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AUTOMATIC CLEANING APPARATUS AND SYSTEM

(57)

An automatic cleaning apparatus having a dust collection function, comprising: a mobile platform (100), which comprises an accommodation chamber (200), the mobile platform (100) being configured to automatically move on an operation surface; and a cleaning module (150), which comprises a dust box (300) and a main brush module (153), the dust box (300) being detachably assembled in the accommodation chamber (200), and the dust box (300) comprising a first side wall (3015) and a second side wall (3016), which are arranged opposite

each other. The accommodation chamber (200) further comprises a third side wall (2011), which is arranged corresponding to the first side wall (3015) of the dust box (300), and a fourth side wall (2012), which is arranged corresponding to the second side wall (3016) of the dust box (300); the third side wall (2011) and the fourth side wall (2012) respectively comprise a plurality of air intake holes (20111); and the plurality of air intake holes (20111) are configured to provide the dust box (300) with intake airflows in two directions during dust collection.

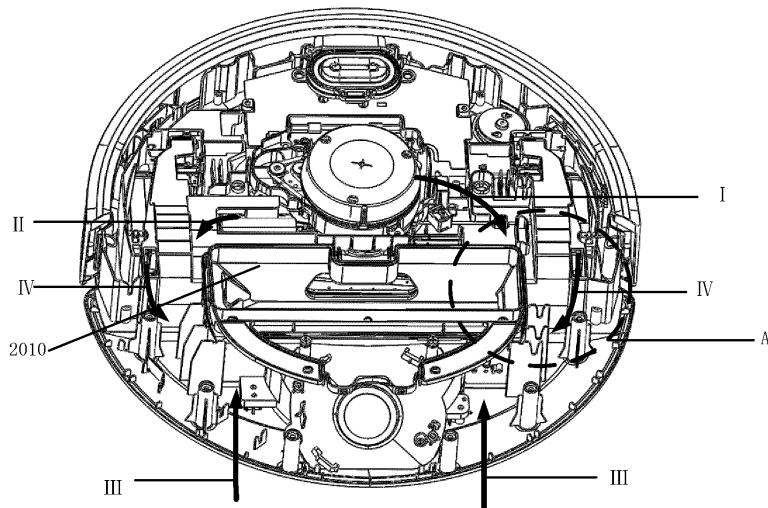


FIG. 18a

Description

CROSS-REFERENCE TO RELATED APPLICATION

[0001] The present application claims priority to Chinese Patent Application No. 202210027204.9 filed on January 11, 2022, the entire contents of which are incorporated herein by reference.

TECHNICAL FIELD

[0002] The present disclosure relates to the technical field of cleaning robots, and in particular to an automatic cleaning device and an automatic cleaning system.

BACKGROUND ART

[0003] In modern life, cleaning robots become more and more popular, bringing convenience to family lives. Cleaning robots include sweeping robots, mopping robots, and sweeping and mopping robots, etc. In the related art, some cleaning robots have been added with structures or functions such as automatic charging, automatic dust collection, lifting and vibration, or the like, making the cleaning robots more intelligent. However, for cleaning robots that can automatically collect dust, the dust in the dust box is often not cleaned cleanly due to insufficient wind power of the fan, insufficient or poor dust collection airflow supply.

SUMMARY OF THE INVENTION

[0004] According to specific embodiments of the present disclosure, the present disclosure provides an automatic cleaning device, configured with a dust collection function, and including: a moving platform, including an accommodating chamber, the moving platform being configured to automatically move on an operating surface; and a cleaning module, including a dust box and a main brush module, the dust box being detachably mounted in the accommodating chamber, and the dust box including a first side wall and a second side wall that are provided opposite to each other; where the accommodating chamber further includes a third side wall provided corresponding to the first side wall of the dust box, and a fourth side wall provided corresponding to the second side wall of the dust box, the third side wall and the fourth side wall respectively include a plurality of air inlet holes, and the plurality of air inlet holes are configured to provide intake airflows to the dust box from two directions during a dust collection process.

[0005] In some embodiments, sources of the intake airflows include at least one of: an airflow entering from a top gap of the moving platform, an airflow entering from a gap of the main brush module, or an airflow entering from a rear side wall of the moving platform.

[0006] According to specific embodiments of the present disclosure, the present disclosure provides an auto-

matic cleaning device, configured with a dust collection function, and including: a moving platform, including an accommodating chamber, the moving platform being configured to automatically move on an operating surface; and a cleaning module, including a dust box and a main brush module, the dust box being detachably mounted in the accommodating chamber, and the dust box including a first side wall and a second side wall that are provided opposite to each other; where the accommodating chamber further includes a third side wall provided corresponding to the first side wall of the dust box, and a fourth side wall provided corresponding to the second side wall of the dust box, and the third side wall and/or the fourth side wall includes a plurality of air inlet holes, and the plurality of air inlet holes are configured to provide intake airflows into the dust box during a dust collection process; and a source of the intake airflows includes at least one of: an airflow entering from a top gap of the moving platform, an airflow entering from a gap of the main brush module, or an airflow entering from a rear side wall of the moving platform.

[0007] In some embodiments, the airflow entering from the top gap of the moving platform includes an airflow entering from a gap between a protecting cover and a top surface of the moving platform and/or from a gap between the protecting cover and a position determination apparatus.

[0008] In some embodiments, the airflow entering from the gap of the main brush module includes an airflow entering from a gap between the main brush and a lower shell, and then passing through an opening around a main brush drive motor to a front wall of the accommodating chamber.

[0009] In some embodiments, the airflow entering from the rear side wall of the moving platform includes an airflow passing thorough air inlet notches of baffles on two sides of a fan bracket to a side surface of the accommodating chamber after entering interior of a shell of the moving platform from an exhaust port.

[0010] In some embodiments, the airflow entering from the rear side wall of the moving platform includes: an airflow entering directly from the exhaust port and reaching the side of the accommodating chamber.

[0011] In some embodiments, the third side wall and/or the fourth side wall respectively include a plurality of spacers on outer sides, and the plurality of spacers form a plurality of air paths.

[0012] In some embodiments, a front side wall of the accommodating chamber respectively includes an air passage on an upper outer side, and the airflow entering from the top gap of the moving platform and/or the airflow entering from the gap of the main brush module passes through the air passage to the plurality of air inlet holes.

[0013] In some embodiments, the accommodating chamber includes a first chamber and a second chamber that are provided adjacent to each other in sequence in a forward direction of the automatic cleaning device, a dust suction port is provided at a bottom of a front side wall of

the first chamber, an air outlet is provided on a rear side wall at a connection between the first chamber and the second chamber, the dust box further includes a first opening and a second opening, and the dust suction port, the air outlet, the first opening and the second opening are all substantially located on a central axis in a front-to-back direction of the automatic cleaning device.

[0014] In some embodiments, the dust box includes a first air inlet door and a second air inlet door, the first air inlet door and the second air inlet door are respectively located on the first side wall and the second side wall of the dust box, and wherein the plurality of air inlet holes cover at least a portion of the first air inlet door and the second air inlet door.

[0015] In some embodiments, the first air inlet door and the second air inlet door are located at asymmetric positions of the first side wall and the second side wall respectively, to increase swirl speed of an airflow after entering the dust box.

[0016] According to a specific embodiment of the present disclosure, the present disclosure provides an automatic cleaning system, including: a dust collection station and the automatic cleaning device as described in any one of the above items, wherein the dust collection station includes a dust collection port, and the dust collection port is docked with a port of the main brush module for dust collection.

[0017] Compared with the related art, the embodiments of the present disclosure have the following technical effects.

[0018] The present disclosure provides an automatic cleaning device and system. The automatic cleaning device has an automatic dust collection function. By providing a plurality of air inlet holes on the side wall of the accommodating chamber of the automatic cleaning device, airflows entering the dust box form convection and form a vortex cyclone in the dust box, thus smoothly sucking the garbage in the dust box into the dust collection station. In addition, the main brush module, the dust suction port, the air outlet, the first opening and the second opening are all substantially provided on the central axis in the front-to-back direction of the automatic cleaning device, which can further increase the speed of the airflows entering the dust box, thus making it easier to suck the garbage in the dust box into the dust collection station.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate embodiments consistent with the present disclosure and, together with the description, serve to explain the principles of the present disclosure. Apparently, the accompanying drawings in the following description show merely some embodiments of the present disclosure, and a person of ordinary skill in the art may still

derive other drawings from these accompanying drawings without creative efforts. In the accompanying drawings:

FIG. 1 is an oblique view of an automatic cleaning device according to some embodiments of the present disclosure.

FIG. 2 is a schematic diagram of a bottom structure of an automatic cleaning device according to some embodiments of the present disclosure.

FIG. 3a is an oblique view of an accommodating chamber of an automatic cleaning device according to some embodiments of the present disclosure.

FIG. 3b is a schematic diagram of a structure of an air outlet of an accommodating chamber of an automatic cleaning device according to some embodiments of the present disclosure.

FIG. 4 is a three-dimensional view of a dust box according to some embodiments of the present disclosure.

FIG. 5 is an oblique view of a dust box according to some embodiments of the present disclosure.

FIG. 6a - FIG. 6h are schematic diagrams of structure layouts of a top cover according to some embodiments of the present disclosure.

FIG. 7 is an enlarged schematic diagram of a first positive locking member according to some embodiments of the present disclosure.

FIG. 8 is an enlarged schematic diagram of a first locking member according to some embodiments of the present disclosure.

FIG. 9a is an enlarged schematic diagram of a second positive locking member according to some embodiments of the present disclosure.

FIG. 9b is a schematic diagram of an overall structure of a second positive locking member according to some embodiments of the present disclosure.

FIG. 9c is an enlarged schematic diagram of a second catcher portion according to some embodiments of the present disclosure.

FIG. 10 is an enlarged schematic diagram of a second locking member according to some embodiments of the present disclosure.

FIG. 11 is a three-dimensional structural diagram of a dust box filter from an outside perspective according

to some embodiments of the present disclosure.

FIG. 12 is a three-dimensional structural diagram of a dust box filter from an inner side perspective according to some embodiments of the present disclosure.

FIG. 13a is a front view of an inner side of a dust box filter according to some embodiments of the present disclosure.

FIG. 13b is a three-dimensional structural diagram of a filter of a dust box from an inner side perspective according to some embodiments of the present disclosure.

FIG. 14 is a schematic diagram of an assembly structure of a dust box and a filter according to some embodiments of the present disclosure.

FIG. 15 is an enlarged schematic diagram of an assembly structure of a dust box and a filter according to some embodiments of the present disclosure.

FIG. 16 is a schematic diagram of an air intake structure of a protecting cover according to some embodiments of the present application.

FIG. 17 is a schematic diagram of an air intake structure of a base according to some embodiments of the present application.

FIG. 18a is a schematic diagram of an internal airflow structure according to some embodiments of the present application.

FIG. 18b is a schematic diagram of an air intake structure of an exhaust port according to some embodiments of the present application.

FIG. 19 is an enlarged schematic diagram of an air passage structure according to some embodiments of the present application.

FIG. 20 is a schematic diagram of a structure of an accommodating chamber according to some embodiments of the present application.

FIG. 21 is a schematic diagram of a structure of a dust box according to some embodiments of the present application.

FIG. 22 is a diagram showing a symmetrical structure of an automatic cleaning device along axis BB according to some embodiments of the present application.

FIG. 23 is a schematic diagram of a structure of a dust collection station according to some embodi-

ments of the present application.

FIG. 24 is a schematic diagram of a structure of an automatic cleaning system according to some embodiments of the present application.

Description of reference numerals:

[0020] Moving platform 100, backward portion 110, forward portion 111, sensing system 120, buffer 122, cliff sensor 123, control system 130, driving system 140, driving wheel assembly 141, steering assembly 142, cleaning module 150, dry cleaning module 151, side brush 152, main brush module 153, dust box 300, filter 500, energy system 160, human-computer interaction system 170, wet cleaning assembly 400, accommodating chamber 200, first chamber 201, second chamber 202, dust suction port 203, exhaust port 204, air outlet 208, accommodating portion 301, top cover 302, first opening 3011, second opening 3012, first portion 3021, edge portion 30211, step portion 205, second portion 3022, support structure 3023, groove 2021, first recess 206, second recess 207, first positive locking member 601, second positive locking member 602, first catcher recess 603, first elastic arm 6011, first catcher portion 6012, first snapping-fit portion 6013, first locking member 701, second catcher recess 605, second elastic arm 6021, second catcher portion 6022, second snapping-fit portion 6023, second locking member 702, soft rubber frame 501, soft rubber protrusion 5011, filter element 502, first rib portion 510, anti-mistake protrusion 509, inner sealing lip 507, outer sealing lip 506, step surface 503, magnet mounting hole 504, second rib portion 5041, catcher handle 505, hollow structure 508, third protrusion 5012, elastic structure 5013, blocking portion 5014, first air inlet door 3013, second air inlet door 3014, first side wall 3015, second side wall 3016, protecting cover 1212, position determination apparatus 1211, air passage 209, air inlet hole 20111, third side wall 2011, fourth side wall 2012, spacer 20112, notch 20113, dust collection station 700, dust collection station base 710, dust collection station body 720, dust collection port 711, sealing rubber pad 714.

DETAILED DESCRIPTION

[0021] For clearer descriptions of the purposes, technical solutions and advantages in the present application, the present application is further described in detail hereinafter in combination with the accompanying drawings. Apparently, the described embodiments are merely some embodiments, rather than all embodiments, of the present application. Based on the embodiments of the present application, all other embodiments derived by a person of ordinary skill in the art without creative efforts shall fall within the protection scope of the present application.

[0022] The terms used in the embodiments of the pre-

sent application are only for the purpose of describing specific embodiments, but are not intended to limit the present application. The singular forms "a", "the" and "said" used in the embodiments and the appended claims of the present application are intended to include the plural forms as well, unless otherwise clearly specified in the context. "A plurality of" generally includes at least two.

[0023] It should be understood that the term "and/or" used herein only describes an associated relationship of associated objects, indicating three kinds of relationships. For example, A and/or B can represent that A exists alone, A and B exist concurrently, and B exists alone. In addition, the character "/" herein generally indicates that the associated objects are in an "or" relationship.

[0024] It should be understood that although the terms first, second, third, etc. may be used in the embodiments of the present application to describe certain objects, these objects should not be limited by these terms. These terms are merely used for distinguishing. For example, a first object may also be referred to as a second object, and similarly, a second object may also be referred to as a first object, without departing from the scope of the embodiments of the present application.

[0025] It should also be noted that the terms "comprise", "include" or any other variants are intended to cover the nonexclusive containing, such that the commodities or apparatuses including a series of elements not only include those elements, but also include other unclosely listed elements, or also include the inherent elements of such commodities or apparatuses. Without more limitations, the element defined by the phrase "comprising a .." does not exclude the existence of other identical elements in the commodity or apparatus that includes such an element.

[0026] Alternative embodiments of the present application will be described in detail below with reference to the accompanying drawings.

[0027] FIG. 1 and FIG. 2 are schematic structural diagrams of an automatic cleaning device according to an exemplary embodiment. As shown in FIG. 1 and FIG. 2, the automatic cleaning device may be a vacuum cleaning robot, a mopping/brushing robot, a window climbing robot, or the like. The automatic cleaning device may include a moving platform 100, a sensing system 120, a control system 130, a driving system 140, a cleaning module 150, an energy system 160, and a human-machine interaction system 170. Among them:

[0028] The moving platform 100 may be configured to automatically move on an operation surface in a target direction. The operation surface may be a surface to be cleaned by the automatic cleaning device. In some embodiments, the automatic cleaning device may be a mopping robot, in which case the automatic cleaning device works on a floor, and the floor is the operation surface; the automatic cleaning device may also be a window cleaning robot, in which case the automatic

cleaning device works on the exterior surface of glass of a building, and the glass is the operation surface; and the automatic cleaning device may also be a pipeline cleaning robot, in which case the automatic cleaning device works on the interior surface of a pipeline, and the interior surface of the pipeline is the operation surface. Merely for the purpose of illustration, the following description in the present application is illustrated by taking a mopping robot as an example.

[0029] In some embodiments, the moving platform 100 may be an autonomous moving platform or a non-autonomous moving platform. The autonomous moving platform means that the moving platform 100 itself can automatically and adaptively make operation decisions according to unexpected environmental inputs, while the non-autonomous moving platform itself, instead of adaptively making operation decisions according to unexpected environmental inputs, can execute given programs or run according to certain logic. Correspondingly, in the case that the moving platform 100 is the autonomous moving platform, the target direction may be autonomously determined by the automatic cleaning device; and in the case that the moving platform 100 is the non-autonomous moving platform, the target direction may be set systematically or manually. The moving platform 100 includes a forward portion 111 and a backward portion 110 when the moving platform 100 is the autonomous moving platform.

[0030] The sensing system 120 includes a position determination apparatus 121 located above the moving platform 100, a buffer 122 located on the forward portion 111 of the moving platform 100, and sensing devices such as a cliff sensor 123, an ultrasonic sensor (not shown in the figures), an infrared sensor (not shown in the figures), a magnetometer (not shown in the figures), an accelerometer (not shown in the figures), a gyroscope (not shown in the figures) and an odometer (not shown in the figures), which are located at the bottom of the moving platform for providing various position information and motion state information of the automatic cleaning robot for the control system 130.

[0031] For clearer descriptions of the actions of the automatic cleaning device, the following directions are defined as follows. The automatic cleaning device may travel on the floor through various combinations of movements relative to the following three perpendicular axes defined by the moving platform 100: a transverse axis Y, a front-back axis X, and a central vertical axis Z. A forward driving direction along the front-back axis X is marked as "forward", and a backward driving direction along the front-back axis X is marked as "backward". The transversal axis Y extends substantially between a right wheel and a left wheel of the automatic cleaning device along an axis center defined by the center point of a driving wheel assembly 141, where the automatic cleaning device may rotate about the axis Y. It is called "pitch up" when the forward portion of the automatic cleaning device tilts upwards and the backward portion thereof tilts down-

wards, and it is called "pitch down" when the forward portion of the automatic cleaning device tilts downwards and the backward portion thereof tilts upwards. In addition, the automatic cleaning device may rotate around the axis Z. In the forward direction of the automatic cleaning device, it is called "turn right" when the automatic cleaning device tilts to the right of the axis X, and it is called "turn left" when the automatic cleaning device tilts to the left of the axis X.

