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(54) **CLEANING SYSTEM AND SELF-PROPELLED CLEANING APPARATUS**

(57) A cleaning system, comprising a self-propelled cleaning device (1) and a base station (300). The self-propelled cleaning device (1) comprises a driving wheel (125), a device main body (100), and a hand-held dust suction apparatus (200). The hand-held dust suction apparatus (200) is detachably connected to the device main body (100). The driving wheel (125) is mounted on the device main body (100) and is used to drive the device main body (100) to travel on a working surface. The hand-held dust suction apparatus (200) comprises a handle (241) and a fan (209). A dust collection cavity (201) as well as an air inlet (202) and a dust removal port (203) in communication with the dust collection cavity (201) are formed in the hand-held dust suction apparatus (200). The device main body (100) is provided with a dust suction port (101). The dust suction port (101) is in communication with the air inlet (202). The fan (209) is provided with an air intake port (2091) in communication with the dust collection cavity (201). The fan (209) is used to form an air flow that flows from the dust suction port (101) into the dust collection cavity (201) via the air inlet (202), and the dust collection cavity (201) is used to accommodate garbage objects carried by the air flow. The base station (300) is provided with a dust collection

port (301). The dust collection port (301) is used to be in communication with the dust removal port (203), so that the garbage objects in the dust collection cavity (201) can enter the inside of the base station (300) via the dust removal port (203) and the dust collection port (301). By means of the described method, the cleaning system can have diverse cleaning actions.

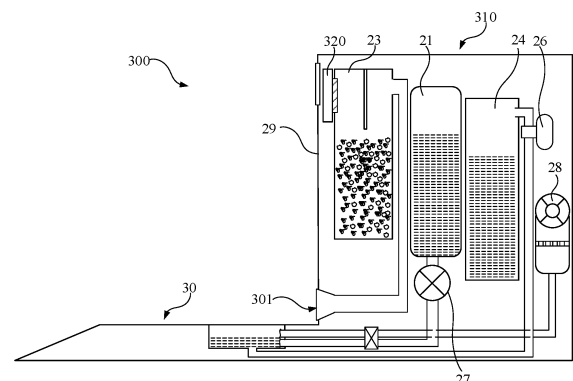


FIG. 1

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Description

[0001] The present application claims priorities to Chinese patent application Nos. 202410939317.5, 202410942449.3, 202421658174.2, 202323448127.3 and 202410940022.X, filed on July 12, 2024, entitled "A CLEANING SYSTEM" and "SELF-PROPELLED CLEANING DEVICE", all of which are herein incorporated by reference in their entirety.

TECHNICAL FIELD

[0002] The present disclosure relates to the technical field of cleaning devices, and in particular to a cleaning system and a self-propelled cleaning apparatus.

BACKGROUND

[0003] With development of technology, intelligent devices have permeated every aspect of people's daily lives. Intelligent cleaning devices such as robotic vacuum cleaners, dust collectors, and vacuum cleaners have been widely welcomed by people.

[0004] During a cleaning process, a cleaning device typically needs to remove a waste object from an environment to maintain cleanliness. For example, airflow may be generated by a fan to suck up dust and debris from the environment. A base station may clean the cleaning device by collecting the waste object through a dust-collection operation. However, in the related art, the dust-collection operation of the base station is relatively monotonous, which limits a dust-collection effect.

SUMMARY OF THE DISCLOSURE

[0005] The present disclosure provides a cleaning system and a self-propelled cleaning apparatus, so as to reduce risk of waste object blockage during the dust-collection process and improve a dust-collection effect.

[0006] In order to solve the above technical problem, technical solutions in the present disclosure are as follows.

[0007] In a first aspect, the present disclosure provides a cleaning system including a self-propelled cleaning device and a base station. The base station is configured to be docked with the self-propelled cleaning device. The self-propelled cleaning device defines a dust-collection chamber. The self-propelled cleaning device includes a fan, and the fan is communicated with the dust-collection chamber. The fan is configured to generate airflow that flows into the dust-collection chamber, and the dust-collection chamber is configured to accommodate a waste object carried by the airflow. The base station includes a dust-collection fan, and the dust-collection fan is configured to suck the waste object in the dust-collection chamber into the base station. The cleaning system has a dust-collection mode, and the self-propelled cleaning device is configured to be docked with the base station in the dust-collection mode. In the dust-collection mode, the dust-collection fan and the fan have an alternating start-up phase, and the dust-collection fan and the fan are started alternately during the alternating start-up phase.

[0008] In a second aspect, the present disclosure provides a cleaning system including a self-propelled cleaning device and a base station. The self-propelled cleaning device includes a driving wheel, a device body, and a handheld vacuum cleaner. The handheld vacuum cleaner is detachably connected to the device body, and the driving wheel is disposed on the device body and configured to drive the device body to travel on an operating surface. The handheld vacuum cleaner includes a handle and a fan. The handheld vacuum cleaner defines a dust-collection chamber, an air inlet, and a dust-removal port. The air inlet and the dust-removal port are communicated with the dust-collection chamber. The device body defines a dust-suction port, and the dust-suction port is communicated with the air inlet. The fan defines an air intake that is communicated with the dust-collection chamber, and the fan is configured to form airflow that flows from the dust-suction port to the dust-collection chamber through the air inlet. The dust-collection chamber is configured to accommodate a waste object carried by the airflow. The base station defines a dust-collection port. The dust-collection port is configured to be communicated with the dust-removal port, so that the waste object in the dust-collection chamber is able to enter the base station through the dust-removal port and the dust-collection port.

[0009] In a third aspect, the present disclosure provides a self-propelled cleaning device including a first functional mechanism and a device body. The first functional mechanism includes a first body and an electronic control system disposed on the first body. The first body is detachably connected to the device body. The electronic control system includes a power supply circuit and a monitoring circuit electrically connected to the power supply circuit. The monitoring circuit is configured to detect an electrical connection state between the first functional mechanism and the device body, and to control the power supply circuit to supply power to the device body when the first functional mechanism and the device body are in the electrical connection state.

[0010] Different from the related art, the effects of the present disclosure are as follows. In the present disclosure, the cleaning system includes the self-propelled cleaning device and the base station. The self-propelled cleaning device

includes the driving wheel, the device body, and the handheld vacuum cleaner. The handheld vacuum cleaner is detachably connected to the device body, and the driving wheel is disposed on the device body and configured to drive the device body to travel on an operating surface. The handheld vacuum cleaner includes the handle and the fan. The handheld vacuum cleaner defines the dust-collection chamber, the air inlet, and the dust-removal port. The air inlet and the dust-removal port are communicated with the dust-collection chamber. The device body defines the dust-suction port, and the dust-suction port is communicated with the air inlet. The fan defines the air intake that is communicated with the dust-collection chamber, and the fan is configured to form airflow that flows from the dust-suction port to the dust-collection chamber through the air inlet. The dust-collection chamber is configured to accommodate the waste object carried by the airflow. The base station defines the dust-collection port. The dust-collection port is configured to be communicated with the dust-removal port, so that the waste object in the dust-collection chamber is able to enter the base station through the dust-removal port and the dust-collection port. The handheld vacuum cleaner is configured to suck up the waste object when the handheld vacuum cleaner is removed from the device body to be held. The handheld vacuum cleaner may also be assembled with the device body to suck up the waste object, so that the self-propelled cleaning device has diversified cleaning actions. The dust-collection chamber may be used independently by the handheld vacuum cleaner. The dust-collection chamber may also be used when the handheld vacuum cleaner is assembled with the device body to form the self-propelled cleaning device. This may save space and improve space utilization rate of the self-propelled cleaning device. The saved space may be configured to accommodate components that are configured to enhance a cleaning function and improve the cleaning effect.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011]

FIG. 1 is a structural schematic view of a base station of a cleaning system in some embodiments of the present disclosure.

FIG. 2 is a three-dimensional structural schematic view of a self-propelled cleaning device in the present disclosure.

FIG. 3 is a cross-sectional structural schematic view of the self-propelled cleaning device shown in FIG. 2.

FIG. 4 is a cross-sectional structural schematic view of a handheld vacuum cleaner shown in FIG. 2.

FIG. 5 is a bottom structural schematic view of the self-propelled cleaning device shown in FIG. 2.

FIG. 6 is a structural schematic view illustrating disassembly and separation of a device body and the handheld vacuum cleaner shown in FIG. 2.

FIG. 7 is a three-dimensional structural schematic view of the handheld vacuum cleaner shown in FIG. 2.

FIG. 8 is a structural schematic view of the cleaning system in some embodiments of the present disclosure.

FIG. 9 is a three-dimensional structural schematic view of the self-propelled cleaning device in the present disclosure.

FIG. 10 is a cross-sectional structural schematic view of the self-propelled cleaning device shown in FIG. 9.

FIG. 11 is a structural schematic view illustrating disassembly and separation of the device body and the handheld vacuum cleaner shown in FIG. 9.

FIG. 12 is a cross-sectional structural schematic view of the handheld vacuum cleaner shown in FIG. 9.

FIG. 13 is a structural schematic view illustrating assembly of the handheld vacuum cleaner and a brush suction head shown in FIG. 9.

FIG. 14 is a structural schematic view illustrating assembly of the handheld vacuum cleaner and a dust-suction tube serving as a suction nozzle shown in FIG. 9.

FIG. 15 is a structural schematic view illustrating assembly of the handheld vacuum cleaner and another dust-suction tube shown in FIG. 9.

FIG. 16 is a partial structural schematic view illustrating the handheld vacuum cleaner and the dust-suction tube.

FIG. 17 is a schematic view illustrating an operating state of a storage bracket.

FIG. 18 is a structural schematic view of the self-propelled cleaning device in some embodiments of the present disclosure.

FIG. 19 is a circuit structural schematic view illustrating partial circuit of an electronic control system of the self-propelled cleaning device in the present disclosure.

FIG. 20 is a circuit structural schematic view illustrating a first communication circuit and a second communication circuit of the self-propelled cleaning device in the present disclosure.

FIG. 21 is a schematic view illustrating communication interaction between a first functional mechanism and the device body of the self-propelled cleaning device in the present disclosure.

FIG. 22 is a schematic flowchart illustrating a control method for the self-propelled cleaning device in an embodiment of the present disclosure.

FIG. 23 is a schematic flowchart illustrating a control method for the self-propelled cleaning device in another embodiment of the present disclosure.

DETAILED DESCRIPTION

[0012] As shown in FIGS. 1 to 3 and FIG. 8, a cleaning system in some embodiments of the present disclosure includes a self-propelled cleaning device 1 and a base station 300. The self-propelled cleaning device 1 defines a dust-collection chamber 201. A function of the dust-collection chamber 201 is to collect various waste objects sucked by the self-propelled cleaning device 1 during a cleaning operation. The base station 300 defines a dust-collection port 301, and the dust-collection port 301 is configured to be communicated with the dust-collection chamber 201.

[0013] In some embodiments, the self-propelled cleaning device 1 defines a dust-removal port 203. When the self-propelled cleaning device 1 is docked with the base station 300, the waste object collected in the dust-collection chamber 201 may enter the base station 300 through the dust-removal port 203 and the dust-collection port 301.

[0014] As shown in FIGS. 3 to 5, as well as FIGS. 9 to 12, the self-propelled cleaning device 1 may include a device body 100 and a fan 209.

[0015] The device body 100 may further include a main housing 124, a traveling assembly, and a cleaning assembly 126. The main housing 124 may serve as an overall structural framework of the device body 100.

[0016] The traveling assembly may be mainly disposed on the main housing 124, and the traveling assembly may enable the self-propelled cleaning device 1 to have movable and self-propelled functions. The traveling assembly includes a driving wheel 125 and a universal wheel 1251, and the universal wheel 1251 may be driven by the driving wheel 125 to move. The cleaning assembly 126 may include a rolling brush. The rolling brush may be disposed on a bottom of the main housing 124, so as to provide a cleaning function when the self-propelled cleaning device 1 is operating, and to clean an operating surface of the self-propelled cleaning device 1. The fan 209 is configured to suck dust, debris, or other waste objects from the operating surface into the dust-collection chamber 201.

[0017] The cleaning assembly 126 and the fan 209 may cooperate and act together. In some embodiments, a dust-suction port 101 may be disposed adjacent to the rolling brush, so that the waste object or the dust that is swept out during rotation of the rolling brush may be sucked into the dust-collection chamber 201.

[0018] The above-described structure of the self-propelled cleaning device 1 is merely an exemplary, and the present disclosure is not limited to the above exemplary structure.

[0019] In some embodiments, as shown in FIG. 1, the base station 300 may include a base station body 310 and a base 30. The base station body 310 is connected to the base 30. In some embodiments, the base station body 310 may be disposed on a side of the base 30, or the base station body 310 may be disposed above the base 30. The base 30 may be configured to support the self-propelled cleaning device 1. In some embodiments, the base station 300 may also be configured without the base 30.

[0020] In some embodiments, the base station 300 may include a dust-collection box 23, a wastewater tank 24, a dust-collection fan 320, a water pumping mechanism 26, a liquid supply mechanism 27, and a gas supply mechanism 28. In some embodiments, the base station body 310 includes the dust-collection box 23, a clean water box 21, the wastewater box 24, the dust-collection fan 320, the water pumping mechanism 26, the liquid supply mechanism 27, and the gas supply mechanism 28. In some embodiments, the base station body 310 may further include a first housing 29. The clean water box 21, the dust-collection box 23, the wastewater tank 24, and the gas supply mechanism 28 may be disposed inside the first housing 29 and spaced apart from one another.

[0021] Regarding the self-propelled cleaning device 1 of the cleaning system in some embodiments of the present disclosure, specific details may also refer to the following content.

[0022] As shown in FIGS. 2 to 5, the self-propelled cleaning device 1 includes the driving wheel 125, the device body 100, and a handheld vacuum cleaner 200. The handheld vacuum cleaner 200 is detachably connected to the device body 100. The driving wheel 125 is disposed on the device body 100 and configured to drive the device body 100 to travel on the operating surface. The handheld vacuum cleaner 200 includes a handle 241 and the fan 209. The handheld vacuum cleaner 200 defines the dust-collection chamber 201, an air inlet 202, and the dust-removal port 203. The air inlet 202 and the dust-removal port 203 are communicated with the dust-collection chamber 201. The device body 100 defines the dust-suction port 101, and the dust-suction port 101 is communicated with the air inlet 202. The fan 209 defines an air intake 2091 communicated with the dust-collection chamber 201. The fan 209 is configured to generate the airflow that flows from the dust-suction port 101 into the dust-collection chamber 201 through the air inlet 202. The dust-collection chamber 201 is configured to accommodate the waste objects carried by the airflow. The base station 300 defines the dust-collection port 301. The dust-collection port 301 is configured to be communicated with the dust-removal port 203, so that the waste objects in the dust-collection chamber 201 may enter the base station 300 through the dust-removal port 203 and the dust-collection port 301.

[0023] After the handheld vacuum cleaner 200 is detached from the device body 100, the handheld vacuum cleaner 200 may be used alone by a user to suck up the waste objects. In some embodiments, after being detached from the device body 100, the handheld vacuum cleaner 200 may generate the airflow during operation. The airflow flows into the handheld vacuum cleaner 200 through the air inlet 202, and then transports the waste objects carried by the airflow to the dust-collection chamber 201 through the air inlet 202.

[0024] When the handheld vacuum cleaner 200 is assembled on the device body 100, the handheld vacuum cleaner 200 and the device body 100 may cooperate to suck up the waste objects. In some embodiments, when the handheld vacuum cleaner 200 is assembled on the device body 100, the dust-suction port 101 is communicated with the air inlet 202. During operation, the handheld vacuum cleaner 200 forms the airflow that flows from the dust-suction port 101 into the handheld vacuum cleaner 200 through the air inlet 202, so that the waste objects carried by the airflow are transported to the dust-collection chamber 201 through the dust-suction port 101 and the air inlet 202.

[0025] In some embodiments, when both the handheld vacuum cleaner 200 and the device body 100 are in operation, the generated airflow may enter an interior of the device body 100 through the dust-suction port 101, and then flow into the handheld vacuum cleaner 200 through the air inlet 202, so as to transport the waste objects carried by the airflow to the dust-collection chamber 201.

[0026] As shown in FIGS. 3 to 6, the dust-removal port 203 may be spaced apart from the air inlet 202. The dust-removal port 203 is configured to be communicated with the dust-collection port 301 of the base station 300 when the self-propelled cleaning device 1 is docked with the base station 300, so that the waste objects in the dust-collection chamber 201 may be sucked into the base station 300 through the dust-removal port 203 and the dust-collection port 301.

[0027] In some embodiments, the dust-collection port 301 is communicated with the dust-removal port 203 by alignment.

[0028] In some embodiments, as shown in FIGS. 3 to 6, the device body 100 defines a dust outlet 102 that is communicated with the dust-suction port 101. The dust outlet 102 is configured to be communicated with the air inlet 202 when the handheld vacuum cleaner 200 is assembled on the device body 100. In some embodiments, the dust outlet 102 is configured to be aligned and communicated with the air inlet 202 when the handheld vacuum cleaner 200 is assembled on the device body 100.

[0029] In a state where the handheld vacuum cleaner 200 is assembled on the device body 100, the airflow generated during the operation of the handheld vacuum cleaner 200 may enter the interior of the device body 100 from the dust-suction port 101, then flow out of the dust outlet 102, and then enter the dust-collection chamber 201 of the handheld vacuum cleaner 200 through the air inlet 202. Therefore, the waste objects carried by the airflow are transported to the dust-collection chamber 201, thereby achieving the cleaning function.

[0030] In some embodiments, as shown in FIG. 3, the device body 100 defines a dust-discharge port 103 and a dust inlet 104 that are communicated with each other. The dust-discharge port 103 is configured to be communicated with the dust-collection port 301, and the dust inlet 104 is configured to be communicated with the dust-removal port 203. In some embodiments, the dust-discharge port 103 is configured to be aligned and communicated with the dust-collection port 301, and the dust inlet 104 is configured to be aligned and communicated with the dust-removal port 203.

[0031] In the state where the handheld vacuum cleaner 200 is assembled on the device body 100, during a dust-collection process of the base station 300, the airflow formed by the base station 300 may flow into the dust-collection chamber 201 through the dust-suction port 101 and the air inlet 202 in sequence, then flow out of the dust-collection chamber 201 through the dust-removal port 203 and enter the device body 100 through the dust inlet 104, and finally enter the base station 300 through the dust-discharge port 103 and the dust-collection port 301. The airflow is configured to carry the waste objects inside the dust-collection chamber 201 when flowing through the dust-collection chamber 201, so as to collect the waste objects inside the dust-collection chamber 201 into the base station 300.

[0032] The device body 100 defines the dust-discharge port 103, therefore compatibility of the base station 300 with different self-propelled cleaning devices 1 may be improved.

[0033] In some embodiments, as shown in FIGS. 2 and 4, the handheld vacuum cleaner 200 includes a covering member 210, the covering member 210 may be movably disposed on the dust-removal port 203, so that the covering member 210 is able to switch between a closed position and an open position relative to the dust-removal port 203. The covering member 210 is disposed to cover the dust-removal port 203 in the closed position. The covering member 210 is also disposed to be attracted by the dust-collection fan 320 to move from the closed position to the open position, thereby uncovering the dust-removal port 203.

[0034] When the self-propelled cleaning device 1 is used to perform the cleaning operation, or the handheld vacuum cleaner 200 is removed from the device body 100 and is held to perform the cleaning operation, the covering member 210 may cover the dust-removal port 203 in the closed position. When the self-propelled cleaning device 1 needs to perform dust collection, the covering member 210 may be in the open position to uncover the dust-removal port 203 due to a suction force of the dust-collection fan 320. The airflow formed by the dust-collection fan 320 may carry the waste objects, flow out of the dust-collection chamber 201 through the dust-removal port 203, and enter the base station 300, thereby achieving the dust-collection function.

[0035] In some embodiments, the handheld vacuum cleaner 200 includes an elastic member, and the covering member 210 is rotatably disposed on the dust-removal port 203. The elastic member is configured to limit the covering member 210 to the closed position, and the elastic member is in an elastic compression state when the covering member 210 is in the open position.

[0036] In some embodiments, the covering member 210 is configured to be attracted by the fan 209 and move to the

closed position. In some embodiments, the covering member 210 is configured to move to the closed position by the combined action of the suction of the fan 209 and the elastic recovery of the elastic member. In some embodiments, the elastic member may also be omitted, and the covering member 210 itself is made of an elastic material. In some embodiments, the covering member 210 may be made of a rubber material. In some embodiments, the covering member 210 may also be configured to be driven by a motor to move between the closed position and the open position.

