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(54) **DUST BOX, CLEANING APPARATUS AND CLEANING SYSTEM**

(57) A dust box, a cleaning apparatus and a cleaning system, which relate to the technical field of smart homes. The dust box comprises : a first chamber (111), the first chamber (111) comprising a garbage inlet (1112); a second chamber (112), the second chamber (112) comprising an exhaust port (1123); and a transition channel (113), the first chamber (111) being in communication with the second chamber (112) by means of the transition channel (113), wherein the transition channel (113) is approximately tangent to the second chamber (112).

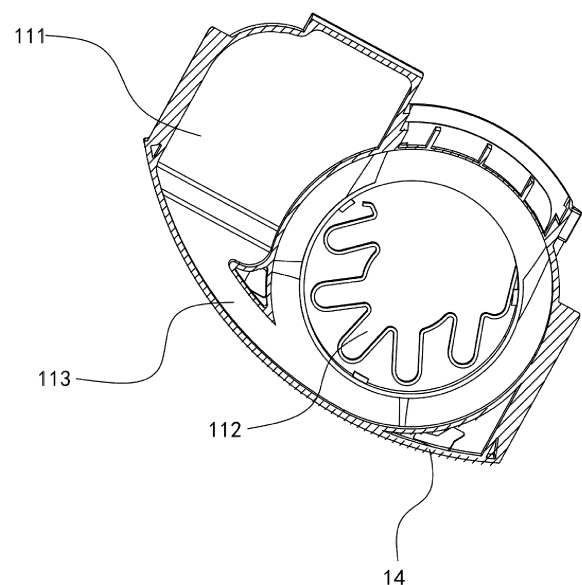


FIG. 16

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Description**CROSS REFERENCE TO RELATES APPLICATIONS**

[0001] This application claims priorities to Chinese Patent Application Nos. 202210731460.6 and 202210730487.3, both of which were filed on June 24, 2022 and which are incorporated herein by reference in their entireties.

TECHNICAL FIELD

[0002] The present disclosure relates to the field of smart home technologies, and in particular to a dust box, a cleaning apparatus and a cleaning system.

BACKGROUND OF THE INVENTION

[0003] A cleaning apparatus in the related arts usually collects dust on the ground into a dust box located inside the cleaning apparatus during a cleaning process.

SUMMARY OF THE INVENTION

[0004] According to an aspect of the present disclosure, a dust box is provided. The dust box includes:

- a first chamber, including a waste inlet;
- a second chamber, including an air outlet; and
- a transition channel, the first chamber being communicated with the second chamber through the transition channel;
- where the transition channel is approximately tangent to the second chamber.

[0005] According to another aspect of the present disclosure, there is provided a cleaning apparatus. The cleaning apparatus includes the above dust box and a main body on which the dust box is arranged.

[0006] According to yet another aspect of the present disclosure, there is provided a cleaning system. The cleaning system includes the above cleaning apparatus and a cleaning base station.

BRIEF DESCRIPTION OF DRAWINGS

[0007] Various objects, features and advantages of the present disclosure will become more apparent by considering the following detailed description of preferred embodiments of the present disclosure in conjunction with the accompanying drawings. The accompanying drawings are only exemplary illustrations of the present disclosure and are not necessarily drawn to scale. In the accompanying drawings, the same reference signs always indicate the same or similar components. Among them:

FIG. 1 is a schematic structural diagram of a cleaning

robot according to an exemplary embodiment from a first view angle;

FIG. 2 is a schematic structural diagram of the cleaning robot according to the exemplary embodiment from a second view angle;

FIG. 3 is a schematic structural diagram of the cleaning robot according to the exemplary embodiment from a third view angle;

FIG. 4 is a schematic structural diagram of the cleaning robot according to the exemplary embodiment from a fourth view angle;

FIG. 5 is a schematic structural diagram of a part of a cleaning robot according to an exemplary embodiment from one view angle;

FIG. 6 is a schematic structural diagram of the part of the cleaning robot according to the exemplary embodiment from another view angle;

