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(54) AUTOMATIC CLEANING APPARATUS

(57) Provided in the present application is an automatic cleaning apparatus, comprising: a mobile platform, which is configured to automatically move on an operation surface, the mobile platform comprising an accommodation chamber, and the accommodation chamber comprising a first chamber and a second chamber; and a cleaning module, which comprises a dust box, the dust box being detachably assembled in the accommodation chamber, wherein the first chamber and the second chamber are adjacently arranged front and back in sequence in an advancing direction of the automatic cleaning apparatus, and the depth of the first chamber is greater than the depth of the second chamber. After the dust box is assembled in the accommodation chamber, an upper surface of a top cover of the dust box is roughly coplanar with an upper surface of the mobile platform, thereby simplifying the structure of a top surface of the automatic cleaning apparatus and increasing the design space of the accommodation chamber.

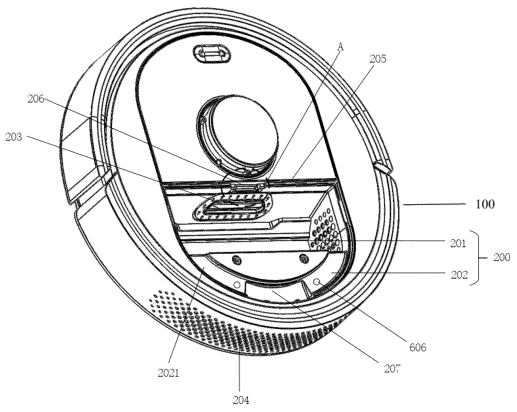

FIG. 3A

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Description

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application is based on and claims priority to Chinese Patent Application No. 202220063144.1 filed on January 11, 2022, contents of which are incorporated herein by reference in its entirety.

TECHNICAL FIELD

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

BACKGROUND

[0003] Cleaning robots including sweeping robots, mopping robots, sweeping and mopping integrated robots and the like are becoming more and more popular in modern life, which brings convenience to family life. With the popularity of the cleaning robots, the functions and structures of the cleaning robots have become more and more complex, and accordingly, their production cost is getting increasingly high.

[0004] In the related art, some cleaning robots are additionally provided with structures or functions such as automatic charging, automatic dust removal, lifting and vibration. In this way, although the cleaning robots are more intelligent, the complexity of various parts of the cleaning robots is increased, causing a lot of inconvenience to subsequent maintenance.

SUMMARY

[0005] The present disclosure provides an automatic cleaning device, which includes:

a mobile platform configured to automatically move on an operation surface and including an accommodating chamber, the accommodating chamber including a first chamber and a second chamber; and a cleaning module including a dust box detachably assembled to the accommodating chamber,

wherein the first chamber and the second chamber are sequentially arranged next to each other in an advancing direction of the automatic cleaning device, and a depth of the first chamber is greater than a depth of the second chamber.

[0006] In some embodiments, the dust box includes an accommodating portion and a top cover located above the accommodating portion, and the top cover is fixedly connected to the accommodating portion.

[0007] In some embodiments, the top cover includes a first portion covering the accommodating portion, and a second portion protruding from the accommodating portion to extend outward; and when the dust box is assembled to the accommodating chamber, the accommodating portion and the first portion of the top cover are accommodated in the first chamber, and the second portion of the top cover is accommodated in the second chamber.

[0008] In some embodiments, the first portion of the top cover includes an edge portion protruding from an edge contour of the accommodating portion to extend outward.

[0009] In some embodiments, the accommodating chamber includes a step portion extending around an edge of a top end of the accommodating chamber, and the step portion is configured to accommodate at least part of the edge portion and at least part of an outer edge of the second portion, such that an upper surface of the top cover is substantially coplanar with an upper surface of the mobile platform.

[0010] In some embodiments, a support structure is disposed below the second portion of the top cover and is configured to support the second portion of the top cover, and the support structure and at least part of the accommodating portion are integrally molded.

[0011] In some embodiments, a surface of the second chamber includes a groove, and the groove is substantially matched with a contour of the support structure and is configured to accommodate the support structure when the second portion of the top cover is accommodated in the second chamber.

[0012] In some embodiments, the top cover is symmetrically disposed along a central axis in the advancing direction of the automatic cleaning device.

[0013] In some embodiments, the top cover has a shape of at least one or a combination of: a D-shape, a rectangle, a square, a circle, an oval, a triangle, a quadrilateral, a pentagon, a hexagon, a heptagon or an octagon.

[0014] In some embodiments, the dust box includes: a dust suction inlet located in a first side wall of the dust box; an air outlet located in a second side wall of the dust box opposite the first side wall; and a filter detachably assembled to the air outlet.

[0015] In some embodiments, the cleaning module further includes a fan disposed below the second chamber and corresponding to the air outlet, and the fan is configured to provide a suction force to suck debris into the dust box from the dust suction inlet.

[0016] In some embodiments, the first chamber includes a first locking member; the second chamber includes a second locking member; the first portion of the top cover includes a first mating member; the second portion of the top cover includes a second mating member; the first mating member cooperates with the first locking member for lockup; and the second mating member cooperates with the second locking member for lockup.

[0017] In some embodiments, the first chamber includes a first recess at a position substantially corresponding to the first mating member, and the first recess is configured to accommodate a finger.

[0018] In some embodiments, a lower surface of the second chamber includes a second recess configured to accommodate the second mating member.

[0019] The present disclosure provides the automatic cleaning device, and in particular relates to the dust box of the automatic cleaning device and a mounting structure thereof. The accommodating chamber is disposed on the back side of the automatic cleaning device in the advancing direction, the accommodating chamber includes the first chamber and the second chamber, and the depth of the first chamber is greater than the depth of the second chamber. In this way, after the dust box is assembled to the accommodating chamber, the upper surface of the top cover of the dust box is substantially coplanar with the upper surface of the mobile platform, which simplifies the top surface structure of the automatic cleaning device while increasing the design space for the accommodating chamber.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] 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 structural diagram 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 stereoscopic 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;

FIGS. 6A-6H are schematic diagrams each showing a layout of a top cover structure according to some embodiments of the present disclosure;

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

FIG. 9B is a schematic diagram of an overall structure of a second mating member according to some embodiments of the present disclosure;

FIG. 9C is an enlarged schematic diagram of a second handle portion according to some embodiments of the present disclosure;

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

FIG. 11 is a stereoscopic structural view of a filter of a dust box from an outer side perspective according to some embodiments of the present disclosure;

FIG. 12 is a stereoscopic structural view of a filter of a dust box from an inner side perspective according to some embodiments of the present disclosure;

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

FIG. 13B is a stereoscopic structural view 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 assembled structure of a dust box and a filter according to some embodiments of the present disclosure; and

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

DETAILED DESCRIPTION

[0021] For clearer descriptions of the purposes, technical solutions and advantages in the present disclosure, the present disclosure 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 disclosure. Based on the embodiments of the present disclosure, all other embodiments derived by a person of ordinary skill in the art without creative efforts should fall within the protection scope of the present disclosure.

[0022] The terms used in the embodiments of the present disclosure are only for the purpose of describing example embodiments, but are not intended to limit the present disclosure. The singular forms "a," "the" and "said" used in the embodiments and the appended claims of the present disclosure are intended to include the plural forms as well, unless otherwise clearly specified in the context. The term "a plurality of" generally includes at least two.

[0023] It should be understood that the term "and/or" used herein only describes an association relationship of associated objects, indicating three kinds of relation-

ships. 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 disclosure to describe certain objects, these objects should not be limited by these terms. These terms are merely used to distinguish similar objects. 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 disclosure.

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

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

[0027] FIGS. 1 and 2 are schematic structural diagrams of an automatic cleaning device according to some embodiments. As shown in FIGS. 1 and 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 mobile platform 100, a perception 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.

[0028] The mobile 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 serves as 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 exterior surface of glass serves as the operation surface. 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 serves as the operation surface. Merely for the purpose of illustration, the following descriptions of the present disclosure are given by taking an example in which the automatic cleaning device is a mopping robot.

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

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

[0031] For clearer descriptions of the actions of the automatic cleaning device, the following directions are defined: the automatic cleaning device may travel on a floor by various combinations of movement relative to the following three perpendicular axes defined by the mobile 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 a "forward" direction, and a backward driving direction along the front-back axis X is marked as a "backward" direction. 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 a center point of a driving wheel assembly 141. The automatic cleaning device may rotate about the axis Y. It is called "pitch up" when the forward portion of the automatic cleaning device is tilted up and the backward portion thereof is tilted down, and it is called "pitch down" when the forward portion of the automatic cleaning device is tilted down and the backward portion thereof is tilted up. 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 is tilted to the right of the axis X, and it is called "turn left" when the automatic cleaning device is tilted to the left of the axis X.

[0032] As shown in FIG. 2, cliff sensors 123 are disposed at the bottom of the mobile platform 100 and in

front and rear of the driving wheel assembly 141 and 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 from being damaged. 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 determining apparatus 121 includes, but is not limited to, a camera or a laser distance sensor (LDS).

[0034] Various components in the perception system 120 may work independently, or may work jointly to achieve intended functions more accurately. The surface to be cleaned is identified by the cliff sensor(s) 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 determination may be made in combination with the camera, or the laser distance sensor, etc.

[0035] For example, whether the surface to be cleaned is a carpet may be determined by the ultrasonic sensor, and 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 disposed on the forward portion 111 of the mobile platform 100. The buffer 122 detects one or more events (or objects) in a travel path of the automatic cleaning device via the sensor system (for example, an infrared sensor) when the driving wheel assembly 141 propels the automatic cleaning device to walk on the floor in the process of cleaning. The automatic cleaning device may control, according to the events (or objects) such as an obstacle or a wall detected by the buffer 122, the driving wheel assembly 141 to make the automatic cleaning device respond to the events (or objects), for example, moving away from the obstacle.

[0037] The control system 130 is disposed on a main circuit board in the mobile platform 100, and includes a computing processor, such as a central processing unit or an application processor, which communicates with a non-transitory memory, such as a hard disk, a flash memory or a random-access memory. The application processor is configured to receive environmental information sensed by the plurality of sensors and transmitted from the perception 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 laser distance sensor, autonomously determine the travel path according to the environmental information and the environmental map, and then control the driving system 140 to move forward, backward and/or turn according to the autonomously determined travel path. Further, the control system 130 may also determine, according to the environmental information and the environmental map, whether to activate the cleaning module 150 to perform a cleaning operation.

[0038] In some embodiments, 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 an upper portion or a lower portion, having a full dust box or being picked up) of the sweeping robot according to distance information or speed information fed back by the buffer 122 and the sensing devices such as the cliff sensor 123, the ultrasonic sensor, the infrared sensor, the magnetometer, the accelerometer, the gyroscope or the odometer, and may also give specific strategies for next actions according to different situations, making the work of the automatic cleaning device more in line with the requirements of an owner, and 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 specific distance and angle information, such as x, y and θ components and thus 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 includes a left driving wheel assembly and a right driving wheel assembly, respectively. The left driving wheel assembly and the right driving wheel assembly are symmetrically arranged along a transverse axis defined by the mobile platform 100.