[0037] In some embodiments, as shown in FIGS. 6 and 7, the device body 100 includes a first electrical connection part 110, and the handheld vacuum cleaner 200 includes a second electrical connection part 220. When the handheld vacuum cleaner 200 is assembled onto the device body 100, the first electrical connection part 110 and the second electrical connection part 220 are electrically connected to each other.

[0038] As shown in FIG. 18, the handheld vacuum cleaner 200 of the self-propelled cleaning device 1 includes a first body 11a and an electronic control system disposed on the first body 11a. The first body 11a is detachably connected to the device body 100. The electronic control system includes a power supply circuit 121a and a monitoring circuit 122a electrically connected to the power supply circuit 121a. The monitoring circuit 122a is configured to detect an electrical connection state between the handheld vacuum cleaner 200 and the device body 100, and control the power supply circuit 121a to supply power to the device body 100 when the handheld vacuum cleaner 200 and the device body 100 are in an electrical connection state.

[0039] The first body 11a of the handheld vacuum cleaner 200 at least includes an apparatus body 240 of the handheld vacuum cleaner 200, and the apparatus body 240 may be configured to at least support the electronic control system, etc. The apparatus body 240 may cooperate with the electronic control system to achieve the functions of the handheld vacuum cleaner 200 and provide power to the device body 100.

[0040] In some embodiments, the monitoring circuit 122a is configured to detect a voltage change of the transmission voltage between the handheld vacuum cleaner 200 and the device body 100, and to determine the electrical connection state between the handheld vacuum cleaner 200 and the device body 100 based on the voltage change. When the transmission voltage changes from a first preset voltage value to a second preset voltage value, it is determined that a connection state between the handheld vacuum cleaner 200 and the device body 100 is switched from a separated state to an electrically connected state. The first preset voltage value is different from the second preset voltage value.

[0041] The first preset voltage value is different from the second preset voltage value. The first preset voltage value is a voltage value of the transmission voltage between the handheld vacuum cleaner 200 and the device body 100 when they are in the separated state. The second preset voltage value is the voltage value of the transmission voltage between the handheld vacuum cleaner 200 and the device body 100 when they are in the separated state.

[0042] In some embodiments, the monitoring circuit 122a includes a main control circuit 123a, the second electrical connection part 220, and an insertion detection circuit 125a. The device body 100 includes a second body 21a, a power feeding circuit 22a disposed on the second body 21a, and the first electrical connection part 110 disposed on the second body 21a. The second electrical connection part 220 is configured to be electrically connected to the first electrical connection part 110. The insertion detection circuit 125a is electrically connected to the main control circuit 123a and the second electrical connection part 220, respectively. The insertion detection circuit 125a is configured to detect the voltage change of the transmission voltage of the second electrical connection part 220. The power feeding circuit 22a is electrically connected to the first electrical connection part 110. The power supply circuit 121a is electrically connected to the second electrical connection part 220 and the main control circuit 123a, respectively. When the main control circuit 123a determines, based on a detection result of the insertion detection circuit, that the second electrical connection part 220 is electrically connected to the first electrical connection part 110, the main control circuit 123a controls the power supply circuit 121a to supply power to the second electrical connection part 220, thereby supplying power to the first electrical connection part 220.

[0043] When the handheld vacuum cleaner 200 is in the separated state from the device body 100, the second electrical connection part 220 is not electrically connected to the first electrical connection part 110. When the handheld vacuum cleaner 200 is in the connected state with the device body 100, the second electrical connection part 220 is electrically connected to the first electrical connection part 110. In these two states, a voltage on the second electrical connection part 220, that is, the transmission voltage mentioned above, may change. In this embodiment, the voltage change of the second electrical connection part 220 may be detected by the insertion detection circuit 125a, and this change may be fed back to the main control circuit 123a. Based on the detection result of the insertion detection circuit 125a, the main control circuit 123a may determine the electrical connection state between the second electrical connection part 220 and the first electrical connection part 110. When the second electrical connection part 220 is electrically connected to the first electrical connection part 110, the main control circuit 123a may control the power supply circuit 121a to supply power to the second electrical connection part 220, thereby supplying power to the first electrical connection part 110, and thus supplying power to the power feeding circuit 22a of the device body 100, so that the device body 100 may be powered.

[0044] The second body 21a of the device body 100 serves as the main housing 124 of the device body 100. The second body 21a is configured to support the power feeding circuit 22a and the first electrical connection part 110. The second body 21a is also configured to cooperate with the power feeding circuit 22a and the first electrical connection part 110, so as

to achieve the functions of the device body 100.

[0045] In some embodiments, as shown in FIGS. 18 and 19, the insertion detection circuit 125a includes a first voltage-dividing resistor R447, a second voltage-dividing resistor R448, and a third voltage-dividing resistor R450. A first end of the first voltage-dividing resistor R447 is configured to be connected to a supply voltage VBAT_SYS. A first end of the second voltage-dividing resistor R448 is electrically connected to a second end of the first voltage-dividing resistor R447, the power supply circuit 121a, and the second electrical connection part 220, respectively. A first end of the third voltage-dividing resistor R450 is electrically connected to the main control circuit 123a and a second end of the second voltage-dividing resistor R448, respectively. A second end of the third voltage-dividing resistor R450 is grounded. The device body 100 further includes a fourth voltage-dividing resistor R451, a first end of the fourth voltage-dividing resistor R451 is electrically connected to the first electrical connection part 110 and the power feeding circuit 22a, and a second end of the fourth voltage-dividing resistor R451 is grounded.

[0046] The first end of the third voltage-dividing resistor R450 serves as a detection terminal BASE_DET and is electrically connected to the main control circuit 123a.

[0047] When the handheld vacuum cleaner 200 is in the separated state from the device body 100, the voltage of the detection terminal BASE_DET is equal to the second preset voltage value:

$$(VBAT - 0.6V) * \frac{R450}{R447 + R448 + R450}.$$

[0048] When the handheld vacuum cleaner 200 is electrically connected to the device body 100, the voltage of the detection terminal BASE_DET is equal to the first preset voltage value:

$$(VBAT - 0.6V) * \frac{R450}{R446} * \left(1 - \frac{R447}{\frac{(R448 + R450) * R451}{R448 + R450 + R451} + R447}\right),$$

wherein, R446 = R448 + R450.

[0049] When the voltage of the detection terminal BASE_DET changes from the first preset voltage value to the second preset voltage value, the main control circuit 123a controls the power supply circuit 121a to supply power, that is, the main control circuit 123a controls a VBASE1 terminal to supply power to a VBASE2 terminal that is electrically connected to the power feeding circuit 22a of the device body 100, thereby supplying power to the device body 100.

[0050] In some embodiments, the insertion detection circuit 125a further includes a diode D135, an anode of the diode D135 is connected to the supply voltage VBAT_SYS, and a cathode of the diode D135 is electrically connected to the first end of the first voltage-dividing resistor R447.

[0051] In some embodiments, the insertion detection circuit 125a further includes a current-limiting filter circuit. The current-limiting filter circuit is electrically connected to the main control circuit 123a, the second end of the second voltage-dividing resistor R448, and the first end of the third voltage-dividing resistor R450, respectively.

[0052] In this embodiment, the current-limiting and filtering functions between the insertion detection circuit 125a and the main control circuit 123a are achieved through the current-limiting filter circuit, thereby improving accuracy of the voltage of the detection terminal BASE_DET.

[0053] In some embodiments, the current-limiting filter circuit may include a resistor R449 and a capacitor C473. An end of the resistor R449 is electrically connected to the second end of the second voltage-dividing resistor R448 and the first end of the third voltage-dividing resistor R450. Another end of the resistor R449 serves as the detection terminal BASE_DET and is electrically connected to the main control circuit 123a. An end of the capacitor C473 is grounded, and another end of the capacitor C473 is electrically connected to another end of the resistor R449.

[0054] In some embodiments, the electronic control system further includes a switch SW. A control terminal of the switch SW is electrically connected to the monitoring circuit 122a, a communication terminal of the switch SW is electrically connected to the power supply circuit 121a, another communication terminal of the switch SW is configured to be electrically connected to the device body 100. The monitoring circuit 122a is configured to control the switch SW to close when the handheld vacuum cleaner 200 is electrically connected to the device body 100, and to control the switch SW to open when the handheld vacuum cleaner 200 is separated from the device body 100.

[0055] In some embodiments, the control terminal of the switch SW may be electrically connected to the main control circuit 123a. The main control circuit 123a is configured to control the switch SW to close when the second electrical connection part 220 is in the electrically connected state with the first electrical connection part 110, and to control the switch SW to open when the second electrical connection part 220 is in the separated state from the first electrical connection part 110.

[0056] In some embodiments, the handheld vacuum cleaner 200 further includes a first communication circuit 126a. The device body 100 further includes a second communication circuit 24a. The first communication circuit 126a is configured to be in signal communication with the second communication circuit 24a. The monitoring circuit 122a is electrically connected to the first communication circuit 126a. When the monitoring circuit 122a determines, based on the communication state between the first communication circuit 126a and the second communication circuit 24a, that the handheld vacuum cleaner 200 is separated from the device body 100, the monitoring circuit 122a controls the power supply circuit 121a to disconnect power supply to the device body 100.

[0057] In some embodiments, the main control circuit 123a is electrically connected to the first communication circuit 126a. When the main control circuit 123a determines, based on the communication state between the first communication circuit 126a and the second communication circuit 24a, that the second electrical connection part 220 is separated from the first electrical connection part 110, the main control circuit 123a controls the power supply circuit 121a to disconnect power supply to the second electrical connection part 220. In this embodiment, the separation state between the handheld vacuum cleaner 200 and the device body 100 may be determined through a communication mode, without resorting to an electrical signal detection mode. Therefore, the following problem can be avoided: when the handheld vacuum cleaner 200 and the device body 100 are in the electrically connected state, the power supply circuit 121a supplies power to the second electrical connection part 220, thereby causing a voltage change on the second electrical connection part 220. Such a voltage change would reduce the detection accuracy of the separation state between the handheld vacuum cleaner 200 and the device body 100. Therefore, in this embodiment, the separation state between the handheld vacuum cleaner 200 and the device body 100 may be determined through the communication mode, which may improve the accuracy of separation state detection, thereby improving safety and reliability.

[0058] The first communication circuit 126a and the second communication circuit 24a may include wired communication modules, such as serial communication modules, optical communication modules, etc. The serial communication modules may include RS485 buses, etc. When the second electrical connection part 220 is in the electrical connection state with the first electrical connection part 110, the first communication circuit 126a and the second communication circuit 24a are in a communication connection state. When the second electrical connection part 220 is in the separated state from the first electrical connection part 110, the first communication circuit 126a and the second communication circuit 24a are in a non-communication connection state.

[0059] In some embodiments, the insertion detection circuit 125a is configured to detect an insertion state between the handheld vacuum cleaner and the device body, and the voltage or the change is configured to identify whether the handheld vacuum cleaner is connected to the device body. When the handheld vacuum cleaner is inserted into the device body, the handheld vacuum cleaner supplies power to the device body. It is determined whether the handheld vacuum cleaner has been removed from the device body through the communication mode.

[0060] After the main control circuit 123a controls the power supply circuit 121a to supply power to the device body 100, whether the handheld vacuum cleaner 200 is in the separated state from the device body 100 is detected through the above communication module. If so, the power supply circuit 121a is controlled to disconnect power supply to the second electrical connection part 220 after a certain period of time. This greatly reduces arcing due to hot-plugging (i.e., inserting while it is powered), thereby preventing the electrical connection terminals from sparking and turning black.

[0061] In some embodiments, when the handheld vacuum cleaner 200 is electrically connected to the device body 100, the first communication circuit 126a sends a heartbeat data packet to the second communication circuit 24a and receives feedback data of the heartbeat data packet from the second communication circuit 24a. When the first communication circuit 126a does not receive the feedback data within the preset time, the monitoring circuit 122a controls the power supply circuit 121a to disconnect power supply to the device body 100.

[0062] In some embodiments, when the second electrical connection part 220 is in the electrical connection state with the first electrical connection part 110, the main control circuit 123a controls the first communication circuit 126a to send the heartbeat data packet to the second communication circuit 24a, and controls the first communication circuit 126a to receive the feedback data of the heartbeat data packet from the second communication circuit 24a. When the main control circuit 123a determines that no feedback data is received within the preset time, the main control circuit 123a controls the power supply circuit 121a to disconnect power supply to the second electrical connection part 220, thereby disconnecting power supply to the device body 100.

[0063] In some embodiments, as shown in FIG. 20, the first communication circuit 126a includes a first communication terminal 127a and a first protection circuit 128a electrically connected to the first communication terminal 127a. The second communication circuit 24a includes a second communication terminal 129a and a second protection circuit 130a electrically connected to the second communication terminal 129a. The first communication terminal 127a is configured to be electrically connected to the second communication terminal 129a, so as to achieve signal communication. The first protection circuit 128a is configured to block high voltage input when the first communication terminal 127a is electrically connected to the second communication terminal 129a. The second protection circuit 130a is configured to block the high voltage input when the second communication terminal 129a is electrically connected to the first communication terminal 127a.

[0064] In some embodiments, the first communication terminal 127a, the first protection circuit 128a, the second communication terminal 129a, and the second protection circuit 130a are also electrically connected to the main control circuit 123a.

[0065] The first protection circuit 128a may include a current-limiting resistor R1, a current-limiting resistor R3, a switching transistor Q27 and a switching transistor Q28, a pull-up resistor R11, etc. The first communication circuit 126a is provided with two first communication terminals 127a. A control terminal of switching transistor Q27 and a control terminal of the switching transistor Q28 are connected to the main control circuit 123a through the pull-up resistor R11, so as to obtain the power supply voltage. The switching transistor Q27 and the current-limiting resistor R1 are connected in series between an MCU_TX terminal of the main control circuit 123a and a first one of the two first communication terminals 127a. The switching transistor Q28 and the current-limiting resistor R3 are connected in series between an MCU_RX terminal of the main control circuit 123a and a second one of the two first communication terminals 127a.

[0066] The second communication circuit 24a further includes a communication module. The second protection circuit 130a may include a current-limiting resistor R4, a current-limiting resistor R2, a switching transistor Q3, and a switching transistor Q5, etc. The second communication circuit 24a is provided with two second communication terminals 129a. A control terminal of the switching transistor Q3 and a control terminal of the switching transistor Q5 are connected to the power supply voltage. The switching transistor Q3 and the current-limiting resistor R2 are connected in series between a BASE_RX terminal of the communication module and a first one of the two second communication terminals 129a. The switching transistor Q5 and the current-limiting resistor R4 are connected in series between a BASE_TX terminal of the communication module and a second one of the two second communication terminals 129a.

[0067] The first one of the two second communication terminals 129a is configured to be in communication connection with the first one of the two first communication terminals 127a, and the second one of the two second communication terminals 129a is configured to be in communication connection with the second one of the two first communication terminals 127a.

[0068] In some embodiments, the second electrical connection part 220 of the handheld vacuum cleaner 200 and the first communication terminal 127a may be integrated into the same interface, and the first electrical connection part 110 of the device body 100 and the second communication terminal 129a may be integrated into the same first interface. The above terminals may be connected through corresponding electrode plates. In some embodiments, the handheld vacuum cleaner 200 is provided with four electrode plates, two electrode plates are configured for power supply, namely Vcc and GND, and the other two electrode plates are configured for communication, namely Tx and Rx. The device body 100 may also be designed similarly.

[0069] In an application scenario, as shown in FIG. 22, a control method for the self-propelled cleaning device includes the following operations at blocks S41 and S42.

[0070] At block S41, the control method may include detecting the electrical connection state between the second electrical connection part and the first electrical connection part by using the monitoring circuit.

[0071] At block S42, the control method may include controlling the power supply circuit to supply power to the second electrical connection part when the second electrical connection part is in the electrical connection state with the first electrical connection part, thereby supplying power to the device body.

[0072] In another application scenario, as shown in FIG. 23, the control method for the self-propelled cleaning device includes the following operations at blocks S51 to S54.

[0073] At block S51, the control method may include detecting the electrical connection state between the second electrical connection part and the first electrical connection part by using the monitoring circuit.

[0074] The specific implementation method may refer to the operation at block S41 mentioned above.

[0075] At block S52, the control method may include controlling the power supply circuit to supply power to the second electrical connection part when the second electrical connection part is in the electrical connection state with the first electrical connection part, thereby supplying power to the device body.

[0076] The specific implementation method may refer to the operation at block S42 mentioned above.

[0077] At block S53, the control method may include controlling the first communication circuit to send the heartbeat data packet to the second communication circuit, and controlling the first communication circuit to receive the feedback data of the heartbeat data packet from the second communication circuit when the second electrical connection part is in the electrical connection state with the first electrical connection part.

[0078] At block S54, the control method may include controlling the power supply circuit to disconnect power supply to the second electrical connection part when the first communication circuit does not receive the feedback data within the preset time.

[0079] In some embodiments, as shown in FIG. 4, the handheld vacuum cleaner 200 further includes a power supply assembly 221. The power supply assembly 221 is electrically connected to the second electrical connection part 220 and the fan 209, respectively. The power supply assembly 221 is configured to supply power to the device body 100 when the second electrical connection part 220 is electrically connected to the first electrical connection part 110. The power supply assembly 221 may also be configured to supply power to the fan 209.

[0080] The power supply assembly 221 serves as the power supply circuit 121a and is electrically connected to the fan 209 and the monitoring circuit 122a. The power supply assembly 221 supplies power to the handheld vacuum cleaner 200 under the control of the monitoring circuit 122a.

[0081] In some embodiments, the fan 209 is also electrically connected to the monitoring circuit 122a, and the monitoring circuit 122a controls the operation of the fan 209.

[0082] In some embodiments, the power supply assembly 221 may include a battery or the like.

[0083] In some embodiments, as shown in FIG. 11, the second electrical connection part 220 and the first electrical connection part 110 are electrically connected through a plug-in connection or elastic abutment.

[0084] In some embodiments, the power supply assembly 221 is detachably disposed on the device body 100. In some embodiments, batteries may be separately disposed on the device body 100 and the handheld vacuum cleaner 200. When the handheld vacuum cleaner 200 is assembled on the device body 100, the two batteries are connected in series. When the handheld vacuum cleaner 200 is removed from the device body 100, the two batteries may operate independently.

[0085] In some embodiments, as shown in FIGS. 2 and 6, the device body 100 defines a recessed groove 105, and the handheld vacuum cleaner 200 may be detachably disposed in the recessed groove 105. By defining the recessed groove 105, it is convenient to assemble the handheld vacuum cleaner 200 on the device body 100. The recessed groove 105 may play a role in limiting a position of the handheld vacuum cleaner 200, which is conducive to improving the connection stability between the handheld vacuum cleaner 200 and the device body 100.

[0086] In some embodiments, as shown in FIGS. 2 and 6, the device body 100 includes a positioning post 106 disposed in the recessed groove 105, and the handheld vacuum cleaner 200 defines a positioning groove 204 that cooperates with the positioning post 106. The positioning post 106 is configured to be inserted into the positioning groove 204, so as to limit the handheld vacuum cleaner 200 in the recessed groove 105.

[0087] By setting the positioning post 106 and positioning groove 204, assembly positioning and limit fixing of the handheld vacuum cleaner 200 and the device body 100 may be performed, which is conducive to improving connection stability between the handheld vacuum cleaner 200 and the device body 100.

[0088] In some embodiments, as shown in FIG. 6, the handheld vacuum cleaner 200 includes the apparatus body 240 and the handle 241. The handle 241 and the apparatus body 240 enclose to define a positioning groove 204. The user may insert their fingers into the positioning groove 204 to grip the handle 241.

[0089] In some embodiments, as shown in FIGS. 4 and 6, the positioning post 106 is provided with a catch 107, and a groove wall of the positioning groove 204 defines a snap groove 205. The catch 107 is configured to be embedded in the snap groove 205 when the positioning post 106 is inserted into the positioning groove 204, so that the handheld vacuum cleaner 200 is connected to the device body 100 by a snap-fit connection.

[0090] In some embodiments, the handle 241 forms partial groove wall of the positioning groove 204, and the snap groove 205 is disposed on the handle 241. In some embodiments, as shown in FIG. 11, the apparatus body 240 forms partial groove wall of the positioning groove 204, and the snap groove 205 is disposed on the apparatus body 240.

[0091] In some embodiments, the catch 107 protrudes from a side surface of the positioning post 106. An insertion direction of the catch 107 into the snap groove 205 intersects with an extension direction of the positioning post 106. In some embodiments, the positioning post 106 extends along a height direction D4 of the self-propelled cleaning device 1.

[0092] In some embodiments, the device body 100 includes an unlocking mechanism 109, and the unlocking mechanism 109 is movably disposed on the positioning post 106 and exposed to the outside. The unlocking mechanism 109 is configured to be pressed to drive the catch 107 to detach from the snap groove 205, so that the handheld vacuum cleaner 200 is disconnected from the device body 100 by releasing the snap-fit connection. In some embodiments, the unlocking mechanism 109 is disposed on a top surface of the positioning post 106 facing upwards, making it convenient for the user to press.