FIG. 7 is a schematic structural diagram of a dust box of a cleaning robot according to an exemplary embodiment from one view angle;

FIG. 8 is a schematic structural diagram of the dust box of the cleaning robot according to the exemplary embodiment from another view angle;

FIG. 9 is a schematic structural diagram of a dust box of a cleaning robot according to an exemplary embodiment, wherein a first chamber of the dust box is released;

FIG. 10 is a schematic structural diagram of the dust box of the cleaning robot according to the exemplary embodiment, wherein a second chamber of the dust box is released;

FIG. 11 is a schematic structural diagram of the dust box of the cleaning robot according to the exemplary embodiment, wherein the first chamber and the second chamber of the dust box are released;

FIG. 12 is a schematic structural diagram of an inner structure of a dust box of a cleaning robot according to an exemplary embodiment;

FIG. 13 is a schematic structural diagram of a base of a cleaning robot according to an exemplary embodiment from a first view angle;

FIG. 14 is a schematic structural diagram of the base of the cleaning robot according to the exemplary embodiment from a second view angle;

FIG. 15 is a schematic structural diagram of the base of the cleaning robot according to the exemplary embodiment from a third view angle;

FIG. 16 is a schematic structural diagram of a sectional structure of a base of a cleaning robot according to an exemplary embodiment;

FIG. 17 is a schematic structural diagram of a bottom cover and a locking member of a cleaning robot according to an exemplary embodiment;

FIG. 18 is a schematic structural diagram of a cyclone separator of a cleaning robot according to an exemplary embodiment;

FIG. 19 is a schematic structural diagram of a sectional structure of the cyclone separator of the clean-

ing robot according to the exemplary embodiment;
 FIG. 20A is a schematic structural diagram of a
 cleaning module of a cleaning robot according to
 an exemplary embodiment from one view angle;
 FIG. 20B is a schematic structural diagram of a
 cleaning module of a cleaning robot in one state
 according to an exemplary embodiment;
 FIG. 20C is a schematic structural diagram of the
 cleaning module of the cleaning robot in another
 state according to the exemplary embodiment;
 FIG. 20D is a schematic diagram of a combined
 structure of a cleaning module of the cleaning robot
 and a first connecting assembly, a second connect-
 ing assembly and a protective casing cleaning robot
 according to an exemplary embodiment;
 FIG. 20E is a schematic diagram of a combined
 structure of a cleaning module of the cleaning robot
 and a first connecting assembly and a second connect-
 ing assembly according to an exemplary embod-
 iment of the present disclosure;
 FIG. 20F is a schematic structural diagram of a
 cleaning casing and a dust extraction duct of a
 cleaning robot according to the exemplary embod-
 iment;
 FIG. 21 is a schematic structural diagram of the
 cleaning module of the cleaning robot according to
 the exemplary embodiment from another view angle;
 FIG. 22 is a schematic structural diagram of a clean-
 ing casing of a cleaning module of a cleaning robot
 according to an exemplary embodiment from one
 view angle;
 FIG. 23 is a schematic structural diagram of the
 cleaning casing of the cleaning module of the clean-
 ing robot according to an exemplary embodiment
 from another view angle;
 FIG. 24 is a schematic structural diagram of a driving
 structure of a cleaning module of a cleaning robot
 according to an exemplary embodiment from one
 view angle;
 FIG. 25 is a schematic structural diagram of the
 driving structure of the cleaning module of the clean-
 ing robot according to the exemplary embodiment
 from another view angle;
 FIG. 26 is a schematic structural diagram of a clean-
 ing module of a cleaning robot according to another
 exemplary embodiment;
 FIG. 27A is a schematic structural diagram of a fan
 assembly of a cleaning robot according to an ex-
 emplary embodiment;
 FIG. 27B is an exploded schematic structural dia-
 gram of the fan assembly of the cleaning robot
 according to the exemplary embodiment from one
 view angle;
 FIG. 28 is an exploded schematic structural diagram
 of the fan assembly of the cleaning robot according to
 the exemplary embodiment from another view angle;
 FIG. 29 is an exploded schematic structural diagram
 of a filtering portion of the fan assembly of the clean-