[0040] For more stable movement on the floor or a higher movement ability of the automatic cleaning device, the automatic cleaning device may include one or more steering components 142, which may be driven wheels or driving wheels, and the structure form of the one or more steering components 142 includes 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 connected to a charging control circuit, a battery pack charging temperature detecting circuit, and a battery undervoltage monitoring circuit which are then connected to a single-chip microcomputer control circuit. A host is connected to a charging station by a charging electrode disposed on a side of the body of the automatic cleaning device or below the body of the automatic cleaning device for charging. If the exposed charging electrode is covered with dust, due to the accumulative effect of charges in the procedure of charging, a plastic body around the electrode will be melted and deformed and even the electrode

itself will be deformed and thus is unable to continue to perform normal 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, the indicator light and the speaker show the user the current state or function options of the automatic cleaning device. For a route navigation type cleaning device, a mobile phone client may show the user a map of the environment where the device is located, as well as the location of the device, thereby 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 with 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 part(s) among the dust suction inlet, the dust box, the fan and the air outlet, and the type and the power of the fan, and thus is a complex problem of system design. The improvement of dust removal capacity is of greater significance to an 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 charging for once may be improved to clean 180 square meters or more with charging for once. 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 angled with respect to the floor, for moving the debris into a roller brush area of the cleaning module 150.

[0045] In some embodiments, 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. 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] An existing automatic cleaning device is complex in housing layout and frame structure, has a large number of parts, requires long assembling time, has complicated procedures and high cost. For example, the automatic cleaning device is additionally provided with a top surface flip cover and a flipping mechanism, the top surface flip cover is designed with decorating parts on the housing, or the like. Although the decorating parts on the housing and the top surface flip cover have functions of beautifying the appearance, protecting inner elements, and the like, the resulting automatic cleaning device is complex in overall structure and high in cost, and the design space for elements such as a dust box below the top flip cover is adversely affected.

[0047] To this end, an embodiment of the present disclosure provides an automatic cleaning device without a flip cover, which eliminates unnecessary elements of the automatic cleaning device and increases the design space for the dust box and the accommodating chamber for accommodating the dust box. Since identical structures have identical technical effects, some of the technical effects are not described in details herein. The present disclosure provides an automatic cleaning device. As shown in FIGS. 3 to 5, the automatic cleaning device includes: a mobile platform 100 configured to automatically move on an operation surface and including an accommodating chamber 200. In some embodiments, the accommodating chamber 200 is disposed on the slightly backward side of the automatic cleaning device in an advancing direction, and the accommodating chamber 200 includes a first chamber 201 and a second chamber 202. The automatic cleaning device further includes: a dry cleaning module, which includes a dust box 300 detachably assembled to the accommodating chamber 200. The first chamber 201 and the second chamber 202 are sequentially arranged next to each other in the advancing direction of the automatic cleaning device, and the depth of the first chamber is greater than the depth of the second chamber 202. The first chamber 201 and the second chamber 202 are sequentially arranged next to each other in the advancing direction of the automatic cleaning device, and the part with a larger volume and weight in the entire dust box may be disposed closer to the middle part of the automatic cleaning device, such that the dust box is allowed to be disposed more stably in the accommodating chamber 200, and the entire automatic cleaning device is more stable in the center of gravity, allowing for higher stability in the process of traveling, turning, obstacle crossing and the like, without overturning. Meanwhile, it is convenient to make the accommodating portion and top cover of the dust box into an integrated structure, such that the top cover of the dust box can serve as a part of the top surface of the mobile platform and can be flush with other parts on the top surface of the mobile platform, which eliminates

the flip cover structure of a traditional cleaning device; and moreover, it is convenient to directly align a dust suction inlet located at the substantially central position at the bottom of the automatic cleaning device with the dust box, such that the dust can directly enter the dust box from the dust suction inlet, which reduces the travel path for the dust to enter the interior of the automatic cleaning device and avoids dust contamination to the interior of the automatic cleaning device. The depth of the first chamber 201 is greater the depth of the second chamber 202, such that the dust box and the top cover of the dust box can be accommodated in different structures, which facilitates the integrated design of the top cover of the dust box. A dust suction inlet 203 is formed in the bottom of the front side wall of the first chamber 201. An air outlet 208 is formed in the back side wall at the position where the first chamber 201 is connected to the second chamber 202, and the air outlet 208 has a grille structure. A fan is accommodated in a space below the second chamber 202, and the fan may be borne by a fan bracket. In some embodiments, the air outlet 208 constitutes a part of the fan bracket. An air exhaust opening 204 is formed in the back side wall of the mobile platform 100. Under the action of a suction force of the fan, dust enters the dust box 300 from the dust suction inlet 203, and an air flow is filtered by a filter of the dust box and then emitted from the air exhaust opening 204.

[0048] In some embodiments, the dust box 300 includes an accommodating portion 301 and a top cover 302 located above the accommodating portion 301, and the top cover 302 is fixedly connected to the accommodating portion 301. Fixed connections include, but are not limited to, bonding, welding, integral molding, bolted connection, snap connection, and the like. The accommodating portion 301 serves to accommodate debris sucked from the dust suction inlet 203, and substantially matches the first chamber 201 in shape.

[0049] The roller brush, which has a certain interference with the floor, sweeps up debris on the floor and brings the debris in a rolling manner to the front of the dust suction inlet 203 between the roller brush and the dust box 300 under the action of the negative-pressure air flow generated by the fan; then the debris is sucked into the dust box 300 by an air flow with a suction force generated by the fan and passing through the dust box; the debris is isolated in the dust box 300 by a filter 500; and the filtered air enters the fan.

[0050] In some embodiments, the accommodating portion 301 of the dust box 300 has a first opening 3011 located in the front side of the dust box 300; and the first opening 3011 is aligned with the dust suction inlet 203. The accommodating portion 301 has a second opening 3012 located in the back side of the dust box; and the filter 500 is disposed at the second opening 3012 and the second opening 3012 interfaces with the air outlet 208. The filter 500 is detachably connected to a body of the dust box 300, facilitating the assembling, disassembling and cleaning of the filter. The front side means a side in the X direction along the advancing direction of the automatic cleaning device after the dust box 300 is mounted in the accommodating chamber 200. The rear side refers to a side in the X direction opposite to the advancing 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 protruding from the accommodating portion 301 to extend outward. When the dust box 300 is assembled to 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 substantially matches the top end portion of the first chamber 201 and the structure of the second chamber 202, such that the dust box 300 can be stably mounted in the accommodating chamber 200, avoiding the shaking of the dust box caused by bumping of the automatic cleaning device in the travelling procedure. Meanwhile, the top cover of the dust box can just cover the positions where the accommodating portion and the fan are located, such that the upper surface of the top cover of the dust box is substantially horizontal with the upper surface of the mobile platform, which ensures the neat outer surface of the automatic cleaning device. Thus, the overall harmony of the appearance is higher, and more space options are also provided for the design of individual components including the accommodating portion below the top cover, facilitating the arrangement of the positions of different components; and the dust box is improved in volume selectivity, allowing for setting the specific size on demand without affecting the overall opening size of the accommodating chamber, and the molding cost is reduced.

[0052] In some embodiments, the first portion 3021 of the top cover 302 includes an edge portion 30211 protruding from an edge contour of the accommodating portion to extend outward. The accommodating chamber 200 includes a step portion 205 extending around an edge of a top end of the accommodating chamber, and the step portion 205 is configured to accommodate at least part of the edge portion 30211 and at least part of an outer edge of the second portion 3022, such that the upper surface of the top cover is substantially coplanar with the upper surface of the mobile platform. The step portion 205 of the accommodating chamber 200 extending around the edge of the top end of the accommodating chamber can completely receive the edge of the top cover 302, such that the top cover 302 can be basically tightly accommodated in the accommodating chamber 200, making it possible to prevent foreign bodies from falling directly into a gap at the edge of the dust box, further preventing the dust box from being stuck, while ensuring the aesthetics of the top cover as the upper surface of the automatic cleaning device.

[0053] In some embodiments, a support structure 3023

is disposed below the second portion 3022 of the top cover 302, and the support structure 3023 is configured to support the second portion 3022 of the top cover 302. In some embodiments, the support structure 3023 and at least part of the accommodating portion 301 are integrally molded so as to enhance the supporting force of the supporting structure 3023 for the second portion 3022 of the top cover 302 and effectively prevent the second portion from being damaged. The support structure 3023 may include, but is not limited to, an arc structure, or a linear structure. For example, the support structure 3023 includes two symmetrically arranged arc 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 202 is substantially matched with a contour of the support structure 3023 and is configured to accommodate the support structure 3023 when the second portion 3022 of the top cover is accommodated in the second chamber 202, such that the upper surface of the top cover 302 is substantially horizontal.

[0055] In some embodiments, the top cover 302 is symmetrically disposed along a central axis in the advancing direction of the automatic cleaning device. In some embodiments, the top cover has a shape of at least one or a combination of: a D-shape, a rectangle, a square, a circle, an oval, a triangle, a quadrilateral, a pentagon, a hexagon, a heptagon or an octagon, as shown in FIGS. 6A to 6H. The symmetrical arrangement can ensure the attractive appearance of the automatic cleaning device even without the sheltering of an outer cover, and provide convenience in assembling and disassembling the dust box.

[0056] In some embodiments, as shown in FIG. 8, the first chamber 201 includes a first locking member 701. As shown in FIG. 10, the second chamber 202 includes a second locking member 72. As shown in FIGS. 5 and 7, the first portion 3021 of the top cover includes a first mating member 601. As shown in FIG. 9A, the second portion 3022 of the top cover includes a second mating member 602. The first mating member 601 cooperates with the first locking member 701 for lockup; and the second mating member 602 cooperates with the second locking member 72 for lockup.

[0057] The above embodiment relates to the dust box of the automatic cleaning device and the mounting structure thereof. The accommodating chamber is disposed on the back side of the automatic cleaning device in the advancing direction, and includes the first chamber and the second chamber, and the depth of the first chamber is greater than the depth of the second chamber. After the dust box is assembled to the accommodating chamber, the upper surface of the top cover of the dust box is substantially coplanar with the upper surface of the mobile platform, which simplifies the top surface structure of the automatic cleaning device, reduces the production cost, and increases the design space for the accommodating chamber.

[0058] A pop-up dust box and a non-pop-up dust box may be arranged in existing automatic cleaning devices. The pop-up dust box includes a top surface flip cover and a flipping mechanism, and it is necessary to open the top surface flip cover, and the dust box is popped up by pressing the dust box. In this implementation, it is necessary to provide a complex dust box pop-up mechanism that includes a plurality of components such as a spring. The dust box probably may not be popped up smoothly because the elasticity of the spring is reduced after repeatedly use of the spring. Furthermore, many other components are prone to causing the dust box to be popped up abnormally, thereby adversely affecting its use. For most of the non-pop-up dust boxes, a complex locking structure is used, in which case a spring assembly is prone to aging and damage and the matching comfort level between a pressing component and a finger during operation is also insufficient, leading to poorer overall use experience.

[0059] To this end, an embodiment of the present disclosure provides an automatic cleaning device without a flip cover, which eliminates the unnecessary elements of the automatic cleaning device while facilitating the smooth taking and placing of the dust box. This embodiment briefly describes some structural characteristics compared with the above embodiments, and since identical structures have identical technical effects, some of the technical effects are not repeated herein. As shown in FIGS. 1 to 5 and 7, an automatic cleaning device includes: a mobile platform 100 configured to automatically move on an operation surface and including an accommodating chamber 200 arranged on a back side in an advancing direction; and a cleaning module, including a dust box 300 that is detachably assembled to the accommodating chamber 200. The dust box includes an accommodating portion 301, a top cover 302 located above the accommodating portion and a locking mechanism. The locking mechanism includes a first locking mechanism 610 substantially located at the central axis of the top cover. The first locking mechanism 610 includes at least a first handle recess 603, and a first mating member 601 located in the first handle recess 603. The first mating member 601 may elastically move relative to the first handle recess 603 under the action of external force. The first handle recess 603 forms a recess downward along the edge of the first portion of the top cover, and provides sufficient depth in the direction Z to enable the height of the first mating member 601 to be smaller than that of the surface of the top cover. The first handle recess 603 provides a sufficient elastic space in the direction X to achieve a sufficient movement space when the first mating member 601 elastically moves inward.