[0032] As shown in FIG. 2, the cliff sensors 123 are provided at the bottom of the moving platform 100 and provided in front and rear of the driving wheel assembly 141. The cliff sensors are configured to prevent the automatic cleaning device from falling off when the automatic cleaning device moves back, so as to protect the automatic cleaning device against damage. The aforementioned "front" refers to the side in the same direction as the travelling direction of the automatic cleaning device, and the aforementioned "rear" refers to the side in a direction opposite to the travelling direction of the automatic cleaning device.

[0033] A specific type of the position determination apparatus 121 includes, but is not limited to, a camera and a laser distance sensor (LDS).

[0034] The various components in the sensing system 120 may work independently or jointly to achieve intended functions more accurately. The surface to be cleaned is identified by the cliff sensor 123 and the ultrasonic sensor to determine the physical properties of the surface to be cleaned, including surface materials, the degree of cleanliness, etc., and more accurate determinations may be performed in combination with the camera, and the laser distance sensor, etc.

[0035] For example, it may be determined by the ultrasonic sensor whether the surface to be cleaned is a carpet or not. If the ultrasonic sensor determines that the surface to be cleaned is made of a carpet material, the control system 130 controls the automatic cleaning device to conduct carpet-mode cleaning.

[0036] The buffer 122 is provided on the forward portion 111 of the moving platform 100. The buffer 122 detects one or more events (or objects) in a travelling path of the automatic cleaning device via the sensing system (for example, an infrared sensor) when the driving wheel assembly 141 propels the automatic cleaning device to travel on the floor in the process of cleaning. The automatic cleaning device may control, according to the events (or objects), such as an obstacle and a wall, detected by the buffer 122, the driving wheel assembly 141 to enable the automatic cleaning device to respond to the events (or objects), for example, moving away from the obstacle.

[0037] The control system 130 is provided on a main circuit board in the moving platform 100, and includes a computing processor, such as a central processing unit or an application processor, which communicates with non-transitory memories, such as a hard disk, a flash memory and a random access memory. The application

processor is configured to receive environmental information sensed by the plurality of sensors and transmitted from the sensing system 120, to draw a simultaneous map of an environment where the automatic cleaning device is located by using a positioning algorithm (for example, SLAM) according to obstacle information fed back by the position determination apparatus, to autonomously determine the travelling path according to the environmental information and the environmental map, and then to control the driving system 140 to perform operations of moving forwards, moving backwards and/or turning according to the autonomously determined travelling path. Furthermore, the control system 130 may also determine whether to activate the cleaning module 150 to perform a cleaning operation according to the environmental information and the environmental map.

[0038] In particular, the control system 130 may comprehensively determine a current working state (such as crossing a threshold, getting on a carpet, being at a cliff, being stuck from above or below, having a full dust box or being picked up, etc.) of the sweeping robot in combination with distance information and speed information fed back by the buffer 122, the cliff sensor 123, and the sensing devices such as the ultrasonic sensor, the infrared sensor, the magnetometer, the accelerometer, the gyroscope and the odometer, and may also give a specific next action strategy for different situations, so that the working of the automatic cleaning device is more in line with the requirements of an owner, thus achieving better user experience. Furthermore, the control system may plan the most efficient and reasonable cleaning path and cleaning mode based on the information of the simultaneous map drawn by SLAM, which greatly improves the cleaning efficiency of the automatic cleaning device.

[0039] The driving system 140 may execute a driving command based on a specific distance and angle information, such as components of x , y and θ to control the automatic cleaning device to travel across the floor. As shown in FIG. 2, the driving system 140 includes a driving wheel assembly 141, and may control a left wheel and a right wheel simultaneously. In order to control the movement of the automatic cleaning device more accurately, the driving system 140 preferably includes a left driving wheel assembly and a right driving wheel assembly that are symmetrically provided along a transverse axis defined by the moving platform 100.

[0040] For more stable movement on the floor or higher movement ability of the automatic cleaning device, the automatic cleaning device may include one or more steering components 142. The steering components 142 may be driven wheels or driving wheels, the structure forms of which include but is not limited to universal wheels. The steering component 142 may be located in front of the driving wheel assembly 141.

[0041] The energy system 160 includes a rechargeable battery, such as a nickel-hydrogen battery and a lithium battery. The rechargeable battery may be con-

nected to a charging control circuit, a battery pack charging temperature detecting circuit, and a battery under-voltage monitoring circuit, which are then connected to a single-chip microcomputer control circuit. A host of the automatic cleaning device is connected to a charging pile by a charging electrode provided on a side of or below the body of the automatic cleaning device for charging.

[0042] The human-machine interaction system 170 includes buttons on a panel of the host for a user to select functions, and may further include a display screen and/or an indicator light and/or a speaker, as well as a mobile phone client program. The display screen, the indicator light and the speaker show the current state or function options of the automatic cleaning device to the user. For a route navigation type cleaning device, a mobile phone client may show a map of the environment where the device is located, as well as the location of the device to the user, thus providing the user with richer and more user-friendly function items.

[0043] As shown in FIG. 2, the cleaning module 150 may include a dry cleaning module 151.

[0044] The dry cleaning module 151 includes a roller brush, a dust box, a fan, and an air outlet. The roller brush in a certain interference with the floor sweeps up debris on the floor and rolls up it to the front of a dust suction inlet between the roller brush and the dust box, and then the debris is sucked into the dust box by a gas with a suction force, which is generated by the fan and passes through the dust box. The dust removal capacity of the sweeping robot can be characterized by the dust pickup (DPU) efficiency of the debris, which is affected by the structure and the material of the roller brush, the utilization rate of air in an air passage formed by the dust suction inlet, the dust box, the fan, the air outlet and connecting parts among the dust suction inlet, the dust box, the fan and the air outlet, and affected by the type and the power of the fan; and thus it is a complex problem of system design. The improvement of dust removal capacity is of greater significance to the energy-limited automatic cleaning device than an ordinary plug-in vacuum cleaner. This is because the improvement of the dust removal capacity directly and effectively reduces the demand for energy, i.e., an original cleaning device capable of cleaning 80 square meters of the floor with one charge may be improved to clean 180 square meters or more with one charge. In addition, the service life of a battery with a reduced number of charging times may be greatly prolonged, such that the frequency of replacing the battery by the user may be reduced. More intuitively and importantly, the improvement of the dust removal capacity is the most obvious and important user experience as the user can directly draw a conclusion about whether the thorough sweeping/mopping is achieved. The dry cleaning module may further include a side brush 152 provided with a rotating shaft at a certain angle relative to the floor, for moving the debris into a roller brush area of the cleaning module 150.

[0045] As an optional cleaning module, the automatic

cleaning device may further include a wet cleaning module configured to clean at least part of the operation surface in a wet cleaning manner. Among them, the wet cleaning module includes a water tank, a cleaning head, a driving unit, or the like. Water from the water tank flows along a waterway to the cleaning head, and the cleaning head cleans at least part of the operation surface under the driving of the driving unit.

[0046] For the layout frame of the shell of the existing automatic cleaning device, the structure is complex, the number of parts is large, the assembly time is long, the process is complicated, and the cost is high. For example, a top cover and a flip mechanism are added to the automatic cleaning device, and an upper shell decorative part is designed on the top cover. Although the upper shell decorative part and the upper cover can cover up the ugliness and protect the internal components, they result in that the structure of the whole machine is complex and the cost is high, and the design space of components such as the dust box under the top cover is affected.

[0047] To this end, embodiments of the present disclosure provides an automatic cleaning device without a flip cover, in which the design space of the dust box and its accommodating chamber is increased, while unnecessary components of the automatic cleaning device are omitted. The same structure produces the same technical effect, and some technical effects are not repeated here. In particular, the present disclosure provides an automatic cleaning device, as shown in FIG. 3, which includes a moving platform 100 configured to move automatically on an operating surface. The moving platform 100 includes an accommodating chamber 200. In some embodiments, the accommodating chamber 200 is provided at a slightly rear side in a forward direction of the automatic cleaning device. The accommodating chamber 200 includes a first chamber 201 and a second chamber 202. The automatic cleaning device further includes a dry cleaning module 151 which includes a dust box 300. The dust box 300 is detachably assembled in the accommodating chamber 200. Among them, the first chamber 201 and the second chamber 202 are provided adjacent to each other in sequence in the forward direction of the automatic cleaning device. The depth of the first chamber 201 is greater than the depth of the second chamber 202. The first chamber 201 and the second chamber 202 are provided adjacent to each other in sequence in the forward direction of the automatic cleaning device, so that the part with larger volume and weight in the whole dust box may be provided closer to the middle of the automatic cleaning device, resulting in that the dust box is more stably provided in the accommodating chamber 200, and the center of gravity of the whole cleaning device is more stable. It is more stable and not easy to overturn during the process of traveling, turning, and crossing obstacles. At the same time, it is convenient to make the dust box accommodating portion and the dust box top cover into an integrated structure, so

that the dust box top cover may be used as a part of the top surface of the moving platform, and is flush with other parts of the top surface of the moving platform, omitting the flip cover structure of the traditional cleaning device. At the same time, it is convenient to directly align the dust suction port provided at the approximately central position of the bottom of the cleaning device with the dust box, so that the dust enters the dust box directly from the dust suction port, reducing the distance of dust entering the machine, and avoiding dust pollution to the inside of the machine. The depth of the first chamber 201 is greater than the depth of the second chamber 202, so that the dust box and the dust box top cover can be accommodated in a separate structure, which is convenient for the integrated design of the dust box top cover. A dust suction port 203 is provided at the bottom of a front side wall of the first chamber 201. An air outlet 208 is provided at a rear side wall where the first chamber 201 and the second chamber 202 are connected. The air outlet 208 has a grid structure. The space below the second chamber 202 accommodates a fan, which may be carried by a fan bracket. In some embodiments, the air outlet 208 constitutes a part of the fan bracket. An exhaust port 204 is provided on a rear side wall of the moving platform 100. Under the action of the fan suction force, the dust enters the dust box 300 via the dust suction port 203, and the airflow is filtered by the dust box filter and discharged from the exhaust port 204.

[0048] In some embodiments, the dust box 300 includes an accommodating portion 301 and a top cover 302 provided above the accommodating portion 301. The top cover is fixedly connected to the accommodating portion. The fixed connection method includes but is not limited to bonding, welding, integral molding, bolt connection, snap connection, etc. The accommodating portion is used to accommodate the garbage sucked from the dust suction port 203. The appearance of the accommodating portion is substantially matched with the first chamber 201.

[0049] A roller brush in a certain interference with the ground sweeps up the garbage on the ground. The garbage is rolled to the front of the dust suction port 203 between the roller brush and the dust box 300 under the action of a negative pressure airflow generated by the fan, and then is sucked into the dust box 300 by a suction airflow generated by the fan and passing through the dust box 300. The garbage is isolated inside the dust box 300 by a filter 500, and the filtered air enters the fan.

[0050] Typically, the accommodating portion 301 of the dust box 300 is provided with a first opening 3011 provided at a front side of the dust box. The first opening 3011 is aligned with the dust suction port 203. The accommodating portion 301 is provided with a second opening 3012 provided at a rear side of the dust box. The filter 500 is provided at the second opening 3012. The second opening 3012 is connected to the air outlet 208. The filter 500 is detachably connected to the box body of the dust box 300, which is convenient for the removal and clean-

ing of the filter. Among them, the front side refers to the side of the X direction along the forward direction of the automatic cleaning device after the dust box 300 is assembled in the accommodating chamber 200, and the rear side refers to the side of the X direction opposite to the forward direction of the automatic cleaning device.

[0051] In some embodiments, the top cover 302 includes a first portion 3021 covering the accommodating portion 301 and a second portion 3022 extending outwards beyond the accommodating portion 301. When the dust box 300 is assembled in the accommodating chamber 200, the accommodating portion 301 and the first portion 3021 of the top cover 302 are accommodated in the first chamber 201, and the second portion 3022 of the top cover 302 is accommodated in the second chamber 202. The top cover 302 and the top part of the first chamber and the structure of the second chamber are substantially matched with each other, so that the dust box 300 may be stably installed in the accommodating chamber 200, avoiding the shaking of the dust box due to the bumps during the movement of the automatic cleaning device. At the same time, the dust box top cover can exactly cover the accommodating portion and the position of the fan, so that the upper surface of the dust box top cover is substantially level with the upper surface of the moving platform, ensuring the flatness of the outer surface of the automatic cleaning device, and the overall coordination of the appearance is better. It also provides more space options for the design of various components under the top cover including the accommodating portion, which facilitates the arrangement of the positions of different components. The volume of the dust box may be selectively increased, and the specific size may be provided as needed without affecting the overall opening size of the accommodating chamber, thus reducing the mold opening cost.

[0052] In some embodiments, the first portion 3021 of the top cover 302 includes an edge portion 30211 that protrudes from the edge contour of the accommodating portion and extends outwards. The accommodating chamber 200 includes a step portion 205 extending around the top edge of the accommodating chamber. The step portion 205 is configured to accommodate at least a portion of the edge portion 30211 and at least a portion of the outer edge of the second portion, so that the upper surface of the top cover is substantially coplanar with the upper surface of the moving platform. The step portion 205 of the accommodating chamber 200 extending around the top edge of the accommodating chamber 200 can completely accommodate the edge of the top cover 302, so that the top cover 302 may be basically tightly accommodated in the accommodating chamber 200, which can prevent foreign objects from falling directly into the edge gap of the dust box, further preventing the dust box from getting stuck, and at the same time ensuring the aesthetic appearance of the top cover as the upper surface of the automatic cleaning device.

[0053] In some embodiments, a support structure 3023

is provided below the second portion 3022 of the top cover 302, and configured to support the second portion 3022 of the top cover. Alternatively, the support structure 3023 is integrally formed with at least a portion of the accommodating portion 301 to enhance the support force of the support structure 3023 on the second portion 3022 of the top cover 302, effectively preventing damage to the second portion 3022. The support structure 3023 may include, but is not limited to, an arc-shaped structure and a linear structure. As an implementation, for example, the support structure 3023 is two symmetrically provided arc-shaped structures that substantially match the outer edge contour of the second portion 3022 of the top cover 302.

[0054] In some embodiments, the lower surface of the second chamber 202 includes a groove 2021. The groove 2021 substantially matches with the contour of the support structure 3023, and is configured such that when the second portion of the top cover is accommodated in the second chamber, the support structure 3023 is accommodated in the groove 2021, so that the upper surface of the top cover 302 is basically horizontal.

[0055] In some embodiments, the top cover is symmetrically provided along the central axis of the forward direction of the automatic cleaning device. In some embodiments, the top cover has at least one or a combination of the following shapes: D shape, rectangular, square, circular, elliptical, triangular, quadrilateral, pentagon, hexagon, heptagon or octagon, as shown in FIG. 6a-FIG. 6h. The symmetrical arrangement can make the appearance of the machine more beautiful without the cover, and it is more convenient for the installation and removal of the dust box.

[0056] In some embodiments, the first chamber 201 includes a first locking member 701. The second chamber 202 includes a second locking member 72. The first portion 3021 of the top cover includes a first positive locking member 601. The second portion 3022 of the top cover includes a second positive locking member 602. The first positive locking member 601 cooperates with the first locking member 701 to achieve locking. The second positive locking member 602 cooperates with the second locking member 72 to achieve locking.

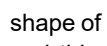
[0057] The above-mentioned embodiments relate to a dust box of an automatic cleaning device and its mounting structure. An accommodating chamber is provided on a rear side of a forward direction of the automatic cleaning device. The accommodating chamber includes a first chamber and a second chamber. The depth of the first chamber is greater than the depth of the second chamber. When the dust box is assembled in the accommodating chamber, the upper surface of the dust box top cover is substantially coplanar with the upper surface of the moving platform, thus simplifying the structure of the top surface of the automatic cleaning device, reducing the production cost, and increasing the design space of the accommodating chamber.

[0058] The existing automatic cleaning device is pro-

vided with a pop-up dust box or a non-pop-up dust box. The pop-up dust box is provided with a top cover and a flip mechanism. When taking and placing the dust box, the top cover needs to be opened, and then the dust box is ejected by pressing the dust box. This implementation requires a complex dust box ejection mechanism, which includes a plurality of parts such as springs. Due to repeated use of the spring, the elasticity decreases, making it impossible for the dust box to pop up smoothly. In addition, many other parts and components can easily cause the dust box to not pop up normally, affecting its use. The non-pop-up dust boxes often adopt a complex locking structure, in which the spring assembly is prone to aging and damage, and the pressing component is not comfortable enough to match the finger during operation, resulting in a poor overall user experience.

[0059] To this end, embodiments of the present disclosure provides an automatic cleaning device without a flip cover, which facilitates the smooth placement of the dust box, while unnecessary components of the automatic cleaning device are omitted. Compared with the above embodiment, this embodiment briefly describes some structural features. The same structure has the same technical effect, and some technical effects are not repeated here. In particular, as shown in FIG. 1- FIG. 5 and FIG. 7, an automatic cleaning device includes: a moving platform 100, configured to automatically move on an operating surface and including an accommodating chamber 200 provided on a rear side in a forward direction; and a cleaning module, including a dust box 300. The dust box 300 is detachably assembled in the accommodating chamber 200; and the dust box includes an accommodating portion 301, a top cover 302 provided above the accommodating portion, and a locking mechanism. The locking mechanism includes a first locking mechanism 610 substantially provided at a central axis of the top cover. Among them, the first locking mechanism 610 includes at least a first catcher recess 603 and a first positive locking member 601. The first positive locking member 601 is provided in the first catcher recess 603. The first positive locking member 601 can elastically move relative to the first catcher recess 603 under the action of an external force. The first catcher recess 603 is formed downwards along an edge of a first portion of the top cover. The first catcher recess 603 provides a sufficient depth in the Z direction so that the height of the first positive locking member 601 is lower than the surface of the top cover. The first catcher recess 603 provides a sufficient elastic space in the X direction so that when the first positive locking member 601 elastically moves inwards, there is sufficient activity space.

[0060] In some embodiments, the first positive locking member 601 includes a first elastic arm 6011, a first catcher portion 6012 and a first snapping-fit portion 6013. The first elastic arm 6011 extends upwards from the bottom of the first catcher recess 603. The first catcher portion 6012 is provided at an end of the first elastic arm 6011 that extends upwards. The first snap-

ping-fit portion 6013 extends laterally along the first elastic arm 6011. The first elastic arm 6011 is generally in the shape of  to reduce materials and increase elasticity, and this shape and structure are not limited. The first catcher portion 6012 is laterally provided above the first elastic arm 6011. The first catcher portion 6012 includes a bottom surface that protrudes generally outwards and a catcher surface that extends upwards along the bottom surface. The catcher surface extends to a position that is generally flush with the top cover. The catcher surface may be an arc structure, that is, its projection on the horizontal plane is an arc. The catcher surface is convenient for receiving manual operation, and is more in line with the force relationship of ergonomics with the finger shape. In some embodiments, the first snapping-fit portion 6013 is a pair of sheet-like structures symmetrically provided along two sides of the first elastic arm 6011. The width of the sheet-like structure decreases from a root to a free end, so as to facilitate smooth insertion of the first locking member 701. The first elastic arm 6011 may be made of common elastic materials, such as plastic or organic elastic materials.