ing robot according to the exemplary embodiment;
 FIG. 30 is a schematic structural diagram of a dust
 collecting pile according to an exemplary embod-
 iment;
 FIG. 31 is a schematic local structural diagram of the
 dust collecting pile according to the exemplary em-
 bodiment;
 FIG. 32 is a schematic structural diagram of a stop-
 per of a dust collecting pile according to an exemp-
 lary embodiment from one view angle; and
 FIG. 33 is a schematic structural diagram of the
 stopper of the dust collecting pile according to the
 exemplary embodiment from another view angle.

15 **[0008] The reference signs are described as below.**

1. Pile body; 2. dust inlet channel; 3. dust inlet; 4. dust
 bucket; 7. fan structure; 9. stopper; 91. first stopper;
 911. first rack; 92. second stopper; 921. second rack;
 93. driving member; 931. motor; 932. first gear; 933.
 second gear; 94. adsorption member;
 10. dust box; 11. dust storage chamber; 111. first
 chamber; 1111. first opening; 1112. waste inlet; 112.
 second chamber; 1121. second opening; 1122. third
 opening; 1123. air outlet; 113. transition channel; 12.
 door body; 121. first door body piece; 122. second
 door body piece; 13. cyclone separator; 131. primary
 separation cyclone; 132. secondary separation cy-
 clone; 133. separation filter screen; 14. base; 141.
 avoidance space; 15. bottom cover; 151. rolling part;
 16. locking member; 161. toggle part; 162. first snap-
 ping part; 163. second snapping part;
 20. main body; 21. position determining device; 22.
 top main plane; 23. top raised plane; 24. transition
 surface; 25. buffer; 26. forward-facing portion; 27.
 rearward-facing portion; 28. protective casing;
 30. cleaning module; 31. cleaning casing; 311. in-
 stallation cavity; 3111. main air duct; 3112. second-
 ary air duct; 3113. first air duct section; 3114. second
 air duct section; 312. air duct opening; 32. first roller
 brush; 33. second roller brush; 331. main body sup-
 port; 3311. clamping slot; 332. adapter; 333. buckle;
 334. elastic member; 335. power adapter; 34. third
 roller brush; 35. fourth roller brush; 36. driving struc-
 ture; 361. power part; 362. first gear body; 363.
 second gear body; 364. third gear body; 365. fourth
 gear body; 366. fifth gear body; 367. sixth gear body;
 368. seventh gear body; 369. eighth gear body;
 3610. transmission rod; 3611. ninth gear body;
 3612. tenth gear body; 3613. eleventh gear body;
 3614. twelfth gear body; 3615. thirteenth gear body;
 37. side brush; 38. first gap; 39. second gap; 301. first
 roller brush structure; 302. second roller brush struc-
 ture;
 40. fan assembly; 41. fan; 42. air duct; 421. first air
 duct opening; 422. second air duct opening; 43. filter
 part; 431. filter layer; 432. frame; 44. silencer part;
 441. sound channel through hole; 442. sound-ab-

sorbing hole; 45, filter member; 46, protective casing;
 50, driving system; 51, first driving wheel module; 52, second driving wheel module; 53, driven wheel;
 60, first connecting assembly; 61, first connecting rod; 62, second connecting rod; 70, second connecting assembly; 71, third connecting rod; 72, fourth connecting rod; 73, dust suction duct; 731, third air duct; 732, fourth air duct; and 733, air outlet end.

DETAILED DESCRIPTION

[0009] Typical embodiments embodying the features and advantages of the present disclosure will be described in detail in the following description. It is to be understood that the present disclosure is subject to various variations in different embodiments, none of which is outside the scope of the present disclosure, and that the description thereof and the accompanying drawings are essentially illustrative and not intended to limit the present disclosure.