[0060] In some embodiments, the first mating member 601 includes a first elastic arm 6011, a first handle portion 6012 and a first fastener portion 6013. The first elastic arm 6011 extends upward from the bottom of the first handle recess 603. The first handle portion 6012 is

located at the upward extending tail end of the first elastic arm 6011. The first fastener portion 6013 transversely extends along the first elastic arm 6011. The first elastic arm 6011 is substantially n-shaped as a whole, so as to reduce the materials and increase the elasticity, and the shape and structure are not limited herein. The first handle portion 6012 is transversely disposed above the first elastic arm 6011, and includes a bottom surface substantially protruding outward and a handle surface (or gripping surface) extending upward along the bottom surface. The handle surface extends to a position that is substantially flush with the top cover, and may be of an arc-shaped structure, that is, its projection on the horizontal plane is arc-shaped. The handle surface facilitates the reception of a manual operation, and has a shape contributing to the ergonomic stress relationship with the fingers. In some embodiments, the first fastener portion 6013 is a pair of sheet-like structures symmetrically arranged along two sides of the first elastic arm 6011, and the width of each of the sheet-like structures decreases from a root to a free end, so as to facilitate the successful insertion into the first locking member 701. The first elastic arm 6011 may be wholly made of a common elastic material, such as a plastic or an organic elastic material.

[0061] In some embodiments, as shown in FIG. 8, it is an enlarged schematic diagram of the first locking member 701 at A in FIG. 3A. The first locking member 701 is disposed at the position of the inner wall of the accommodating chamber 200 substantially corresponding to the first mating member 601; and the first mating member 601 cooperates with the first locking member 701 for lockup. In some embodiments, the first locking member 701 is a pair of through holes, and the free ends of the sheet-like structures are inserted into the through holes to achieve lockup.

[0062] In some embodiments, a first recess 206 is formed in the position of in the inner wall of the accommodating chamber substantially corresponding to the first handle recess 603, and the pair of through holes are formed in two sides of the first recess 206. Lockup is achieved when the first mating member 601 extends into the through holes, and unlocking is achieved when a finger is put in via the first recess 206 to apply a force to pull out the first mating member 601 from the through holes. The synergistic cooperation between the first recess 206 and the first handle recess 603 allows the finger entering operation is 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 handle recess 605 and a second mating member 602. The second handle recess 605 inward forms a notch, for example, an arc-shaped notch or a square notch, substantially along the centerline position of the second portion 3022 of the top cover, which is convenient for the finger to enter for a pulling operation. The second mating member 602 is located on the lower side of the second handle recess 605, the second handle recess 605 provides a sufficient space for the finger to control the second mating member 602, and the second mating member 602 moves inward elastically under the action of external force. The second mating member 602 includes second elastic arms 6021, a second handle portion 6022 and second fastener portions 6023. The second elastic arms 6021 are located below the second handle recess 605, and includes two symmetrical portions; and each second elastic arm 6021 extends first in the opening direction of the second handle recess 605, then in the edge direction of the top cover, and then in the edge direction of the second handle recess 605. Here, the opening direction of the second handle recess 605 is, as shown in FIG. 9A, the direction A outward from the center of the top cover, and in this embodiment, it is also the backward direction of the top cover of the dust box. The two portions of the second elastic arms 6021 are substantially in the form that two H-shaped structures are symmetrically connected. The second handle portion 6022 connects the symmetrically arranged two portions of the second elastic arms 6021, and is disposed above the two second elastic arms. As shown in FIG. 9B and FIG. 9C, FIG. 9C is an enlarged view of the second handle portion at C in FIG. 9B. The bottom of the second handle portion 6022 includes a bottom surface 60221 protruding substantially outward and a handle surface 60222 extending upward along the bottom surface. The handle surface extends to a position that is substantially flush with the top cover, and may be of an arc structure to facilitate the reception of a manual operation and allow the finger to apply a force. In some embodiments, the second handle portion 6022 is integrally molded with the symmetrically arranged second elastic arms 6021. The second fastener portions 6023 are disposed on the transverse extension portion of the second elastic arm. A pair of the second fastener portions 6023 are symmetrically arranged along two sides of the second elastic arm 6021, and for example, the pair of the second fastener portions 6023 are of a convex or sheet-like structure extending in the direction A. In some embodiments, each of the second fastener portions 6023 includes a groove extending inward from the end of the second fastener portions 6023, and the groove may avoid difficulty in fastening caused by excessive deformation of the whole piece of molded and cooled second fastener portion. In some embodiments, the second mating member 602 further includes substantially planar connectors 6024 that are symmetrically disposed; one end of a second elastic arm 6021 is connected to one side of a connector 6024; and the other side of the connector 6024 is connected and fixed to the end surface of the support structure. The second handle portion 6022 is exposed from the second handle recess 605 in the direction X. In this way, in the case of unlocking, the finger may stretch into the second handle recess 605 to press against the second handle portion 6022, and apply a force along the axis X to the inner side of the dust box

to drive the second fastener portions 6023 to elastically retract inward, allowing the second fastener portions 6023 to eject from the bottom of the second locking member 702 to achieve unlocking. The second elastic arm 6021 may be wholly made of a common elastic material, for example, a plastic or an organic elastic material.

[0064] In some embodiments, as shown in FIG. 10, it is an enlarged view of the second locking member 702 shown at B in FIG. 3B. The second locking member 702 is disposed at the position on the inner wall of the accommodating chamber 200 substantially corresponding to the second mating member 602; and the second mating member 602 cooperates with the second locking member 702 for lockup. The second locking member 702 is a pair of protrusions, and the second fastener portions 6023 is inserted into the bottom of the second locking member 702 to achieve lockup. The protrusions may be flat, cylindrical, cuboidal, or the like, which is not limited herein, as long as the second fastener portions can be fastened.

[0065] In some embodiments, a second recess 207 is disposed at the position of the lower surface of the second chamber 202 substantially corresponding to the second handle recess 605, and the pair of protrusions are disposed on the back side wall of the second chamber 202 in an equal-height manner, and are located above the second recess 207. The second recess 207 is configured to avoid and accommodate the second mating member 602 when the dust box 300 is placed into the accommodating chamber 200, allowing the whole dust box to be better disposed 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 to extend outward, and the second handle recess 605 and the second member 602 are located on the second portion of the top cover. A support structure 3023 is disposed below the second portion of the top cover and configured to support the second portion of the top cover. The second member 602 is disposed on the support structure 3023. As shown in FIG. 4, the symmetrically arranged support structure 3023 forms an inward compression space in the direction X, allowing for a sufficient elastic space to respond to the applied inward action force when the second elastic arms 6021 are connected to the symmetrical support structure 3023.

[0067] For the lockup structures of the dust box as described in the above embodiment, the lockup structures are symmetrically disposed in the front-and-back direction of the top cover of the dust box, such that unlocking is achieved when the force is applied to both the front and back elastic structures of the dust box with one hand, and the dust box is prevented from tilting caused by the dust box being popped up from one side after the unlocking is achieved only from one side. Meanwhile, due to the simple elastic structure, elastic unlocking can be achieved just by the elastic arms made of the elastic material only, thereby avoiding the risk that complex unlocking devices using springs and the like are likely to be damaged.

[0068] In some embodiments, as shown in FIG. 4, the second locking mechanism 620 includes at least one first magnetic module 604 disposed between the second portion of the top cover and the support structure. As shown in FIG. 3A, the accommodating chamber includes at least one second magnetic module 606 configured to cooperate and attract with the first magnetic module 604 for lockup. In the application process, the first mating member 601 and the second handle recess 605 may be manually pushed to retract the first mating member 601 corresponding to the dust box. After the dust box is placed into the accommodating chamber and is released by the hand, the first fastener portion 6013 on the first mating member 601 automatically pops out and is inserted into the first locking member 701, and the first magnetic module 604 and the second magnetic module 606 attract each other to firmly lock the dust box. The locking structure is simple, and is easy to operate, which facilitates the locking of the dust box.

[0069] In some embodiments, the second locking mechanism 620 as described above may include the second handle recess 605 and the second mating member 602 as described in an embodiment, or may include the first magnetic module 604 as described in another embodiment, or may include the components in the above two embodiments, which is not limited here.

[0070] The dust box of an existing automatic cleaning device needs to be equipped with a replaceable filter of a dust box. A traditional filter is generally made of plastic or metal into a hard frame. A stacked filter element is placed in the frame, the frame and the filter element are connected by glue dispensing with the peripheries being sealed, and then a sealing strip is pasted to the frame to seal a slit between the filter and the dust box. Therefore, part of the traditional filter of the dust box is complex, and mounting steps of the filter are cumbersome, leading to waste of labor and cost, and moreover the glue used during sealing is neither economical nor environmentally friendly.

[0071] To this end, an embodiment of the present disclosure provides an automatic cleaning device. The automatic cleaning device includes: a mobile platform configured to automatically move on an operation surface and including an accommodating chamber; and a cleaning module including a dust box detachably assembled to the accommodating chamber. The dust box includes a filter of the dust box, and the filter is applied to the dust box of the automatic cleaning device, simplifying the assembling process of the filter of the dust box. This embodiment briefly describes some structural features compared with the above embodiment, and since identical structures have identical technical effects, some of the technical effects are not described in detail herein. As shown in FIGS. 11 to 12, the filter 500 of the dust box

includes: a soft rubber frame 501, which includes at least one soft rubber protrusion for sealing an assembling gap with the dust box during assembling; and a filter element 502 sleeved in the soft rubber frame 501. Here, the soft rubber frame 501 is non-detachably connected to the filter element 502. In some embodiments, the non-detachable connection between the soft rubber frame 501 and the filter element 502 may be implemented by the rubber coating and injection molding process, in which the filter element is pre-sleeved in the frame in advance, then soft rubber is sleeved on the pre-sleeved frame assembly, and a plurality of required sealing protrusions are integrally formed. Alternatively, a hard rubber frame body may be first inject-molded with a double-injection process, the filter element is sleeved on the frame body, and then soft rubber is injected to form inner and outer sealing protrusions.

[0072] The soft rubber frame 501 may be of a rectangular, square, oval, circular, polygonal structure or other structures, which is not limited herein. In some embodiments, the soft rubber frame is a rectangular structure, in which case the soft rubber frame 501 includes two first side walls 50111 and two second side walls 50113 arranged oppositely. The soft rubber protrusions include first protrusions 5011 distributed on the outer peripheral surface of one first side wall 50111 and second protrusions 5015 distributed on the outer peripheral surface of the other first side wall 50111. The pair of first side walls 50111 and the pair of second side walls 50113 form the frame of the rectangular structure, and the filter element is sleeved in the frame of the rectangular structure, as shown in FIGS. 11 and 12.

[0073] In some embodiments, the first protrusion 5011 and the second protrusion 5015 may be continuous protruding structures. For example, each of the first protrusion 5011 and the second protrusion 5015 extends continuously from one end of the outer peripheral surface of the corresponding first side wall 50111 to the other end. Because the first protrusion 5011 and the second protrusion 5015 are of soft rubber structures, when the filter of the dust box is assembled on the dust box, the first protrusion 5011 and the second protrusion 5015 will be pressed and directly sealed between the filter 500 of the dust box and a second opening 3012 of the dust box, and are in full contact and sealed with the inner wall of the second opening 3012 of the dust box extending substantially in the horizontal direction. This arrangement can replace the step of performing sealing by means of a sealing strip after the traditional filter of a dust box is assembled onto the dust box.

[0074] In some embodiments, as shown in FIG. 14, at least one of the first and second protrusions is of a snap-fit structure. The snap-fit structure is configured to seal the assembling gap between the soft rubber frame and the dust box while preventing the filter of the dust box from falling off from the dust box. For example, the snap-fit structure is an arc structure, which is tilted to a side opposite to the assembling direction of the filter of the dust box. During the assembling process of the filter of the dust box, along with the friction produced when the filter of the dust box is inserted into the assembling opening of the dust box, it is convenient for the snap-fit structure to tilt towards the side opposite to the assembling direction, and then the snap-fit structure is pressed and sealed between the dust box and the filter of the dust box.