[0061] In some embodiments, as shown in FIG. 8, FIG. 8 is an enlarged schematic diagram of the first locking member at position A in FIG. 3a. The first locking member 701 is provided on an inner wall of the accommodating chamber 200 at a position substantially corresponding to the first positive locking member 601. The first positive locking member 601 cooperates with the first locking member 701 to achieve locking. In some embodiments, the first locking member 701 is a pair of through holes. The free end of the sheet-like structure is inserted into the through hole to achieve locking.

[0062] In some embodiments, a first recess 206 is provided on the inner wall of the accommodating chamber at a position substantially corresponding to the first catcher recess 603. The pair of through holes are provided on two sides of the first recess 206. When the first positive locking member 601 is inserted into the through hole, locking is achieved. When a finger is inserted into the first recess 206 to apply a force to pull the first positive locking member 601 out of the through hole, unlocking is achieved. The coordinated cooperation between the first recess 206 and the first catcher recess 603 makes the insertion operation of the finger easier and more convenient.

[0063] In some embodiments, as shown in FIG. 9a, the locking mechanism further includes a second locking mechanism 620. The second locking mechanism 620 includes a second catcher recess 605 and a second positive locking member 602. The second catcher recess 605 forms a notch inwardly along the approximate mid-line position of the second portion 3022 of the top cover, such as an arc-shaped or square notch, to facilitate the insertion of a finger for snapping-fit operations. The second positive locking member 602 is provided on the lower side of the second catcher recess 605. The second catcher recess 605 provides sufficient space for a finger

to control the second positive locking member 602. The second positive locking member 602 elastically moves inwards under action of an external force. In particular, the second positive locking member 602 includes a second elastic arm 6021, a second catcher portion 6022 and a second snapping-fit portion 6023. Among them, the second elastic arm 6021 is provided below the second catcher recess 605. The second elastic arm 6021 includes two symmetrical parts. Each of the second elastic arms 6021 first extends along an opening direction of the second catcher recess 605, then extends along an edge direction of the top cover, and then extends along an edge direction of the second catcher recess 605. Among them, the opening direction of the second catcher recess 605 is as shown in FIG. 9a, which is the A direction from the center of the top cover to the outside; and in this embodiment, it is also the rear direction of the dust box top cover. The two parts of the second elastic arm 6021 are symmetrically connected substantially as two structures in the shape of . The second catcher portion 6022 connects the two parts of the second elastic arms 6021 that are symmetrically provided. In particular, the second catcher portion 6022 is provided above the two second elastic arms, as shown in FIG. 9b and FIG. 9c. FIG. 9c is an enlarged view of the second catcher portion at position C in FIG. 9b. The bottom of the second catcher portion 6022 includes a bottom surface 60221 that protrudes generally outwards and a catcher surface 60222 that extends upwards along the bottom surface. The catcher surface extends to a position that is generally flush with the top cover. The catcher surface may be an arc-shaped structure, which is convenient for receiving manual operation and for fingers to apply force. Alternatively, the second catcher portion 6022 is integrally formed with the symmetrically provided second elastic arms 6021. The second snapping-fit portion 6023 is provided on the lateral extension portion of the second elastic arm. The second snapping-fit portion 6023 is a pair of portions symmetrically provided along two sides of the second elastic arm 6021, for example, protrusions or sheet-like structures extending along the A direction. As an optional implementation, each of the second snapping-fit portions 6023 includes a groove extending inwards from the end of the second snapping-fit portion 6023. The groove can prevent the entire second snapping-fit portion from being deformed too much after being formed and cooled, causing snapping-fit difficulties. Alternatively, the second positive locking member 602 further includes a symmetrically provided connecting member 6024. The connecting member 6024 is substantially planar. One end of the second elastic arm 6021 is connected to one side of the connecting member 6024. The other side of the connecting member 6024 is connected and fixed to the end face of the support structure. The second catcher portion 6022 exposes the second catcher recess 605 in the X direction, so that when unlocking, a finger may be inserted into the second catcher recess 605 and press on the second catcher portion 6022, applying force to the

inside of the dust box along the X axis and driving the second snapping-fit portion 6023 to elastically contract inwards, so that the second snapping-fit portion 6023 pops out from the bottom of the second locking member 702 to achieve unlocking. The second elastic arm 6021 may be made of common elastic materials, such as plastic or organic elastic materials.

[0064] In some embodiments, as shown in FIG. 10, FIG. 10 is an enlarged view of the second locking member 702 shown at position B in FIG. 3b. The second locking member 702 is provided on the inner wall of the accommodating chamber 200 at a position substantially corresponding to the second positive locking member 602. The second positive locking member cooperates with the second locking member to achieve locking. The second locking member is a pair of protrusions. The second snapping-fit portion 6023 extends onto the bottom of the second locking member 702 to achieve locking. The protrusion may be flat, cylindrical, rectangular, etc., which is not limited, as long as it can lock the second snapping-fit portion.

[0065] In some embodiments, a second recess 207 is provided on the lower surface of the second chamber 202 at a position substantially corresponding to the second catcher recess 605. The pair of protrusions are provided on the rear side wall of the second chamber 202 in the same height, and above the second recess 207. The second recess 207 is configured to avoid and accommodate the second positive locking member 602 when the dust box 300 is placed in the accommodating chamber 200, so that the entire dust box may be better placed in place in the accommodating chamber 200.

[0066] In some embodiments, the top cover includes a first portion covering the accommodating portion and a second portion protruding from the accommodating portion and extending outwards. The second catcher recess 605 and the second positive locking member 602 are provided in the second portion of the top cover. The second portion of the top cover includes a support structure 3023 on the lower part, which is configured to support the second portion of the top cover. The second positive locking member 602 is provided on the support structure 3023. As shown in FIG. 4, the symmetrically provided support structures 3023 form a space compressed inwards in the X direction. When the second elastic arm 6021 is connected to the symmetrical support structure 3023, there is enough elastic space to respond to the applied inward force.

[0067] For the locking structure of the dust box described in the above embodiment, locking structures are symmetrically provided in the front and rear directions of the top cover of the dust box, so that when a single hand applies a force to the two elastic structures in front and back of the dust box, unlocking may be achieved, and the dust box will not tilt due to the dust box being ejected from one side after only one side is unlocked. At the same time, due to the simple elastic structure, elastic unlocking may be achieved by only using elastic materials to form elastic

arms, avoiding the risk of damage to complex unlocking devices such as springs.

[0068] In some embodiments, as shown in FIG. 4, the second locking mechanism 620 includes at least one first magnetic module 604. The first magnetic module 604 is provided between the second portion of the top cover and the supporting structure. As shown in FIG. 3a, the accommodating chamber includes at least one second magnetic module 606, which is configured to cooperate with the first magnetic module 604 to achieve locking after being magnetized. During an application process, the first positive locking member 601 and the second catcher recess 605 may be pushed back by a hand to retract the first positive locking member 601 corresponding to the dust box. When the dust box is placed in the accommodating chamber and the hand is released, the first snapping-fit portion 6013 on the first positive locking member 601 will automatically pop out and is inserted into the first locking member 701, and the first magnetic module 604 and the second magnetic module 606 are magnetized to each other, thus realizing the locking of the dust box. The locking structure is simple and easy to operate, which facilitates the locking of the dust box.

[0069] In some embodiments, the second locking mechanism 620 described above may be an implementation including the second catcher recess 605 and the second positive locking member 602, or an implementation including the first magnetic module 604, or an implementation including both of the above, which is not limited.

[0070] The existing automatic cleaning device needs to be equipped with a dust box including a replaceable dust box filter. The traditional filter is generally made of a hard frame made of plastic or metal. The stacked filter element is placed in the frame, and the frame and the filter element are connected and sealed by glue peripherally. Then, a sealing strip is pasted on the frame to seal the gap between the filter and the dust box. Therefore, in the traditional filter part of the dust box, the is complex, the installation steps of the filter are cumbersome, and it wastes labor and costs. In addition, the glue used for sealing is not economical and environmentally friendly.

[0071] To this end, embodiments of the present disclosure provide an automatic cleaning device. The automatic cleaning device includes: a moving platform, configured to automatically move on an operating surface and including an accommodating chamber; and a cleaning module, including a dust box. The dust box is detachably mounted in the accommodating chamber, the dust box includes a dust box filter, the dust box filter is applied to the dust box of the automatic cleaning device, simplifying the assembly process of the dust box filter. This embodiment briefly describes some structural features compared to the above-mentioned embodiments. The same structure produces the same technical effect, and some technical effects are not repeated here. In particular, as shown in FIG. 11- FIG. 12, the dust box filter 500 includes: a soft rubber frame 501, the soft rubber frame including at least one soft rubber protrusion 5011 used to

seal the assembly gap with the dust box during the assembly process; and a filter element 502, sleeved in the soft rubber frame 501. Among them, the soft rubber frame 501 is non-detachably connected to the filter element 502. In particular, the non-detachable connection process between the soft rubber frame 501 and the filter element 502 may adopt a plastic injection molding process, in which the filter element is sleeved in the frame in advance, and then the soft rubber is applied to the sleeved frame assembly to integrally form a plurality of required sealing protrusions. Alternatively, a double-shot process may be used to first inject the hard rubber frame body, and then the filter element is mounted on the frame body, and then the soft rubber is injected to form the inner and outer sealing protrusions.

[0072] The soft rubber frame may be a rectangular, square, oval, circular, polygonal or other structure, and this structure is not limited. In some embodiments, the soft rubber frame is a rectangular structure. The soft rubber frame of the rectangular structure includes two first side walls 50111 and two second side walls 50113 provided opposite to each other. The soft rubber protrusions include a first protrusion 5011 distributed on the outer peripheral surface of one of the first side walls 50111 and a second protrusion 5015 distributed on the outer peripheral surface of the other first side wall 50111. A pair of first side walls 50111 and a pair of second side walls 50113 form a rectangular structure frame, and a filter element is sleeved inside the frame of rectangular structure, as shown in FIG. 11 and FIG. 12.

[0073] In some embodiments, the first protrusion 5011 and the second protrusion 5015 may be continuous protrusion structures. For example, the first protrusion 5011 and the second protrusion 5015 extend continuously from one end of the outer peripheral surface of the first side wall 50111 to the other end. Since the first protrusion 5011 and the second protrusion 5015 are soft rubber structures, when the dust box filter is assembled on the dust box, the first protrusion 5011 and the second protrusion 5015 will be squeezed and directly sealed between the dust box filter 500 and the second opening 3012 of the dust box, and fully contact and seal with the inner wall of the second opening 3012 of the dust box extending substantially in the horizontal direction, replacing the traditional step of sealing with a sealing strip after the dust box filter is assembled on the dust box.

[0074] In some embodiments, as shown in FIG. 14, at least one of the first protrusion and the second protrusion is an inverted structure. The inverted structure is configured to seal the gap between the soft rubber frame and the dust box assembly while preventing the dust box filter from falling off the dust box. In particular, the inverted structure is an arc structure. The arc structure is inclined to the side opposite to the assembly direction of the dust box filter. The inverted structure facilitates the dust box filter to tilt to the side opposite to the assembly direction during the dust box filter assembly process due to the friction force caused as the dust box filter extends into the

assembly opening of the dust box, and then be squeezed and sealed between the dust box filter and the dust box.

[0075] In some embodiments, the second side wall of the soft rubber frame further includes at least one third protrusion 5012. The third protrusion 5012 is distributed on the outer peripheral surface of at least one second side wall 50113 of the frame structure. The third protrusion 5012 may be a structure of a plurality of discrete protrusion. As an embodiment, the third protrusion 5012 is distributed on the outer peripheral surfaces of the two second side walls 50113 of the frame structure. When the dust box filter is assembled on the dust box, the third protrusion 5012 provided on the outer peripheral surface of one second side wall 50113 of the frame structure has a slightly longer structure, which may be extended into the recess of the dust box side wall, and plays the role of snapping-fit and preventing the dust box filter from falling off. At the same time, when assembling the dust box filter, the slightly longer third protrusion 5012 may be first extended into the recess of the dust box side wall, and then the other side of the dust box filter may be installed into the dust box after rotating about the third protrusion 5012. The third protrusion 5012 distributed on the outer peripheral surface of another second side wall 50113 of the frame structure has a smoother structure. When the dust box filter is assembled on the dust box, the third protrusion 5012 on this side is interference-locked with the elastic structure 5013 of the dust box side wall to prevent the dust box filter from falling off. Among them, the elastic structure 5013 is generally an S structure, which has an inner concave portion for accommodating the third protrusion 5012 and an outer convex portion locked with the third protrusion 5012. The outer convex portion may be elastically moved under the action of an external force and locked with the third protrusion 5012. As shown in FIG. 15, it is a top diagram of the installation structure of the dust box filter viewed from the bottom of the dust box. In some embodiments, as shown in FIG. 13a and FIG. 13b, the soft rubber frame further includes a first rib portion 510, which is provided on the outer peripheral surface of the second side wall and is configured to prevent the dust box filter from being installed too deep or too shallow into the dust box, avoiding the poor assembly. During the process of installing the dust box filter into the dust box, when the dust box filter is assembled in place, the first rib portion 510 will abut against a blocking portion 5014 provided at the corresponding position of the dust box frame, preventing the filter from extending further inward, thus preventing the dust box filter from being installed too deep into the dust box. At the same time, if the first rib portion 510 does not abut against the blocking portion 5014 of the dust box frame during the assembly process, it is considered that the dust box filter is not assembled in place, thus preventing the dust box filter from being installed too shallowly into the dust box, as shown in FIG. 15.

[0076] In some embodiments, as shown in FIG. 13a and FIG. 13b, the soft rubber frame further includes an

anti-mistake protrusion 509, which is provided on the outer peripheral surface of the second side wall, and is configured to prevent the dust box filter from being installed upside down. A recess is provided at the position of the dust box corresponding to the anti-mistake protrusion 509. When the dust box filter is normally installed, the anti-mistake protrusion 509 will enter the recess so that the dust box filter may be normally assembled. When the dust box filter is installed upside down, since there is no such a recess on the other side of the dust box, the anti-mistake protrusion 509 will prevent the dust box filter from being assembled, thus playing an anti-mistake effect of prompting that the dust box filter is installed upside down.

[0077] In some embodiments, as shown in FIG. 3a and FIG. 3b, the accommodating chamber 200 includes a first chamber 201 and a second chamber 202. The first chamber 201 and the second chamber 202 are provided adjacent to each other in sequence in the forward direction of the automatic cleaning device. The depth of the first chamber 201 is greater than the depth of the second chamber 202. A dust suction port 203 is provided at the bottom of the front side wall of the first chamber 201. An air outlet 208 is provided at the rear side wall where the first chamber 201 and the second chamber 202 are connected. A fan is accommodated in the space below the second chamber 202. An exhaust port 204 is provided at the rear side wall of the moving platform 100. Under the action of the fan suction force, the dust enters the dust box 300 from the dust suction port 203, and the airflow is discharged from the exhaust port 204 after being filtered by the dust box filter. The air outlet 208 is provided with a grid structure.

[0078] As shown in FIG. 11 and FIG. 12, the soft rubber frame further includes an inner sealing lip 507 and an outer sealing lip 506. The inner sealing lip 507 is provided on the first end surface 50116 of the soft rubber frame 501 around the filter element 502, and is configured to achieve a sealed fit between the dust box filter and the assembly surface 30121 of the second opening 3012 of the dust box. The assembly surface 30121 of the second opening 3012 of the dust box is formed on one side of the second opening close to the inner wall of the dust box, and is a substantially planar structure, which is used to assemble the soft rubber frame after abutting against the first end surface 50116 of the soft rubber frame 501, as shown in FIG. 14. The outer sealing lip 506 is provided on the second end surface 50115 of the soft rubber frame 501 around the filter element 502, and is configured to seal the dust box filter and the edge of the air outlet 208 of the accommodating chamber 200. The inner sealing lip 507 and the outer sealing lip 506 are higher than the first end face 50116 or the second end face 50115 where they are provided. After being assembled in place, the inner sealing lip 507 will be squeezed between the dust box filter and the assembly surface of the dust box. Since the inner sealing lip 507 is made of a flexible material, the assembly surface of the dust box filter and the dust box is

sealed under the action of the extrusion force. When the dust box is assembled on the automatic cleaning device, the outer sealing lip 506 of the dust box filter will be squeezed between the dust box filter and the outer side of the grid of the air outlet 208 of the accommodating chamber 200, thus sealing the assembly surface between the dust box filter and the fan bracket. As shown in FIG. 3a and FIG. 3b, the side wall connecting the first chamber 201 and the second chamber 202 constitutes the assembly surface of the fan bracket. The fan is provided below the second chamber 202. The grid-type air outlet 208 is provided on the side wall connecting the first chamber 201 and the second chamber 202. By providing the inner sealing lip 507 and the outer sealing lip 506 on the soft rubber frame 501, the inner end face of the dust box filter 500 and the assembly surface of the dust box air outlet, as well as the outer end face of the dust box filter 500 and the outer surface of the air outlet grid of the accommodating chamber 200 are sealed and mated, thus omitting the cumbersome step of adding sealing strips inside and outside the traditional dust box filter to meet the air path sealing requirements. In addition, the soft rubber frame 501 serves as a carrier, and the inner sealing lip 507 and the outer sealing lip 506, which also have a certain flexibility, serve as a sealing structure, so that the contact seal is more closely matched, the fit is more complete, and the sealing effect is stronger, thus ensuring the airtightness of the entire air path and providing a better guarantee for the dust suction and dust exhaust functions of the cleaning device that rely on negative pressure.

[0079] In some embodiments, as shown in FIG. 11 and FIG. 12, the soft rubber frame further includes a step surface 503 extending outwardly along the second end surface 50115 of the soft rubber frame 501, so that the step surface 503 and the side wall of the soft rubber frame 501 form a step structure, which is configured to prevent the dust box filter from being installed too deep into the dust box. During the assembly process, when the dust box filter is extended into the dust box assembly opening, the step surface 503 will abut against the outer edge of the dust box assembly, thus being stuck at the outer edge of the dust box, and preventing the dust box filter from being installed too deep into the dust box, as shown in FIG. 14.

