guide 172 ascends, overcoming the resilience of the biasing member 180, and presses the actuator 161 of the micro switch 160. When the suction brush 120 gets apart from the surface being cleaned by a predetermined distance, the wheel guide 172 is biased away from the actuator 161 by the biasing member 180. Accordingly, the wheel guide 172 is released from contact with the actuator 161, and the contact of the micro switch 160 is moved from an on state to an off state. As a result, the operation of the sterilizer 140 is stopped.

[0032] As described above, the safety device 150 can ensure stable operation of the vacuum cleaner 100 by interrupting power supply to the sterilizer 140 with the simple mechanical structure.

[0033] Meanwhile, since the sterilizer 140 is stopped when the suction brush 120 is separated from the surface being cleaned by the predetermined distance, determination of the separation distance matters. According to an embodiment of the present invention, the sterilizer 140 is not stopped merely by releasing contact between the suction brush 120 and the surface being cleaned but stopped when the suction brush 120 is separated from the surface being cleaned by at least a certain predetermined distance. This is to prevent loss of power and inconvenience to the user. Because the upright-type vacuum cleaner usually cleans a wide floor or a carpet placed on the wide floor and is often lifted from the floor, for example, by a height of the carpet

when being moved from the floor up to the carpet, the sterilizer 140 is turned off every time the vacuum cleaner is moved up from the floor to the carpet. The frequent operation of the switch causes loss of power and the user has to intervene frequently. Since thickness of the carpet does not generally exceed approximately 20 mm, it is preferable that the predetermined distance be approximately the thickness of the carpet or approximately 20 mm. However, this is only by way of an example; therefore, the present invention is not limited so.

[0034] Hereinbelow, the operation of the vacuum cleaner 100 having the safety device 150 will be described with reference to FIGS. 5 to 7.

[0035] Referring to FIG. 5, while the vacuum cleaner 100 is normally working, the suction brush 120 moves in contact with a surface being cleaned A. At this time, the driving wheels 122 of the suction brush 120 and the wheel 171 of the safety device 150 are in contact with the surface being cleaned A. Accordingly, the wheel guide 172 is lifted, thereby pressing the actuator 161 of the micro switch 160. Therefore, the micro switch 160 is turned on, and the sterilizer 140 is operated to project the UV ray for sterilization.

[0036] Referring to FIG. 6, when the suction brush 120 cleans a carpet C spread on the surface being cleaned A, the front portion of the suction brush 120 ascends along the carpet C. Here, while the driving wheels 122 of the suction brush 120 are in contact with the surface being cleaned A, the wheel 171 and the wheel guide 172 of the safety device 150 are lifted by a height H of the carpet C. However, when the distance H is less than a predetermined distance X, the wheel guide 172 of the safety device 150 continuously applies pressure on the actuator 161 of the micro switch 160, thereby keeping the micro switch 160 in the on state. Accordingly, the sterilizer 140 can continuously project the UV ray.

[0037] With reference to FIG. 7, when the vacuum cleaner 100 is moved after the cleaning or tipped over by mistake, the suction brush 120 is separated from the surface being cleaned A. Therefore, the wheel 171 of the safety device 150 is separated from the surface being cleaned A. The wheel guide 172 is biased away from the actuator 161 by the biasing member 180. When the distance H between the suction brush 120 and the surface being cleaned A is equal to or more than the predetermined distance X, contact between the wheel guide 172 and the actuator 161 of the micro switch 160 is released. Accordingly, the contact of the micro switch 160 is moved to the off state, thereby stopping the operation of the sterilizer 140.

[0038] The safety device 150 according to an embodiment of the present invention, may serve as a switch for other parts of the vacuum cleaner 100, for example, the suction motor (not shown) of the cleaner body 110 and the rotary drum 121 (FIG. 2). In this case, the safety device 150 may stop operation of the suction motor (not shown) or the rotary drum 121 when operation of the sterilizer 140 is stopped. When the vacuum cleaner 100 is moved after cleaning or tipped over by mistake with a power switch turned on, if the suction motor (not shown) or the rotary drum is continuously driven, loss of power and even an accident may be caused. A simplified flowchart of FIG. 8 shows processes for controlling the vacuum cleaner 100 in this case.

[0039] When power is applied to the vacuum cleaner 100 (S10), the suction motor (not shown) in the cleaner body 110 or the rotary drum 121 of the suction brush 120 is driven. At the same time, the sterilizer 140 is applied with the power (S20). Although the sterilizer 140 is turned on upon application of the power to the vacuum cleaner 100 in this embodiment, power of the sterilizer 140 may be separately turned on and off by providing a power switch (not shown) to the sterilizer 140.