[0075] In some embodiments, the second side walls of the soft rubber frame further include at least one third protrusion 5012 distributed on the outer peripheral surface of at least one second side wall 50113 of the frame structure. The third protrusion 5012 may be of a structure with a plurality of discrete protrusions. As an embodiment, the third protrusions 5012 are distributed on the outer peripheral surfaces of the two second side walls 50113 of the frame structure. When the filter of the dust box is assembled to the dust box, the third protrusions 5012 located on the peripheral surface of one of the second side walls 50113 of the frame structure have slightly longer structures, and may extend into the recess in the side wall of the dust box, achieving the effect of fastening and preventing the filter of the dust box from falling off. Meanwhile, in the case of assembling the filter of the dust box, the slightly longer third protrusion 5012 may be first inserted into the recess of the side wall of the dust box, and the other side of the filter of the dust box may be mounted into the dust box after rotating around the third protrusion 5012. The third protrusions 5012 distributed on the outer peripheral surface of the other second side wall 50113 of the frame structure have smoother structure. When the filter of the dust box is assembled to the dust box, the third protrusions 5012 on this side are in interference fit with the elastic structure 5013 on the side wall of the dust box to prevent the filter of the dust box from falling off. Here, the elastic structure 5013 is substantially S-shaped, and has an inner concave portion for accommodating the third protrusion 5012 and an outer convex portion for fastening with the third protrusion 5012. The outer convex portion may elastically move under the action of an external force to be fastened with the third protrusion 5012. As shown in FIG. 15, it is a mounting structure diagram when the filter of the dust box is looked up from the bottom end of the dust box. In some embodiments, as shown in FIGS. 13A and 13B, the soft rubber frame further includes: first ribs 510 disposed on the outer peripheral surfaces of the second side walls and configured to avoid improper assembling caused by the filter in the dust box being mounted into the dust box too deeply or too shallowly. In the process of assembling the filter of the dust box into the dust box, after the filter of the dust box is assembled in place, each the first rib 510 is abutted against a pillow position 5014 disposed at the corresponding position of a dust box border, thereby preventing the filter from further stretching inward, i.e., preventing the filter from being assembled into the dust box too deeply. Meanwhile, when the first ribs 510 are not abutted against the pillow positions 5014 of the dust box

border during assembling, it is considered that the assembling is not in place, thereby preventing the filter from being assembled into the dust box too shallowly, as shown in FIG. 15.

[0076] In some embodiments, as shown in FIGS. 13A and 13B, the soft rubber frame further includes: a foolproof protrusion 509, which is disposed on the outer peripheral surface of the second side wall and configured to avoid reversed assembling of the filter of the dust box. A recess is disposed on the dust box at the position corresponding to the foolproof protrusion 509. When the filter of the dust box is mounted normally, the foolproof protrusion 509 enters the recess to allow normal assembling of the filter of the dust box. When the filter of the dust box is mounted reversely, the foolproof protrusion 509 will stop the assembling of the filter since the other side of the dust box is not provided with the recess, thereby playing a foolproof role of prompting reverse mounting of the filter of the dust box.

[0077] In some embodiments, as shown in FIGS. 3A and 3B, the accommodating chamber 200 includes a first chamber 201 and a second chamber 202 which are sequentially arranged next to each other in the advancing direction of the automatic cleaning device, and the depth of the first chamber 201 is greater than the depth of the second chamber 202. A dust suction inlet 203 is disposed at the bottom of the front side wall of the first chamber 201; and an air outlet 208 is disposed in the back side wall at a position where the first chamber 201 is connected to the second chamber 202. A fan is accommodated in the space below the second chamber 202. An air exhaust opening 204 is formed in the back side wall of the mobile platform 100. Under the action of a suction force generated by the fan, dust enters the dust box 300 from the dust suction inlet 203, and an air flow is filtered by the filter of the dust box and then discharged from the air exhaust opening 204. Here, the air outlet 208 is provided with a grille structure.

[0078] As shown in FIGS. 11 and 12, the soft rubber frame further includes: an inner sealing lip 507, and an outer sealing lip 506. The inner sealing lip is disposed on a first end surface 50116 of the soft rubber frame 501 around the filter element 502, and is configured to achieve sealing fit between the filter of the dust box and an assembling surface 30121 of the second opening 3012 of the dust box. The assembling surface 30121 of the second opening 3012 of the dust box is formed on the side in the second opening close to the inner wall of the dust box, is substantially of a planar structure, and is configured to be abutted against the first end surface 50116 of the soft rubber frame for assembling the soft rubber frame, as shown in FIG. 14. The outer sealing lip 506 is disposed on a second end surface 50115 of the soft rubber frame 501 around the filter element 502, and is configured to seal the edge of the filter of the dust box 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 surface 50116 or the second end surface 50115 where they are located. After being assembled in place, the inner sealing lip 507 is pressed between the filter of the dust box and the assembling surface of the dust box; and since inner sealing lip 507 is made of a flexible material, the filter of the dust box and the assembling surface of the dust box are sealed under a pressing force. After the dust box is assembled to the automatic cleaning device, the outer sealing lip 506 of the filter of the dust box is pressed between the filter of the dust box and the outer side of the grille of the air outlet 208 of the accommodating chamber 200, thereby sealing the filter of the dust box and an assembling surface of a fan bracket. As shown in FIGS. 3A and 3B, the side wall where the first chamber 201 and the second chamber 202 are connected forms the assembling surface of the fan bracket, the fan is disposed below the second chamber 202, and the grille-type air outlet 208 is disposed on the side wall where the first chamber 201 and the second chamber 202 are connected. The arrangement of the inner sealing lip 507 and the outer sealing lip 506 on the soft rubber frame 501 allows the sealing fit between the inner end surface of the filter 500 of the dust box and the assembling surface of the air outlet of the dust box, as well as between the outer end surface of the filter 500 of the dust box and the outer surface of the grille of the air outlet of the accommodating chamber 200, which eliminates tedious steps of additionally mounting sealing strips on inner and outer sides in the traditional dust box filter to meet sealing requirements of an air path. Moreover, the soft rubber frame 501 is used as a carrier, and the sealing inner lip 507 and the sealing outer lip 506, which also have certain flexibility, are used as sealing structures, such that the contact sealing fit is closer, the fitting is more sufficient, and the sealing effect is stronger. Thus, the air tightness of the whole air path is ensured and a better role of ensuring the functions such as dust suction and dust discharge is fulfilled by the cleaning device relying on negative pressure.

[0079] In some embodiments, as shown in FIGS. 11 and 12, the soft rubber frame further includes: a step surface 503, which extends outward along the second end surface 50115 of the soft rubber frame 501, such that the step surface 503 and the side wall of the soft rubber frame 501 form a step structure, and is configured to prevent the filter of the dust box from being assembled into the dust box too deeply. During assembling, when the filter of the dust box is inserted into the assembling opening of the dust box, the step surface 503 will be abutted against the outer assembling edge of the dust box, so as to be fastened at the outer edge of the dust box and to prevent the filter of the dust box from being assembled into the dust box too deeply, 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 formed in the second end surface 50115 of the soft rubber frame 501 and configured for assembling of a magnetic element to ensure that

the filter of the dust box is mounted in place. The magnetic element may be a magnet or other electromagnetic components. The magnetic element mounting hole 504 is used for mounting of an inductive magnetic element, and is deep enough to ensure that the magnetic element can be mounted at a fixed position on the inner side of the filter, such that the magnetic element can be detected by a Hall sensor when the overall filter is mounted at the fixed position, so as to ensure that the filter is mounted in place.

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

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

[0083] In some embodiments, as shown in FIG. 12, the soft rubber frame further includes a hollow-out structure 508, which is disposed 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-out structure 508 may include a plurality of inward sunk blind holes, the structure of which is not limited, and may be circular, square, rectangular, irregularly-shaped, or the like.

[0084] According to the automatic cleaning device described in the above embodiments, the filter of the dust box, due to the design of the soft rubber frame, can be directly pressed and assembled in the opening of the dust box during assembling. Meanwhile, in cooperation with the structures such as the first protrusion, the inner sealing lip and the outer sealing lip, tight sealing between the filter and the assembling surface can be achieved while assembling, such that the manual assembling of glue dispensing and bonding in the traditional process is avoided after the filter is assembled, which simplifies the process and reduces the components to be assembled while reducing the cost. Furthermore, glue bonding and peculiar smell are eliminated, providing improved environmental friendliness.

[0085] Finally, it should be noted that the various embodiments in the specification 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.

[0086] 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 make the nature of the corresponding technical solution depart from the spirit and scope of the technical solutions of the various embodiments of the present disclosure.

Claims

1. An automatic cleaning device, comprising:

   a mobile platform configured to automatically move on an operation surface and comprising an accommodating chamber, the accommodating chamber comprising a first chamber and a second chamber; and
   a cleaning module comprising a dust box detachably assembled to the accommodating chamber,
   wherein the first chamber and the second chamber are sequentially arranged next to each other in an advancing direction of the automatic cleaning device, and a depth of the first chamber is greater than a depth of the second chamber.

2. The automatic cleaning device according to claim 1, wherein the dust box comprises an accommodating portion and a top cover located above the accommodating portion, and the top cover is fixedly connected to the accommodating portion.

3. The automatic cleaning device according to claim 2, wherein the top cover comprises: a first portion covering the accommodating portion, and a second portion protruding from the accommodating portion to extend outward; and
   wherein when the dust box is assembled to the accommodating chamber, the accommodating portion and the first portion of the top cover are accommodated in the first chamber, and the second portion of the top cover is accommodated in the second chamber.

4. The automatic cleaning device according to claim 3, wherein the first portion of the top cover comprises an edge portion protruding from an edge contour of the accommodating portion to extend outward.

5. The automatic cleaning device according to claim 4, wherein the accommodating chamber comprises a step portion extending around an edge of a top end of the accommodating chamber, and the step portion is

configured to accommodate at least part of the edge portion and at least part of an outer edge of the second portion, such that an upper surface of the top cover is substantially coplanar with an upper surface of the mobile platform.

6. The automatic cleaning device according to claim 3, wherein a support structure is disposed below the second portion of the top cover, and is configured to support the second portion of the top cover, and the support structure and at least part of the accommodating portion are integrally molded.

7. The automatic cleaning device according to claim 6, wherein a surface of the second chamber comprises a groove, the groove is substantially matched with a contour of the support structure, and the groove is configured to accommodate the support structure when the second portion of the top cover is accommodated in the second chamber.

8. The automatic cleaning device according to claim 2, wherein the top cover is symmetrically disposed along a central axis in the advancing direction of the automatic cleaning device.

9. The automatic cleaning device according to claim 8, wherein the top cover has a shape of at least one or a combination of: a D-shape, a rectangle, a square, a circle, an oval, a triangle, a quadrilateral, a pentagon, a hexagon, a heptagon or an octagon.