[0093] In some embodiments, as shown in FIGS. 8 and 11, the first electrical connection part 110 is disposed on periphery of the positioning post 106, the second electrical connection part 220 is disposed adjacent to the snap groove 205. The second electrical connection part 220 and the first electrical connection part 110 are inserted or elastically contacted along the height direction D4 of the self-propelled cleaning device 1. In this way, the stability of the second electrical connection part 220 and the first electrical connection part 110 may be improved.

[0094] In some embodiments, as shown in FIGS. 3 and 5, the device body 100 includes a top 121 and a bottom 122 that are disposed opposite to each other, and the recessed groove 105 is recessed along a direction from the top 121 to the bottom 122. In some embodiments, the device body 100 includes a peripheral side 123 connected between the top 121 and the bottom 122. The recessed groove 105 is recessed from the top 121 towards the bottom 122, and passes through a portion of the peripheral side 123. The dust-suction port 101 is defined on the bottom 122.

[0095] In some embodiments, as shown in FIGS. 10 and 11, the bottom 122 defines an extension port 1051, and the extension port 1051 is communicated with the recessed groove 105. When the handheld vacuum cleaner 200 is assembled onto the device body 100, a portion of the handheld vacuum cleaner 200 is exposed through the extension port 1051.

[0096] In some embodiments, the recessed groove 105 is communicated with the outside through the extension port

1051. The portion of the handheld vacuum cleaner 200 may be disposed in the extension port 1051. In some embodiments, a bottom wall of the recessed groove 105 defines the extension port 1051.

[0097] In some embodiments, a portion of the handheld vacuum cleaner 200 may extend to the outside through the extension port 1051. In some embodiments, the traveling mechanism has the function of supporting the device body 100, so that the bottom 122 of the device body 100 defines a spacing space, and the device body 100 is spaced apart from the operating surface (such as the ground). The recessed groove 105 may be communicated with the spacing space through the extension port 1051, and the portion of the handheld vacuum cleaner 200 may extend into the spacing space through the extension port 1051. This setting is beneficial for further reducing a height size of the self-propelled cleaning device 1. In some embodiments, the extension port 1051 may also be omitted.

[0098] In some embodiments, the extension direction of the positioning post 106 is parallel to a depression direction of the recessed groove 105.

[0099] In some embodiments, as shown in FIG. 6, the device body 100 includes a head part 128 facing a forward direction of the self-propelled cleaning device 1 and a tail part 129 facing away from the forward direction. The handheld vacuum cleaner 200 is detachably disposed on the tail part 129 and exposed to the outside. This setting may make a gravity center layout of the device body 100 more compact and reasonable, while facilitating installation and disassembly of the handheld vacuum cleaner 200 on the device body 100. The forward direction of self-propelled cleaning device 1 refers to a direction in which the self-propelled cleaning device 1 moves forward when traveling to clean a to-be-cleaned scene.

[0100] In some embodiments, the dust-discharge port 103 is defined on the tail part 129. This setting is beneficial for reducing a distance between the dust-discharge port 103 and the dust-collection chamber 201, reducing a length of a movement path of the waste objects during dust-collection, and reducing risk of blockage. Correspondingly, in this embodiment, the dust-collection port 301 is defined on the base station body 310. In some embodiments, the dust-discharge port 103 may also be defined on the bottom 122, and correspondingly, in this embodiment, the dust-collection port 301 is defined on the base 30.

[0101] In some embodiments, as shown in FIG. 9, a shape of the handheld vacuum cleaner 200 matches a contour of the peripheral side 123 of the device body 100. In some embodiments, a peripheral contour of the tail part 129 is in the shape of a circular arc. Correspondingly, an outer contour of the peripheral contour of the handheld vacuum cleaner 200 close to the tail part 129 is in the shape of a matching circular arc, so as to correspond with and match the peripheral contour of the tail part 129.

[0102] In some embodiments, as shown in FIG. 9, on a reference plane perpendicular to the height direction D4 of the self-propelled cleaning device 1, a projection of the handheld vacuum cleaner 200 falls within a projection of the device body 100. In some embodiments, the projection of the handheld vacuum cleaner 200 on the operating surface falls within the projection of the device body 100 on the operating surface.

[0103] In some embodiments, as shown in FIG. 6, the self-propelled cleaning device 1 further includes an accessory 400a for the handheld vacuum cleaner 200. The accessory 400a is configured to be assembled on the air inlet 202. The device body 100 includes the head part 128 facing the forward direction of the self-propelled cleaning device 1 and the tail part 129 facing away from the forward direction. The head part 128 defines a receiving groove 108, and the accessory 400a is detachably received in the receiving groove 108. This setting may make a layout of the device body 100 more compact and reasonable.

[0104] In some embodiments, as shown in FIG. 6, the self-propelled cleaning device 1 further includes the accessory 400a for the handheld vacuum cleaner 200. At least one accessory 400a is detachably disposed on the device body 100.

[0105] As shown in FIG. 8 and FIGS. 13 to 17, the attachment 400a may be used by cooperating with the handheld vacuum cleaner 200. In some embodiments, the attachment 400a may include a dust-suction tube 400 and a brush suction head 402. The brush suction head 402 may be configured for cleaning sofas, narrow gaps, or other application scenarios.

[0106] In some embodiments, the dust-suction tube 400 is configured to be detachably assembled onto the air inlet 202 when the handheld vacuum cleaner 200 is detached from the device body 100. The dust-suction tube 400 may be configured to improve the compatibility of the handheld vacuum cleaner 200 with cleaning scenarios. The number of the dust-suction tubes 400 may be one, two, or multiple, and different dust-suction tubes 400 have different shapes and different application scenarios.

[0107] Two dust-suction tubes 400 with different shapes and their corresponding application scenarios are described in detail below.

[0108] In some embodiments, as shown in FIGS. 8 and 14, the dust-suction tube 400 is detachably disposed on the device body 100. The dust-suction tube 400 may be used as a suction nozzle. In some embodiments, a diameter of an end of the dust-suction tube 400 away from the air inlet 202 may be less than that of the air inlet 202, making it easier to clean the narrow gaps and enhancing suction.

[0109] By detachably disposing the dust-suction tube 400 on the device body 100, the original space of the device body 100 is fully utilized, reducing an overall space occupied by the cleaning system. The device body 100 may store the dust-suction tube 400, making it convenient to take and use the dust-suction tube 400 whenever needed.

[0110] In some embodiments, as shown in FIG. 6, the device body 100 defines the receiving groove 108, and the dust-suction tube 400 may be detachably received in the receiving groove 108.

[0111] In some embodiments, the dust-suction tube 400 may be directly placed in the receiving groove 108, or the dust-suction tube 400 may be connected to an inner wall of the receiving groove 108 through a tight-fit connection, a snap-fit connection, and/or a magnetic suction connection.

[0112] In some embodiments, the receiving groove 108 is recessed from the top 121 towards the bottom 122.

[0113] In some embodiments, as shown in FIGS. 15 to 17, the attachment 400a may further include a floor brush assembly 403 and an extension tube 404. An end of the extension tube 404 is configured to be detachably connected to the handheld vacuum cleaner 200, so that the extension tube 404 is communicated with the air inlet 202. Another end of the dust-suction tube is detachably connected to the floor brush assembly 403.

[0114] In some embodiments, the extension tube 404 defines a first aligning port 4001, a second aligning port 4002, and an extension channel 4005. The extension channel 4005 extends along an extension direction of the extension tube 404, and two ends of the extension channel 4005 are communicated with the first aligning port 4001 and the second aligning port 4002, respectively. The first aligning port 4001 is configured to be communicated with the air inlet 202. The second aligning port 4002 is configured to allow the waste objects to enter the extension channel 4005.

[0115] The floor brush assembly 403 is disposed on the second aligning port 4002. The floor brush assembly 403 may be configured to clean the operating surface. The dust and the waste objects that are swept by the floor brush assembly 403 may be sucked into the extension channel 4005 through the second aligning port 4002 under the suction force of the handheld vacuum cleaner 200. Then, the dust and the waste objects may pass through the extension channel 4005 and the first aligning port 4001, and finally be sucked into the dust-collection chamber 201 of the handheld vacuum cleaner 200 through the air inlet 202.

[0116] In some embodiments, the floor brush assembly 403 includes a floor brush body, a driving motor, and a brush body. The driving motor is disposed on the floor brush body, and the brush body is rotatably connected to the floor brush body. The driving motor may drive the brush body to rotate relative to the floor brush body.

[0117] In some embodiments, the handheld vacuum cleaner 200 includes the power supply assembly 221. In a state where the extension tube 404 is assembled and connected to the handheld vacuum cleaner 200 and the floor brush assembly 403, respectively, the power supply assembly 221 is electrically connected to the floor brush assembly 403 through the extension tube 404, so that the power supply assembly 221 may supply power to the floor brush assembly 403.

[0118] In some embodiments, as shown in FIGS. 15 to 17, the handheld vacuum cleaner 200 is provided with a first electrical connection contact 2021 that is electrically connected to the power supply assembly 221. The two ends of the extension tube 404 are provided with a second electrical connection contact 4003 and a third electrical connection contact, respectively. In the assembled and connected state between the extension tube 404 and the handheld vacuum cleaner 200, the first electrical connection contact 2021 is electrically connected to the second electrical connection contact 4003. The floor brush assembly 403 is provided with a fourth electrical connection contact. In a state where the extension tube 404 is assembled and connected to the floor brush assembly 403, the third electrical connection contact is electrically connected to the fourth electrical connection contact. A wire may be disposed inside the extension tube 404 to connect the second electrical connection contact 4003 and the third electrical connection contact. In this way, in the state where the extension tube 404 is assembled and connected to the handheld vacuum cleaner 200 and the floor brush assembly 403, respectively, the power supply assembly 221 may supply power to the floor brush assembly 403. By disposing the extension tube 404, the suction force of the handheld vacuum cleaner 200 may reach farther distances. The dust and the waste object on the operating surface may be swept out through the floor brush assembly 403, thus enriching the application scenarios of the handheld vacuum cleaner 200 and improving the cleaning effect.

[0119] A setting mode of the third electrical connection contact and a setting mode of the fourth electrical connection contact may refer to the first electrical connection contact 2021 and the second electrical connection contact 4003 mentioned above.

[0120] In some embodiments, as shown in FIG. 16, the handheld vacuum cleaner 200 is provided with a first snap part 2022, and an end of the extension tube 404 that is configured for docking or connecting with the handheld vacuum cleaner 200 is provided with a second snap part 4004. The first snap part 2022 is configured to be connected to the second snap part 4004 by the snap-fit connection. The extension tube 404 may be detachably connected to the handheld vacuum cleaner 200 through the first snap part 2022 and the second snap part 4004.

[0121] In some embodiments, the second snap part 4004 and the second electrical connection contact 4003 are both disposed in the first aligning port 4001 and are adjacent to each other.

[0122] In some embodiments, a pressing mechanism is disposed on an outer side of the extension tube 404, and the pressing mechanism is in transmission connection with the second snap part 4004. When the pressing mechanism is pressed, it may drive the second snap part 4004 to disconnect from the first snap part 2022.

[0123] In some embodiments, the extension tube 404 may be detachably connected to the floor brush assembly 403 through a third snap part and a fourth snap part. In this way, it is beneficial for maintaining the stable connection between the extension tube 404 and the floor brush assembly 403, as well as for maintaining the electrical connection stability of the

third electrical connection contact and the fourth electrical connection contact. A setting mode of the third snap part and a setting mode of the fourth snap part may also refer to the first snap part 2022 and the second snap part 4004 mentioned above.

[0124] In some embodiments, as shown in FIG. 17, the cleaning system 10 includes a storage bracket 401, and the storage bracket 401 may be configured to fix idle accessories 400a.

[0125] In some embodiments, the storage bracket 401 is provided with at least two fixed positions, one of the at least two fixed positions may be configured to fix the idle extension tube 404, and another of the at least two fixed positions may be configured to fix the idle brush suction head 402. The extension tube 404 or the brush suction head 402 may be removed from the storage bracket 401 when needed for operation.

[0126] In some embodiments, the device body 100 includes a laser radar 127, and the laser radar 127 is configured for drawing a 3D map and positioning. The laser radar 127 is disposed in an area between the receiving groove 108 and the recessed groove 105.

[0127] In some embodiments, as shown in FIG. 6, the handheld vacuum cleaner 200 includes a receiving part 242, and the receiving part 242 is detachably connected to the apparatus body 240 to define the dust-collection chamber 201. The air inlet 202 is defined on the apparatus body 240, the dust-removal port 203 is defined on the receiving part 242, the fan 209 is disposed inside the apparatus body 240, and the handle 241 is connected to the apparatus body 240.

[0128] In some embodiments, as shown in FIG. 4, when the receiving part 242 is disassembled and separated from the apparatus body 240, a separation space 232 is exposed to the outside, so that the waste objects inside the separation space 232 may be dumped to the outside.

[0129] In some embodiments, the power supply assembly 221 is disposed adjacent to the receiving part 242.

[0130] In some embodiments, as shown in FIGS. 9, 11 to 13, the handheld vacuum cleaner 200 includes a control button assembly 2411. The handle 241 and the air inlet 202 are disposed on two opposite sides of the apparatus body 240, respectively. The handle 241 includes a first end and a second end. The power supply assembly 221 is adjacent to the first end of the handle 241, and the second end of the handle 241 is connected to the apparatus body 240. The control button assembly 2411 is disposed on the handle 241 and close to the second end of the handle 241.

[0131] In some embodiments, as shown in FIGS. 9, 11 to 13, the handheld vacuum cleaner 200 has a first direction D1, a second direction D2, and a third direction D3 that are perpendicular to one another. The handle 241 and the air inlet 202 are disposed on both sides of the handheld vacuum cleaner 200 along the first direction D1, respectively. Therefore, it is easy for the user to perform cleaning operation by holding the handheld vacuum cleaner 200. The fan 209 and the power supply assembly 221 are disposed on both sides of the handheld vacuum cleaner 200 along the second direction D2, respectively. Both the fan 209 and the power supply assembly 221 have a relatively large weight, which is beneficial for the overall weight distribution of the handheld vacuum cleaner 200. When the user holds the handheld vacuum cleaner 200, it is easy to maintain the balance of the handheld vacuum cleaner 200, and the setting of the handheld vacuum cleaner 200 is more ergonomic.

[0132] In some embodiments, the handheld vacuum cleaner 200 defines an air exhaust port 207 that is communicated with the outside. The fan 209 is communicated with the air exhaust port 207. In some embodiments, the air intake 2091 is communicated with the outside through the air exhaust port 207. The air exhaust port 207 faces outward along the third direction D3. Therefore, when the user holds the handheld vacuum cleaner 200 to perform the cleaning operation, the air exhaust port 207 does not directly face the user and the area being cleaned, which may reduce the impact of the airflow discharged from the air exhaust port 207 on the cleaning operation.

[0133] In some embodiments, when the handheld vacuum cleaner 200 is assembled and connected to the device body 100, the air exhaust port 207 is defined to face upwards, and the device body 100 is disposed to avoid the air exhaust port 207.

[0134] When the handheld vacuum cleaner 200 is assembled and connected to the device body 100, the device body 100 may avoid the air exhaust port 207, so that the airflow may be smoothly discharged from the air exhaust port 207. In some embodiments, when the handheld vacuum cleaner 200 is assembled and connected to the device body 100, the air exhaust port 207 may face upwards.

[0135] In some embodiments, the fan 209 defines an air outlet 2092 that is communicated with the air intake 2091. The airflow enters the fan 209 from the air intake 2091 and flows out of the fan 209 from the air outlet 2092. In some embodiments, the air outlet 2092 is communicated with the air exhaust port 207.

[0136] In some embodiments, the power supply assembly 221 is disposed on a corner of the handheld vacuum cleaner 200 close to the handle 241. When the user holds the handheld vacuum cleaner 200 to perform the cleaning operation, the power supply assembly 221 may be disposed in a lower position, and the fan 209 may be disposed in a position that is upper and forward. Under the weight of the fan 209 and the power supply assembly 221, the air inlet 202 may face a position that is forward and downward, making it easier for the user to perform the cleaning operation.

[0137] In some embodiments, when the handheld vacuum cleaner 200 is assembled onto the device body 100, the third direction D3 is parallel to the height direction D4 of the self-propelled cleaning device 1.

[0138] In some embodiments, as shown in FIG. 9, in the second direction D2, the second end of the handle 241 is

provided with the control button assembly 2411. The control button assembly 2411 is configured to control power on/off and gear switching of the handheld vacuum cleaner 200. With such an arrangement, the user may conveniently press the control button assembly 2411 with a thumb while holding the handle 241 with a single hand. Therefore, the risk of accidentally touching or accidentally pressing the control button assembly 2411 may be reduced. When the user removes the handheld vacuum cleaner 200 from the device body 100, the user may press the unlocking mechanism 109 with the single hand and naturally grip the handle 241, and then naturally press the control button assembly 2411 to start the handheld vacuum cleaner 200.

[0139] In some embodiments, as shown in FIG. 9, the handheld vacuum cleaner 200 is provided with an indicator light 243.

[0140] In some embodiments, as shown in FIGS. 4, 6, and 12, the handheld vacuum cleaner 200 includes the fan 209 and a filtering assembly 230, and the filtering assembly 230 is disposed on a side of the fan 209 close to the dust-collection chamber 201. The filtering assembly 230 is configured to intercept the waste objects that enter the dust-collection chamber 201 through the air inlet 202 and allow the waste objects to enter the dust-collection chamber 201. By disposing the filtering assembly 230, the airflow and the waste objects may be separated from each other, so that the waste objects are accommodated in the dust-collection chamber 201.

[0141] In some embodiments, the filtering assembly 230 includes a centrifugal separation mechanism 231. Due to different densities of air and the waste objects, the centrifugal separation mechanism 231 may separate the airflow and the waste objects through the principle of centrifugal separation.

[0142] The centrifugal separation mechanism 231 is connected to the apparatus body 240 and disposed inside the dust-collection chamber 201. In this way, it is beneficial to evenly distribute the overall weight of the handheld vacuum cleaner 200.

[0143] In some embodiments, the centrifugal separation mechanism 231 is disposed between the fan 209 and the receiving part 242, and the air inlet 202 is disposed between the fan 209 and the receiving part 242. In this way, it is beneficial to center the position of the air inlet 202, which may facilitate handheld use of the handheld vacuum cleaner 200.

[0144] In some embodiments, as shown in FIGS. 10 to 12, the separation space 232 is defined inside the centrifugal separation mechanism 231. The separation space 232 is communicated with the air intake 2091 and the dust-collection chamber 201, respectively. The airflow formed by the fan 209 sequentially flows through the dust-suction port 101, the air inlet 202, the dust-collection chamber 201, the separation space 232, and the air intake 2091. The dust-collection chamber 201 is configured to accommodate large-particle waste objects that are prevented by the centrifugal separation mechanism 231 from entering the separation space 232. The centrifugal separation mechanism 231 is configured to centrifugally separate the airflow and the waste objects in the separation space 232, so that small particle waste objects remain in the separation space 232.

[0145] In some embodiments, as shown in FIGS. 10 to 12, the filtering assembly 230 includes an interception net 233, and the interception net 233 is disposed on the entrance of the separation space 232. The interception net 233 may intercept large-sized waste objects and prevent the large-sized waste objects from entering the separation space 232, which is beneficial for improving the separation efficiency of the airflow and the waste objects. In some embodiments, the interception net 233 is a metal mesh.

[0146] In some embodiments, as shown in FIGS. 10 to 12, the centrifugal separation mechanism 231 defines a gas outlet 234 that is communicated with the separation space 232, and the separation space 232 is communicated with the air exhaust port 207 through the gas outlet 234. The purified airflow in the separation space 232 may flow towards the air intake 2091 through the gas outlet 234 and ultimately be discharged to the outside through the air exhaust port 207.

[0147] In some embodiments, as shown in FIGS. 10 to 12, a filtering member 250 may be disposed between the fan 209 and the filtering assembly 230. In some embodiments, the filtering member 250 is disposed between the centrifugal separation mechanism 231 and the fan 209, and the filtering member 250 is spaced apart from the centrifugal separation mechanism 231 and the fan 209.

[0148] In some embodiments, the handheld vacuum cleaner 200 defines a communication port 2013, and the dust-collection chamber 201 is communicated with the separation space 232 through the communication port 2013. During the dust-collection process of the base station 300, the waste objects in the separation space 232 enter the dust-collection chamber 201 through the communication port 2013, then leave the dust-collection chamber 201 through the dust-removal port 203, and then enter the base station 300 through the dust-collection port 301.