[0080] In some embodiments, as shown in FIG. 11, the soft rubber frame further includes a magnetic element mounting hole 504, which is provided on the second end surface 50115 of the soft rubber frame 501 and is configured to accommodate a magnetic element to ensure that the dust box filter is installed in place. The magnetic element may be a magnet or other electromagnetic component. The magnetic element mounting hole 504 is used for installing an inductive magnetic element. The magnetic element mounting hole 504 has a sufficient depth to ensure that the magnetic element may be installed in a fixed position on the inside of the filter. When the entire filter is installed in a fixed position, it may be

detected by a Hall sensor to ensure that the filter is installed in place.

[0081] In some embodiments, as shown in FIG. 11, the soft rubber frame further includes a second rib portion 5041, which is provided around the periphery of the magnetic element mounting hole and is configured to prevent liquid from entering the magnetic element mounting hole. The second rib portion 5041 tightly wraps the outer end of the magnetic element outside the magnetic element mounting hole 504 to prevent the magnetic element from rusting and failing. The second rib portion 5041 may be a soft rubber material, which further wraps the magnetic element after being squeezed.

[0082] In some embodiments, as shown in FIG. 11, the soft rubber frame further includes a catcher handle 505, which is provided at a position extending outward from the step surface 503 and is configured to facilitate the removal of the dust box filter. The shape and structure of the catcher handle 505 are not limited and may be semicircular, square, rectangular, etc.

[0083] In some embodiments, as shown in FIG. 12, the soft rubber frame further includes a hollow structure 508, which is provided on the first side wall and/or the second side wall of the frame, and is configured to reduce the overall weight of the frame. The hollow structure 508 may be a plurality of blind holes recessed inwardly. The structure of the blind holes is not limited and may be circular, square, rectangular, irregular, etc.

[0084] In the automatic cleaning device described in the above embodiments, the dust box filter, due to the adoption of a soft rubber frame design, may be directly squeezed and assembled in the dust box opening during the assembly process, and at the same time cooperates with the first protrusion, the inner sealing lip and the outer sealing lip and other structures, so that the filter and the assembly surface can achieve a tight sealing effect during assembly, avoiding the manual assembly part of the traditional process of inserting the filter and then gluing and bonding, simplifying the process, reducing the number of assembly parts, and reducing the cost at the same time, and there is no glue bonding, no odor, and it is more environmentally friendly.

[0085] In some embodiments, as shown in FIG. 14, this embodiment further provides a dust box, including a dust box filter as described in any of the above embodiments. The structure of the dust box is as described in the above embodiments, and will not be repeated here.

[0086] In some embodiments, there is further provided an automatic cleaning device, including a dust box as described in any of the above embodiments. The structure of the automatic cleaning device is as described in the above embodiments, and will not be repeated here.

[0087] After the automatic cleaning device finishes dust absorption, it can enter the dust collection station for automatic dust collection. When the automatic cleaning device is automatically collecting the dust, since the air path entering the automatic cleaning device is single and the air path is blocked by the machine structure and is

not smooth enough, it is difficult for the dust collection station to suck all the garbage in the dust box into the garbage bag of the dust collection station. In order to clean the garbage in the dust box as much as possible, it is often necessary to increase the power of the dust collection station fan, which brings greater noise and more energy consumption.

[0088] To this end, an embodiment of the present application further provides an automatic cleaning device with a dust collection function. By improving the air path structure of the automatic cleaning device, the airflow can more easily enter the dust box during the dust collection process of the automatic cleaning device, so that it is easier to clean the garbage in the dust box. Compared with the above embodiment, this embodiment briefly describes some structural features. The same structure produces the same technical effect, and some technical effects are not repeated here. Specifically, according to the specific implementation of the present application, the present application provides an automatic cleaning device with a dust collection function, which includes a moving platform 100. The moving platform 100 is configured to automatically move on an operating surface. The moving platform 100 generally includes an upper shell, a lower shell and a side shell that form the appearance of the automatic cleaning device, as well as structures and accessories provided in the internal space of the aforementioned shells. Specifically, the moving platform 100 includes an accommodating chamber 200 and a driving wheel assembly 141. The accommodating chamber 200 is substantially located in the rear half portion in the forward direction of the moving platform. The accommodating chamber 200 is formed in the form of an inward recess. As described above, the driving wheel assembly 141 is located on the lower shell of the moving platform 100 to provide power for the automatic cleaning device to move forward. The moving platform 100 further includes a cleaning module 150, which includes a dust box 300 and a main brush module 153. The dust box 300 is detachably mounted in the accommodating chamber 200. A part of the structure of the dust box 300 is as described in the above embodiment and will not be described in detail herein. The dust box 300 further includes a first air inlet door 3013 and a second air inlet door 3014. The first air inlet door 3013 and the second air inlet door 3014 are respectively located on a first side wall 3015 and a second side wall 3016 of the dust box. The first air inlet door 3013 and the second air inlet door 3014 are configured to provide two intake airflows in different directions during dust collection, which is beneficial to forming an airflow vortex in the dust box during dust collection, greatly reducing the garbage residue in the dust box, reducing airflow dead angles, and improving the dust collection rate. The provision of the double air inlet doors also increases the air intake rate and improves the efficiency of forming the airflow vortex. Among them, the source of the intake airflows includes at least one of the following: airflow I entering from the top gap of the

moving platform 100, airflow II entering from the gap of the main brush module 153, airflow III entering from the rear side wall of the moving platform, and airflow IV entering from the gap of the driving wheel assembly 141. By providing a plurality of groups of intake airflows, the air intake volume and air intake speed of the automatic cleaning device are increased, thus increasing the dust collection strength and efficiency of the dust collection station, further reducing the airflow dead angle in the dust box, reducing garbage residue, and improving the dust collection rate.

[0089] When the automatic cleaning device finishes dust absorption and returns to the dust collection station for dust collection, the fan at the dust collection station will start to suck the garbage in the dust box. During the suction process, the airflow enters the dust box through a plurality of channels via the first air inlet door 3013 and the second air inlet door 3014, and then is sucked out from the dust collection port by the dust collection station along with the garbage. In the dust collection state, the main cleaning brush of the automatic cleaning device moves in the opposite direction as the fan at the dust collection station starts. The automatic cleaning device is in a "dust-spitting" state. The airflow enters the inner cavity of the dust box from the outside of the automatic cleaning device through the gap between the shells of the automatic cleaning device. The airflow forms a vortex in the inner cavity of the dust box, rotating and throwing up the garbage in the inner cavity of the dust box. The dust collection fan of the dust collection station starts, communicates to the main brush, the first opening 3011 of the dust box, and the inner cavity of the dust box through a certain airway, and then relies on suction to suck the garbage in the inner cavity of the dust box into the garbage collection container or bag inside the dust collection station.

[0090] Among them, the airflow entering the dust box mainly includes the airflow I entering from the top gap of the moving platform 100, as shown in FIG. 16. Specifically, the airflow I entering from the top gap of the moving platform 100 includes the airflow entering from the gap between the protecting cover 1212 and the top surface of the moving platform 100, and the airflow entering from the gap between the protecting cover 1212 and the position determination apparatus 1211. In the present disclosure, when the protecting cover 1212 and the position determination apparatus 1211 are assembled, airflow gaps may be formed between the protecting cover 1212 and the top surface of the moving platform 100 and between the protecting cover 1212 and the position determination apparatus 1211 by means of support structures such as protrusions. With the adsorption of the fan at the dust collection station, a negative pressure is formed in the dust box 300 in fluid communication with the fan at the dust collection station. The first air inlet door 3013 and the second air inlet door 3014 are opened into the dust box to guide the airflow outside the dust box to enter. A negative pressure is also formed in the moving platform, which will

naturally guide the air outside the moving platform to enter the machine through the airflow gap formed between the protecting cover 1212 and the top surface of the moving platform 100 and the protecting cover 1212 and the position determination apparatus 1211. Compared with the traditional sealing structure, the airflow gaps formed between the protecting cover 1212 and the top surface of the moving platform 100 and between the protecting cover 1212 and the position determination apparatus 1211 can add more airflow channels, thus ensuring sufficient airflow entering the dust box, further improving the air intake volume and air intake speed of the dust box, thus increasing the dust collection strength and dust collection efficiency of the dust collection station, and reducing the airflow dead angle in the dust box, reducing garbage residue, and improving the dust collection rate. More importantly, guiding the airflow to pass near the position determination apparatus 1211 helps to take away the excess heat generated by the position determination apparatus during the working process, plays a cooling role, is conducive to improving the operation stability of the position determination device, and prolonging the life of electronic devices. In addition, the top airflow is cleaner than other parts, and is safer and more friendly to the internal air path of the machine.

[0091] The airflow entering the dust box further includes airflow II entering from the gap of the main brush module 153. As shown in FIG. 17, airflow II enters the shell from the assembly gap of the main brush module 153 on the bottom surface of the lower shell of the moving platform 100. Among them, when the device is assembled, the edge gap of the main brush module 153 and the edge gap of the driving wheel assembly 141 are formed through the protrusions or grooves or the inherent assembly gaps. As the fan at the dust collection station is adsorbing, a negative pressure is formed in the moving platform, which will naturally guide the air outside the moving platform to enter the machine from the edge gap of the main brush module 153. Compared with the traditional sealing structure, the edge gap of the main brush module 153 can add more airflow channels, thus ensuring that sufficient airflow enters the dust box, further improving the air intake volume and air intake speed of the dust box, thus increasing the dust collection strength and dust collection efficiency of the dust collection station, and at the same time reducing the airflow dead angle in the dust box, reducing garbage residue, and improving the dust collection rate. In addition, the distance for airflow II to reach the two air inlet doors of the dust box is shorter, and the air passage is smoother, which is conducive to further improving the airflow replenishment speed and ensuring the dust collection efficiency.

[0092] In some embodiments, the rear side wall of the moving platform 100 is provided with an exhaust port 204, as shown in FIG. 3a. Among them, the plurality of groups of intake airflows further include an airflow III entering from the exhaust port 204 in the dust collection state, as shown in FIG. 18a. The exhaust port 204 is in the dust

collection state, and with the adsorption of the dust collection station fan, a negative pressure is formed in the moving platform, which will naturally guide the air outside the moving platform to enter the inside of the machine via the exhaust port 204. Specifically, as shown in FIG. 18b, the air enters the two sides of the fan bracket from the exhaust port 204, and then enters the outside of the side wall of the accommodating chamber from the air inlet notch 20115 of the sealing baffle 20114 on two sides of the fan bracket, and then enters the dust box through the air inlet hole 20111 on the outside of the accommodating side wall, thus ensuring that sufficient airflow enters the dust box, further improving the air intake volume and air intake speed of the dust box, thus increasing the dust collection strength and dust collection efficiency of the dust collection station, further reducing the airflow dead angle in the dust box, reducing garbage residue, and improving the dust collection rate. During the dust collection process, the rear side of the moving platform 100 can be relatively fully exposed to the environment, and the exhaust port provided here serves as the airflow inlet, which can supplement the airflow more smoothly, reducing the interference of the external devices or environment that contact or cooperate with the cleaning device with the airflow, and the airflow supplement is safer and more efficient. In some embodiments, the air inlet notch 20115 is provided at the bottom of the sealing baffle 20114 to reduce the impact of the airflow on other components.

[0093] In addition, as shown in FIG. 18a, the airflow entering the dust box further includes airflow IV entering from the gap of the driving wheel assembly 141. The driving wheel is provided with an air inlet channel. The airflow entering the shell from the gap at the bottom edge of the driving wheel directly enters the two sides of the accommodating chamber from the air inlet channel on the rear side of the upper part of the driving wheel, and then directly enters the dust box through the air inlet holes 20111. The airflow IV entering from the gap of the driving wheel assembly 141 has a shorter path, and the airflow channel entering the dust box is simpler, which can easily provide more incoming airflow.

[0094] As shown in FIG. 18a, the above-mentioned airflows I-II and IV enter the shell of the moving platform 100, and are substantially divided into two parts, where airflows I and II form the first portion, and airflow IV forms the second portion. Among them, in the first portion of the airflows, the airflow I enters from the gap between the protecting cover 1212 and the top surface of the moving platform and the gap between the protecting cover 1212 and the position determination apparatus 1211, directly to the front of the accommodating chamber 200. The airflow II enters from the gap between the main brush and the lower shell, and then passes through the opening around the driving motor of the main brush to the front wall of the accommodating chamber, as shown in FIG. 18a. Due to the obstruction of the front side wall 2010 of the accommodating chamber 200, the airflow cannot directly

reach the side of the accommodating chamber 200, but enters the side of the accommodating chamber 200 through the air passages 209 on two sides of the front side wall. Specifically, as shown in FIG. 19, in some embodiments, the accommodating chamber 200 respectively includes an air passage 209 on its upper outer side of the front side wall. The airflow I entering from the top gap of the moving platform 100 and the airflow II entering from the gap of the main brush module 153, pass through the air passage 209 to the plurality of air inlet holes 20111 on the side of the accommodating chamber 200, enter the accommodating chamber 200 from the plurality of air inlet holes 20111, and enter the dust box through the first air inlet door 3013 and the second air inlet door 3014. The second portion of the airflow IV directly reaches the plurality of air inlet holes 20111 on the side of the accommodating chamber 200 from the air inlet channel on the rear side of the upper part of the driving wheel, enters the accommodating chamber 200 from the plurality of air inlet holes 20111, and enters the dust box through the first air inlet door 3013 and the second air inlet door 3014.

[0095] As shown in FIG. 18b, the moving platform includes a fan bracket 20116 and baffles 20114 located on two sides of the fan bracket 20116 on its rear side. The baffles 20114 are connected to the upper and lower surfaces and the side walls of the shell. The baffles 20114 enclose the fan bracket 20116 at the rear end of the moving platform. The fan is connected to some exhaust ports 204 on the rear side wall of the moving platform through an exhaust duct. These exhaust ports may be referred to as first exhaust ports. When the automatic cleaning device is cleaning, the fan exhausts air through the exhaust duct and some exhaust ports 204 connected to the exhaust duct, that is, the first exhaust ports. When collecting dust, the fan takes in air through other exhaust ports 204 around the above-mentioned some exhaust ports 204 of the fan, that is, the second exhaust ports. That is, the second exhaust ports are actually the air inlets that are not directly connected to the fan exhaust duct. Since the baffle 20114 is provided with an air inlet notch 20115, after the airflow III enters the interior of the shells of the moving platform from the second exhaust port 204, it reaches the plurality of air inlet holes 20111 on the side of the accommodating chamber 200 from the air inlet notches 20115 of the baffles 20114 on two sides of the fan bracket, enters the accommodating chamber 200 from the plurality of air inlet holes 20111, and enters the dust box through the first air inlet door 3013 and the second air inlet door 3014.

[0096] As an optional embodiment, the exhaust port 204 further includes a third exhaust port provided on the side of the baffle 20114 opposite to the first exhaust port or the second exhaust port, i.e., the exhaust ports 204 currently visible in FIG. 18b. The airflow III enters from the third exhaust port, and the airflow III directly reaches the plurality of air inlet holes 20111 on the side of the accommodating chamber 200 from the third exhaust port, enters the accommodating chamber 200 from the plurality

of air inlet holes 20111, and enters the dust box through the first air inlet door 3013 and the second air inlet door 3014. In this way, the air supply efficiency can be further improved.

[0097] In some other embodiments, the third exhaust port is a non-opening hole or a decorative hole which is only used for decoration and is not opened, so as to avoid too much unnecessary connection between the inside and the outside of the automatic cleaning device and make the air intake of the automatic cleaning device controllable.

[0098] In some embodiments, as shown in FIG. 20, the accommodating chamber 200 further includes a third side wall 2011 provided corresponding to the first side wall 3015 of the dust box, and a fourth side wall 2012 provided corresponding to the second side wall 3016 of the dust box. The third side wall 2011 and the fourth side wall 2012 respectively include a plurality of air inlet holes 20111. The plurality of air inlet holes 20111 cover at least a portion of the first air inlet door 3013 and the second air inlet door 3014. The third side wall 2011 and the fourth side wall 2012 of the accommodating chamber 200 respectively include a plurality of spacers 20112 on the outside. The plurality of spacers 20112 form a plurality of air paths. In some embodiments, each of the spacers 20112 includes at least one notch 20113 at the top end, configured to communicate with the plurality of air paths. The plurality of air paths formed by the plurality of spacers 20112 can ensure the uniformity of the airflow entering the accommodating chamber 200, and avoid the airflow loss caused by part of the airflow reaching the outside of the air inlet hole 20111, that is, entering the accommodating chamber 200 but failing to enter the dust box in time, and at the same time, the lost airflow forming convection with the airflows I - IV, affecting the efficiency of the airflow entering the dust box. When a plurality of spacers 20112 are designed and a connecting structure is formed, the plurality of air paths can reach the accommodating chamber 200 through the plurality of air inlet holes 20111 more uniformly, and then enter the dust box efficiently.

[0099] In some embodiments, as shown in FIG. 21, the first air inlet door 3013 and the second air inlet door 3014 are respectively located at asymmetric positions of the first side wall 3015 and the second side wall 3016 to avoid direct collision and offset of the airflows entering from two sides, and to make the airflows entering from two different directions intertwine, which is conducive to forming an airflow vortex in the dust box more quickly during dust collection, improving the swirl speed of the airflow after entering the dust box, greatly reducing the garbage residue in the dust box, reducing the airflow dead angle, and improving the dust collection rate. In some embodiments, the second air inlet door 3014 is provided at a position adjacent to the lower edge of the second side wall 3016, and the lower edge of the second air inlet door 3014 is lower than the lower edge of the first air inlet door 3013, further improving the swirl speed of the airflow after entering the dust box. In some embodiments, the second

air inlet door 3014 is provided adjacent to the rear side wall of the dust box, and the first air inlet door 3013 is provided adjacent to the front side wall of the dust box, further increasing the swirl speed of the airflow after entering the dust box. Among them, in the assembled state, the front side wall of the dust box is the side wall of the dust box facing the forward direction of the automatic cleaning device, and the rear side wall of the dust box is the side wall opposite to the front side wall and facing the tail of the automatic cleaning device. In some embodiments, the first air inlet door 3013 rotates approximately around a first rotating shaft, and the second air inlet door 3014 rotates approximately around a second rotating shaft, and the first rotating shaft is approximately perpendicular to the second rotating shaft, further increasing the swirl speed of the airflow after entering the dust box. Among them, the first rotating shaft and the second rotating shaft may be the rotating shafts actually provided for the first air inlet door 3013 and the second air inlet door 3014; or it may be that they rotate around the positions where the first rotating shaft and the second rotating shaft are located through an elastic driving member.