10. The automatic cleaning device according to claim 2, wherein the dust box comprises:

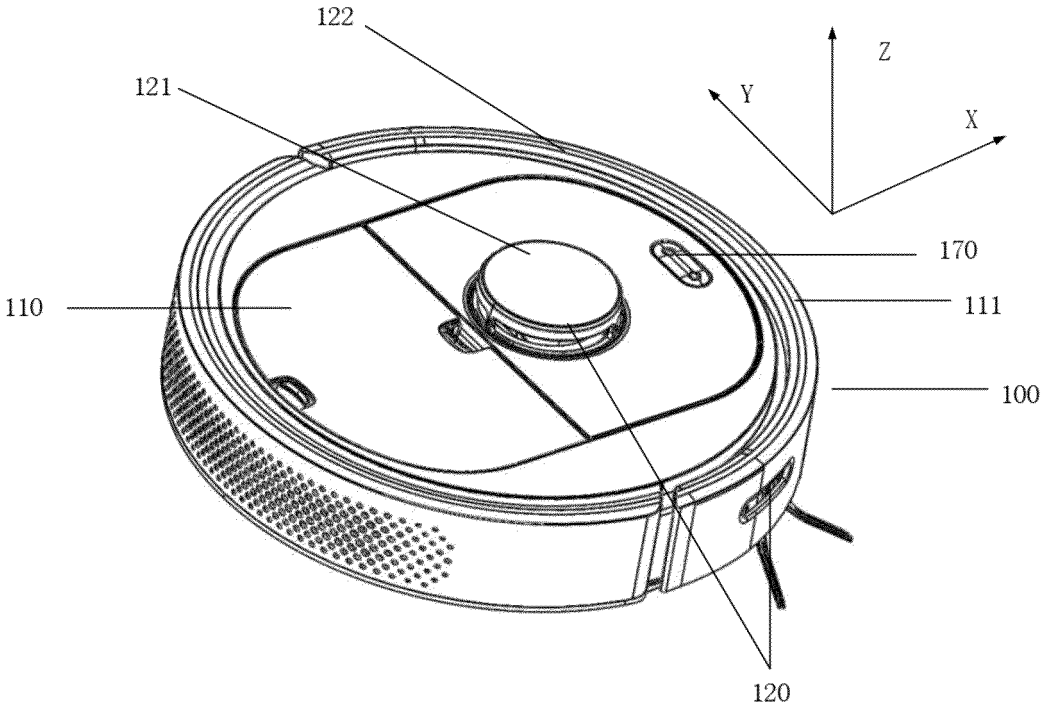
a first opening located in a first side wall of the dust box;
a second opening located in a second side wall of the dust box opposite to the first side wall; and
a filter detachably assembled to the second opening.

11. The automatic cleaning device according to claim 10, wherein the cleaning module further comprises a fan disposed below the second chamber and corresponding to the second opening, and the fan is configured to provide a suction force to suck debris into the dust box from the first opening.

12. The automatic cleaning device according to claim 1, wherein the first chamber comprises a first locking member; the second chamber comprises a second locking member; the first portion of the top cover comprises a first mating member; the second portion of the top cover comprises a second mating member; the first mating member cooperates with the first locking member for lockup; and the second mating member cooperates with the second locking member for lockup.

13. The automatic cleaning device according to claim 12, wherein the first chamber comprises a first recess at a position substantially corresponding to the first mating member, and the first recess is configured to accommodate a finger.

14. The automatic cleaning device according to claim 12, wherein a lower surface of the second chamber comprises a second recess configured to accommodate the second mating member.


122
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Z
Y
X
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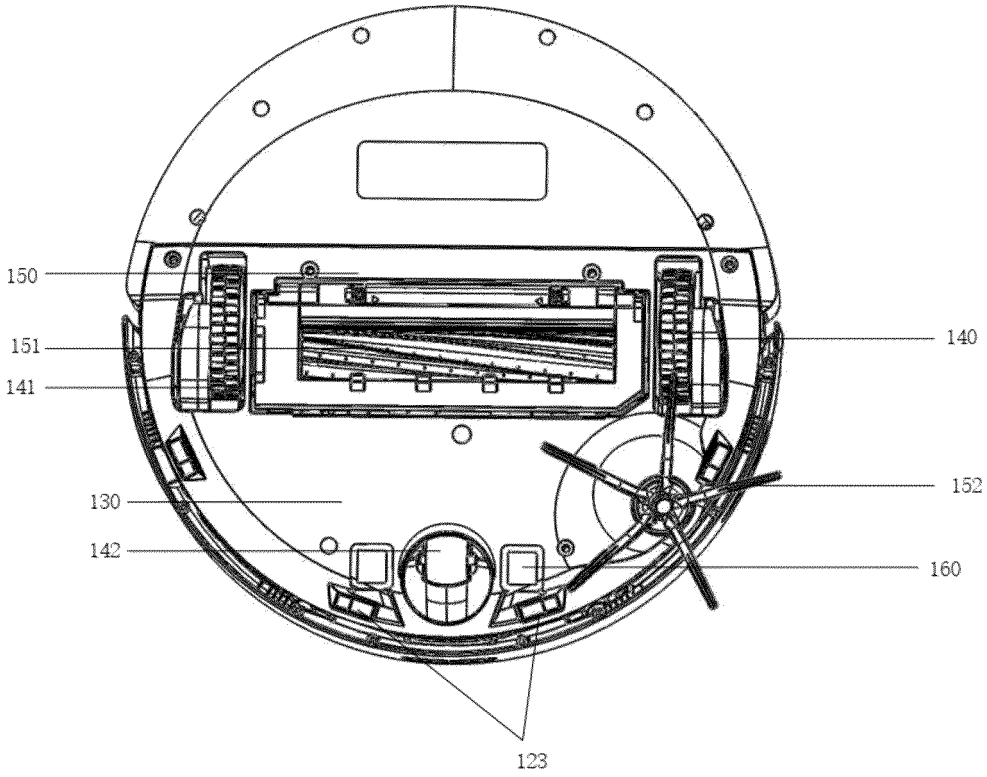
110
111
100
120

FIG. 1


150
151
141
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130
142
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FIG. 2