[0149] In some embodiments, as shown in FIGS. 10 to 12, the handheld vacuum cleaner 200 includes a partition member 2014, and the partition member 2014 is movably disposed on the communication port 2013 to cover or uncover the communication port 2013. The base station 300 includes the dust-collection fan 320 that is communicated with the dust-collection port 301. The partition member 2014 is configured to be attracted by the dust-collection fan 320 and move from a position of covering the communication port 2013 to a position of uncovering the communication port 2013. In some embodiments, the partition member 2014 is configured to be attracted by the fan 209 and move from the position of uncovering the communication port 2013 to the position of covering the communication port 2013.

[0150] When the self-propelled cleaning device 1 is used to perform the cleaning operation, or when the handheld

vacuum cleaner 200 is removed from the device body 100 and is held to perform the cleaning operation, the partition member 2014 may be disposed in the position of covering the communication port 2013. When the self-propelled cleaning device 1 needs to collect dust, the partition member 2014 may be in the position of uncovering the communication port 2013 due to the suction force of the dust-collection fan 320.

[0151] In some embodiments, the handheld vacuum cleaner 200 is provided with an elastic reset member, and the partition member 2014 is rotatably disposed on the communication port 2013. The elastic reset member is configured to limit the partition member 2014, so that the partition member 2014 is in the position of covering the communication port 2013. When the partition member 2014 is in the position of uncovering the communication port 2013, the elastic reset member is in an elastic compression state.

[0152] In some embodiments, unlike the embodiment shown in FIG. 12, in the embodiment shown in FIG. 4, the partition member 2014 is omitted, and the communication port 2013 extends to contact an inner wall of the receiving part 242. In this embodiment, the waste objects in the separation space 232 cannot be sucked away by the base station, and the user may dump the waste objects in the separation space 232 by removing the receiving part 242.

[0153] In some embodiments, as shown in FIG. 10, the device body 100 includes a body 130, a rolling brush 1011, and comb teeth 1012. The rolling brush 1011 is rotatably connected to the body 130 and is disposed on the dust-suction port 101. The comb teeth 1012 are connected to the body 130 and are configured to clean hair wrapped around the rolling brush 1011.

[0154] In some embodiments, as shown in FIGS. 10 and 12, the handheld vacuum cleaner 200 includes a blocking member 2023 that is configured for blocking the air inlet 202. The blocking member 2023 may be movably disposed on the air inlet 202, so that the blocking member 2023 is able to switch between a blocking position and a communication position relative to the air inlet 202. The blocking member 2023 is configured to cover the air inlet 202 in the blocking position. The blocking member 2023 is also configured to be attracted by the fan 209 or the dust-collection fan 320 and move from the blocking position to the communication position, so as to unblock or open the air inlet 202. In some embodiments, the blocking member 2023 is disposed inside the handheld vacuum cleaner 200 to seal or block the air inlet 202.

[0155] In some embodiments, the handheld vacuum cleaner 200 includes an elastic pressing member, and the elastic pressing member is configured to maintain the blocking member 2023 in the sealing position through the elastic action.

[0156] The dust-collection process for the base station 300 is described in detail below.

[0157] The cleaning system 10 in the embodiments of the present disclosure includes the self-propelled cleaning device 1 and the base station 300 that is configured for docking with the self-propelled cleaning device 1. The self-propelled cleaning device 1 defines the dust-collection chamber 201. The self-propelled cleaning device 1 includes the fan 209, and the fan 209 is communicated with the dust-collection chamber 201. The fan 209 is configured to generate the airflow that flows into the dust-collection chamber 201, and the dust-collection chamber 201 is configured to accommodate the waste objects carried by the airflow. The base station 300 includes the dust-collection fan 320, and the dust-collection fan 320 is configured to suck the waste objects in the dust-collection chamber 201 into the base station 300. The cleaning system 10 has a dust-collection mode. In the dust-collection mode, the self-propelled cleaning device 1 is docked with the base station 300. The dust-collection fan 320 and the fan 209 have an alternating start-up phase. During the alternating start-up phase, the dust-collection fan 320 and the fan 209 are started alternately.

[0158] In some embodiments, the self-propelled cleaning device 1 and the base station 300 cooperate with each other to perform a dust-collection method. The dust-collection method includes: S100, controlling the self-propelled cleaning device to dock with the base station; S200, controlling the dust-collection fan and the fan to operate in sequence; and S300, controlling the dust-collection fan to operate again.

[0159] When the dust-collection fan 320 is operating, the waste objects in the dust-collection chamber 201 may be sucked into the base station 300 along the suction path. When there are many waste objects in the dust-collection chamber 201, it is easy to cause blockage of the waste objects in the suction path. In some embodiments, the waste objects in the dust-collection chamber 201 may be sucked into a dust bag of the base station 300 through the dust-collection channel 1031. When there are too many waste objects in the dust-collection chamber 201, it is easy to cause blockage of the waste objects in the dust-collection channel 1031 or at the entrance of the dust-collection channel 1031. The dust-collection fan 320 may be controlled to start at least twice. After the dust-collection fan 320 is started to operate, operating power and operating duration of the dust-collection fan 320 may be controlled, so that some of the waste objects in the dust-collection chamber 201 are first sucked into the base station 300, which is not easy to cause blockage of the waste objects. After the dust-collection fan 320 is subsequently started to operate, the remaining waste objects in the dust-collection chamber 201 are partially sucked into the base station 300.

[0160] During the alternating start-up phase, when the dust-collection fan 320 is controlled to stop operating, the fan 209 may be controlled to start. An airflow path formed by the operation of the fan 209 is different from an airflow path formed by the operation of the dust-collection fan 320. Therefore, the operation of the fan 209 may reduce the risk of waste object blockage and improve the dust-collection effect.

[0161] In addition, the alternating start-up of the dust-collection fan 320 and the fan 209 may reduce generated noise.

[0162] In some embodiments, in the dust-collection mode, during the alternating start-up phase, the fan 209 and the

dust-collection fan 320 operate alternately. This prevents partial airflow generated by the dust-collection fan 320 and partial airflow generated by the fan 209 from opposing and canceling each other out.

[0163] In some embodiments, during the alternating start-up phase, the operating time of the dust-collection fan 320 and the operating time of the fan 209 partially overlap. That is, during the alternating start-up phase, there may be situations where the dust-collection fan 320 and the fan 209 do not operate at the same time, and there are also situations where the dust-collection fan 320 and the fan 209 operate at the same time. The simultaneous operation of the dust-collection fan 320 and the fan may generate a more complex airflow path, which may further reduce the dust-collection dead corners and enhance the suction force on the rolling brush 1011, thereby improving the cleaning effect on the rolling brush 1011.

[0164] In some embodiments, the operation S200 may be performed once during the dust-collection process. In some embodiments, the operation S200 may be repeatedly performed during the dust-collection process. In some embodiments, the operation S200 may be performed at least twice. In some embodiments, the operation S200 may be performed twice or three times, and the operation S300 may be performed after the operation S200 is performed twice or three times.

[0165] In some embodiments, during the dust-collection process, the dust-collection fan 320 may be continuously started at least twice, and then the dust-collection fan 320 stops operating and the fan 209 is started.

[0166] In some embodiments, during the dust-collection process, the fan 209 may be continuously started at least twice, and then the fan 209 stops operating and the dust-collection fan 320 is started.

[0167] In some embodiments, in a dust-collection mode, the first start-up of the dust-collection fan 320 is before the first start-up of the fan 209. In some embodiments, the first operation of the dust-collection fan 320 is before the first operation of the fan 209, that is, the first stop operation of the dust-collection fan 320 is before the first start-up of the fan 209.

[0168] With such arrangement, the waste objects in the dust-collection chamber 201 may be sucked into the base station 300 as early as possible, which is beneficial for shortening the dust-collection time.

[0169] In some embodiments, in the dust-collection mode, the fan 209 is first started.

[0170] In some embodiments, in the dust-collection mode, the last start-up of the dust-collection fan 320 is after the last start-up of the fan 209. In some embodiments, the last operation of the dust-collection fan 320 is after the last operation of the fan 209, that is, the last start-up of the dust-collection fan 320 is after the last stop operation of the fan 209.

[0171] In some embodiments, during the dust-collection process, the dust-collection fan 320 may operate twice, the fan 209 may operate once, and the operation of the fan 209 is disposed between the two operations of the dust-collection fan 320. In some embodiments, during the dust-collection process, the dust-collection fan 320 may operate three times, and the fan 209 may operate two times. In some embodiments, the dust-collection fan 320 and the fan 209 operate alternately according to a sequence shown in Table 1. In some embodiments, the dust-collection fan 320 and the fan 209 operate alternately according to sequences shown in Table 2 and Table 3.

Table 1: example of operating time sequences of dust-collection fan, fan, and rolling brush motor in dust-collection mode

duration (s)	ratio of operating power to rated power of dust-collection fan (%)	ratio of operating power to rated power of fan (%)	voltage of rolling brush motor (mv)
5	65	0	10500
1	0	0	0
5	0	80	-10500
8	100	0	10500
1	0	0	0
5	0	80	-10500
5	100	0	10500

[0172] In some embodiments, there is a power ramp-up process in the operation of the dust-collection fan 320. During the power ramp-up process, the operating power of the dust-collection fan 320 in a previous operating process is less than the operating power of the dust-collection fan 320 in a subsequent operating process.

[0173] In some embodiments, in the dust-collection mode, the dust-collection fan 320 is started at least twice, and the operating power of the dust-collection fan 320 at the first start-up is less than the operating power of the dust-collection fan 320 at the second start-up.

[0174] With such arrangement, during the dust-collection process, the operating power of the dust-collection fan 320 before the power ramp-up process is relatively low, so that the amount of the waste objects sucked by the dust-collection fan 320 may not be too large, which is not easy to cause blockage of the waste objects. After the power ramp-up process, the operating power of the dust-collection fan 320 is relatively larger, which is conducive to fully sucking the waste objects

into the base station 300, thereby improving the dust-collection effect.

[0175] In some embodiments, as shown in Table 1, the power ramp-up process occurs during the first operation and the second operation of the dust-collection fan 320, and a ratio of the operating power to the rated power of the dust-collection fan 320 increases from 65% to 100%.

[0176] In some embodiments, the power ramp-up process may occur over three or four adjacent operations of the dust-collection fan 320. In some embodiments, the ratio of the operating power to the rated power of the dust-collection fan 320 may increase from 40% during the first operation to 65% during the second operation, and then to 100% during the third operation. The number of operating times of the dust-collection fan 320 included in the power ramp-up process may be set according to the capacity of the dust-collection chamber 201 and the cross-sectional size of the suction path. The larger the capacity of the dust-collection chamber 201 and the smaller the cross-sectional size of the suction path, the more the operating times of the dust-collection fan 320 included in the power ramp-up process, and the lower the operating power of the dust-collection fan 320 in the early operation stage.

[0177] In some embodiments, the operating power of the dust-collection fan 320 at the first start-up may also be equal to the operating power of the dust-collection fan 320 at the second start-up. In this embodiment, the operating power of the dust-collection fan 320 may be kept consistent for each start-up.

[0178] In some embodiments, the ratio of the operating power to the rated power of the dust-collection fan 320 may be 30%, 40%, 50%, or 70%.

[0179] In some embodiments, during the power ramp-up process, the ratio of the operating power of the dust-collection fan 320 in the previous operating process to the operating power of the dust-collection fan 320 in the subsequent operating process ranges from 50% to 80%.

[0180] In some embodiments, the ratio of the operating power of the dust-collection fan 320 in the previous operating process to the operating power of the dust-collection fan 320 in the subsequent operating process is 55%, 65%, or 75%.

[0181] In some embodiments, the operating power of the dust-collection fan 320 after the power ramp-up process is the same as the operating power at the last operating cycle during the power ramp-up process.

[0182] In some embodiments, in the dust-collection mode, the dust-collection fan 320 is started at least three times, and the operating power of the dust-collection fan 320 at each start-up after the second start is the same as the operating power at the second start-up.

[0183] The operating power of the dust-collection fan 320 for the second start-up may be the maximum operating power of the dust-collection fan 320 or other set power. In some embodiments, when the operating power of the dust-collection fan 320 during the second start-up is 100% of the rated power, the operating power of the dust-collection fan 320 after the second start-up is all set to 100% of the rated power. In this way, it is beneficial to fully suck the waste objects into the base station 300 and improve the dust-collection effect. In some embodiments, after the operating power of the dust-collection fan 320 reaches the maximum operating power, it may continue to operate for once, twice, or three times.

[0184] In some embodiments, during the dust-collection process, the operating power of the fan 209 may be 80% of the rated power, which is beneficial for improving the service life of fan 209. When cleaning the operating surface by using the self-propelled cleaning device 1, the operating power of the fan 209 may also be 80% of the rated power. It is worth mentioning that the rated power of the fan 209 may be less than or equal to the rated power of the dust-collection fan 320.

[0185] In some embodiments, during the power ramp-up process, the operating duration of the dust-collection fan 320 during the subsequent operating process is greater than the operating duration of the dust-collection fan 320 during the previous operating process. In some embodiments, as shown in Table 1, during the power ramp-up process, the operating duration of the dust-collection fan 320 during the subsequent operating process is 8 seconds, and the operating duration of the dust-collection fan 320 during the previous operating process is 5 seconds. That is, during the power ramp-up process, as the operating power of the dust-collection fan 320 increases, the operating duration of the dust-collection fan 320 in each cycle also increases.

[0186] In some embodiments, when the number of the operating cycles of the dust-collection fan 320 is greater than 2 times during the power ramp-up process, the operating duration of the dust-collection fan 320 may increase progressively with each cycle. In some embodiments, the operating duration of the dust-collection fan 320 in each cycle may increase from 5 seconds in the first operating cycle to 8 seconds in the second operating cycle, and then to 12 seconds in the third operating cycle. The operating duration of the dust-collection fan 320 in each cycle during the later stage of the power ramp-up process may be set according to the capacity of the dust-collection chamber 201 and the cross-section size of the suction path. The larger the capacity of the dust-collection chamber 201 and the smaller the cross-sectional size of the suction path, the longer the operating duration of the dust-collection fan 320 in each cycle during the later stage of the power ramp-up process.

[0187] In some embodiments, the operating duration of the dust-collection fan 320 in each cycle may be 3 seconds, 10 seconds, or 15 seconds.

[0188] In some embodiments, the operating duration of the dust-collection fan 320 in the last operating cycle during the power ramp-up process is greater than the single operating duration of the dust-collection fan 320 after the power ramp-up process. In some embodiments, as shown in Table 1, the operating duration of the dust-collection fan 320 in the last

operating cycle during the power ramp-up process is 8 seconds, and the single operating duration of the dust-collection fan 320 after the power ramp-up process is 5 seconds. In some embodiments, the operating duration of the dust-collection fan 320 in the last operating cycle during the power ramp-up process is 12 seconds, and the single operating duration of the dust-collection fan 320 after the power ramp-up process is 6 seconds.

[0189] During the power ramp-up process, both the operating power and the operating duration of the dust-collection fan 320 in the last operating cycle reach their maximum, which may suck most of the waste objects into the base station 300. Therefore, a smaller single operating duration of the dust-collection fan 320 after the power ramp-up process is beneficial for saving suction time and improving time efficiency.

[0190] In some embodiments, controlling the fan to operate after the dust-collection fan is controlled to stop operating, includes:

S201, controlling the fan to operate after the dust-collection fan is controlled to stop for a preset interval time.

[0191] Controlling the dust-collection fan to operate again after the fan stops operating, includes:

S301: controlling the dust-collection fan to operate after the fan is controlled to stop for a preset interval time.

[0192] In some embodiments, as shown in Table 1, the preset interval time is 1 second. After controlling the dust-collection fan 320 to stop for 1 second, the fan 209 is controlled to start. After controlling the fan 209 to stop for 1 second, the dust-collection fan 320 is controlled to start. In some embodiments, the preset interval time may also be set to 0.5 seconds, 2 seconds, or 3 seconds. Additionally, these two preset interval times may be the same or different.

[0193] After the dust-collection fan 320 or the fan 209 stops, there may be a delay in the cessation of the generated airflow. By setting the preset interval time, cancellation between partial airflow generated by the dust-collection fan 320 and fan 209 may be reduced.

[0194] In some embodiments, in dust-collection mode, the fan 209 has at least first operating power and second operating power, and the first operating power is less than the second operating power. In some embodiments, as shown in Table 2, the first operating power may be 12% of the rated power, and the second operating power may be 80% of the rated power.

[0195] In this way, the fan 209 may change the dust-collection power to achieve different functional effects.

[0196] In some embodiments, in the dust-collection mode, the operating power of the fan 209 increases from the first operating power to the second operating power during at least one continuous operation of the fan 209.

[0197] In some embodiments, when the fan 209 operates at the first operating power, the waste objects may be sucked into the dust-collection chamber 201. When the fan 209 operates at the second operating power, the waste objects in the dust-collection chamber 201 may be stirred up and lifted, so that the waste objects are fully sucked into the base station 300.

Table 2: another example of operating time sequence of fan in dust-collection mode

duration (s, from start of dust-collection mode)	ratio of operating power to rated power of fan (%)
6	0
10	12
5	80
9	0
13	12
5	80
5	0
16	12
8	0

Table 3: another example of operating time sequence of dust-collection fan in dust-collection mode

duration (s, from start of dust-collection mode)	ratio of operating power to rated power of dust-collection fan (%)
5	65
16	0
8	100
19	0
5	100

(continued)

duration (s, from start of dust-collection mode)	ratio of operating power to rated power of dust-collection fan (%)
16	0
8	100

Table 4: another example of operating time sequence of rolling brush motor in dust-collection mode

duration (s, from start of dust-collection mode)	voltage of rolling brush motor
3	10500
1	0
7	-10500
1	0
7	10500
1	0
10	-10500
1	0
5	10500
1	0
10	-10500
1	0
5	10500
1	0
20	-10500

[0198] In some embodiments, the self-propelled cleaning device 1 further includes the rolling brush motor, and the rolling brush motor is configured to drive the rolling brush 1011 to rotate. In dust-collection mode, the rolling brush motor drives the rolling brush 1011 to alternate between forward rotation and reverse rotation. A forward direction refers to a rotation direction of the rolling brush 1011 when the self-propelled cleaning device 1 cleans the operating surface.

[0199] As shown in Tables 1 and 4, when the voltage of the rolling brush motor is positive, the rolling brush 1011 is controlled to rotate in the forward direction. When the voltage of the rolling brush motor is negative, the rolling brush 1011 is controlled to rotate in reverse.

[0200] In some embodiments, in the dust-collection mode, after the rolling brush motor is first started, the rolling brush motor drives the rolling brush 1011 to rotate in the forward direction, so as to prevent the rolling brush 1011 from spitting out large-particle waste objects from the dust-suction port 101 at the beginning of the dust-collection process. Therefore, after the rolling brush motor is first started, the rolling brush motor first drives the rolling brush 1011 to rotate in the forward direction, and then switches to reverse rotation. In some embodiments, the rolling brush motor may first drive the rolling brush 1011 to rotate in reverse.

[0201] In some embodiments, in dust-collection mode, the stop time of the rolling brush 1011 after the last start-up is earlier than the stop time of the dust-collection fan 320 after the last start-up.

[0202] The dust-collection fan 320 may suck the waste objects on the rolling brush 1011 into the dust-collection chamber 201 and further suck them into the base station 300. This setting is beneficial for improving the cleaning effect of the dust-collection fan 320 on the rolling brush 1011.

[0203] In some embodiments, in dust-collection mode, the rolling brush 1011 switches from forward rotation to reverse rotation at least twice. That is, in the dust-collection mode, the rolling brush 1011 undergoes at least two rounds of forward and reverse rotation. This setting is beneficial for improving the cleaning effect of the rolling brush 1011.

[0204] In this embodiment, the dust-discharge port 103 is defined on the tail part 129 of the device body 100. Therefore, in the dust-collection mode, the tail part of the self-propelled cleaning device 1 is docked with the base station 300, that is, the tail part 129 of the device body 100 is docked with the base station 300. As shown in FIG. 5, the self-propelled cleaning device 1 further includes a charging electrode piece 500. The charging electrode piece 500 is disposed on the bottom 122 of the device body 100 and close to the head part 128. Therefore, in a charging mode, the head part of the self-propelled

cleaning device 1 is docked with the base station 300, that is, the head part 128 of the device body 100 is docked with the base station 300. That is, when the self-propelled cleaning device 1 needs to perform the dust-collection operation, the self-propelled cleaning device 1 first mounts onto the base station 300 with its tail part 129 facing the base station 300. After completing the dust-collection operation, the self-propelled cleaning device 1 first needs to leave the base station 300, rotate 180°, and then mount onto the base station 300 with its head part 128 facing the base station 300, so that the base station 300 may charge the self-propelled cleaning device 1. In this embodiment, disposing the charging electrode piece 500 on the bottom 122 of the device body 100 and close to the head part 128 may reduce the weight of the tail part 129 of the device body 100, and reasonably distribute the center of gravity of the self-propelled cleaning device 1, thereby preventing the self-propelled cleaning device 1 from lifting its front end (nose-up phenomenon) during traveling.