[0040] During the cleaning, when the distance H between the suction brush 120 and the surface being cleaned A is less than the predetermined distance X (S30), approximately 20 mm, the micro switch 160 is turned on and that allows the sterilizer 140 to keep projecting the UV ray onto the surface being cleaned (S40). However, when the distance H becomes equal to or more than the predetermined distance X, the micro switch 160 is turned off (S50) so that the operation of the sterilizer 140 is stopped (S60).

[0041] When the sterilizer 140 is turned off, power supply to the vacuum cleaner 100 is blocked off. Accordingly, operation of the suction motor in the cleaner body 110 or the rotary drum 121 of the suction brush 120 is stopped (S70). When power supply to the vacuum cleaner 100 is not blocked off (S80), it is determined again whether the distance H between the suction brush 120 and the surface being cleaned A is less than the predetermined distance X (S20).

[0042] In regard to this embodiment, the safety device 150 applied to the upright-type vacuum cleaner 100 has been illustrated and described; however, the present invention is not limited so and can be applied to a canister-type vacuum cleaner as well.

[0043] Referring to FIG. 9, a canister-type vacuum cleaner 200 comprises a cleaner body 210 and a suction brush 220. The cleaner body 210 and the suction brush 220 are fluidly communicated through an extension pipe 230 and a connection hose 240. The cleaner body 210 includes a dust separator 250 and a suction motor 260, and the suction brush 220 includes the sterilizer 140 and the safety device 150. The safety device 150 is the same one applied in the previous embodiment. The canister-type vacuum cleaner 200 is generally used for domestic cleaning because operation and moving of the suction brush 220 is facile. By using the suction brush 220 according to the present embodiment, germs and ticks inhabiting bedclothes and carpets in general home can be removed.

[0044] As can be appreciated from the above description of the vacuum cleaner, according to an embodiment of the present invention, upon separation of the suction brush from the surface being cleaned by an amount equal to at least the predetermined distance, the micro switch is turned off, thereby interrupting power supply to the sterilizer. As a result, risk of projecting UV light on a human body can be prevented. Also, since the power applied to the sterilizer is controlled by the micro switch operator comprising a wheel and a wheel guide, construction can be simplified, thereby decreasing the manufacturing cost. In addition, operational stability is improved.

[0045] While the invention has been shown and described with reference to certain embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing

from the spirit and scope of the invention as defined by the appended claims. The examples and embodiments described herein are for illustrative purposes only and are not limiting.

What is claimed is:

1. A vacuum cleaner having a suction brush for drawing in dust from a surface being cleaned, wherein the suction brush comprises:

a sterilizer; and

a safety device interrupting power supply to the sterilizer when the suction brush is moved apart from the surface being cleaned by a predetermined distance,

the safety device comprising,

a micro switch turning the sterilizer on and off,

a switch operation part, the switch operation part being released from contact with the micro switch when the suction brush is separated from the surface being cleaned by at least the predetermined distance, thereby turning off the micro switch, and

a resilient member biasing the switch operation part in a direction away from the micro switch.

2. The vacuum cleaner of claim 1, wherein the switch operation part comprises:

a wheel rotated by friction with the surface being cleaned; and

a wheel guide supporting the wheel and in selective contact with an actuator of the micro switch.

3. The vacuum cleaner of claim 2, wherein the wheel guide moves through a bottom frame of the suction brush.

4. The vacuum cleaner of claim 1, wherein the safety device is disposed at a rear portion of the suction brush not exposed to the outside.

5. The vacuum cleaner of claim 1, wherein the sterilizer comprises a UV sterilizing lamp.

6. A vacuum cleaner comprising:

a cleaner body including a suction motor and a dust separator; and

a suction brush disposed at a lower portion in fluid communication with the cleaner body to draw in dust-laden air from a surface being cleaned and discharge the dust-laden air into the cleaner body,

wherein the suction brush comprises,

a UV sterilizing lamp,

a micro switch turning the UV sterilizing lamp on and off,

a switch operation part, the switch operation part being released from contact with the micro switch as the suction brush is separated from the surface being cleaned by at least a predetermined distance, thereby turning off the micro switch, and

a resilient member biasing the switch operation part in a direction away from the micro switch.

7. The vacuum cleaner of claim 6, wherein the switch operation part comprises

a wheel rotated by friction with the surface being cleaned; and

a wheel guide supporting the wheel and in selective contact with an actuator of the micro switch.

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