[0100] The first air inlet door 3013 and the second air inlet door 3014 described in this embodiment refer to the plate surfaces that cover the openings on the first side wall and the second side wall of the dust box. During the actual dust collection process, in order to realize the opening and closing of the first air inlet door 3013 and the second air inlet door 3014, it is also necessary to provide elastic parts connected to the first air inlet door 3013 and the second air inlet door 3014, as well as a fixing structure fixed to the outer surfaces of the first side wall and the second side wall of the dust box, which are not elaborated here.

[0101] In some embodiments, the shapes of the first air inlet door 3013 and the second air inlet door 3014 are at least one of the following or a combination thereof: rectangular, square, circular, elliptical, long strip, etc., which are not limited thereto. In some embodiments, the first air inlet door 3013 is a rectangular structure, and the long side of the first air inlet door 3013 is provided longitudinally. The second air inlet door 3014 is a rectangular structure, and the long side of the second air inlet door 3014 is provided transversely. By arranging the first air inlet door 3013 and the second air inlet door 3014 in the above structure, the airflow generates a vertical vortex and a horizontal vortex, and blows up dust in all directions and angles, effectively improving the dust collection rate, and further improving the swirl speed of the airflow after entering the dust box. In addition, the first air inlet door 3013 and the second air inlet door 3014 are structures that open inwardly, as shown in FIG. 21. When the first air inlet door 3013 is opened inwardly, the air door is in a semi-open state, the air door opening is toward the front side wall of the dust box, and the airflow blows directly toward the front side wall of the dust box when it comes in. When the second air inlet door 3014 is opened inwardly, the air door is also in a semi-open state, the air door

opening is toward the bottom of the dust box, and the airflow blows directly toward the bottom of the dust box when it comes in. The airflows from the two air doors will not blow against each other, but form a swirling airflow, which can accelerate the rotation of the garbage in the dust box, thus facilitating the rapid circulation of the garbage to the dust outlet and sending it out of the dust box.

[0102] In some embodiments, the dust box 300 further includes a first opening 3011 and a second opening 3012. The first opening 3011 is configured as a dust inlet during dust absorption and a dust outlet during dust collection. The dust inlet during dust absorption and the dust outlet during dust collection being provided as the same opening reduces the number of ports and effectively shares the existing ports, thus reducing the probability of air leakage. A filter is provided on the second opening 3012, and the specific structure and disposing method are as described in the above embodiment and will not be repeated here. The first opening 3011 and the second opening 3012 are substantially located on the central axis in the front and rear direction of the automatic cleaning device. This design structure makes the air path a straight line structure when the fan of the automatic cleaning device is used for dust absorption, avoiding the detour of the airflow, thus improving the smoothness of the air path, as shown in FIG. 22.

[0103] In some embodiments, the accommodating chamber 200 includes a first chamber 201 and a second chamber 202 provided adjacent to each other in sequence in the forward direction of the automatic cleaning device. A dust suction port 203 is provided at the bottom of the front side wall of the first chamber 201, and an air outlet 208 is provided at the rear side wall where the first chamber 201 and the second chamber 202 are connected. The dust suction port 203, the air outlet 208, the first opening 3011 and the second opening 3012 are all approximately located on the central axis in the front-to-back direction of the automatic cleaning device. When absorbing or collecting dust, the airflow does not pass through a tortuous air passage or air path, so that the fan power and suction loss are small, the fan effect is maximized, energy consumption is saved, and noise is reduced.

[0104] In some embodiments, the moving platform 100 in some embodiments further includes a position determination apparatus 1211 approximately located on the central axis in the front-to-back direction of the moving platform 100, and a protecting cover 1212 provided above the position determination apparatus 1211. A fan is provided in the space below the second chamber 202. The position determination apparatus 1211, the protecting cover 1212, the fan, the main brush module 153, the dust suction port 203, the air outlet 208, the first opening 3011 and the second opening 3012 are all approximately located on the central axis in the front-to-back direction of the automatic cleaning device. In the related art, when the air inlet is single, the intake airflow is

asymmetric, the dust inlet is usually offset, and it is not beautiful. The entire air intake and air outlet passages are non-linear, and there is obstruction loss of the airflow, which will affect the layout of other devices. After adding the air inlet, the above-mentioned air path structure is provided on the central axis, which avoids the defects of low dust collection rate and residual dust collection under the existing dust collection method. It overcomes the technical defects of the prior art that the air path is offset, the fan power and suction force are lost through the tortuous air passage, and at the same time, it has great improvements in design aesthetics and component placement space. The port of the main brush module 153 is also placed on the central axis, ensuring that the dust collection air path is not obstructed, reducing losses and improving efficiency.

[0105] According to a specific implementation of the present application, the present application provides an automatic cleaning system, which includes a dust collection station and an automatic cleaning device as described in any one of the above items. Among them, the dust collection station includes a dust collection port. The dust collection port is docked with the port of the main brush module and collects dust.

[0106] FIG. 23 is a schematic diagram of the structure of a dust collection station according to some embodiments of the present disclosure. The dust collection station 700 is configured to provide garbage collection for an automatic cleaning device.

[0107] As shown in FIG. 23, the dust collection station 700 includes a dust collection station base 710 and a dust collection station body 720. The dust collection station body 720 is configured to collect garbage in the dust box of the automatic cleaning device, and is provided on the dust collection station base 710. The dust collection station base 710 includes a dust collection port 711, which is configured to dock with the port of the main brush module of the automatic cleaning device. The garbage in the dust box of the automatic cleaning device enters the dust collection station body 720 through the dust collection port 711. In some embodiments, as shown in FIG. 22, a sealing rubber pad 714 is further provided around the dust collection port 711, which is used to seal the dust collection port 711 after it is docked with the port of the main brush module of the automatic cleaning device to prevent garbage leakage.

[0108] FIG. 24 is a schematic diagram of a scene after the automatic cleaning device according to some embodiments of the present disclosure returns to the dust collection station. As shown in FIG. 24, when the moving platform 100 of the automatic cleaning device, such as a sweeping robot, returns to the dust collection station 700 after cleaning, the automatic cleaning device will move along the X direction onto the dust collection station base 710, so that the port of the main brush module of the automatic cleaning device is docked with the dust collection port 711 to transfer the garbage in the dust box of the automatic cleaning device to the garbage bag of the dust

collection station.

[0109] The present application provides an automatic cleaning device and an automatic cleaning device system. The automatic cleaning device has an automatic dust collection function. By asymmetrically arranging two air doors in the dust box of the automatic cleaning device, the airflow entering the dust box forms convection and forms a vortex cyclone in the dust box, thus smoothly sucking the garbage in the dust box into a dust collection station. In addition, the main brush module, the dust suction port, the air outlet, the first opening and the second opening are all substantially provided on the central axis in the front-to-back direction of the automatic cleaning device, which can further increase the speed of the airflow passing through the dust box during dust collection and improve the dust collection efficiency. At the same time, it can also make it easier to suck the garbage in the dust box into the dust collection station during dust collection.

[0110] Finally, it should be noted that the various embodiments in the description are described in a progressive manner, each embodiment focuses on the differences from the other embodiments, and the same or similar parts between the various embodiments may be referred to each other.

[0111] The above embodiments are only used to illustrate, instead of limiting, the technical solutions of the present disclosure. Although the present disclosure is described in detail with reference to the foregoing embodiments, it may be understood by those of ordinary skill in the art that they can still make modifications to the technical solutions disclosed in the above various embodiments or equivalent replacements on part of technical features, and these modifications or replacements do not depart the nature of the corresponding technical solution from the spirit and scope of the technical solutions of the various embodiments of the present disclosure.

Claims

1. An automatic cleaning device, configured with a dust collection function, and comprising:

a moving platform, comprising an accommodating chamber, wherein the moving platform is configured to automatically move on an operating surface; and

a cleaning module, comprising a dust box and a main brush module, wherein the dust box is detachably mounted in the accommodating chamber, and the dust box comprises a first side wall and a second side wall that are provided opposite to each other; wherein the accommodating chamber further comprises a third side wall provided corresponding to the first side wall of the dust box, and a fourth side wall provided corresponding to the

second side wall of the dust box, wherein the third side wall and the fourth side wall respectively comprise a plurality of air inlet holes, and the plurality of air inlet holes are configured to provide intake airflows to the dust box from two directions during a dust collection process.

2. The automatic cleaning device according to claim 1, wherein a source of the intake airflows comprises at least one of: an airflow entering from a top gap of the moving platform, an airflow entering from a gap of the main brush module, or an airflow entering from a rear side wall of the moving platform.

3. An automatic cleaning device, configured with a dust collection function, and comprising:

a moving platform, comprising an accommodating chamber, wherein the moving platform is configured to automatically move on an operating surface; and

a cleaning module, comprising a dust box and a main brush module, wherein the dust box is detachably mounted in the accommodating chamber, and the dust box comprises a first side wall and a second side wall that are provided opposite to each other;

wherein the accommodating chamber further comprises a third side wall provided corresponding to the first side wall of the dust box, and a fourth side wall provided corresponding to the second side wall of the dust box, and the third side wall and/or the fourth side wall comprises a plurality of air inlet holes, and the plurality of air inlet holes are configured to provide intake airflows into the dust box during a dust collection process; and

a source of the intake airflows comprises at least one of: an airflow entering from a top gap of the moving platform, an airflow entering from a gap of the main brush module, or an airflow entering from a rear side wall of the moving platform.

4. The automatic cleaning device according to claim 2 or 3, wherein the airflow entering from the top gap of the moving platform comprises an airflow entering from a gap between a protecting cover and a top surface of the moving platform and/or from a gap between the protecting cover and a position determination apparatus.

5. The automatic cleaning device according to claim 2 or 3, wherein the airflow entering from the gap of the main brush module comprises an airflow entering from a gap between a main brush and a lower shell, and then passing through an opening around a main brush drive motor to a front wall of the accommodating chamber.

6. The automatic cleaning device according to claim 2 or 3, wherein the airflow entering from the rear side wall of the moving platform comprises an airflow passing thorough air inlet notches of baffles on two sides of a fan bracket to a side surface of the accommodating chamber after entering interior of a shell of the moving platform from an exhaust port. 5
7. The automatic cleaning device according to claim 6, wherein the airflow entering from the rear side wall of the moving platform comprises an airflow entering directly from the exhaust port to a side surface of the accommodating chamber. 10
8. The automatic cleaning device according to claim 2 or 3, wherein the third side wall and/or the fourth side wall respectively comprises a plurality of spacers on outer sides, and the plurality of spacers form a plurality of air paths. 15
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9. The automatic cleaning device according to claim 2 or 3, wherein a front side wall of the accommodating chamber respectively comprises an air passage on an upper outer side, and the airflow entering from the top gap of the moving platform and/or the airflow entering from the gap of the main brush module passes through the air passage to the plurality of air inlet holes. 25
10. The automatic cleaning device according to claim 2 or 3, wherein the accommodating chamber comprises a first chamber and a second chamber that are provided adjacent to each other in sequence in a forward direction of the automatic cleaning device, a dust suction port is provided at a bottom of a front side wall of the first chamber, an air outlet is provided on a rear side wall at a connection between the first chamber and the second chamber, the dust box further comprises a first opening and a second opening, and the dust suction port, the air outlet, the first opening and the second opening are all substantially located on a central axis in a front-to-back direction of the automatic cleaning device. 30
35
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11. The automatic cleaning device according to claim 2 or 3, wherein the dust box comprises a first air inlet door and a second air inlet door, the first air inlet door and the second air inlet door are respectively located on the first side wall and the second side wall of the dust box, and wherein the plurality of air inlet holes cover at least a portion of the first air inlet door and the second air inlet door. 45
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12. The automatic cleaning device according to claim 11, wherein the first air inlet door and the second air inlet door are located at asymmetric positions of the first side wall and the second side wall respectively, to increase swirl speed of an airflow after entering the 55

dust box.

13. An automatic cleaning system, comprising: a dust collection station and the automatic cleaning device according to any one of claims 1 to 12, wherein the dust collection station comprises a dust collection port, and the dust collection port is docked with a port of the main brush module for dust collection.