[0010] In the following description of different exemplary embodiments of the present disclosure, reference is made to the accompanying drawings, which form a part of the present disclosure and which show by way of example different exemplary structures, systems, and steps that may realize various aspects of the present disclosure. It should be understood other than specific solutions of components, structures, exemplary devices, systems and steps may be used, and structural and functional modifications may be made without departing from the scope of the present disclosure. Moreover, while the terms such as "on", "between" and "within" may be used in this specification to describe different exemplary features and elements of the present disclosure, these terms are used herein only for convenience, for example, based on the orientations of the examples in the accompanying drawings. Nothing in this specification should be construed as requiring a particular three-dimensional orientation of the structure to fall within the scope of the present disclosure.

[0011] As shown in FIGs. 1 to 33, a cleaning system of embodiments of the present disclosure includes a cleaning robot and a cleaning base station.

[0012] As shown in FIGs. 1 to 29, the cleaning robot includes a main body 20, a dust box 10, a cleaning module 30, a fan assembly 40, a driving system 50, a perception system, a control module, an energy system, and a human-machine interaction system.

[0013] As shown in FIG. 1, the main body 20 includes a forward-facing portion 26 and a rearward-facing portion 27, and the cleaning robot has an approximate circular shape (both at front and rear), and may also have other shapes including, but not limited to, an approximate D-shape that is square at the front and rounded at the rear and a rectangular or square shape that is rectangular or square at the front and rear. The cleaning operation direction of the cleaning robot may be considered to be

a direction from the rearward-facing portion 27 to the forward-facing portion 26.

[0014] As shown in FIGs. 1 to 3, the perception system may include a position determining device 21 located on the main body 20, and sensing devices such as a collision sensor and a proximity sensor both arranged on a buffer 25 of the forward-facing portion 26 of the main body 20, a cliff sensor arranged at a lower portion of the main body of the cleaning robot, and a magnetometer, an accelerometer, a gyroscope (Gyro), and an odograph (ODO) which are arranged inside the main body of the cleaning robot, for providing various position information and motion state information of the cleaning robot to the control module. The position determining device 21 includes, but is not limited to, a camera and a laser distance sensor (LDS).

[0015] As shown in FIGs. 1 and 3, the forward-facing portion 26 of the main body 20 may carry the buffer 25. The buffer 25 detects one or more events in a travel path of the cleaning robot via a sensor system (for example, an infrared sensor) arranged on the buffer when the driving system 50 propels the cleaning robot to travel on the ground in the process of cleaning. The cleaning robot may control, based on the events (such as an obstacle and a wall) detected by the buffer 25, the driving system 50 such that the cleaning robot may respond to the events, e.g., moving away from the obstacle.

[0016] The control module is arranged on a main circuit board within the main body 20 and includes a computing processor, such as a central processing unit and an application processor, in communication with a non-transitory memory, such as a hard disk, a flash memory and a random-access memory. The application processor is configured to draw a simultaneous map of an environment where the cleaning robot is located based on obstacle information fed back by the laser distance sensor by use of a positioning algorithm, for example, simultaneous localization and mapping (SLAM). In addition, based on the distance and speed information fed back by the sensors arranged on the buffer 25, the cliff sensor, the magnetometer, the accelerometer, the gyroscope, the odograph, and other sensing devices, a comprehensive judgment may be made on a current working state and a current position of the cleaning robot, and a current posture of the cleaning robot, such as crossing a doorsill, getting on a carpet, at a cliff, being stuck from above or below, having a full dust box, being picked up, etc. For different cases, specific next action strategies may be provided such that the cleaning robot has better cleaning performance and user experience.