[0205] In some embodiments, the charging electrode piece 500 may also be disposed on the tail part 129 of the device body 100. Therefore, in both the charging mode and the dust-collection mode, the docking positions of the self-propelled cleaning device 1 with the base station 300 are the same. When switching from the dust-collection mode to the charging mode, the self-propelled cleaning device 1 does not need to change the position, thereby improving overall efficiency.

Claims

1. A cleaning system, comprising:

a self-propelled cleaning device, comprising a driving wheel, a device body, and a handheld vacuum cleaner, wherein the handheld vacuum cleaner is detachably connected to the device body; the driving wheel is disposed on the device body and configured to drive the device body to travel on an operating surface; the handheld vacuum cleaner comprises a handle and a fan; the handheld vacuum cleaner defines a dust-collection chamber, an air inlet, and a dust-removal port; the air inlet and the dust-removal port are communicated with the dust-collection chamber; the device body defines a dust-suction port, and the dust-suction port is communicated with the air inlet; the fan defines an air intake that is communicated with the dust-collection chamber, and the fan is configured to form airflow that flows from the dust-suction port to the dust-collection chamber through the air inlet; and the dust-collection chamber is configured to accommodate a waste object carried by the airflow; and a base station, defining a dust-collection port; wherein the dust-collection port is configured to be communicated with the dust-removal port, so that the waste object in the dust-collection chamber is able to enter the base station through the dust-removal port and the dust-collection port.

2. The cleaning system according to claim 1, wherein

the device body defines a dust outlet that is communicated with the dust-suction port, and the dust outlet is configured to be aligned and communicated with the air inlet when the handheld vacuum cleaner is assembled on the device body; and the device body defines a dust-discharge port and a dust inlet that are communicated with each other, the dust-discharge port is configured to be communicated with the dust-collection port, and the dust inlet is configured to be communicated with the dust-removal port.

3. The cleaning system according to claim 1, wherein

the base station is provided with a dust-collection fan; the handheld vacuum cleaner is provided with a covering member, the covering member is movably disposed on the dust-removal port, and the covering member is configured to switch between a closed position and an open position relative to the dust-removal port; the covering member is configured to cover the dust-removal port in the closed position, and to uncover the dust-removal port by moving from the closed position to the open position due to being attracted by the dust-collection fan.

4. The cleaning system according to claim 1, wherein

the device body is provided with a first electrical connection part, and the handheld vacuum cleaner is provided with a second electrical connection part; when the handheld vacuum cleaner is assembled onto the device body, the first electrical connection part is connected to the second electrical connection part; and the handheld vacuum cleaner further comprises a power supply assembly, and the power supply assembly is electrically connected to the second electrical connection part and the fan, respectively; and the power supply assembly is configured to supply power to the device body when the second electrical connection part is connected to the first electrical connection part.

5. The cleaning system according to any one of claims 1 to 4, wherein the device body defines a recessed groove, and the handheld vacuum cleaner is detachably disposed in the recessed groove.

6. The cleaning system according to claim 5, wherein

the device body comprises a top and a bottom that are disposed opposite to each other, and the recessed groove is recessed along a direction from the top to the bottom; and
the bottom defines an extension port, and the extension port is communicated with the recessed groove; when the handheld vacuum cleaner is assembled onto the device body, a portion of the handheld vacuum cleaner is exposed through the extension port.

7. The cleaning system according to claim 5, wherein

the device body comprises a positioning post disposed in the recessed groove, and the handheld vacuum cleaner defines a positioning groove that is configured to cooperate with the positioning post; and the positioning post is configured to be inserted into the positioning groove, so as to limit the handheld vacuum cleaner in the recessed groove;
the positioning post is provided with a catch, and a groove wall of the positioning groove defines a snap groove; and the catch is configured to be embedded in the snap groove when the positioning post is inserted into the positioning groove, so that the handheld vacuum cleaner is connected to the device body by a snap-fit connection; and
the device body comprises an unlocking mechanism, and the unlocking mechanism is movably disposed on the positioning post and exposed to outside; and the unlocking mechanism is configured to be pressed to drive the catch to detach from the snap groove, so that the handheld vacuum cleaner is disconnected from the device body by releasing the snap-fit connection.

8. The cleaning system according to claim 1, wherein

the device body comprises a head part facing a forward direction of the self-propelled cleaning device and a tail part facing away from the forward direction; and the handheld vacuum cleaner is detachably disposed on the tail part and exposed to outside;
the device body defines a dust-discharge port and a dust inlet that are communicated with each other, the dust-discharge port is configured to be communicated with the dust-collection port, and the dust inlet is configured to be communicated with the dust-removal port; and the dust-discharge port is defined on the tail part; and
a peripheral contour of the tail part is in the shape of a circular arc, an outer contour of a peripheral contour of the handheld vacuum cleaner close to the tail part is in the shape of a matching circular arc.

9. The cleaning system according to claim 1, wherein

the cleaning system further comprises an accessory for the handheld vacuum cleaner, and the accessory is configured to be assembled on the air inlet;
at least one accessory is detachably disposed on the device body; and
the device body comprises a head part facing a forward direction of the self-propelled cleaning device and a tail part facing away from the forward direction, the head part defines a receiving groove, and the accessory is configured to be detachably received in the receiving groove.

10. The cleaning system according to claim 1, wherein

the handheld vacuum cleaner defines an air exhaust port that is communicated with outside, and the fan is communicated with the air exhaust port; and
when the handheld vacuum cleaner is assembled and connected to the device body, the air exhaust port is defined to face upwards, and the device body is disposed to avoid the air exhaust port.

11. The cleaning system according to claim 1, wherein

the handheld vacuum cleaner further comprises an apparatus body and a receiving part, and the receiving part is configured to be detachably connected to the apparatus body to define the dust-collection chamber; and the air inlet is defined on the apparatus body, the dust-removal port is defined on the receiving part, the fan is disposed inside the

apparatus body, and the handle is connected to the apparatus body.

12. The cleaning system according to claim 11, wherein
the handheld vacuum cleaner further comprises a power supply assembly and a control button assembly, and the
power supply assembly is disposed adjacent to the receiving part; the handle and the air inlet are disposed on two
opposite sides of the apparatus body, respectively; the handle comprises a first end and a second end, the power
supply assembly is adjacent to the first end of the handle, and the second end of the handle is connected to the
apparatus body; and the control button assembly is disposed on the handle and close to the second end of the handle.

13. The cleaning system according to claim 11, wherein

the handheld vacuum cleaner further comprises a centrifugal separation mechanism, and the centrifugal
separation mechanism is connected to the apparatus body and disposed inside the dust-collection chamber;
a separation space is defined inside the centrifugal separation mechanism, and the separation space is
communicated with the air intake and the dust-collection chamber, respectively; the airflow formed by the fan
sequentially flows through the dust-suction port, the air inlet, the dust-collection chamber, the separation space,
and the air intake; and
the centrifugal separation mechanism is disposed between the fan and the receiving part, and the air inlet is
disposed between the fan and the receiving part.

14. The cleaning system according to claim 13, wherein

The centrifugal separation mechanism defines a communication port;
the handheld vacuum cleaner comprises a partition member, and the partition member is movably disposed on
the communication port to cover or uncover the communication port; and
the base station comprises a dust-collection fan that is communicated with the dust-collection port, the partition
member is configured to be attracted by the dust-collection fan and move from a position of covering the
communication port to a position of uncovering the communication port.

15. The cleaning system according to claim 1, wherein
the device body comprises a body, a rolling brush, and comb teeth; the rolling brush is rotatably connected to the body,
and the rolling brush is disposed on the dust-suction port; and the comb teeth are connected to the body, and the comb
teeth are configured to clean hair wrapped around the rolling brush.

16. A cleaning system, comprising:

a self-propelled cleaning device; and
a base station, configured to be docked with the self-propelled cleaning device;
wherein the self-propelled cleaning device defines a dust-collection chamber; the self-propelled cleaning device
comprises a fan, and the fan is communicated with the dust-collection chamber; the fan is configured to generate
airflow that flows into the dust-collection chamber, and the dust-collection chamber is configured to accommodate
a waste object carried by the airflow; and the base station comprises a dust-collection fan, and the dust-collection
fan is configured to suck the waste object in the dust-collection chamber into the base station;
the cleaning system has a dust-collection mode, and the self-propelled cleaning device is configured to be docked
with the base station in the dust-collection mode; and
in the dust-collection mode, the dust-collection fan and the fan have an alternating start-up phase, and the dust-
collection fan and the fan are started alternately during the alternating start-up phase.

17. The cleaning system according to claim 16, wherein in the dust-collection mode:

first start-up of the dust-collection fan is before first start-up of the fan;
stop time of the fan after last start-up is earlier than stop time of the dust-collection fan after last start-up;
the dust-collection fan is started at least twice, and operating power of the dust-collection fan at the first start-up is
less than or equal to the operating power of the dust-collection fan at second start-up; and/or
the dust-collection fan is started at least three times, and the operating power of the dust-collection fan at each
start-up after the second start-up is the same as the operating power of the dust-collection fan at the second start-
up.

18. The cleaning system according to any one of claims 16 or 17, wherein in the dust-collection mode:

the fan has at least first operating power and second operating power, and the first operating power is less than the second operating power; and
the operating power of the fan increases from the first operating power to the second operating power during at least one continuous operating process.

19. The cleaning system according to any one of claims 16 or 17, wherein in the dust-collection mode:

during the alternating start-up phase, the fan and the dust-collection fan operate alternately; or
during the alternating start-up phase, operating time of the dust-collection fan and operating time of the fan partially overlap.

20. The cleaning system according to any one of claims 16 or 17, wherein,

the self-propelled cleaning device defines a dust-suction port that is communicated with the dust-collection chamber; the self-propelled cleaning device comprises a rolling brush motor and a rolling brush, the rolling brush is disposed on the dust-suction port, and the rolling brush motor is configured to drive the rolling brush to rotate; and
in the dust-collection mode, the rolling brush motor drives the rolling brush to alternate between forward rotation and reverse rotation, and a forward direction refers to a rotation direction of the rolling brush when the self-propelled cleaning device cleans an operating surface.

21. The cleaning system according to claim 20, wherein in the dust-collection mode:

the rolling brush motor drives the rolling brush to rotate in the forward direction after the first start-up; stop time of the rolling brush after the last start-up is earlier than stop time of the dust-collection fan after the last start-up; and
the rolling brush is configured to switch from forward rotation to reverse rotation at least twice.

22. The cleaning system according to any one of claims 16 or 17, wherein

the cleaning system has a charging mode, and the base station is configured to charge the self-propelled cleaning device in the charging mode;
the cleaning system is configured to enter the charging mode after ending the dust-collection mode;
in the dust-collection mode, a tail part of the self-propelled cleaning device is configured to be docked with the base station; and
in the charging mode, a head part of the self-propelled cleaning device is configured to be docked with the base station.

23. A self-propelled cleaning device, comprising:

a first functional mechanism, comprising a first body and an electronic control system disposed on the first body; a device body, wherein the first body is detachably connected to the device body;
wherein the electronic control system comprises a power supply circuit and a monitoring circuit electrically connected to the power supply circuit; and the monitoring circuit is configured to detect an electrical connection state between the first functional mechanism and the device body, and to control the power supply circuit to supply power to the device body when the first functional mechanism and the device body are in the electrical connection state.

24. The self-propelled cleaning device according to claim 23, wherein the monitoring circuit is configured to detect a voltage change of a transmission voltage between the first functional mechanism and the device body, and to determine the electrical connection state between the first functional mechanism and the device body based on the voltage change; and

when the transmission voltage changes from a first preset voltage value to a second preset voltage value, it is determined that a connection state between the first functional mechanism and the device body switches from a separated state to an electrically connected state; and the first preset voltage value is different from the second preset voltage value.

25. The self-propelled cleaning device according to claim 24, wherein the monitoring circuit comprises a main control circuit, a second electrical connection part, and an insertion detection circuit; and the device body comprises a second body, a power feeding circuit disposed on the second body, and a first electrical connection part disposed on the second body;

the second electrical connection part is configured to be electrically connected to the first electrical connection part; the insertion detection circuit is electrically connected to the main control circuit and the second electrical connection part, respectively; the insertion detection circuit is configured to detect the voltage change of the transmission voltage of the second electrical connection part; and the power feeding circuit is electrically connected to the first electrical connection part; and
the power supply circuit is electrically connected to the second electrical connection part and the main control circuit, respectively; when the main control circuit determines, based on a detection result of the insertion detection circuit, that the second electrical connection part is electrically connected to the first electrical connection part, the main control circuit controls the power supply circuit to supply power to the second electrical connection part, so as to supply power to the first electrical connection part.

26. The self-propelled cleaning device according to claim 25, wherein

the insertion detection circuit comprises:

a first voltage-dividing resistor, wherein a first end of the first voltage-dividing resistor is configured to be connected to a supply voltage;
a second voltage-dividing resistor, wherein a first end of the second voltage-dividing resistor is electrically connected to a second end of the first voltage-dividing resistor, the power supply circuit, and the second electrical connection part, respectively; and
a third voltage-dividing resistor, wherein a first end of the third voltage-dividing resistor is electrically connected to the main control circuit and a second end of the second voltage-dividing resistor, respectively;
and a second end of the third voltage-dividing resistor is grounded;

the device body further comprises a fourth voltage-dividing resistor, a first end of the fourth voltage-dividing resistor is electrically connected to the first electrical connection part and the power feeding circuit, and a second end of the fourth voltage-dividing resistor is grounded;
the insertion detection circuit further comprises a diode, an anode of the diode is connected to the supply voltage, and a cathode of the diode is electrically connected to the first end of the first voltage-dividing resistor; and/or
the insertion detection circuit further comprises a current-limiting filter circuit; and the current-limiting filter circuit is electrically connected to the main control circuit, the second end of the second voltage-dividing resistor, and the first end of the third voltage-dividing resistor, respectively.

27. The self-propelled cleaning device according to claim 23, wherein the first functional mechanism further comprises a first communication circuit, and the device body further comprises a second communication circuit; and

the first communication circuit is configured to be in signal communication with the second communication circuit, and the monitoring circuit is electrically connected to the first communication circuit;
when the monitoring circuit determines, based on a communication state between the first communication circuit and the second communication circuit, that the first functional mechanism is separated from the device body, the monitoring circuit controls the power supply circuit to disconnect power supply to the device body.

28. The self-propelled cleaning device according to claim 27, wherein when the first functional mechanism is electrically connected to the device body, the first communication circuit sends a heartbeat data packet to the second communication circuit and receives feedback data of the heartbeat data packet from the second communication circuit;

when the first communication circuit does not receive the feedback data within a preset time period, the monitoring circuit controls the power supply circuit to disconnect power supply to the device body;
the first communication circuit comprises a first communication terminal and a first protection circuit electrically connected to the first communication terminal;
the second communication circuit comprises a second communication terminal and a second protection circuit electrically connected to the second communication terminal;

the first communication terminal is configured to be electrically connected to the second communication terminal, so as to achieve signal communication; the first protection circuit is configured to block high voltage input when the first communication terminal is electrically connected to the second communication terminal; and the second protection circuit is configured to block high voltage input when the second communication terminal is electrically connected to the first communication terminal.

29. The self-propelled cleaning device according to claim 23, wherein the electronic control system further comprises a switch, a control terminal of the switch is electrically connected to the monitoring circuit, a communication terminal of the switch is electrically connected to the power supply circuit, and another communication terminal of the switch is configured to be electrically connected to the device bod; and the monitoring circuit is configured to control the switch to close when the first functional mechanism is electrically connected to the device body, and to control the switch to open when the first functional mechanism is separated from the device body.

30. The self-propelled cleaning device according to any one of claims 23 to 29, wherein the device body defines a dust-suction port, and the first functional mechanism comprises a handheld vacuum cleaner; the handheld vacuum cleaner further comprises a handle, a fan, and a power supply assembly; the handheld vacuum cleaner defines a dust-collection chamber and an air inlet that is configured to be communicated with the dust-collection chamber, and the fan defines an air intake that is communicated with the dust-collection chamber; when the first functional mechanism is connected to the device body, the dust-suction port is communicated with the air inlet; and the fan is configured to form airflow that flows from the dust-suction port and the air inlet into the dust-collection chamber, and the dust-collection chamber is configured to accommodate a waste object carried by the airflow; and the power supply assembly serves as the power supply circuit and is electrically connected to the fan and the monitoring circuit, and the power supply assembly is configured to provide electrical energy to the fan and supply power to the device body under control of the monitoring circuit.