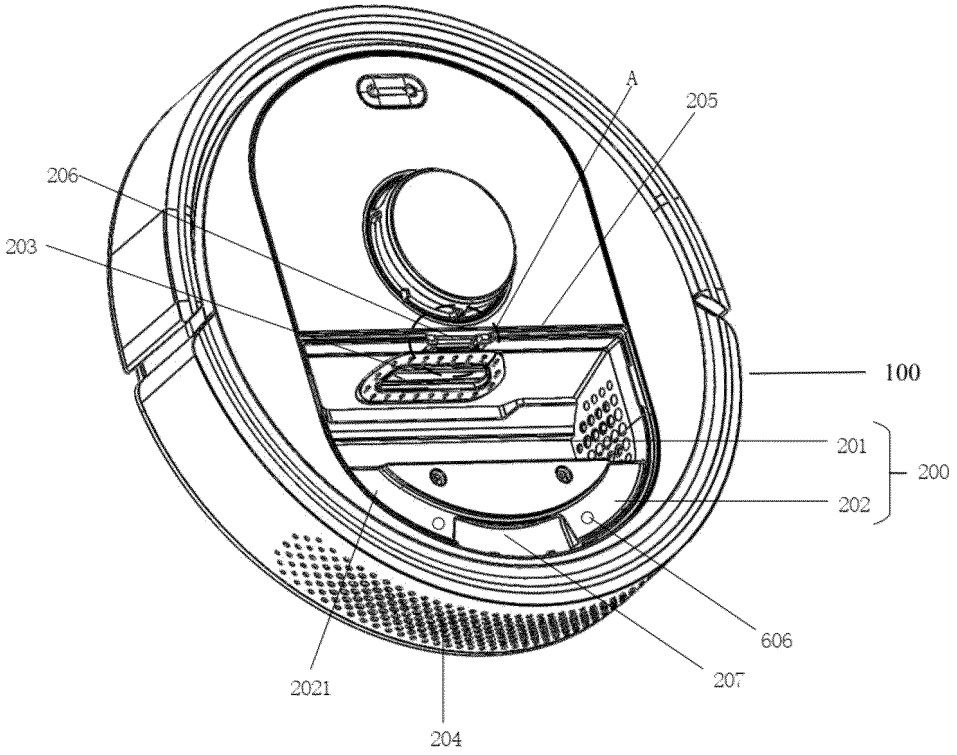

FIG. 3A

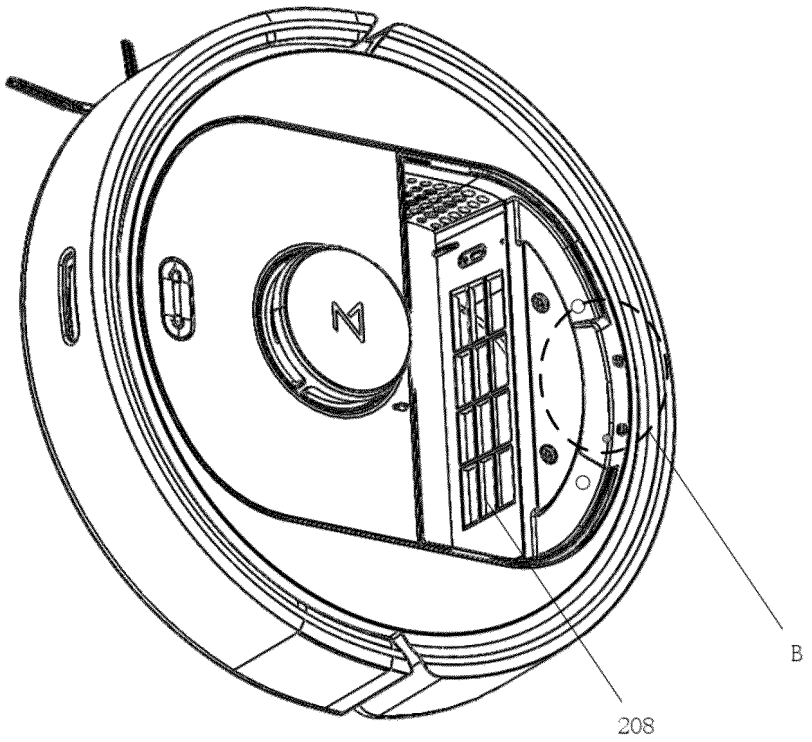

FIG. 3B

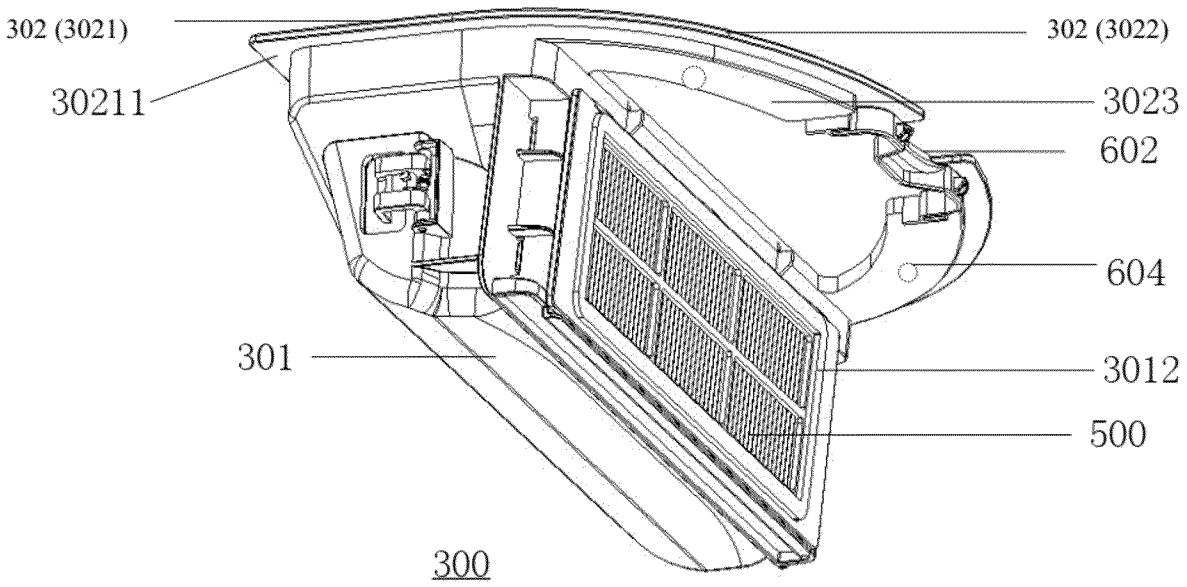

FIG. 4

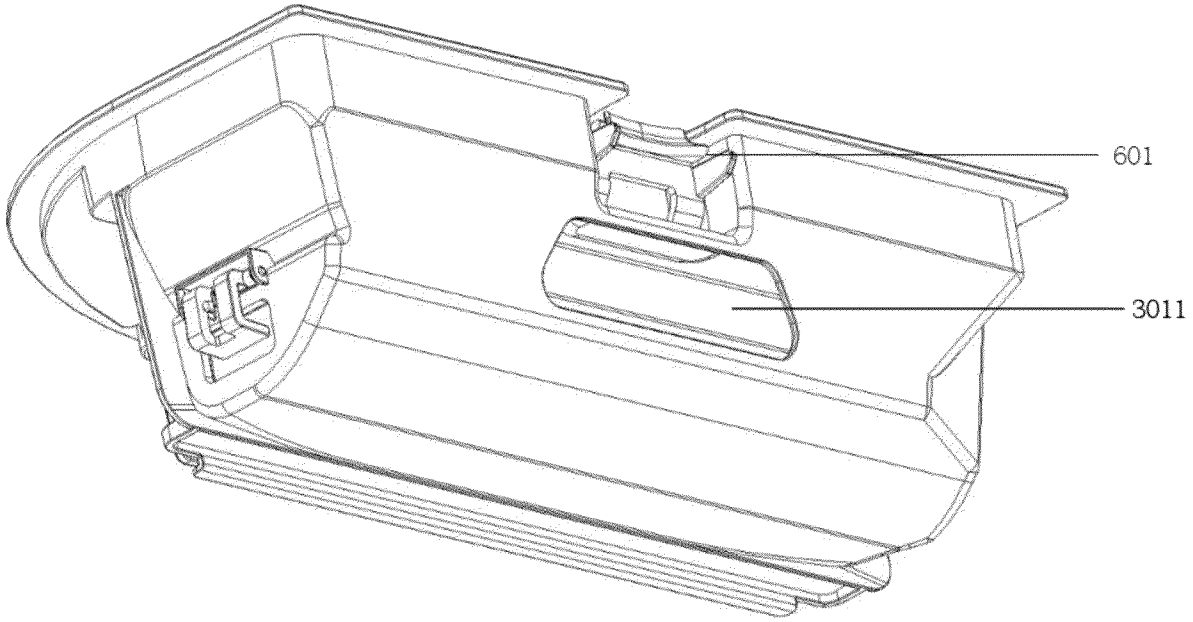

FIG. 5

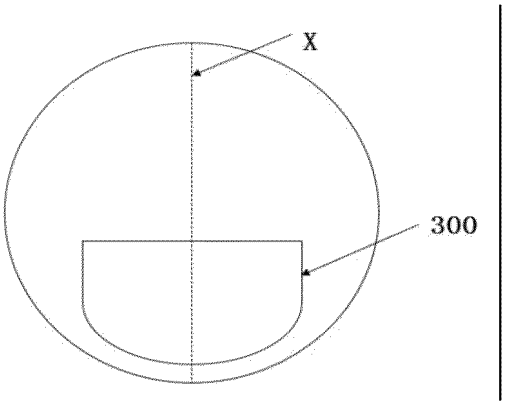

FIG. 6A

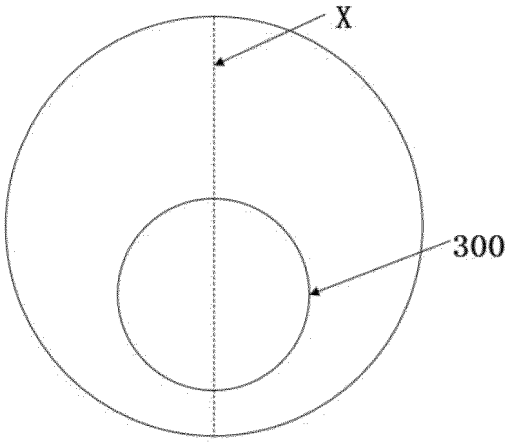

FIG. 6B

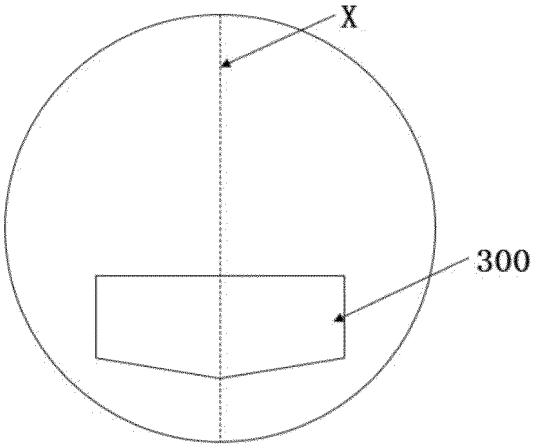

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FIG. 6C

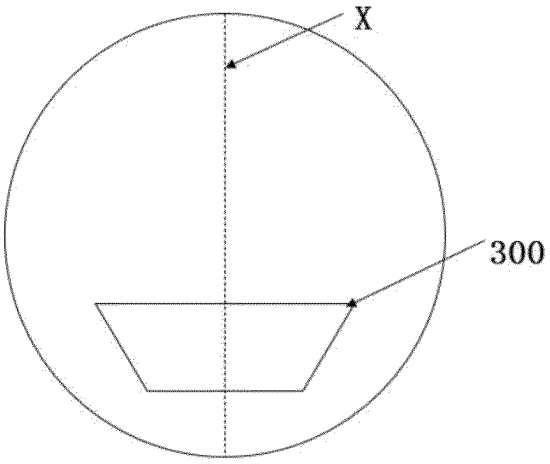

FIG. 6D

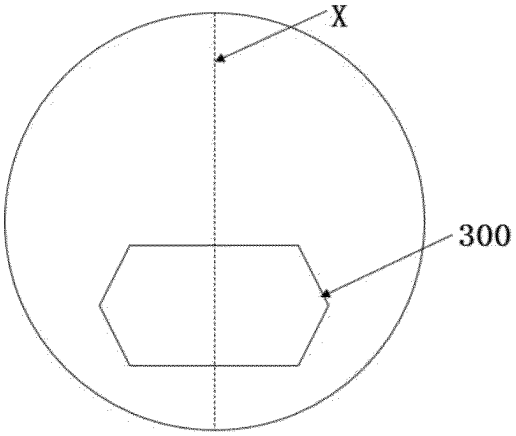

FIG. 6E

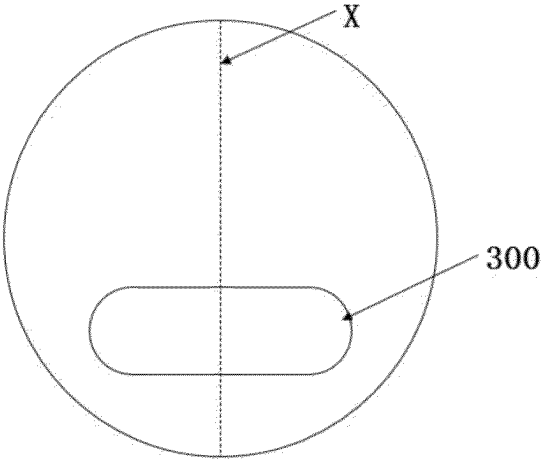

FIG. 6F