[0017] As shown in FIGs. 3 and 4, the driving system 50 may control the main body 20 to travel across the ground based on a driving command with distance and angle information (e.g., x, y, and θ components). The driving system 50 includes a first driving wheel module 51 and a second driving wheel module 52. The first driving wheel module 51 and the second driving wheel module 52 are arranged along a transverse axis defined by the main

body 20. In order to enable the cleaning robot to move more stably or have a better movement ability on the ground, the cleaning robot may include one or more driven wheels 53, which include but are not limited to universal wheels. The driving wheel module includes a traveling wheel, a driving motor, and a control circuit for controlling the driving motor, and may also be connected to a circuit for measuring a driving current and an odograph. The driving wheel module may be detachably connected to the main body 20 to facilitate disassembly, assembly and maintenance. The driving wheel may be provided with an offset drop suspension system, which is fastened movably to (e.g., attached rotatably to) the main body 20, and receives a spring offset biased downward and away from the main body 20. The spring offset allows the driving wheel to maintain contact and traction with the ground with a certain ground attachment force, while cleaning elements of the cleaning robot are also in contact with the ground with certain pressure.

[0018] The main body 20 defines the transverse axis and a longitudinal axis, which are perpendicular to each other and may be understood as a transverse centerline and a longitudinal centerline of the main body 20 respectively.

[0019] The energy system 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 pile through a charging electrode arranged on a side or below the main body of the cleaning robot for charging.

[0020] The human-computer interaction system 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 cleaning robot. For a route navigation type automatic cleaning apparatus, a mobile phone client may show the user a map of the environment where the apparatus is located, and a position of the apparatus, thereby providing the user with richer and more user-friendly function items.

[0021] For the cleaning robot according to an embodiment of the present disclosure, the dust box 10 is arranged on the main body 20, and at least a part of the position determining device 21 protrudes from the main body 20. The top end of the dust box 10 is not lower than at least a part of the top end of the main body 20, and the top end of the position determining device 21 is higher than the top end of the dust box 10, which can ensure that the position determining device 21 triggers an obstacle first on the basis of ensuring the maximum height of the dust box 10, thereby indirectly protecting the dust box 10 or the main body 20 from getting stuck by the obstacle.

[0022] It should be noted that since the top end of the dust box 10 is not lower than at least a part of the top end of the main body 20, the height of the dust box 10 should be made as high as possible without changing the original height of the main body relative to the height of the main body of a cleaning robot in the related art, so as to increase the dust collection capacity of the dust box 10 without increasing the height of the cleaning robot.

[0023] In an embodiment of the present disclosure, as shown in FIGs. 1 and 2, the main body 20 includes a top main plane 22, and at least a part of the position determining device 21 protrudes from the top main plane 22, and the top end of the dust box 10 is higher than the top main plane 22. The top main plane 22 is a large upper surface of the cleaning robot, and at least a part of the position determining device 21 protrudes from the top main plane 22, which can ensure that the position determining device 21 reliably identifies the obstacle. The top end of the dust box 10 is higher than the top main plane 22, which can ensure that the dust box 10 has sufficient dust collection capacity.

[0024] In an embodiment of the present disclosure, as shown in FIGs. 1 and 2, the main body 20 further includes a top raised plane 23, and the top raised plane 23 is higher than the top main plane 22 and lower than the top end of the position determining device 21. At least a part of the dust box 10 is located below the top raised plane 23. The top raised plane 23 is a small upper surface of the cleaning robot. The top end of the position determining device 21 is higher than the top raised plane 23, which can ensure that the position determining device 21 reliably identifies the obstacle. At least a part of the dust box 10 is located below the top raised plane 23, which can prevent the dust box 10 from causing an excessive height of the cleaning robot, and the main body 20 can also achieve a protective effect on the dust box 10.

[0025] In an embodiment of the present disclosure, as shown in FIGs. 1 and 2, the main body 20 further includes a transition surface 24, and the transition surface 24 connects the top main plane 22 to the top raised plane 23. The top main plane 22 and the top raised plane 23 are approximately parallel, and the transition surface 24 is inclined to the top raised plane 23, which not only achieves a more attractive appearance design, but also enables the main body 20 to conveniently pass through a low obstacle to prevent the cleaning robot from getting stuck. Specifically, the transition surface 24 can effectively prevent the cleaning robot from getting stuck by an obstacle which is lower than the top end of the position determining device 21 and higher than the top main plane 22.