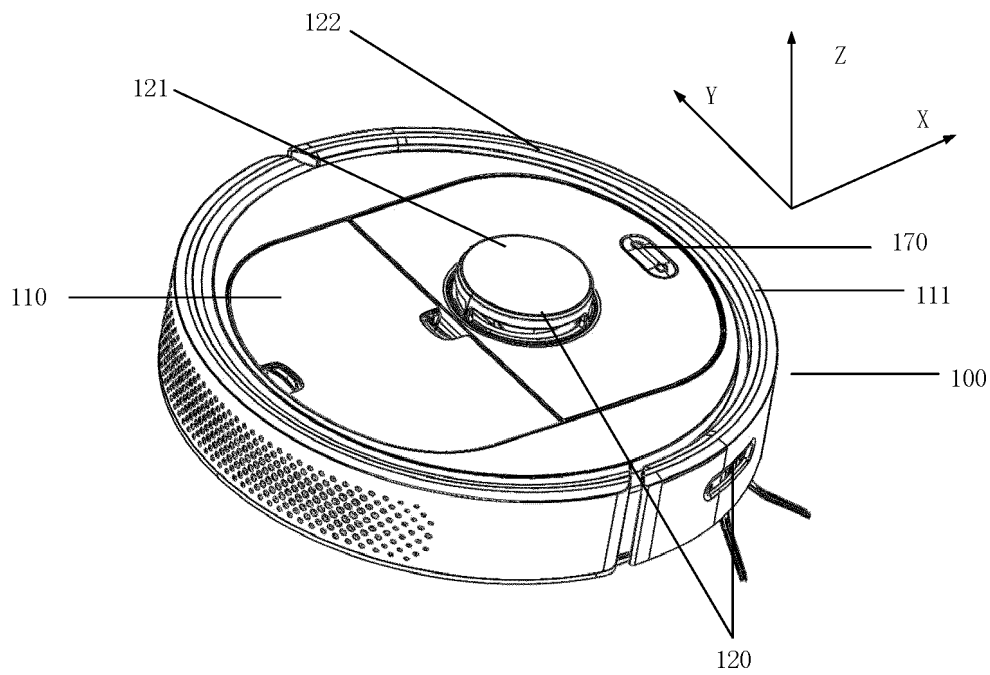


FIG. 1

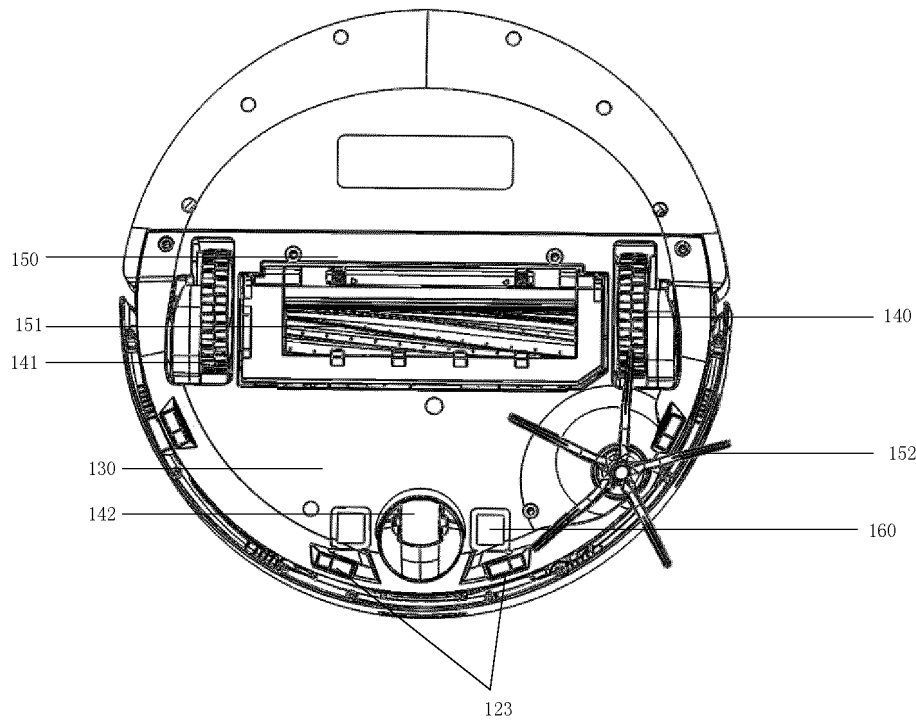


FIG. 2

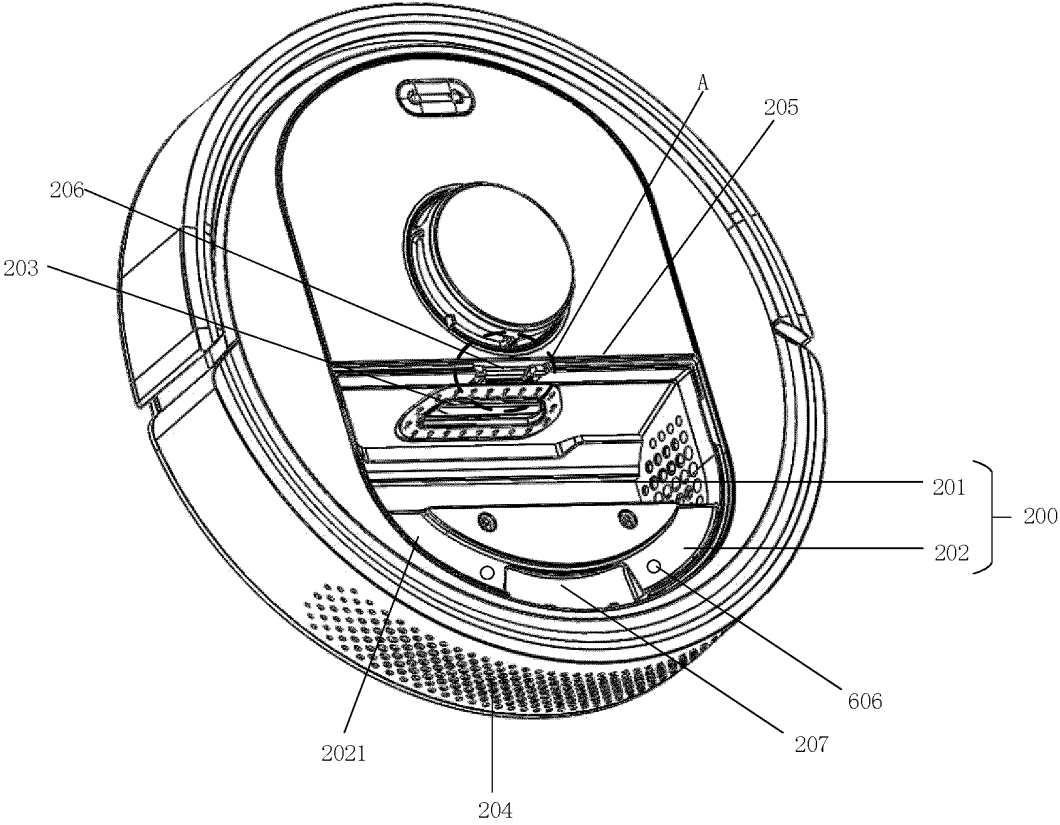


FIG. 3a

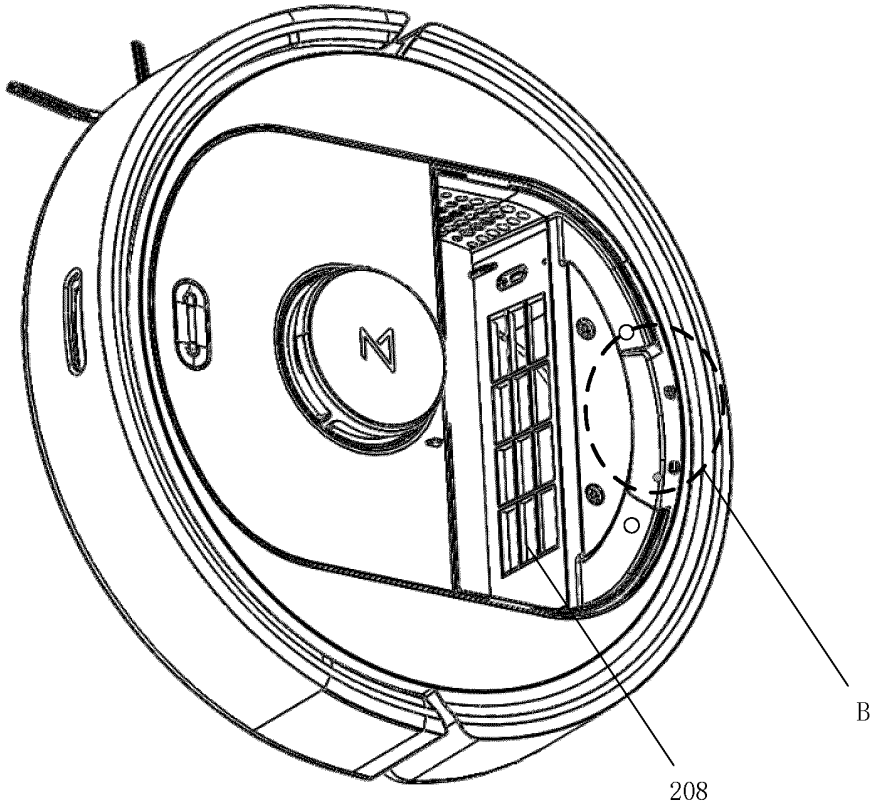


FIG. 3b

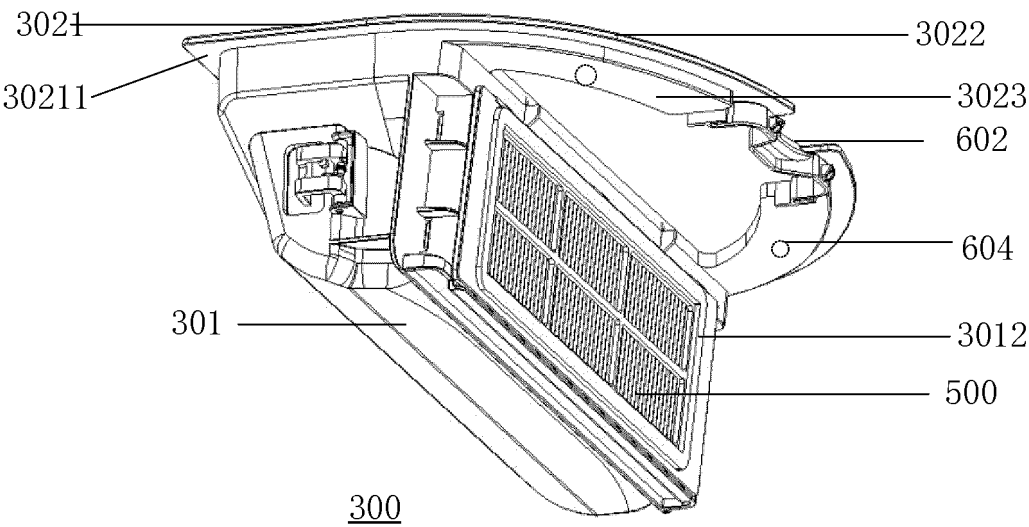


FIG. 4

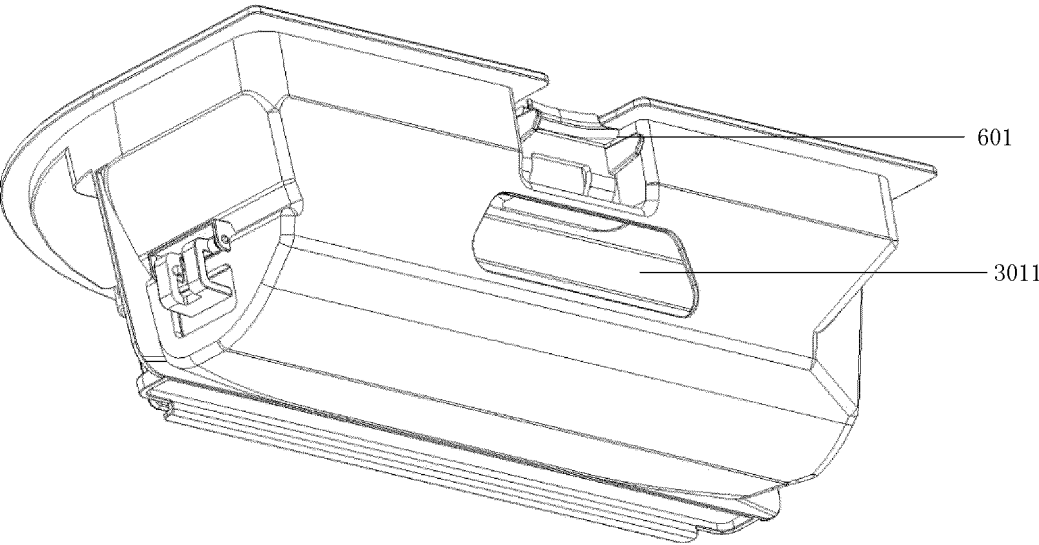


FIG. 5

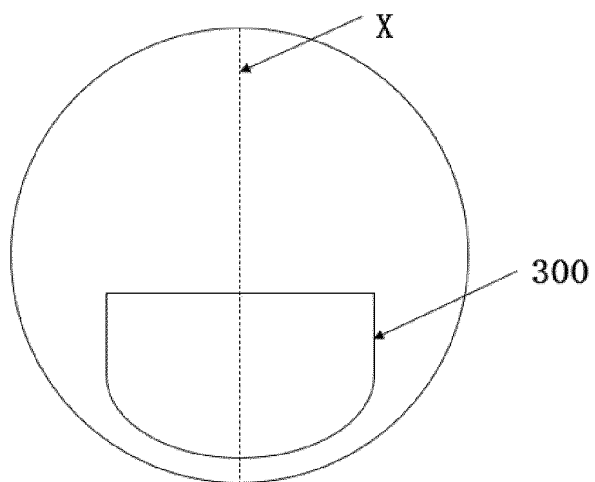


FIG. 6a

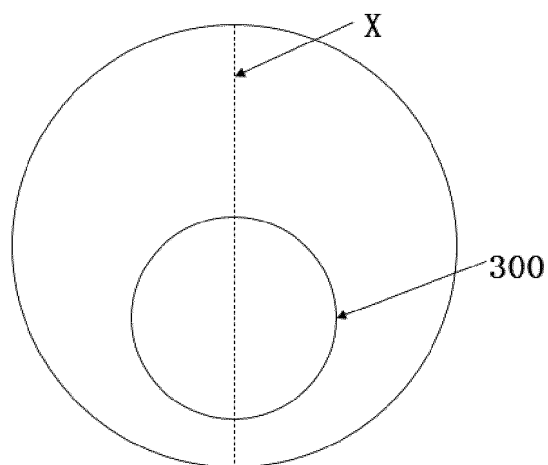


FIG. 6b

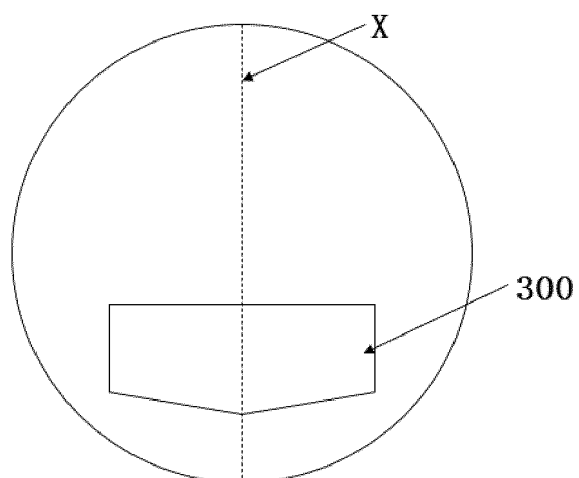


FIG. 6c

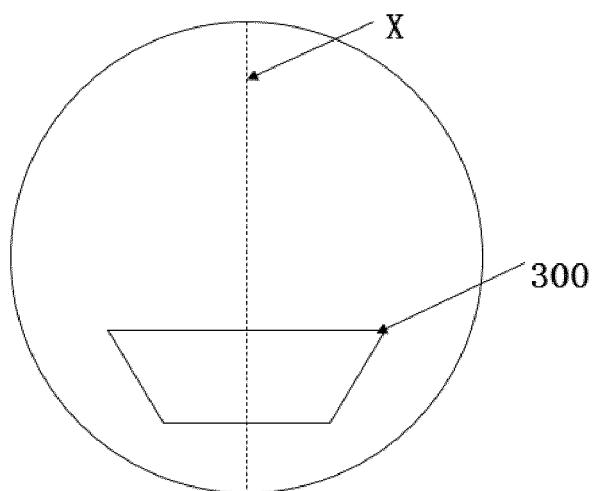


FIG. 6d

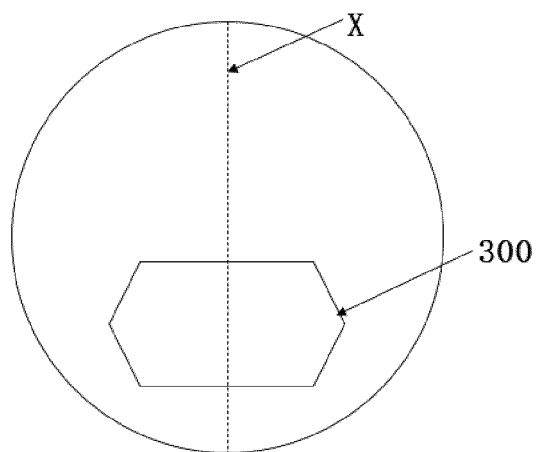


FIG. 6e

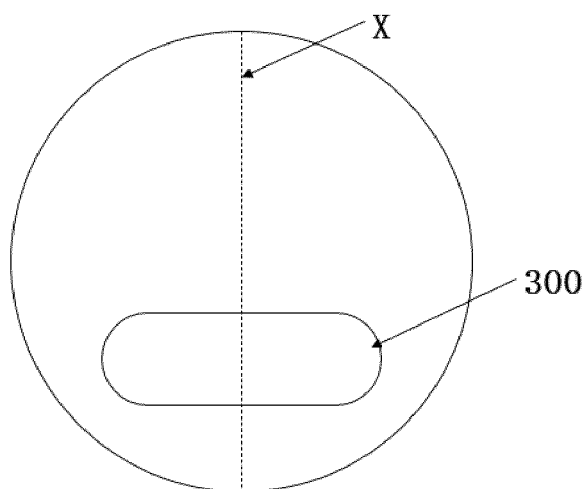


FIG. 6f

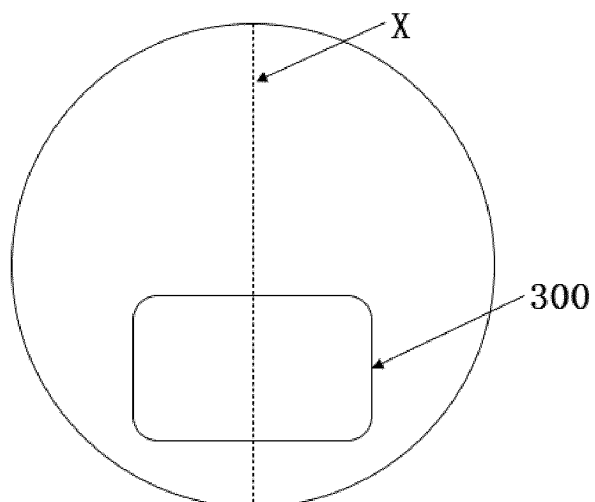


FIG. 6g

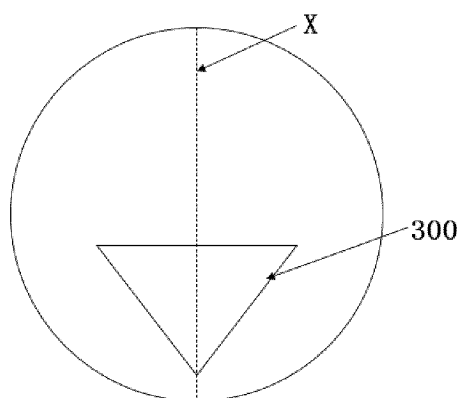


FIG. 6h

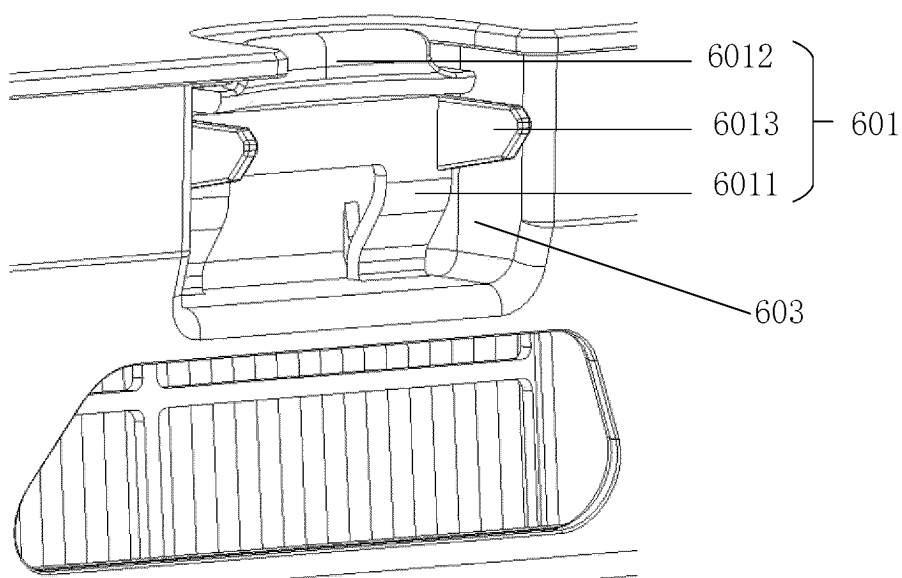


FIG. 7

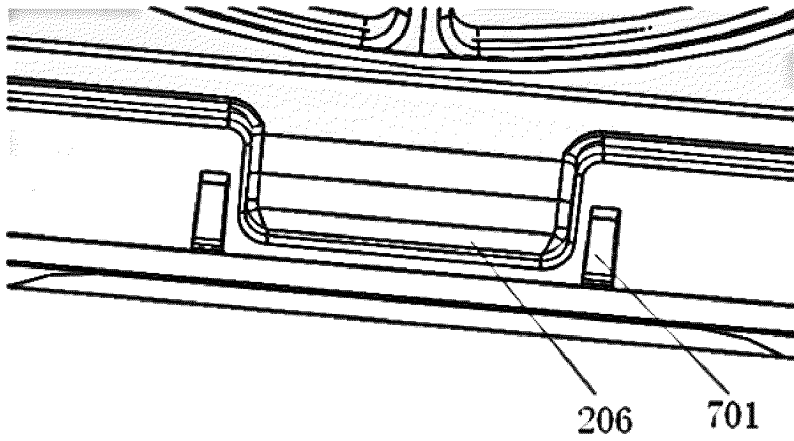


FIG. 8

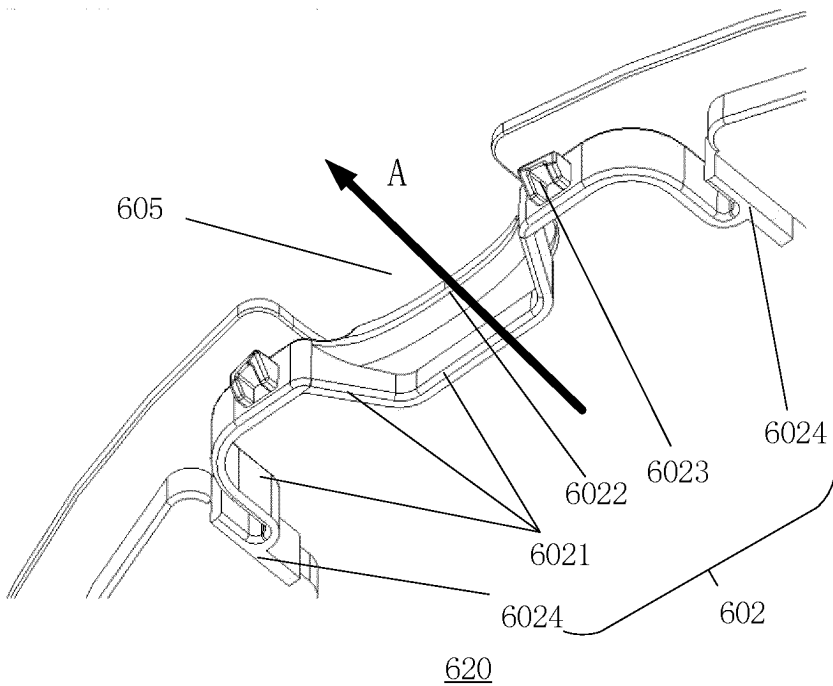


FIG. 9a

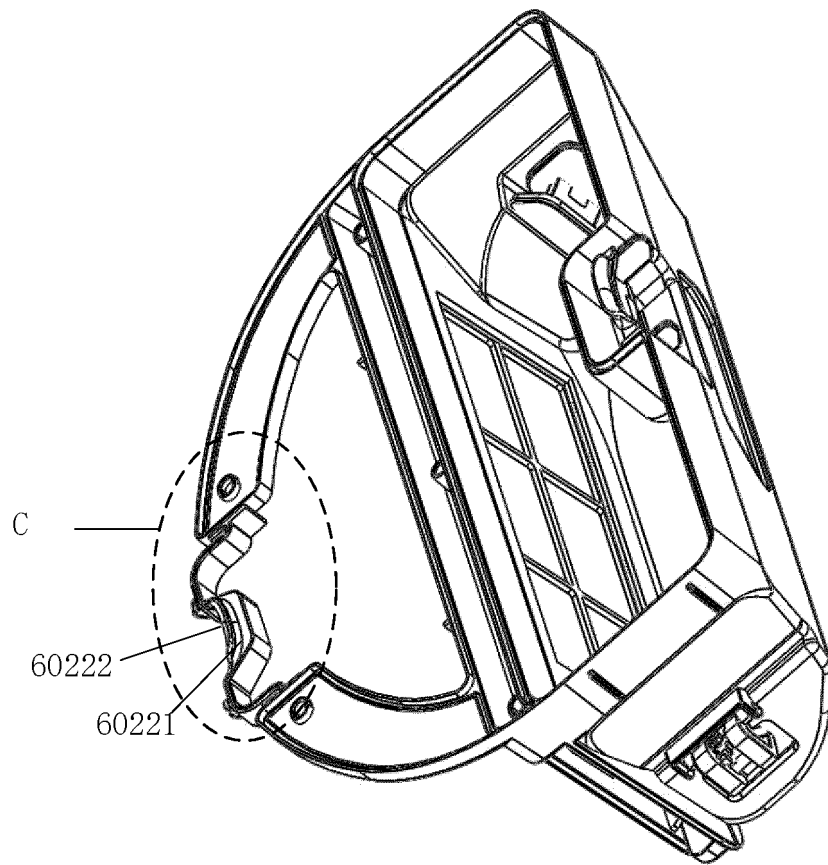


FIG. 9b

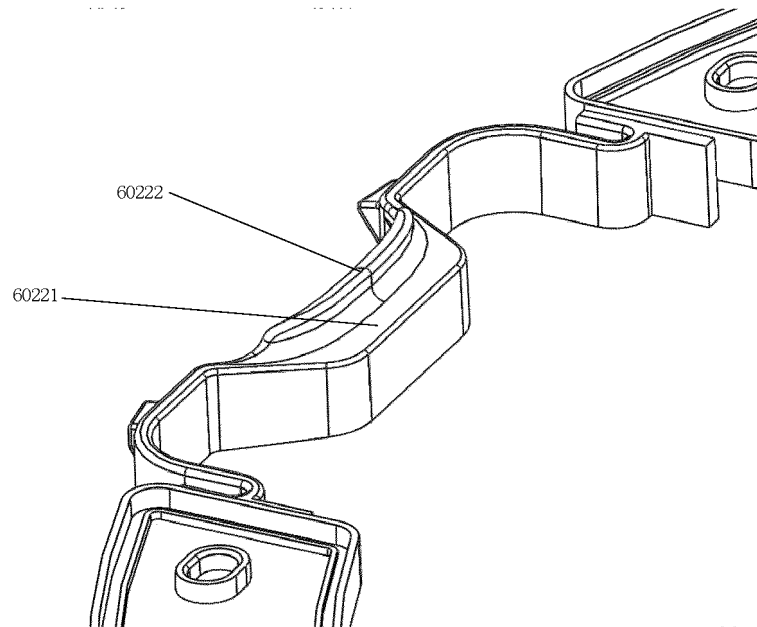


FIG. 9c

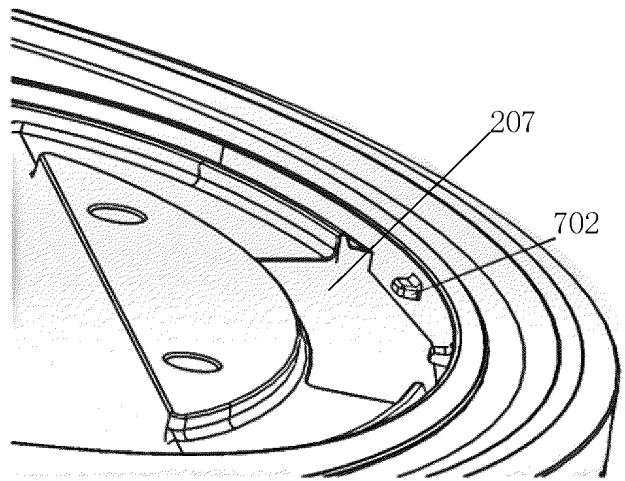


FIG. 10

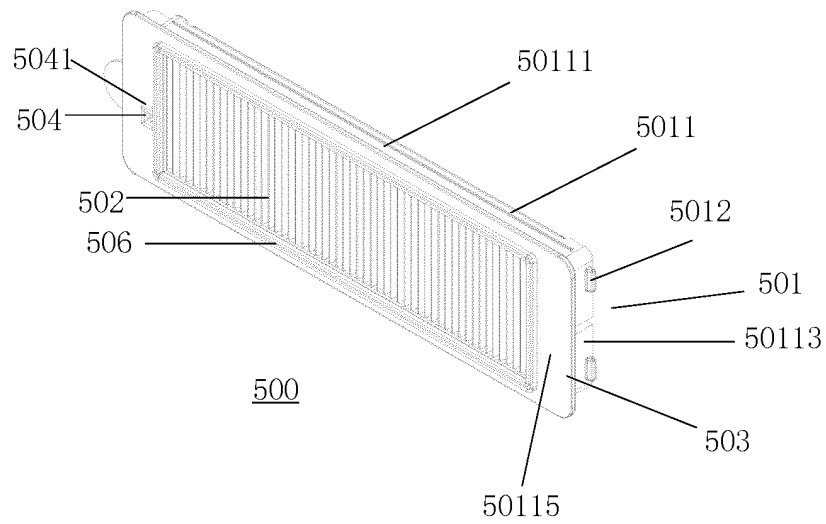


FIG. 11

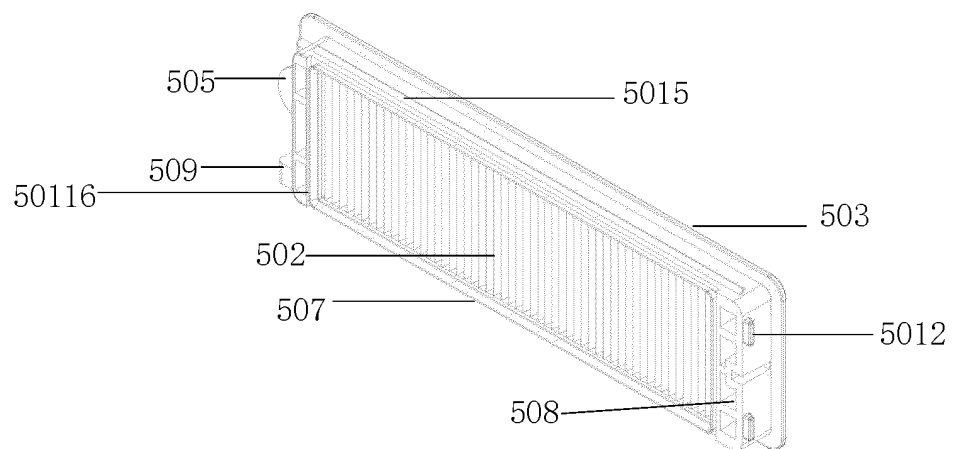


FIG. 12

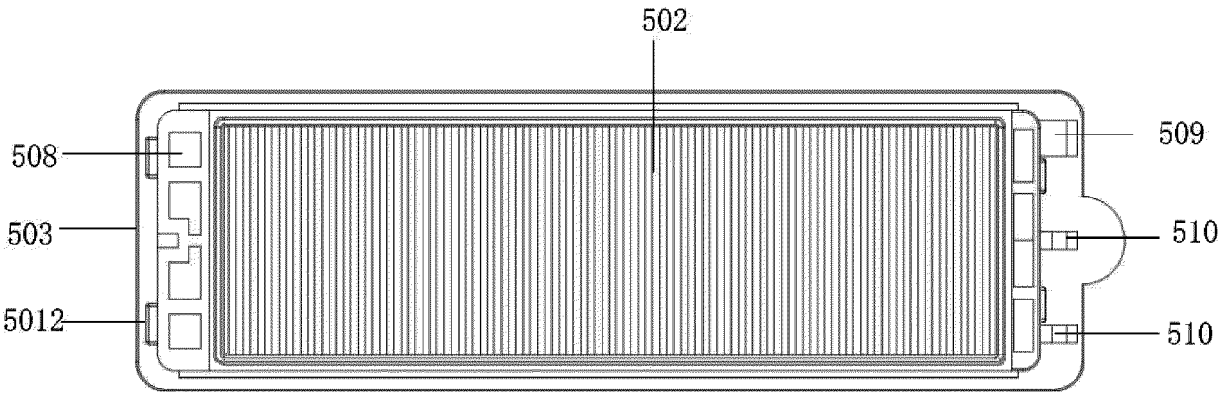


FIG. 13a

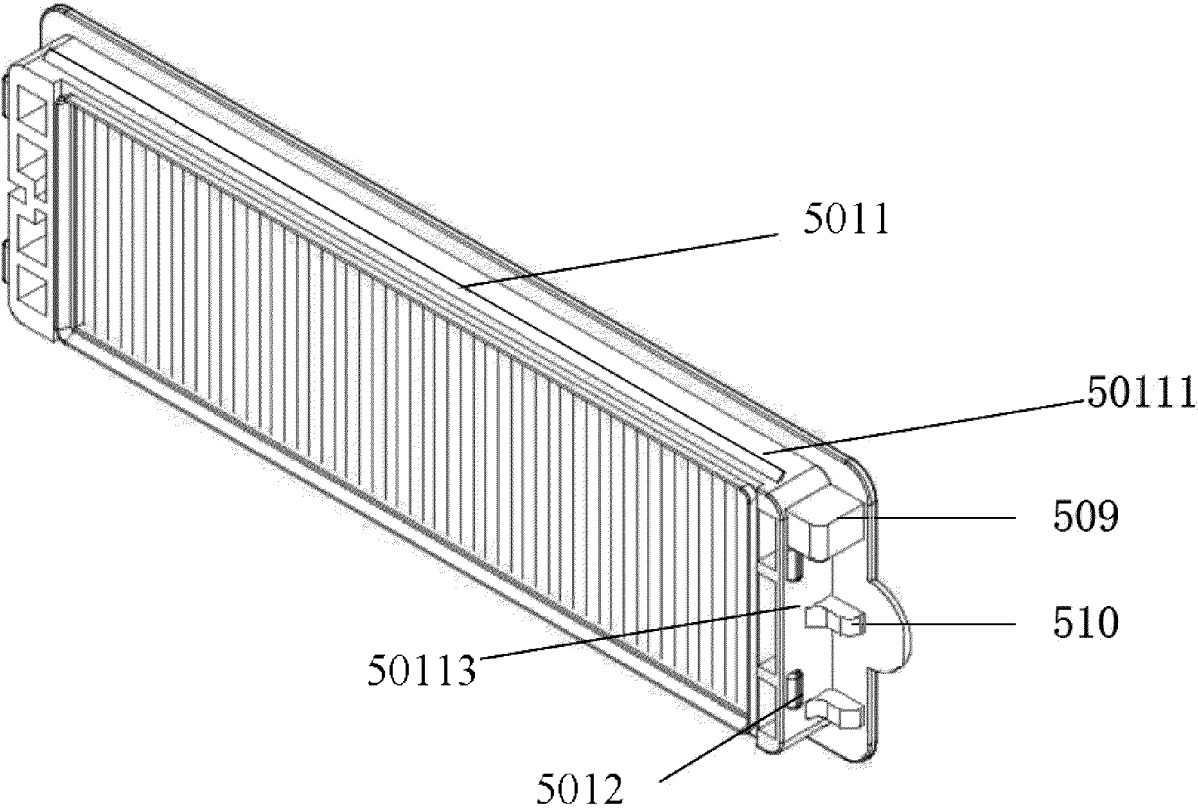


FIG. 13b

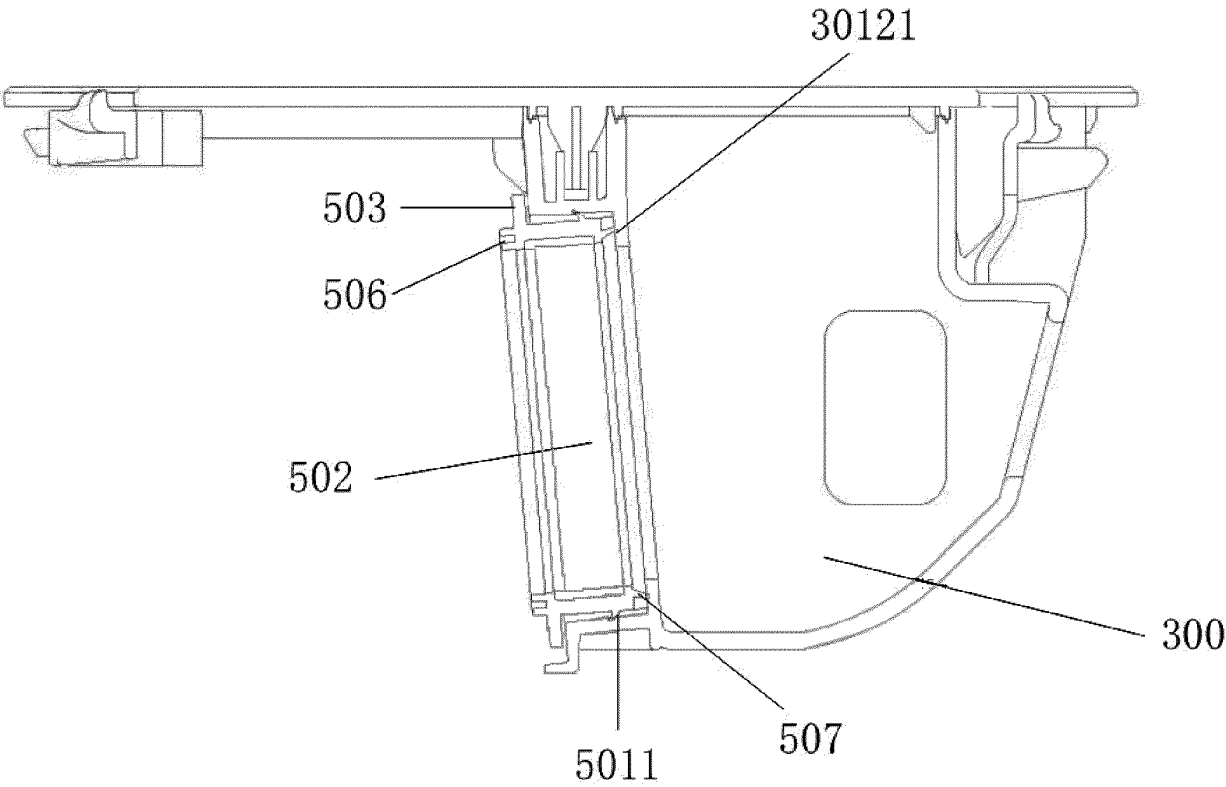


FIG. 14

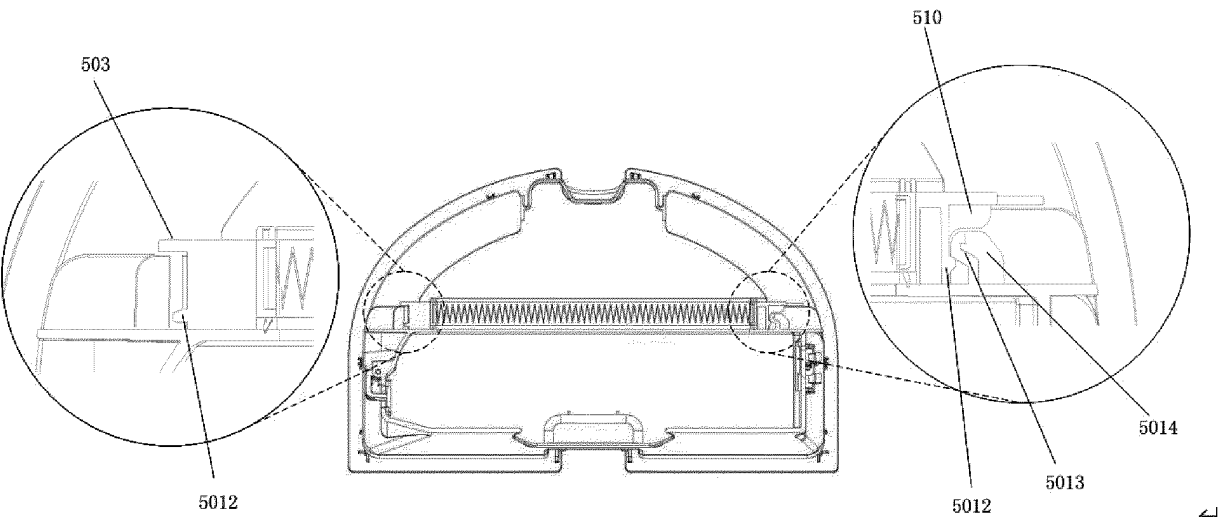


FIG. 15

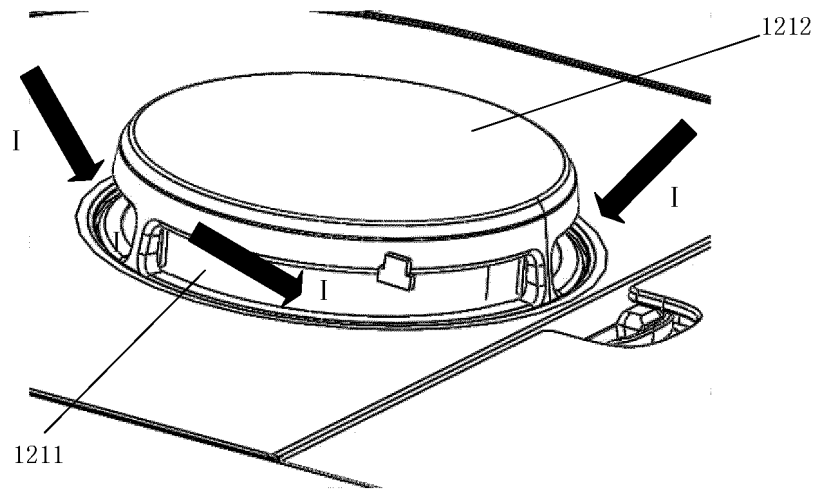


FIG. 16

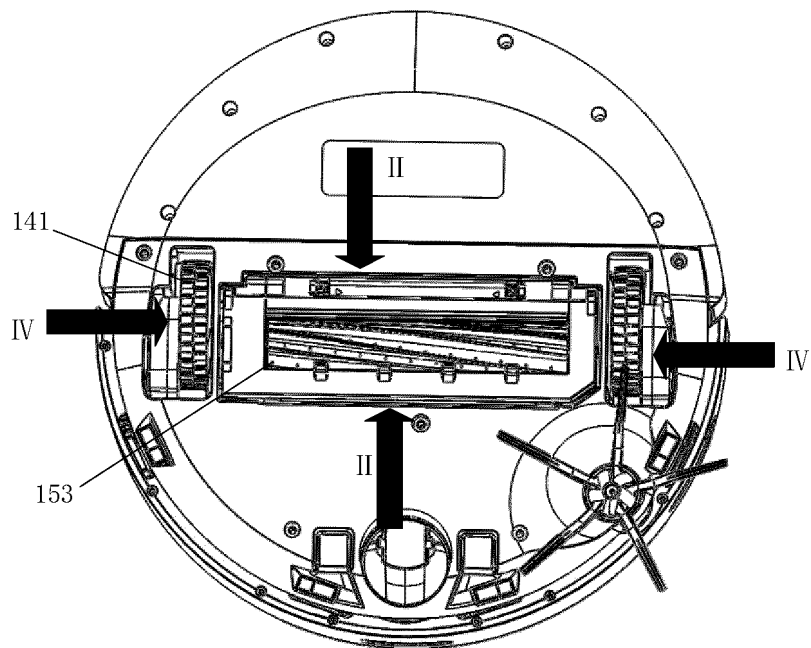


FIG. 17

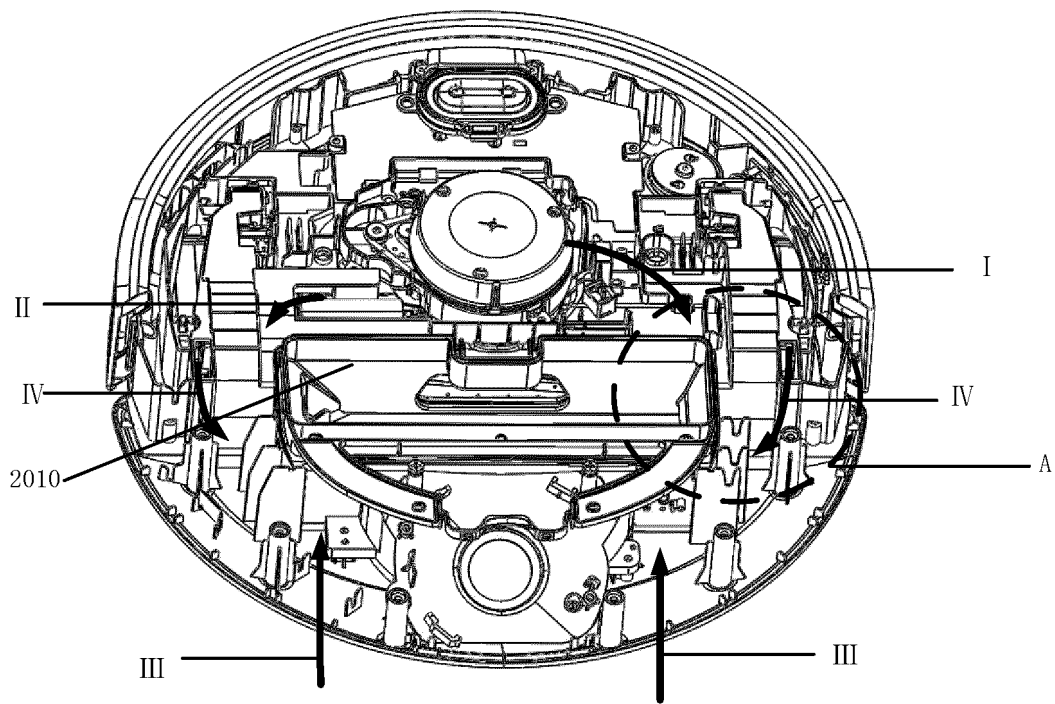


FIG. 18a

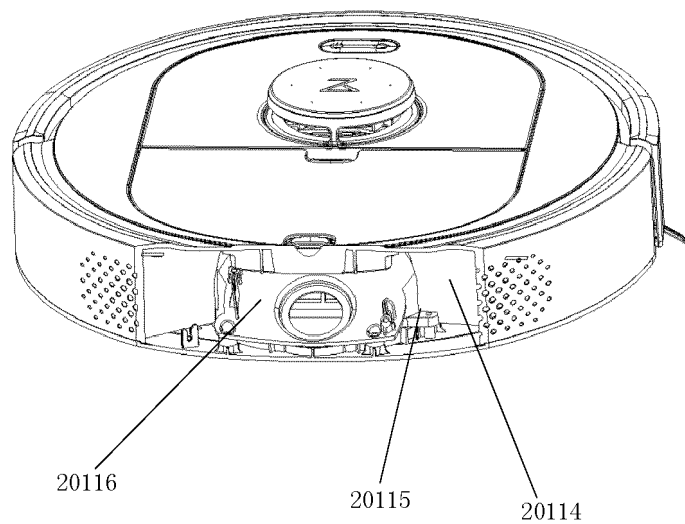


FIG. 18b

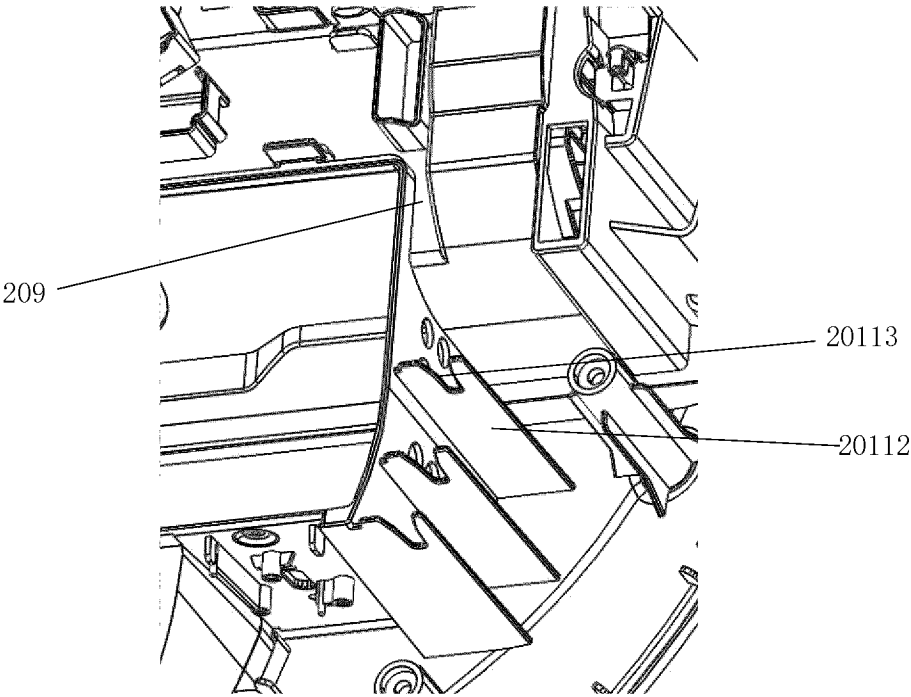