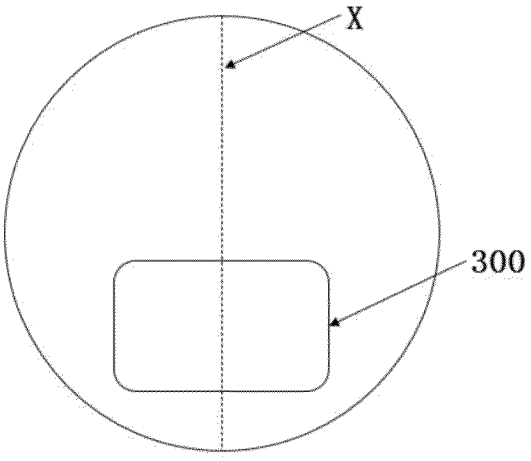

FIG. 6G

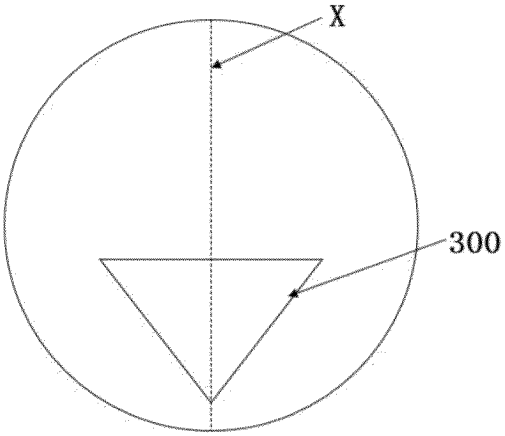

FIG. 6H

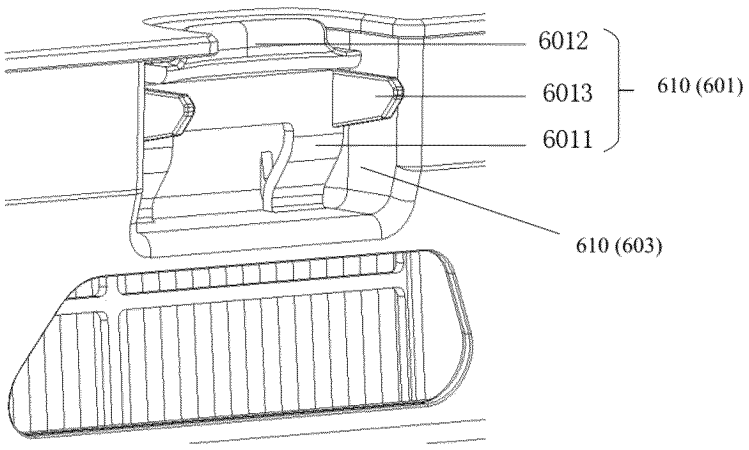

FIG. 7

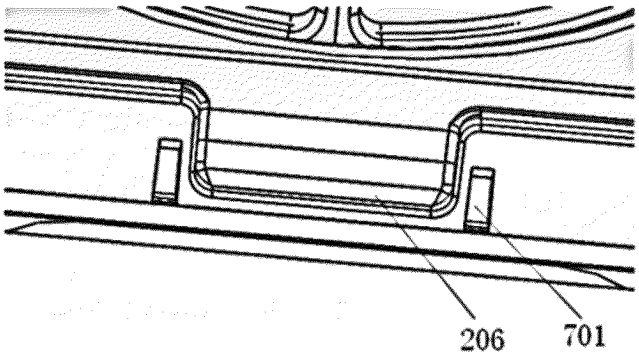

FIG. 8

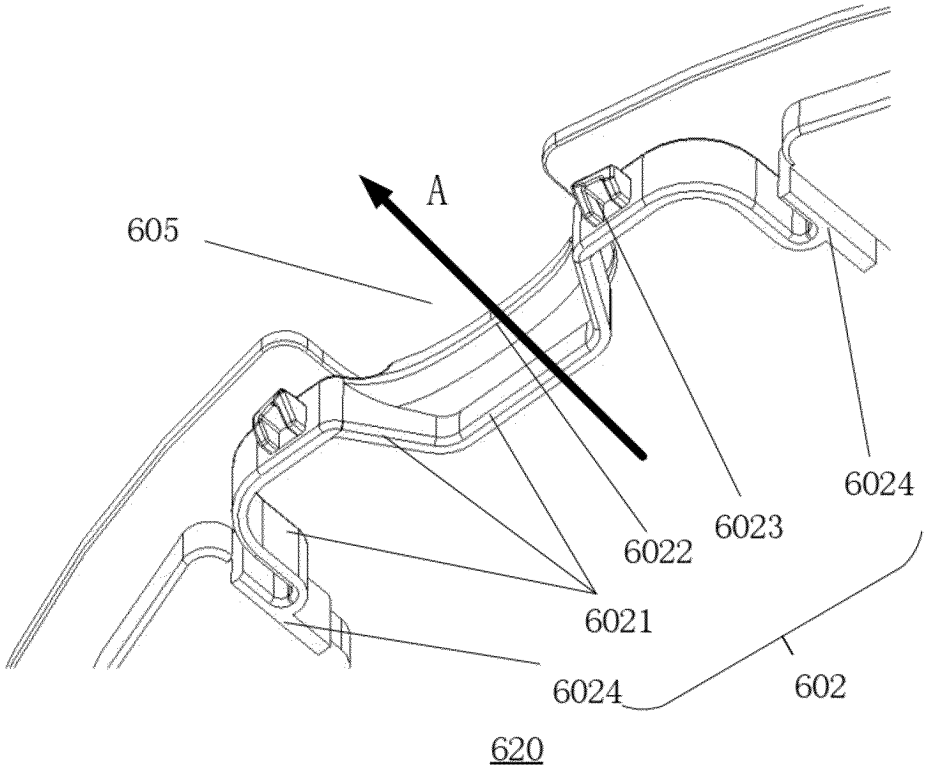

FIG. 9A

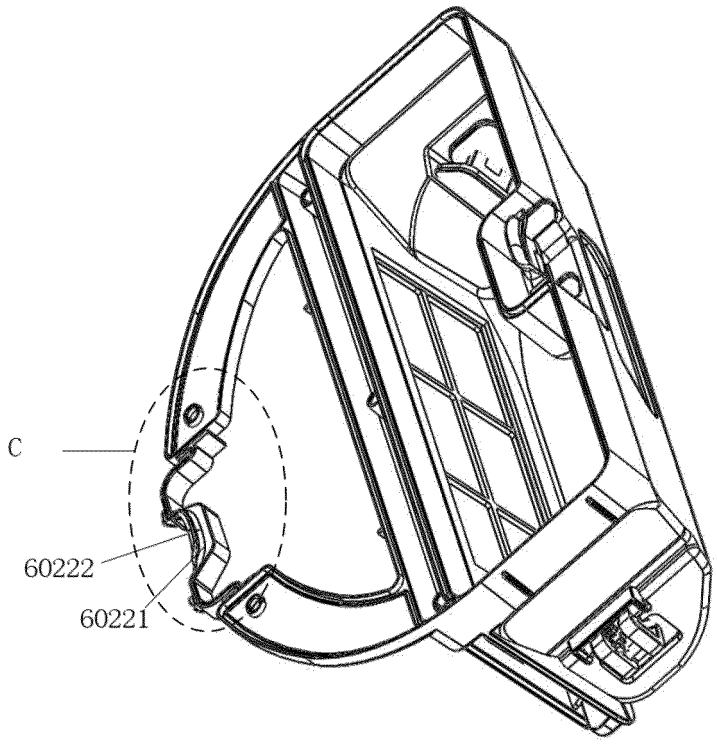

FIG. 9B

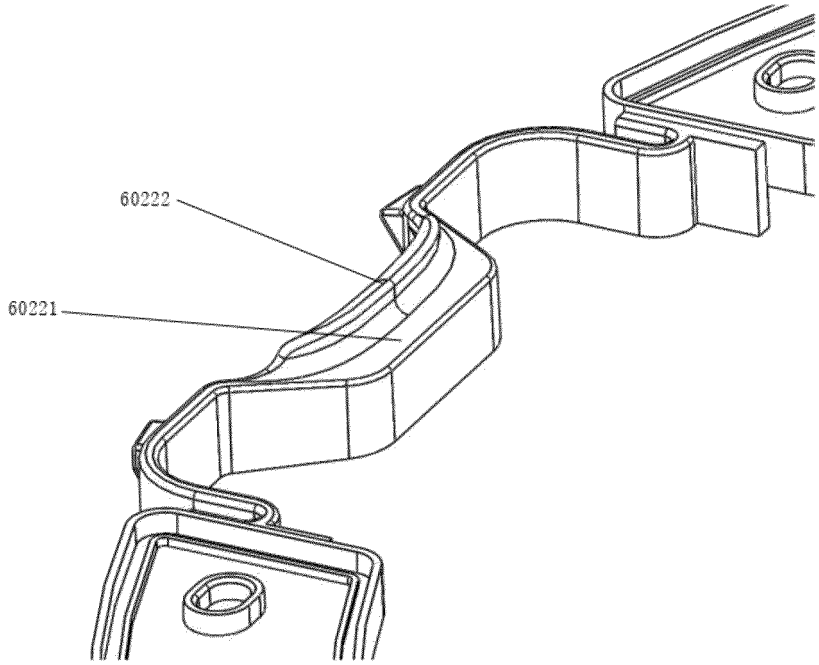

FIG. 9C

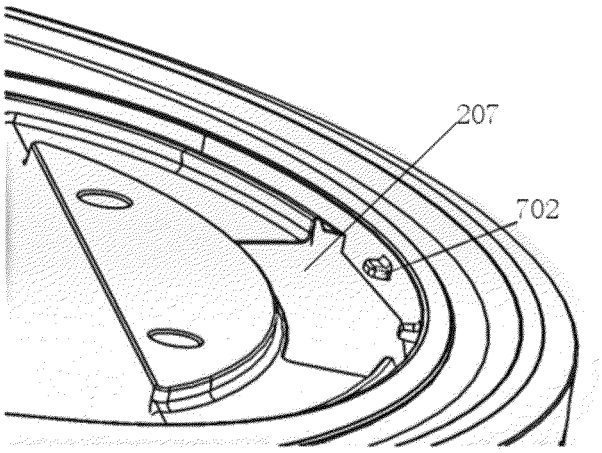
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FIG. 10

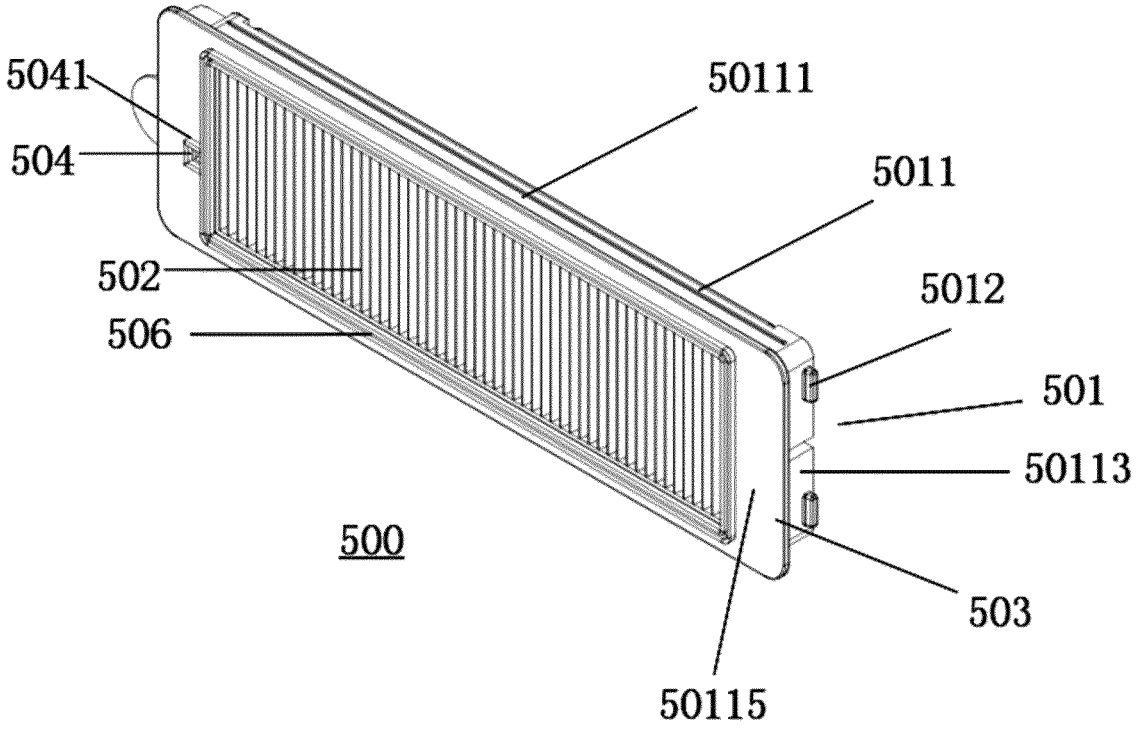
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FIG. 11