[0026] In an embodiment of the present disclosure, a part of the dust box 10 is located below the top main plane 22, and a part of the dust box 10 is located below the top raised plane 23, such that a part of the dust box 10 may be made higher to facilitate the arrangement of other structures, or the dust collection space may be locally increased. The other part of the dust box 10 may adapt

to the height of the main body of the cleaning robot, so that the main body 20 can effectively protect the dust box 10 to prevent the dust box 10 from the problems such as damage and the like.

[0027] As an optional embodiment of the present disclosure, the top end of the position determining device 21 is 0.2 mm-10 mm higher than the top end of the dust box 10, which can not only ensure that the position determining device 21 triggers the obstacle first, but also make the height of the dust box 10 relatively maximum, thereby being conducive to improving the dust collection capacity.

[0028] In an embodiment of the present disclosure, the dust box 10 is located behind the position determining device 21 in the cleaning operation direction of the cleaning robot. The position determining device 21 is located in the middle of the cleaning robot, while the dust box 10 is located at the rear part of the cleaning robot. Vertical projections of the position determining device 21 and the dust box 10 may have no overlapping area, such that the height of at least a part of the dust box 10 may be greater than that of the top main plane 22, regardless of the interference between the position determining device 21 and the dust box 10, which can further ensure the height of the dust box 10.

[0029] The cleaning robot according to the embodiment of the present disclosure is configured to cooperate with a cleaning base station to discharge dust therein into the cleaning base station. The cleaning robot includes: a dust storage chamber 11 and a door body 12. The dust storage chamber 11 includes an opening. The door body 12 is movably arranged relative to the dust storage chamber 11 to release or block the opening. The door body 12 may release the opening after the cleaning robot is docked with the cleaning base station, such that the opening is communicated with a dust inlet of the cleaning base station.

[0030] In the cleaning robot provided according to the embodiment of the present disclosure, the door body 12 is arranged at the opening of the dust storage chamber 11, and the door body 12 is movably arranged relative to the dust storage chamber 11. The door body 12 may release the opening after the cleaning robot is docked with the cleaning base station, such that the opening is communicated with the dust inlet of the cleaning base station, and dust inside the dust storage chamber 11 is discharged into the cleaning base station, which improves the dust discharge efficiency of the cleaning robot and the service performance of the cleaning robot.

[0031] In an embodiment of the present disclosure, the dust storage chamber 11 may be formed by the main body 20, i.e., a cavity is formed inside the main body 20, and the cavity is used for collecting dust, so as to be used as the dust storage chamber 11. The door body 12 may be arranged on the main body 20 to block the opening of the dust storage chamber 11, so as to avoid dust leakage. When the dust in the dust storage chamber 11 is discharged, the door body 12 may be opened to release the

opening of the dust storage chamber 11, such that the dust in the dust storage chamber 11 can be discharged, for example, the dust in the dust storage chamber 11 can be discharged into the cleaning base station.

[0032] In an embodiment of the present disclosure, the dust storage chamber 11 may be formed by the dust box 10 on the main body 20, the dust box 10 is arranged on the main body 20, the dust box 10 and the main body 20 constitute a robot body, and the door body 12 is arranged on the dust box 10, so as to release or block the opening of the dust storage chamber 11.

[0033] In an embodiment of the present disclosure, the dust box 10 includes a dust storage chamber 11, and the dust storage chamber 11 includes a first chamber 111, a second chamber 112 and a transition channel 113. The first chamber 111 includes a waste inlet 1112. The second chamber 112 includes an air outlet 1123. The first chamber 111 is communicated with the second chamber 112 through the transition channel 113.

[0034] With reference to FIGs. 7 to 16, in an embodiment of the present disclosure, the dust box 10 includes a first chamber 111 and a second chamber 112 arranged independently, and the first chamber 111 is communicated with the second chamber 112 through a transition channel 113, such that preliminary separation of dust in the first chamber 111 can be realized, which reduces the probability that the dust blocks the transition channel 113 and can reliably achieve dust collection to improve the dust collection capacity of the dust box 10.