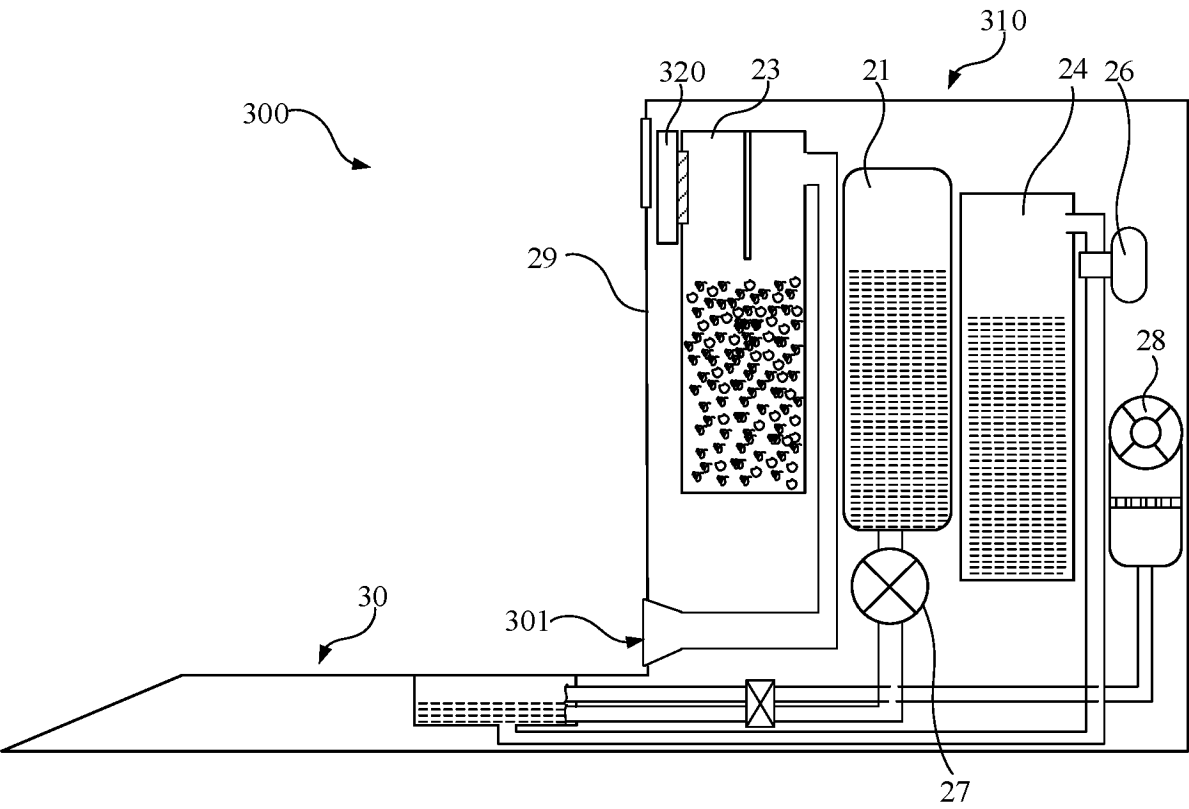


FIG. 1

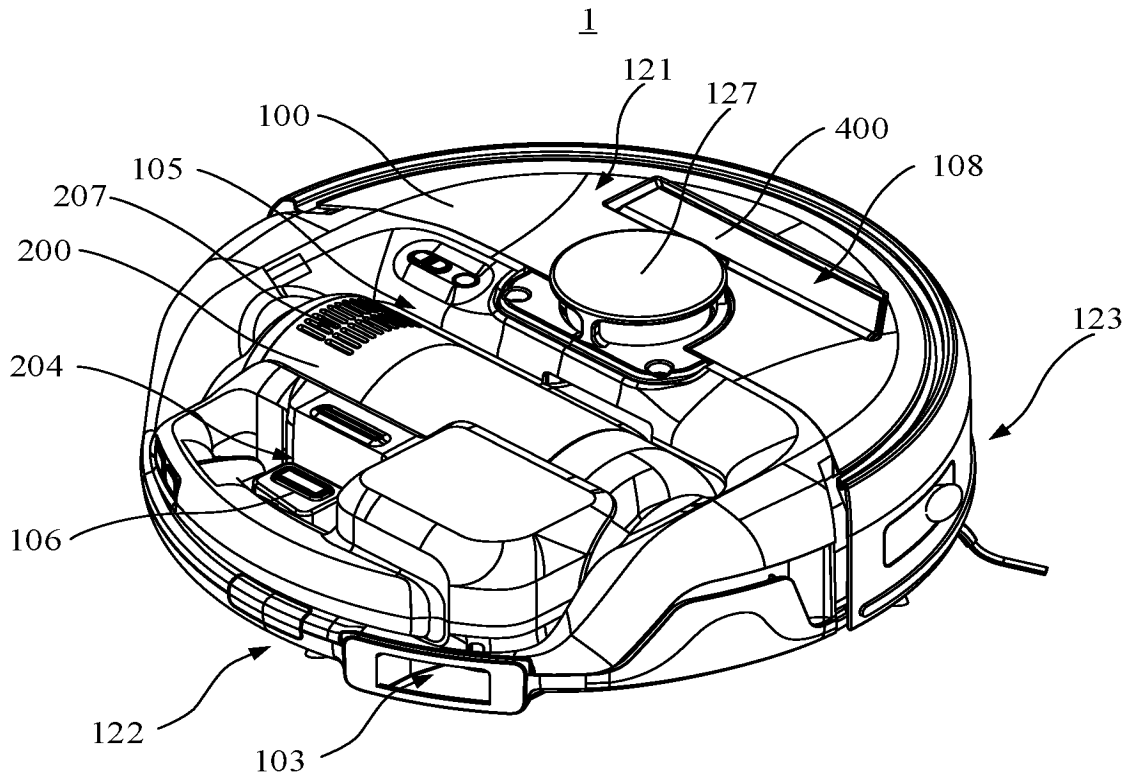


FIG. 2

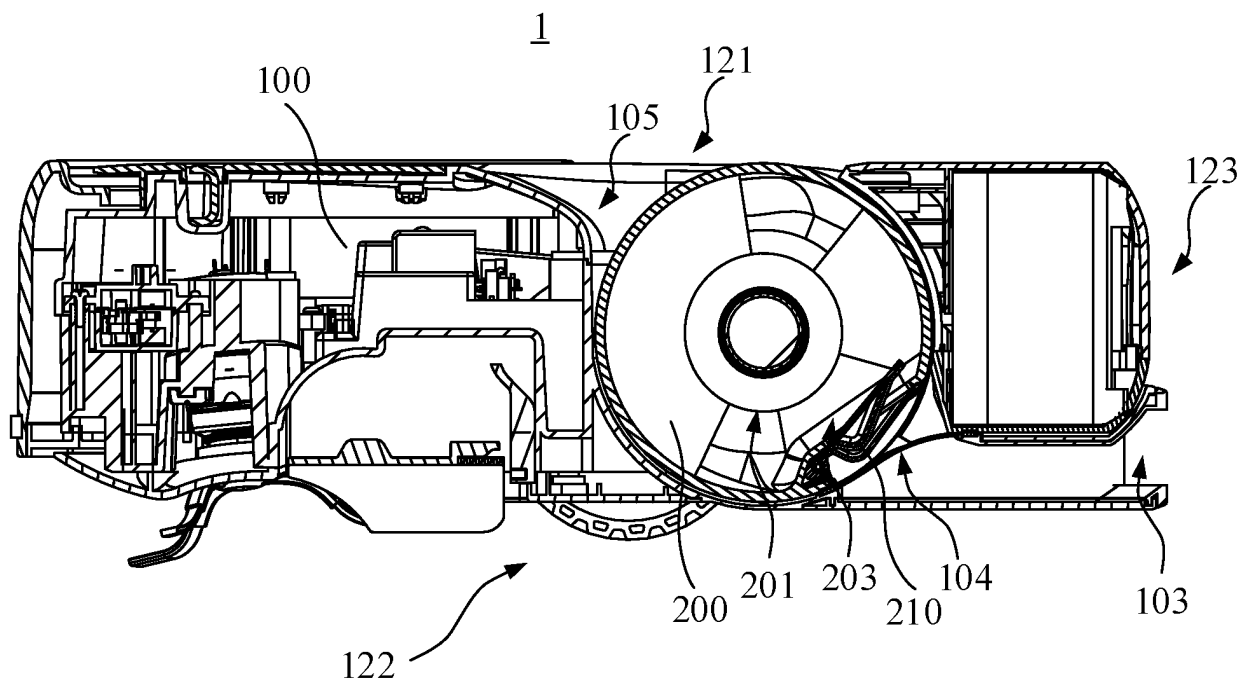


FIG. 3

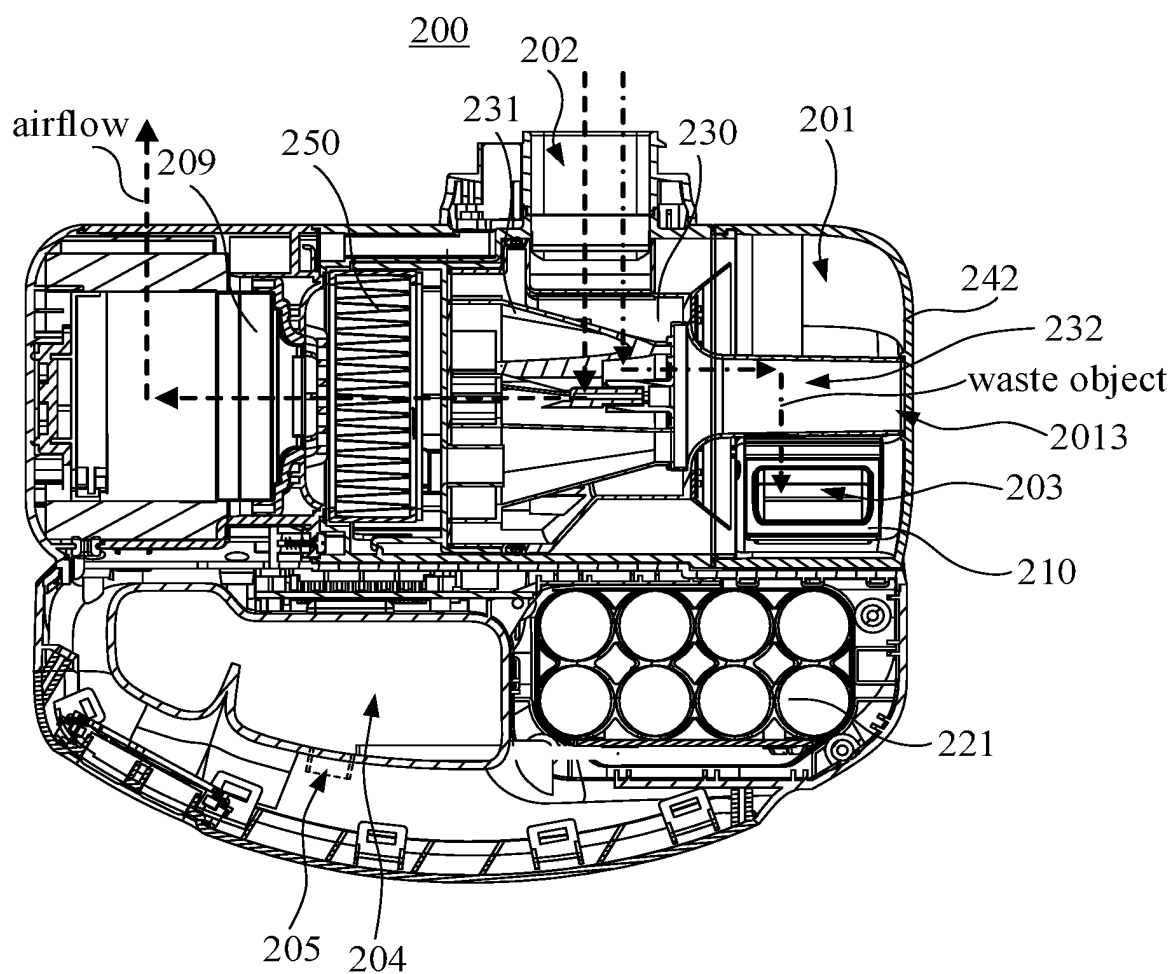


FIG. 4

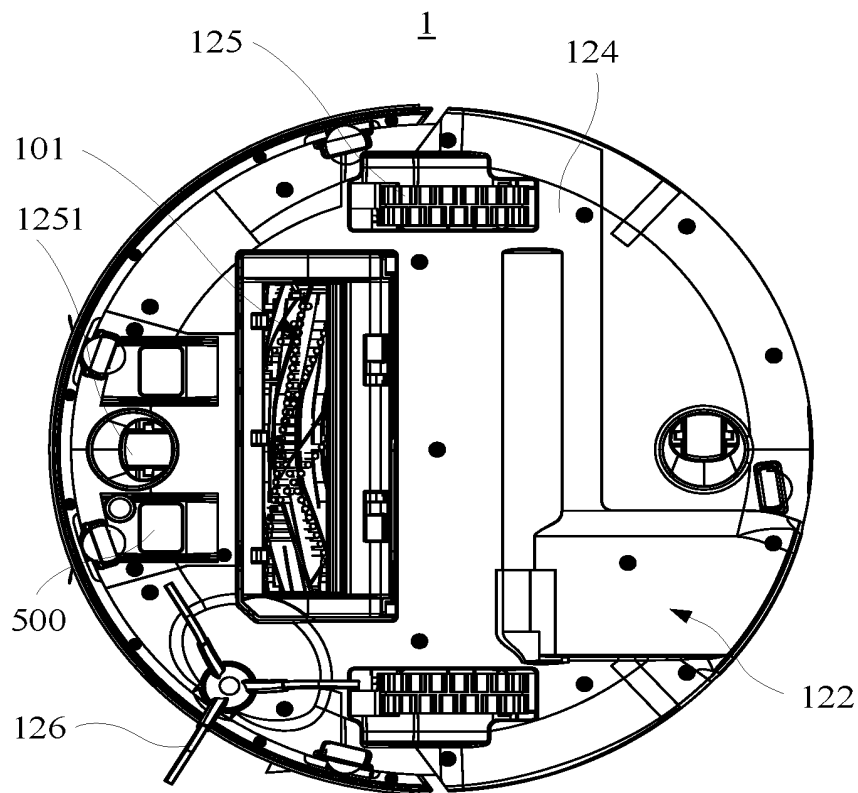


FIG. 5

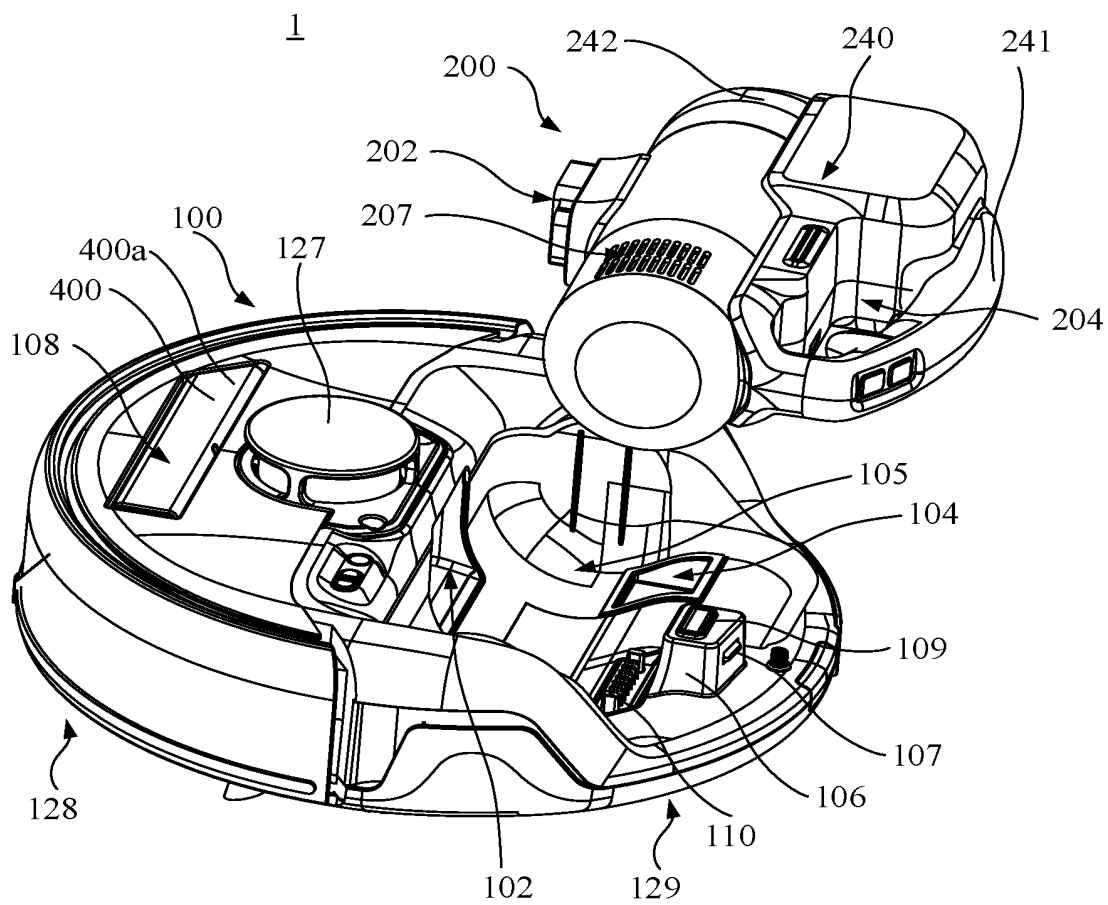


FIG. 6

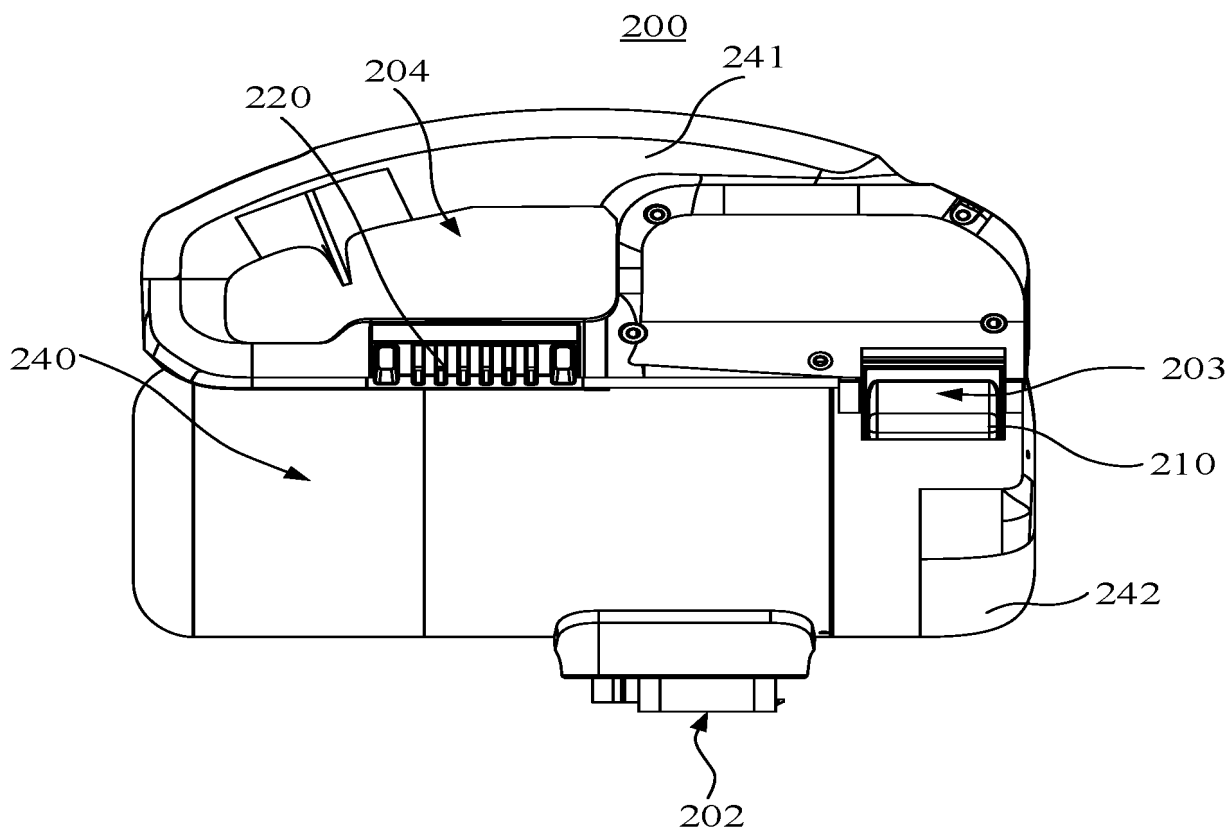


FIG. 7

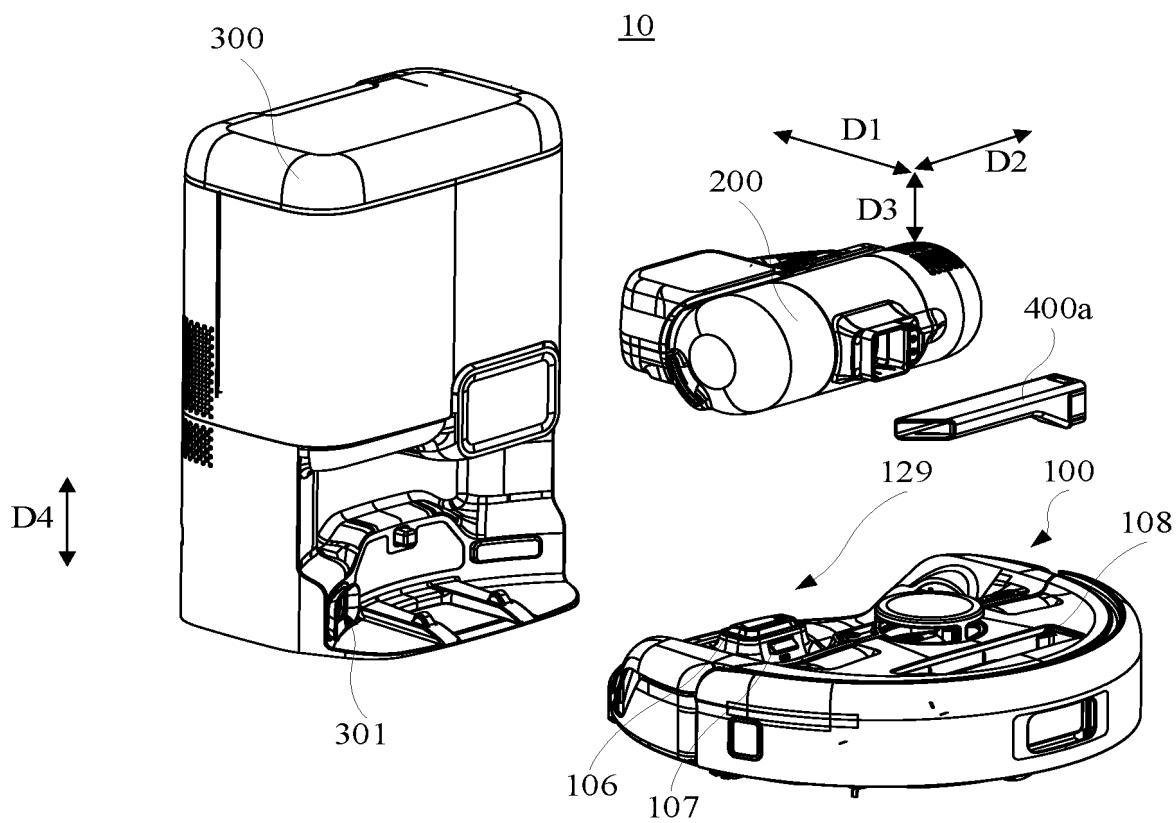


FIG. 8

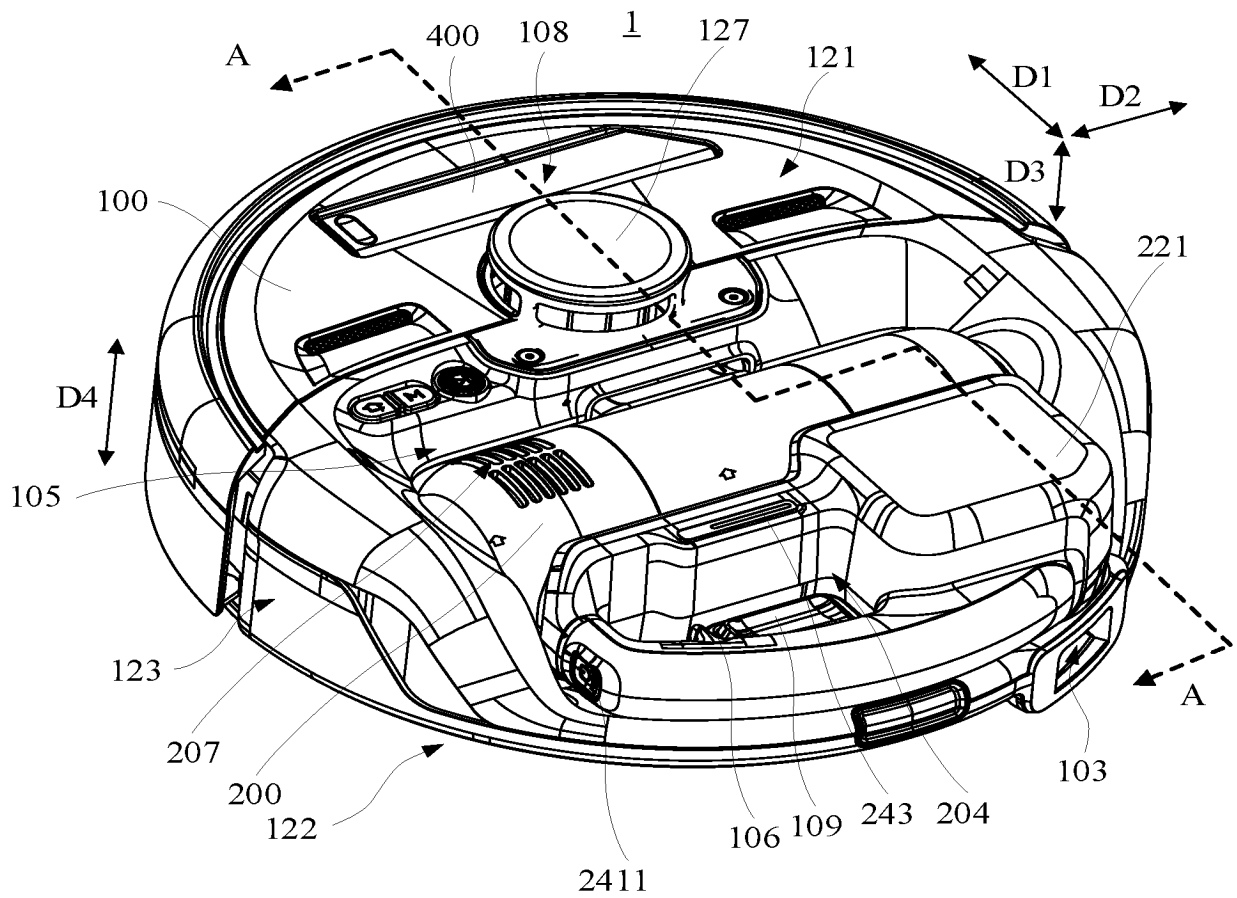


FIG. 9

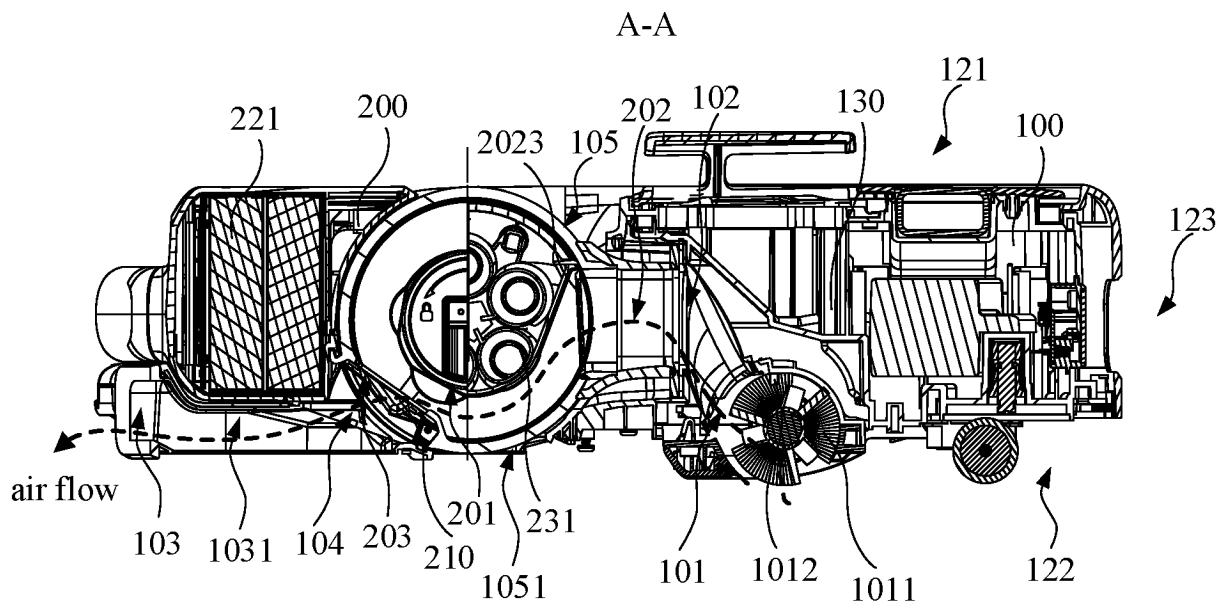


FIG. 10

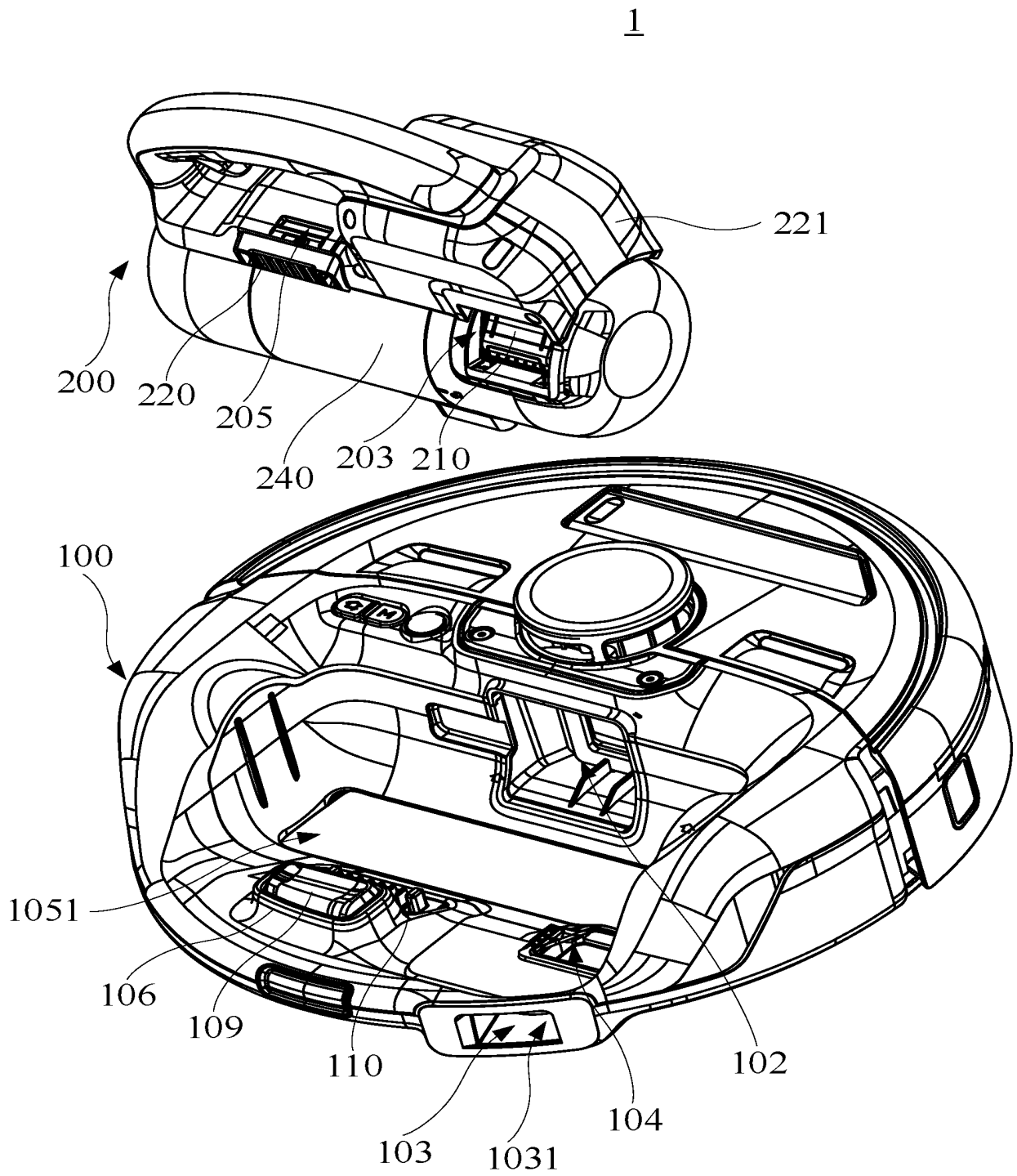


FIG. 11

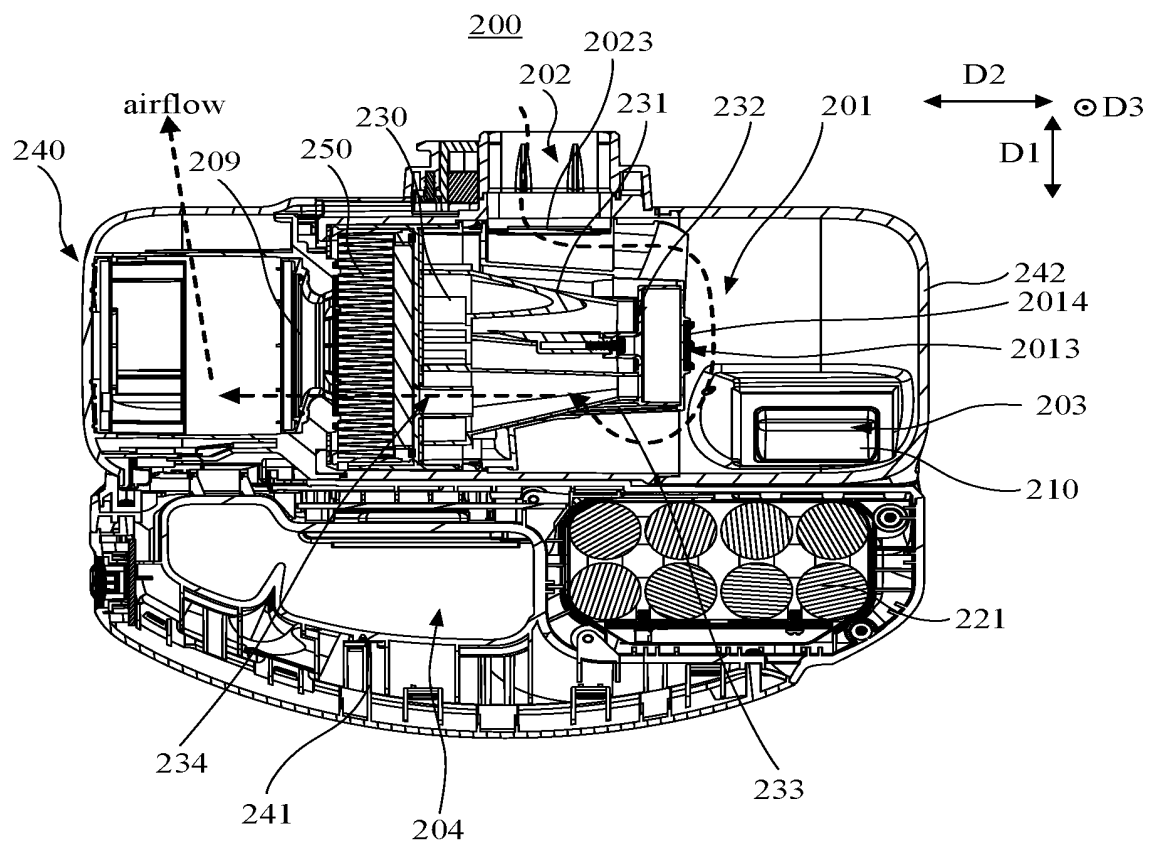


FIG. 12

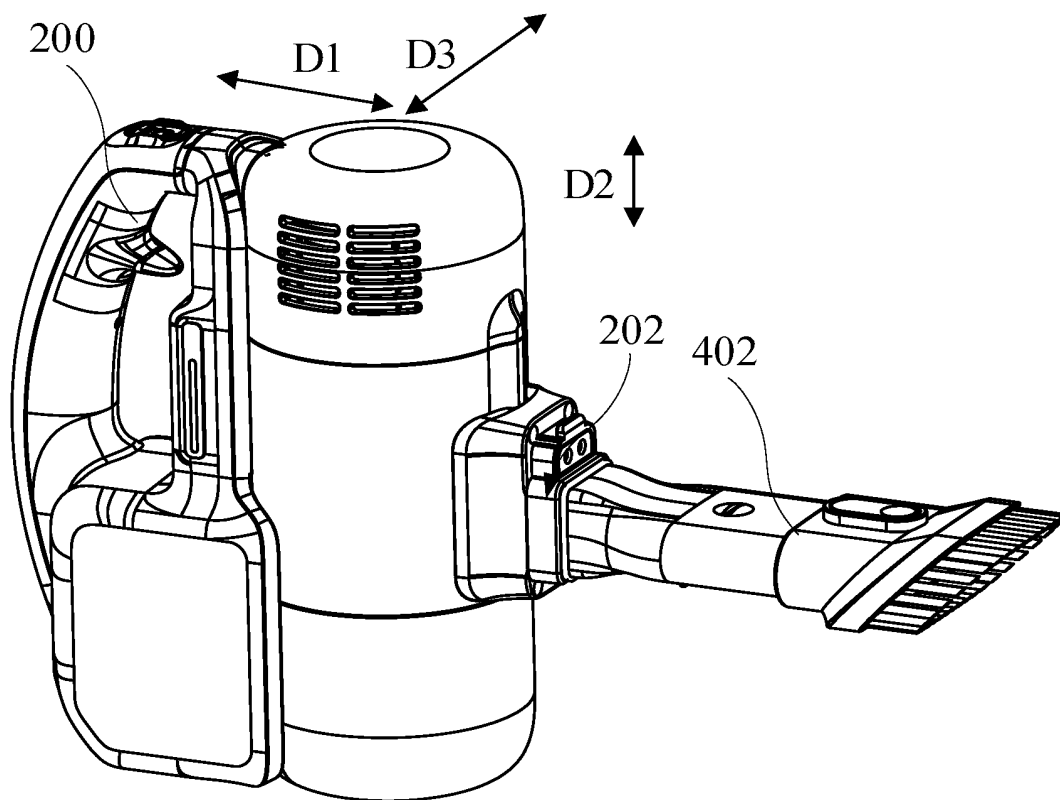


FIG. 13

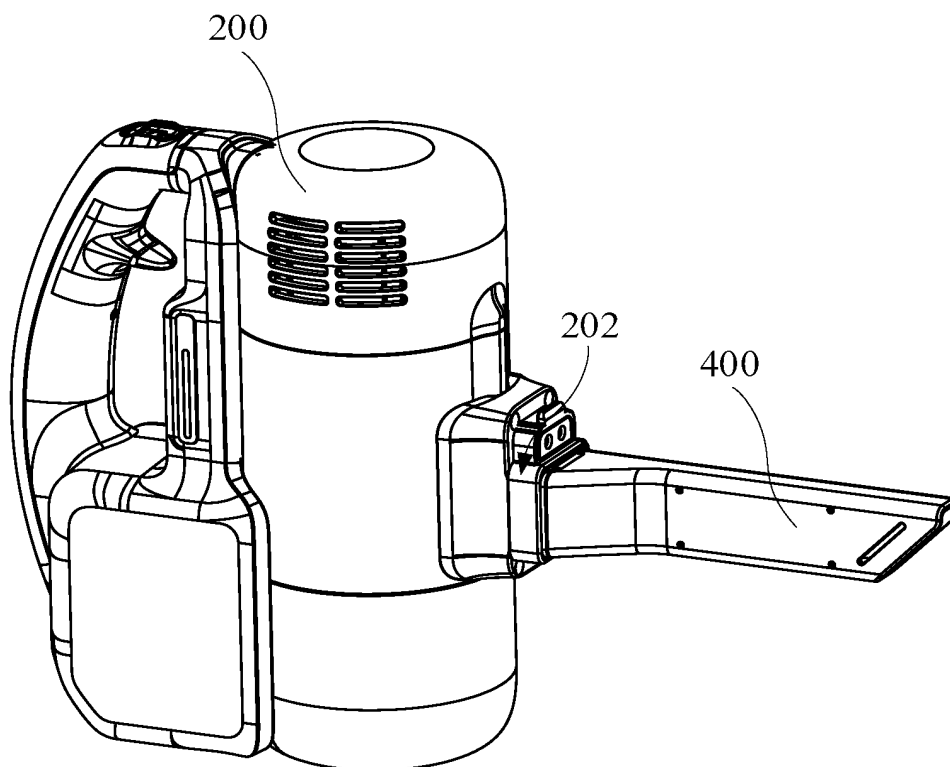


FIG. 14

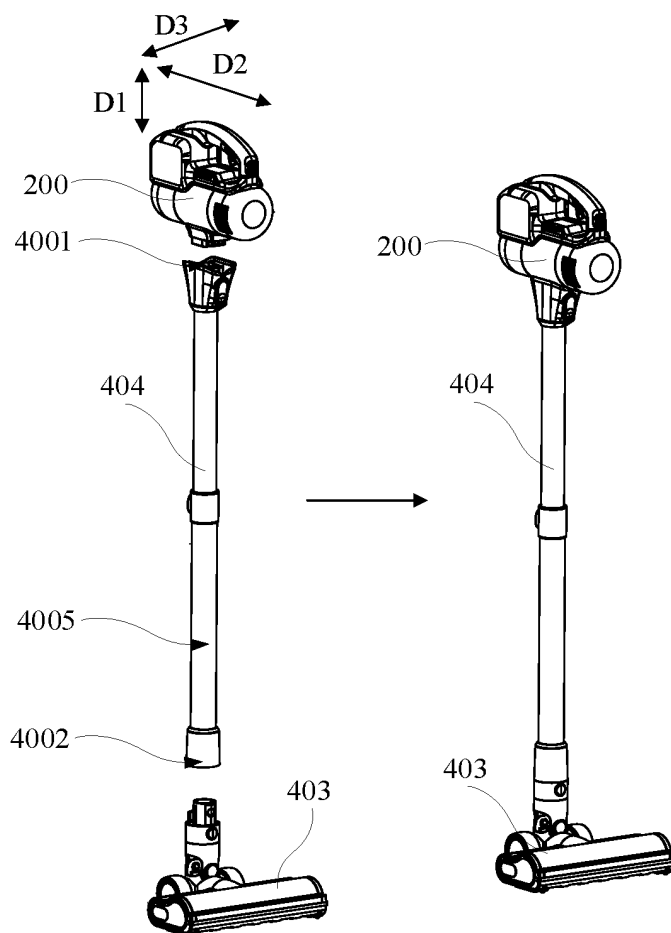


FIG. 15

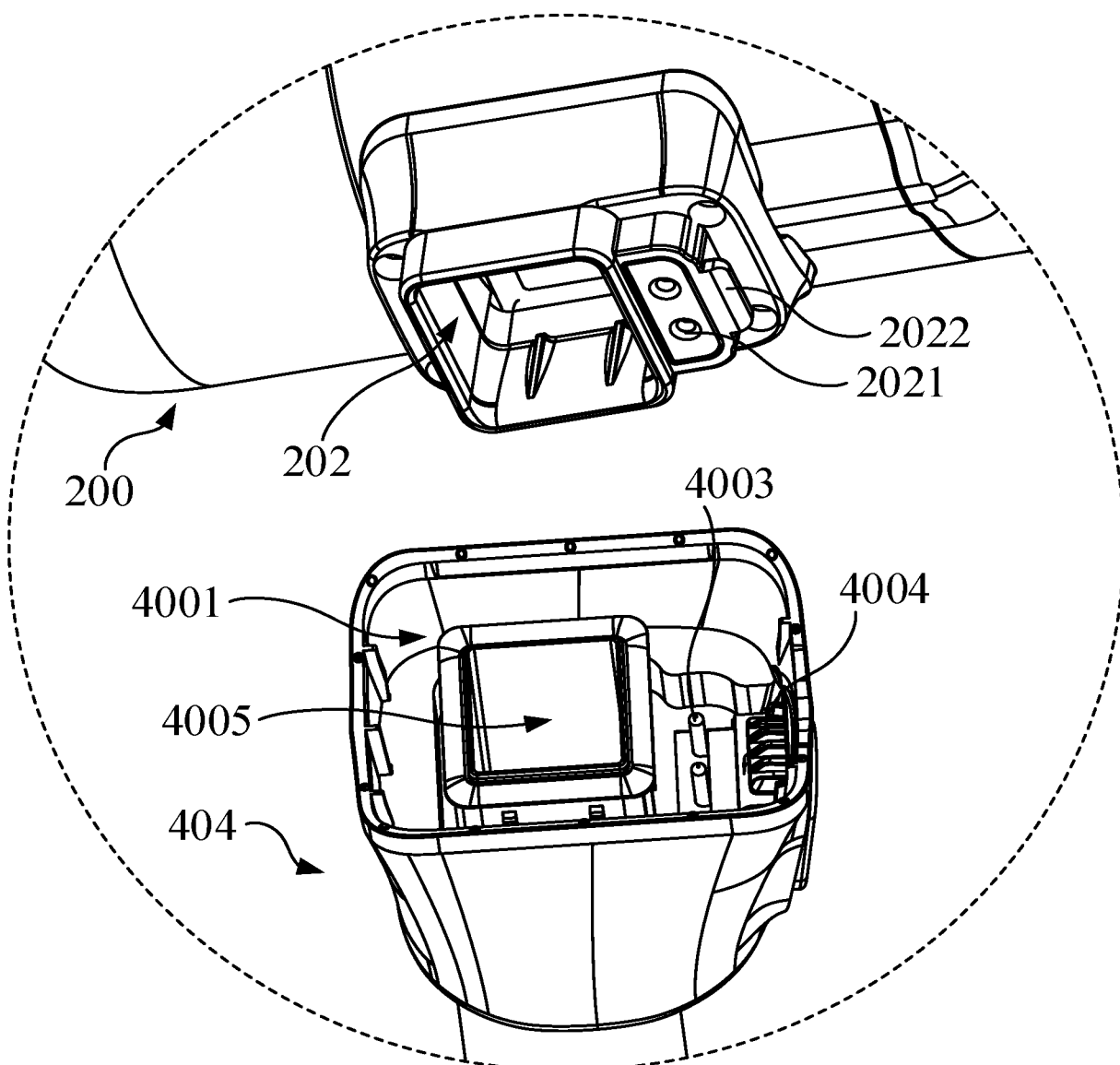


FIG. 16

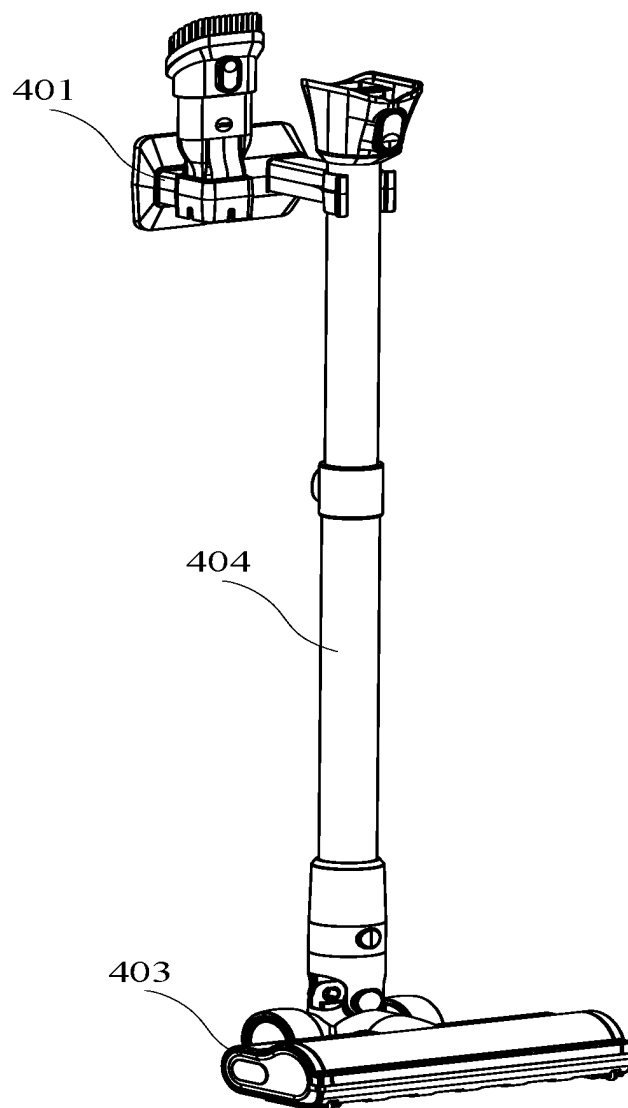


FIG. 17

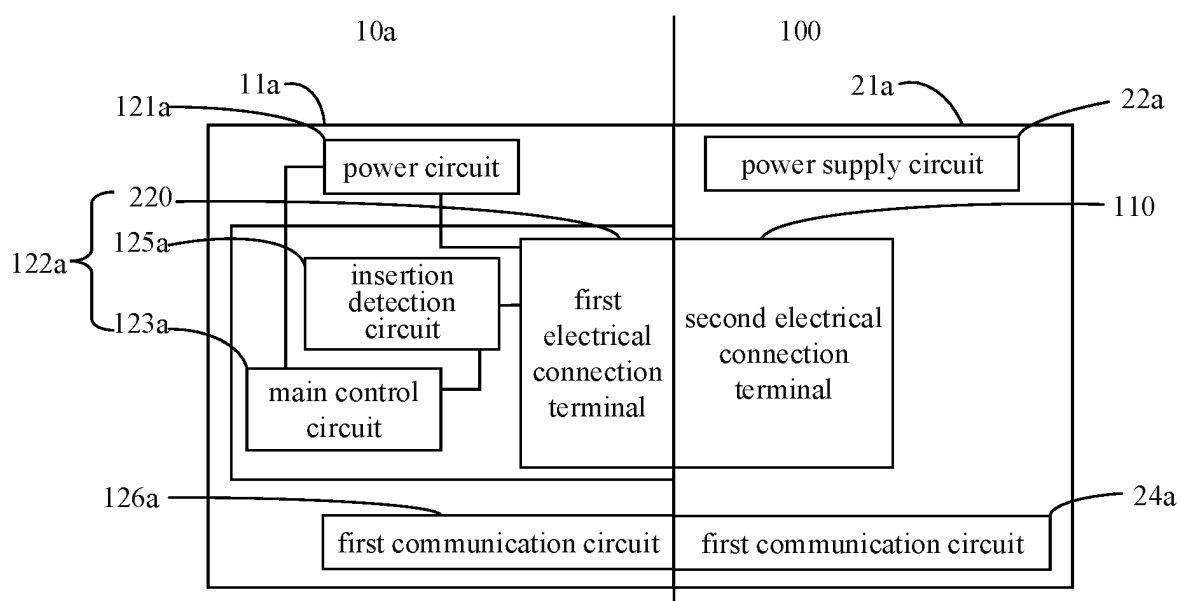


FIG. 18

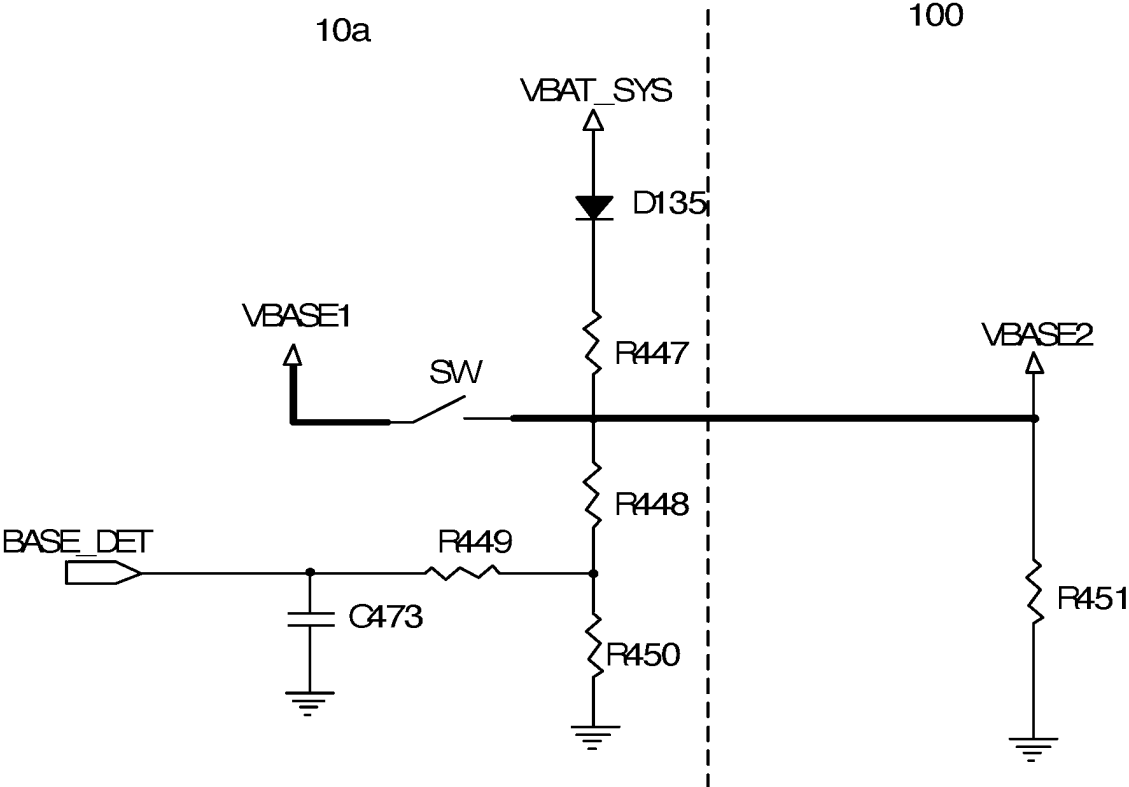


FIG. 19

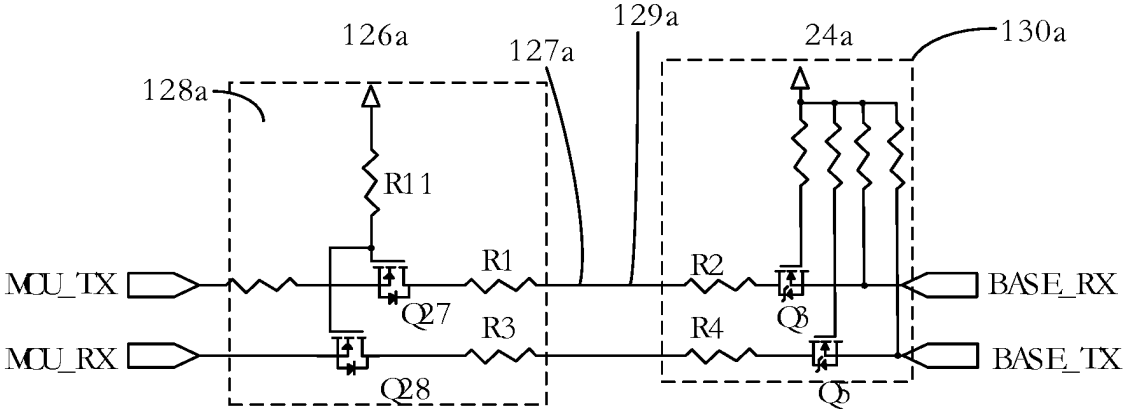


FIG. 20

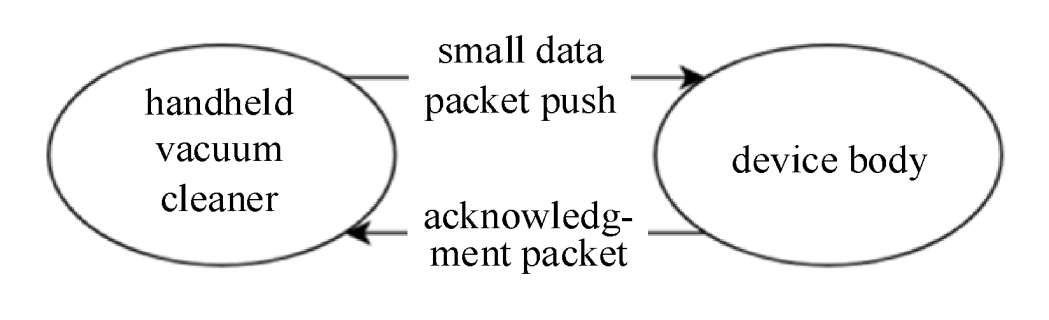


FIG. 21

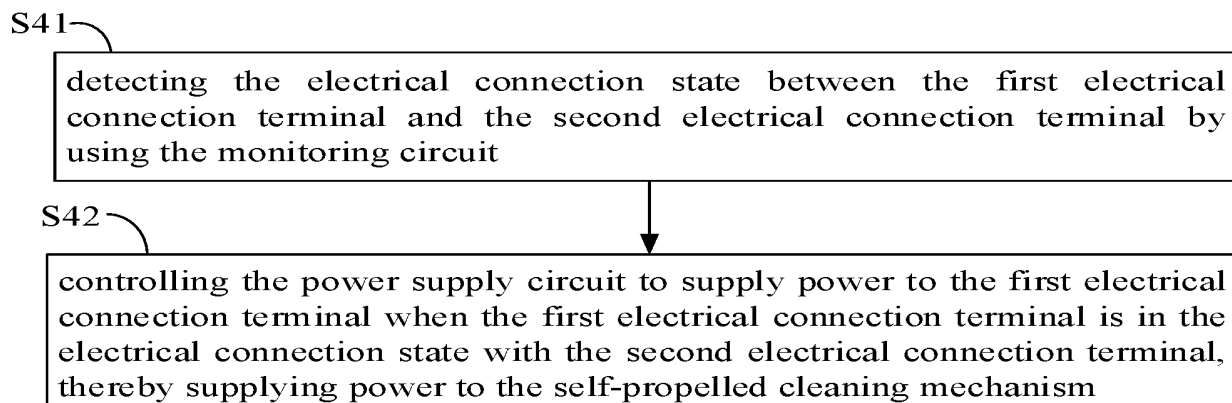


FIG. 22

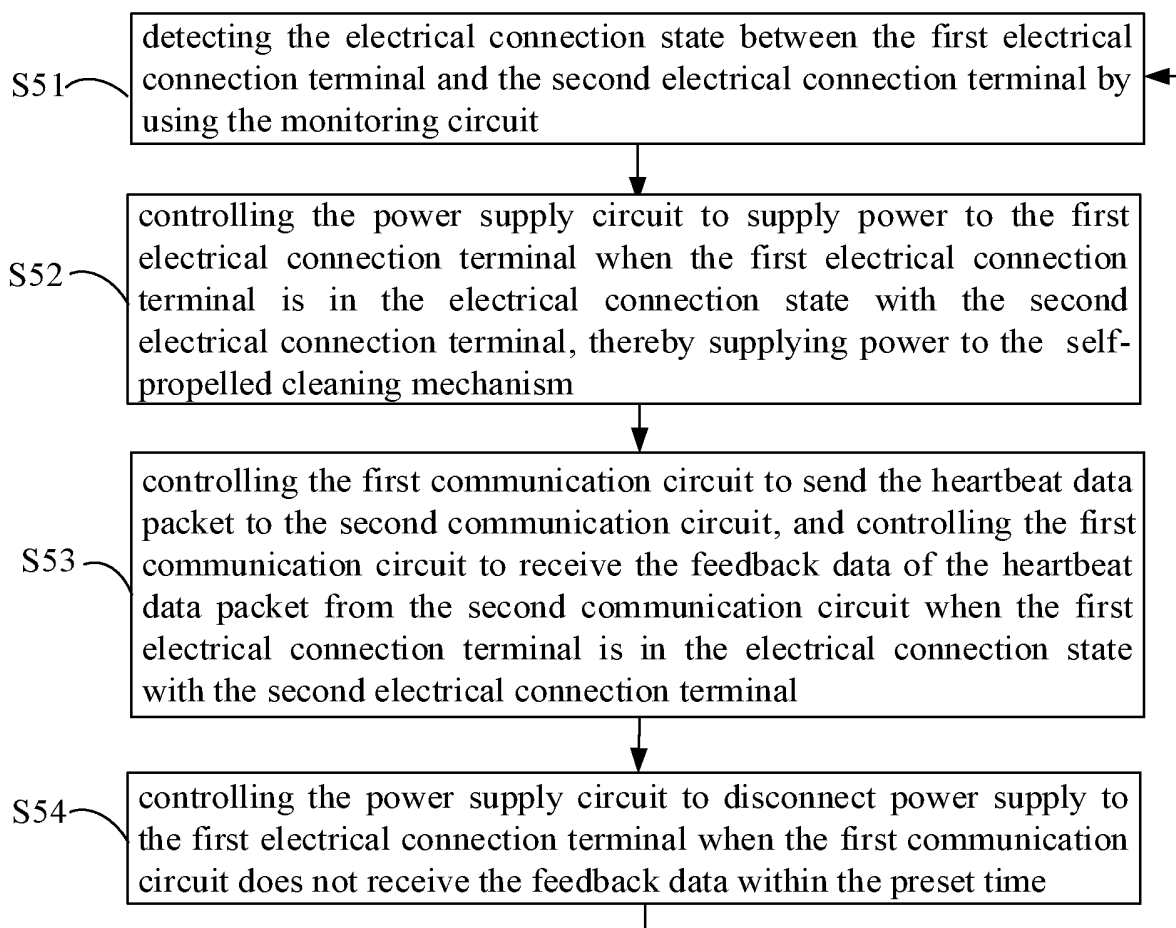


FIG. 23

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2024/134298

A. CLASSIFICATION OF SUBJECT MATTER

A47L 11/24(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)

IPC: A47L

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