FIG. 19

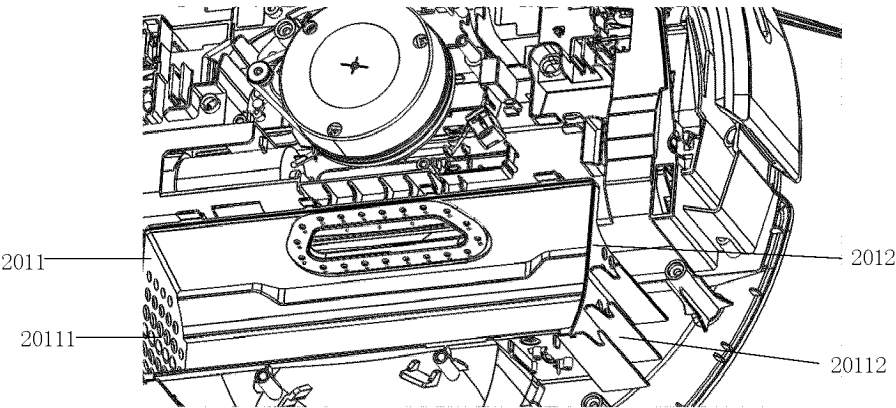


FIG. 20

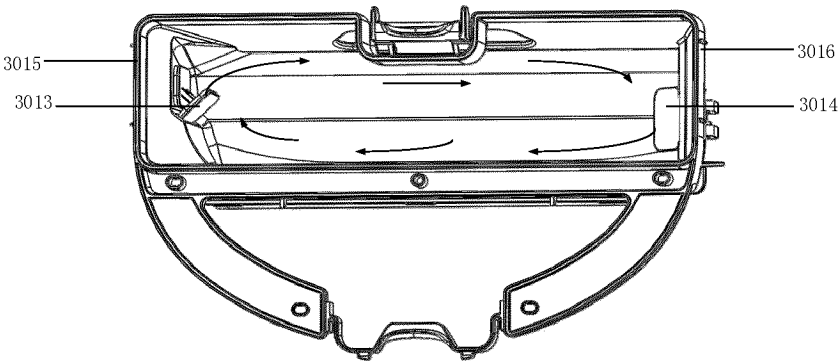


FIG. 21

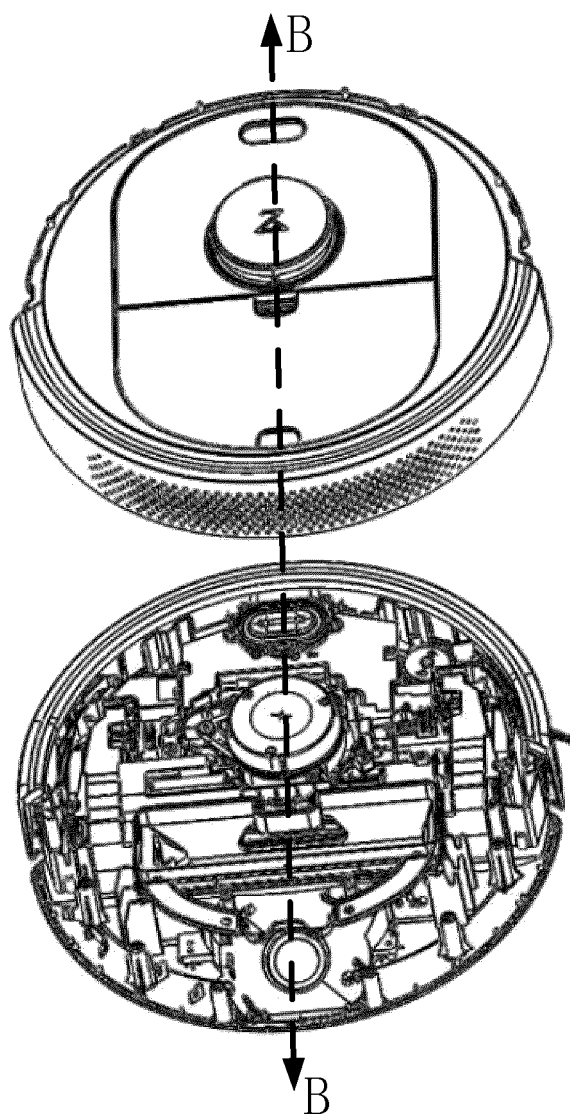


FIG. 22

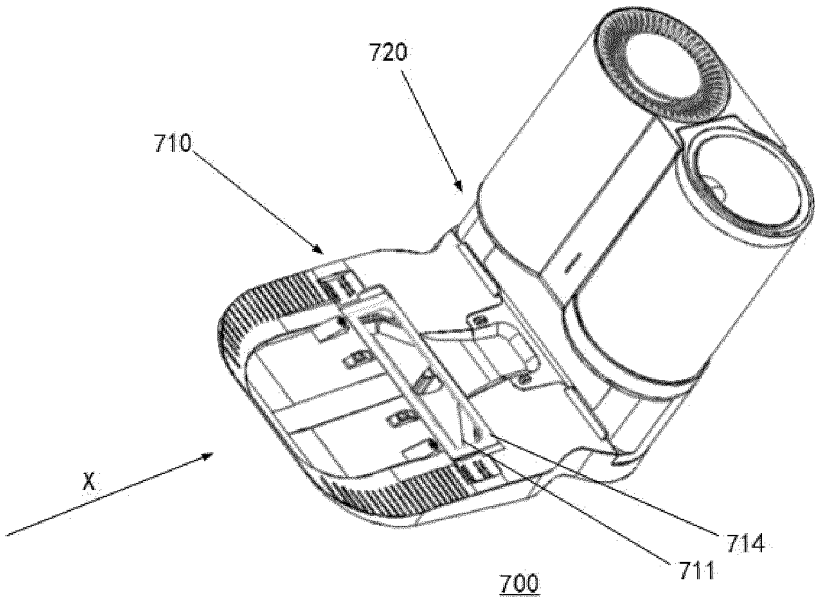


FIG. 23

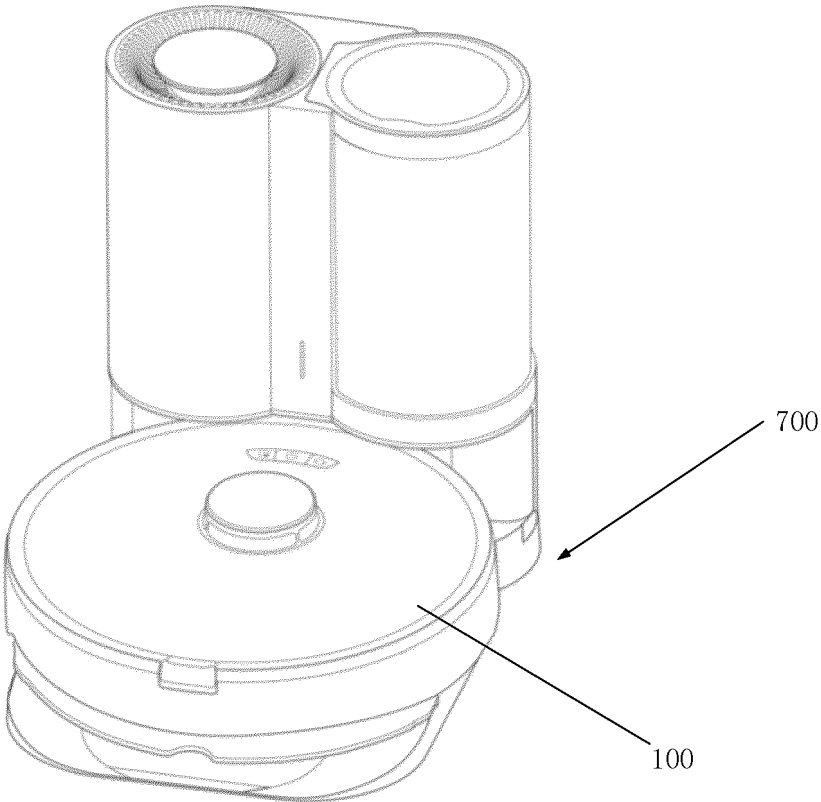


FIG. 24

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2022/110960

A. CLASSIFICATION OF SUBJECT MATTER

A47L 11/40(2006.01)i; 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)

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)

CNABS; CNTXT; CNKI; VEN; WPABS; ENTXT: 集尘, 排尘, 除尘, 孔, 开口, 腔, 室, 容纳, 气流, 进气, 气量, 尘, 垃圾, 残留, 角落, 边角, 不干净, 残余, 漩涡, 对流, shell, body, hole, gap, opening, cavity, dust, rubbish, garbage, remnant+, collect+, exhaust+, chamber, remov+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 114617485 A (BEIJING ROBOROCK TECHNOLOGY CO., LTD.) 14 June 2022 (2022-06-14) claims 1-13	1-13
PX	CN 216854579 U (BEIJING ROBOROCK TECHNOLOGY CO., LTD.) 01 July 2022 (2022-07-01) description, paragraphs [0050]-[0137], and figures 1-24	1-13
PX	CN 216854581 U (BEIJING ROBOROCK TECHNOLOGY CO., LTD.) 01 July 2022 (2022-07-01) description, paragraphs [0076]-[0226], and figures 1-50	1-13
PX	CN 114617486 A (BEIJING ROBOROCK TECHNOLOGY CO., LTD.) 14 June 2022 (2022-06-14) description, paragraphs [0076]-[0226], and figures 1-50	1-13
A	CN 211674025 U (SANKOBOT SHENZHEN INTELLIGENT TECHNOLOGY CO., LTD. et al.) 16 October 2020 (2020-10-16) description, paragraphs [0004]-[0267], and figures 1-33	1-13

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

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Date of the actual completion of the international search