[0035] Dust entering from the cleaning module 30 enters the first chamber 111 through the waste inlet 1112 for preliminary separation, and enters the second chamber 112 through the transition channel 113, thereby realizing effective recovery of the dust. Filtered air is discharged out of the dust box 10 through the air outlet 1123.

[0036] In an embodiment of the present disclosure, the transition channel 113 is approximately tangent to the second chamber 112, such that dust can reliably enter the second chamber 112 through the transition channel 113, and the flow of air can be facilitated, thereby improving the fluidity of dust in the dust storage chamber 11 and hence improving the dust collection capacity of the dust box 10.

[0037] As an optional embodiment of the present disclosure, the transition channel 113 is approximately tangent to the first chamber 111, such that dust can reliably enter the transition channel 113 from the first chamber 111, and the flow of air can be facilitated, thereby improving the fluidity of dust in the dust storage chamber 11.

[0038] A cyclone separator 13 is arranged in the second chamber 112, and air entering the second chamber 112 tangentially may be separated from fine dust by the cyclone separator 13 to ensure the cleanliness of a filter screen. The cyclone separator 13 may be a cone-shaped tube for cyclone separation.

[0039] In an embodiment of the present disclosure, a side wall of the transition channel 113 includes a curved surface, such that dust can flow smoothly within the

transition channel 113, thereby avoiding dust obstruction and other problems.

[0040] In an embodiment of the present disclosure, an extension length of the transition channel 113 is greater than the minimum thickness of a wall between the first chamber 111 and the second chamber 112, such that the airflow carrying dust may pass through the transition channel 113 for a long period of time, thereby avoiding the problem that the transition channel 113 is blocked due to accumulation of a large amount of dust.

[0041] It should be noted that the extension length of the transition channel 113 may be considered as a distance by which air flows within the transition channel 113, and the first chamber 111 and the second chamber 112 are separated by a wall of the dust box 10. Therefore, the extension length of the transition channel 113 is greater than the minimum thickness of the wall between the first chamber 111 and the second chamber 112, which can avoid the problem that the transition channel 113 is blocked due to accumulation of dust.

[0042] In an embodiment of the present disclosure, the door body 12 is rotatably arranged on the dust box 10, such that the door body 12 can conveniently release or block the opening of the dust storage chamber 11.

[0043] The door body 12 may be connected to a driving mechanism which drives the door body 12 to rotate relative to the dust box 10. Alternatively, after the cleaning robot is docked with the cleaning base station, the door body 12 may be driven to open or close by the airflow generated by a fan assembly 40 of the cleaning robot. Alternatively, after the cleaning robot is docked with the cleaning base station, the door body 12 may be driven to open or close by a suction force generated by a power assembly of the cleaning base station.

[0044] As an optional embodiment of the present disclosure, the door body 12 is movably arranged relative to the dust box 10, and the door body 12 may be driven by the driving mechanism to realize horizontal movement of the door body. For example, the driving mechanism may be an electric push rod, and the door body 12 is driven to move horizontally relative to the dust box 10 by the electric push rod.

[0045] In an embodiment of the present disclosure, at least a part of the dust box 10 is located outside the main body 20, such that the opening can be directly communicated with the dust inlet when the door body 12 releases the opening, thereby allowing for easy discharge of dust from the dust box 10 into the cleaning base station.

[0046] A part of the door body 12 may extend to the inside of the dust inlet for storage after the door body 12 releases the opening, so as to ensure reliable docking between the opening of the dust storage chamber 11 and the dust inlet, thereby ensuring that dust can be effectively collected into the cleaning base station.

[0047] The dust box 10 and the main body 20 form at least a part of an outer surface of the cleaning robot, such that the dust box 10 is directly docked with the cleaning base station after the cleaning robot is docked with the

cleaning base station. Therefore, the opening of the dust storage chamber 11 may be reliably docked with the dust inlet after the door body 12 is opened.