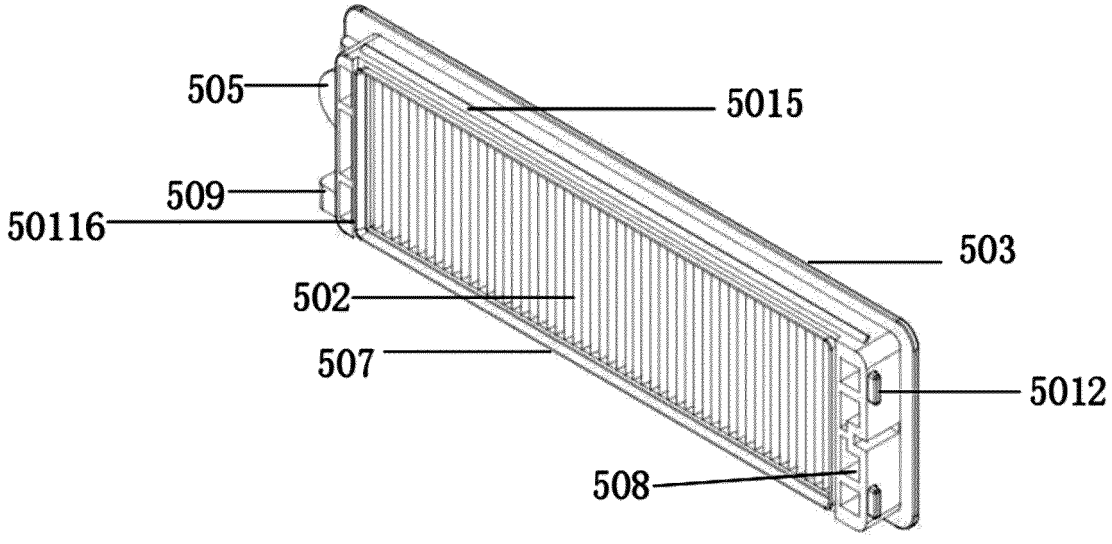

FIG. 12

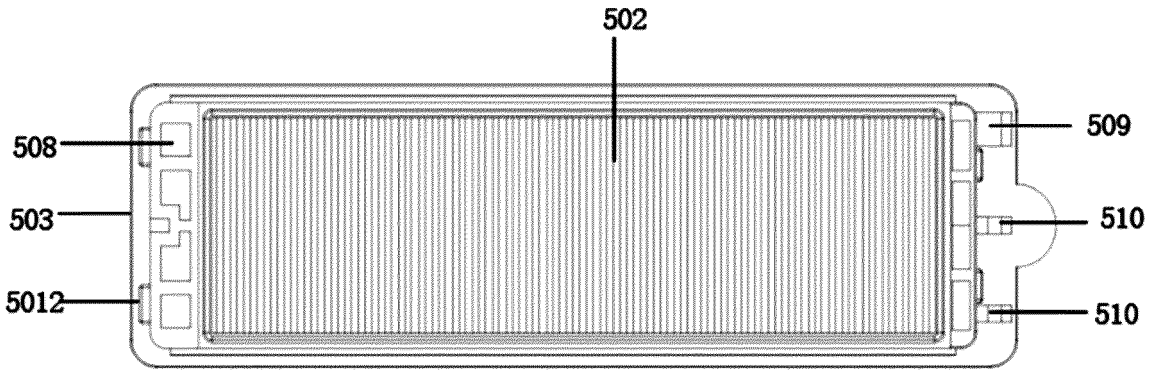

FIG. 13A

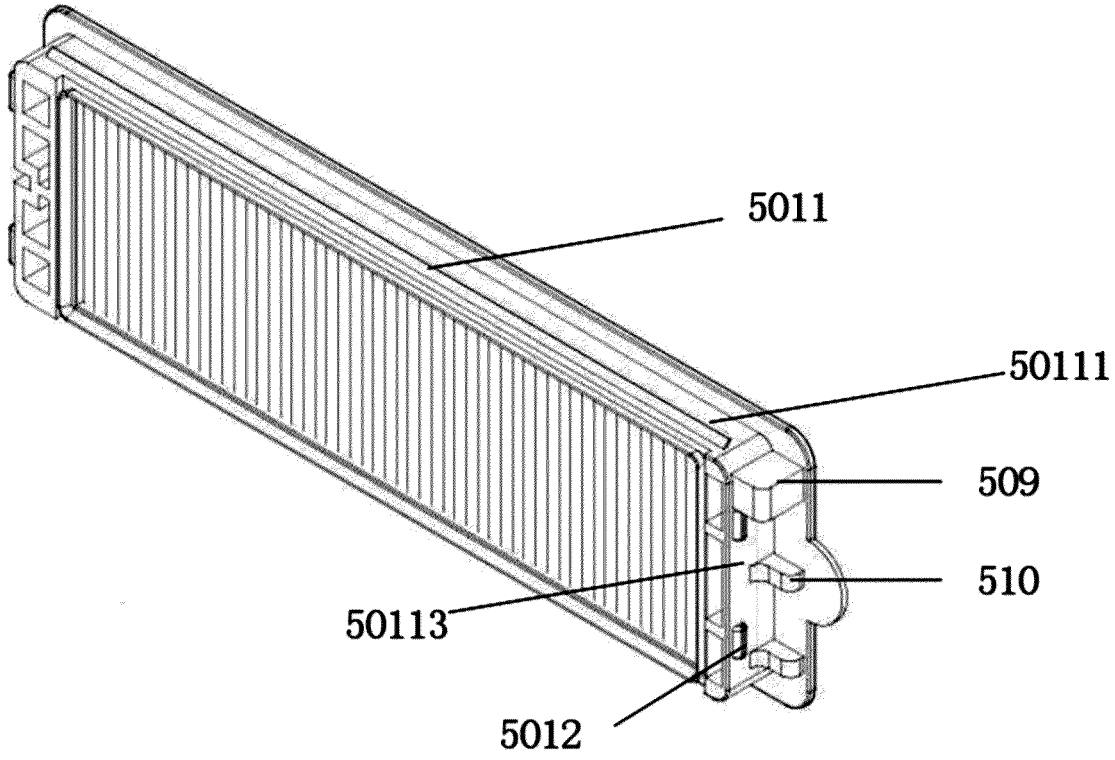

FIG. 13B

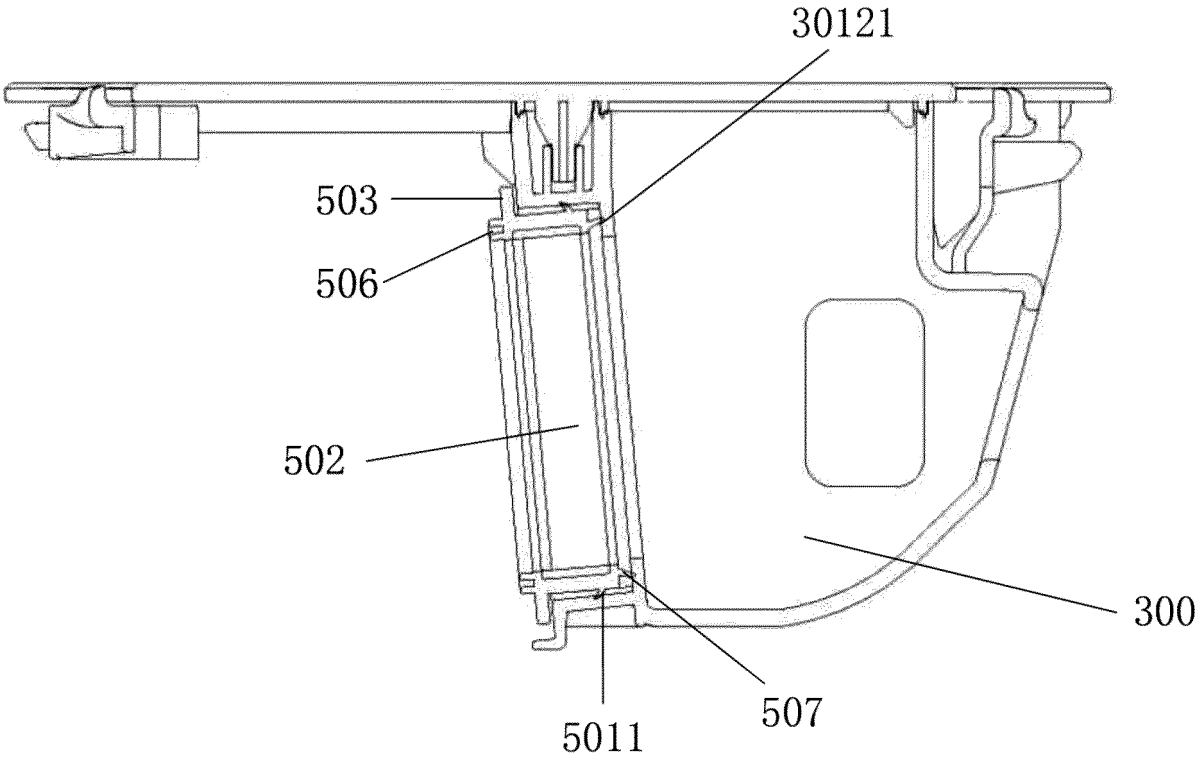

FIG. 14

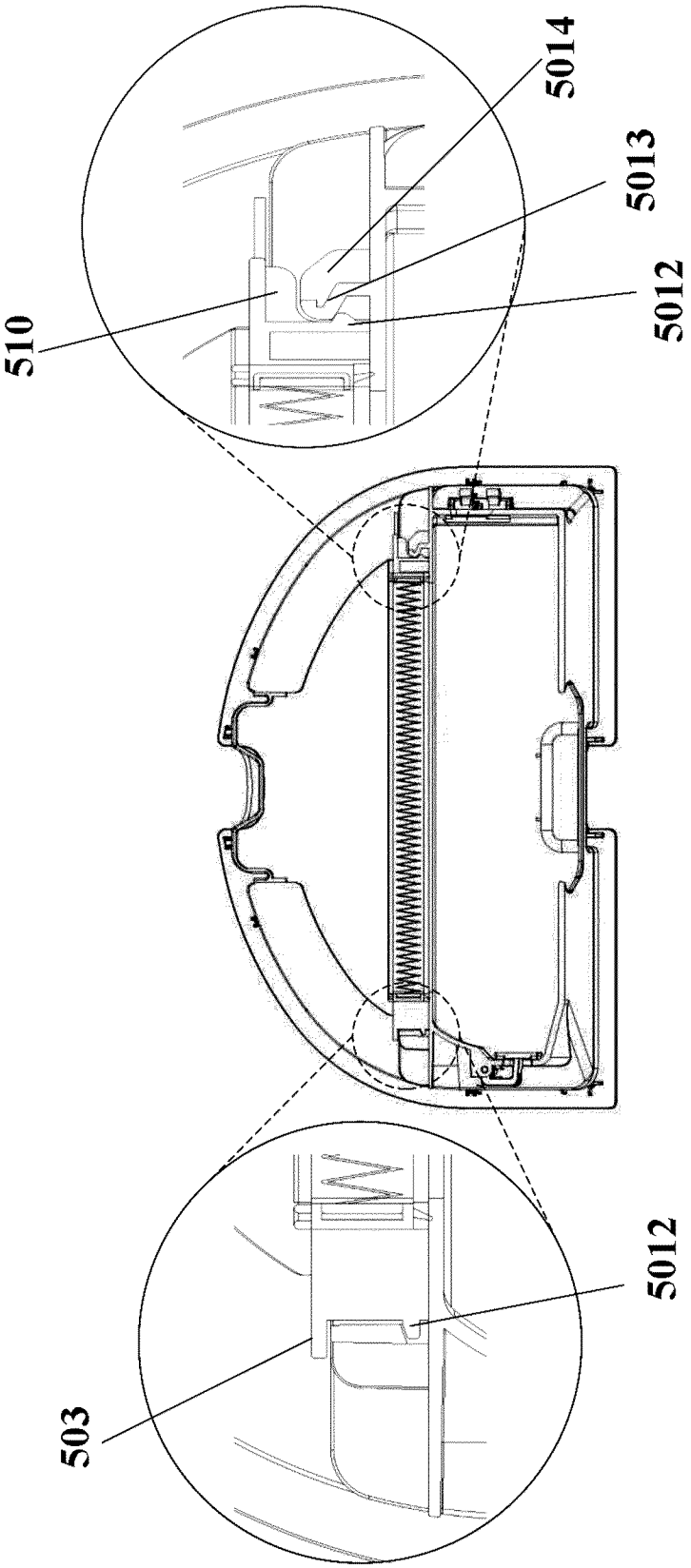

FIG. 15

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2022/110965

A. CLASSIFICATION OF SUBJECT MATTER

A47L 11/24(2006.01)i; A47L 11/40(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: 尘盒, 尘桶, 垃圾盒, 垃圾箱, 垃圾桶, 尘箱, 腔, 槽, 重心, 增大, 扩大, 增加, 拆卸, 锁定, 锁扣, dust, box, chamber, groove, large, disassemble, lock

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 216932995 U (BEIJING ROBOROCK TECHNOLOGY CO., LTD.) 12 July 2022 (2022-07-12) description, paragraphs [0071]-[0103]	1-14
X	CN 209074459 U (SUZHOU DREAM POWER ELECTRIC CO., LTD.) 09 July 2019 (2019-07-09) description, paragraphs [0017]-[0021], and figure 1	1-14
A	CN 209252669 U (BEIJING ROBOROCK TECHNOLOGY CO., LTD.) 16 August 2019 (2019-08-16) entire document	1-14
A	CN 212015461 U (YANCHENG LIQI MACHINERY CO., LTD.) 27 November 2020 (2020-11-27) entire document	1-14
A	JP 2020043906 A (IRIS OHYAMA INC.) 26 March 2020 (2020-03-26) entire document	1-14

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

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"O" document referring to an oral disclosure, use, exhibition or other means
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
01 September 2022	**28 September 2022**
Name and mailing address of the ISA/CN **China National Intellectual Property Administration (ISA/CN)** **No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088, China** Facsimile No. **(86-10)62019451**	Authorized officer Telephone No.

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

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2022/110965

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN 216932995 U	12 July 2022	None	
CN 209074459 U	09 July 2019	None	
CN 209252669 U	16 August 2019	None	
CN 212015461 U	27 November 2020	None	
JP 2020043906 A	26 March 2020	JP 6750898 B2	02 September 2020

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- CN 202220063144 **[0001]**