19 September 2022

Date of mailing of the international search report

14 October 2022

Name and mailing address of the ISA/CN

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Authorized officer

Facsimile No. (86-10)62019451

Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2022/110960

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 213405916 U (YUNMI INTERNET TECHNOLOGY (GUANGDONG) CO., LTD.) 11 June 2021 (2021-06-11) entire document	1-13
A	CN 113693524 A (ECOVACS ROBOT CO., LTD.) 26 November 2021 (2021-11-26) entire document	1-13
A	CN 214259224 U (SHENZHEN 3IROBOTIX CO., LTD.) 24 September 2021 (2021-09-24) entire document	1-13
A	JP 2016182301 A (TOSHIBA LIFESTYLE PRODUCTS & SERVICES CORP.) 20 October 2016 (2016-10-20) entire document	1-13
A	US 2014359966 A1 (SAMSUNG ELECTRONICS CO., LTD.) 11 December 2014 (2014-12-11) entire document	1-13

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2022/110960

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN 114617485 A	14 June 2022	None	
CN 216854579 U	01 July 2022	None	
CN 216854581 U	01 July 2022	None	
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CN 213405916 U	11 June 2021	None	
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CN 214259224 U	24 September 2021	None	
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		EP 2813169 B1	27 April 2016
		KR 101990832 B1	19 June 2019
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		US 9949606 B2	24 April 2018

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- CN 202210027204 [0001]