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

CNTXT, ENTXTC, WPABS, WPABSC, ENTXT, DWPI, VEN: 扫地机器人, 清洁机器人, 手持吸尘器, 基站, 风机, 抽吸, 驱动轮, 电源, 检测, 电压, 垃圾, cleaning robot, hand cleaner, base station, fan, suction, drive wheel, power, detect+, voltage, garbage

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 111657781 A (ANKOBOT (SHENZHEN) SMART TECHNOLOGIES CO., LTD. et al.) 15 September 2020 (2020-09-15) description, paragraphs 40-96, and figures 1-7	23-30
Y	CN 111657781 A (ANKOBOT (SHENZHEN) SMART TECHNOLOGIES CO., LTD. et al.) 15 September 2020 (2020-09-15) description, paragraphs 40-96, and figures 1-7	1-22
Y	CN 115299809 A (BEIJING ROBOROCK TECHNOLOGY CO., LTD.) 08 November 2022 (2022-11-08) description, paragraphs 61-133, and figures 1-12	1-22
A	CN 113768411 A (ANKER INNOVATIONS LIMITED) 10 December 2021 (2021-12-10) entire document	1-30
A	CN 116211163 A (SUZHOU JIANDAN YOUWEI TECHNOLOGY CO., LTD.) 06 June 2023 (2023-06-06) entire document	1-30

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

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"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
"D" document cited by the applicant in the international application	"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
"E" earlier application or patent but published on or after the international filing date	"&" document member of the same patent family
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

08 March 2025

Date of mailing of the international search report

10 March 2025

Name and mailing address of the ISA/CN

China National Intellectual Property Administration (ISA/
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Beijing 100088

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2024/134298

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C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 113854902 A (ECOVACS ROBOT CO., LTD.) 31 December 2021 (2021-12-31) entire document	1-30
A	CN 217390605 U (XIAOTIAN (ZHONGSHAN) INDUSTRIAL CO., LTD.) 09 September 2022 (2022-09-09) entire document	1-30
A	KR 20220092057 A (LG ELECTRONICS INC.) 01 July 2022 (2022-07-01) entire document	1-30
A	CN 112022007 A (ZHUICHUANG TECHNOLOGY (SUZHOU) CO., LTD.) 04 December 2020 (2020-12-04) entire document	1-30

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/CN2024/134298

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN	111657781	A	15 September 2020	None	
CN	115299809	A	08 November 2022	None	
CN	113768411	A	10 December 2021	None	
CN	116211163	A	06 June 2023	None	
CN	113854902	A	31 December 2021	None	
CN	217390605	U	09 September 2022	None	
KR	20220092057	A	01 July 2022	None	
CN	112022007	A	04 December 2020	None	

REFERENCES CITED IN THE DESCRIPTION

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