[0048] In an embodiment of the present disclosure, as shown in FIGs. 11 to 13, the dust storage chamber 11 includes a first chamber 111 and a second chamber 112, and the door body 12 selectively releases the first chamber 111 and the second chamber 112, such that the first chamber 111 and the second chamber 112 may be selectively communicated with the dust inlet, thereby discharging dust in the dust storage chamber 11 by stages, avoiding blockage and other problems due to discharge of a large amount of dust, and improving the dust collection efficiency.

[0049] The first chamber 111 and the second chamber 112 may be arranged independently, such that dust may be stored in both the first chamber 111 and the second chamber 112. However, dust in the first chamber 111 and the second chamber 112 may be dust in different stages. For example, during the cleaning of the cleaning robot, dust first enters the first chamber 111, and then part of dust enters the second chamber 112. Therefore, dust in the first chamber 111 and the second chamber 112 may be of different particle sizes.

[0050] As an optional embodiment of the present disclosure, there may be one door body 12, and the door body 12 may be movably arranged relative to the dust box 10, such that the door body 12 can selectively release the first chamber 111 and the second chamber 112.

[0051] In an embodiment of the present disclosure, as shown in FIGs. 8 and 9, the door body 12 includes a first door body piece 121 and a second door body piece 122. The first door body piece 121 and the second door body piece 122 are separated from each other and correspond to the first chamber 111 and the second chamber 112 respectively, such that the first chamber 111 and the second chamber 112 can be conveniently released by opening the first door body piece 121 and the second door body 122 piece respectively.

[0052] The first door body piece 121 and the second door body piece 122 both are rotatably arranged on the dust box 10. By controlling the first door body piece 121 and the second door body piece 122 to be opened respectively, the first chamber 111 and the second chamber 112 can be controlled to be released respectively. For example, the first door body piece 121 and the second door body piece 122 are driven to move by two different driving mechanisms, so as to control the opening times of the first door body piece 121 and the second door body piece 122.

[0053] In an embodiment of the present disclosure, as shown in FIG. 12, the dust box 10 further includes a cyclone separator 13, and the cyclone separator 13 is arranged in the second chamber 112. It should be noted that the cyclone separator 13 may be a cyclone separator known in the related art. The working principle of the cyclone separator is described below: a rotary motion is caused by tangential introduction of the airflow; when

particles rotate at a high speed in the airflow, a centrifugal force is much greater than the gravity, and the higher the speed is, the higher a centrifugal settling speed of the particles is; and when the particles containing solids enter a cone-shaped cylinder in a tangential direction along with air and rotate in the cylinder, the airflow strikes the cylinder wall, and the particles strike the cylinder wall and rotationally fall down to achieve the purpose of separating the solids from air.

[0054] As shown in FIGs. 18 and 19, the cyclone separator 13 includes a primary separation cyclone 131 and a secondary separation cyclone 132. The secondary separation cyclone 132 may include a plurality of cyclone separation members having cone-shaped main bodies with large upper ends and small lower ends, and the cyclone separators are distributed around an axis of the secondary separation cyclone 132. The multiple sets of cyclone separation members are provided to improve the dust separation efficiency of the secondary separation cyclone and to further enhance the dust storage capacity of the cleaning base station. The number of the secondary cyclone separation members may be nine, twelve and fifteen, and the greater the number is, the higher the separation efficiency is.

[0055] A separation filter screen 133 is arranged at the periphery of the secondary separation cyclone 132. An outer surface of the primary separation cyclone 131, an inner surface of the dust box 10 and an outer surface of the separation filter screen 133 jointly form the primary cyclone. For air separated by the primary cyclone, large particulate waste is separated from the airflow and falls outside the primary separation cyclone 131. The separation filter screen 133 allows the airflow separated by the primary cyclone and then entering the secondary separation cyclone 132 to pass through. The separation filter screen 133 is preferably a metal filter screen, which can prolong the service life and improve the filtering effect. The separation filter screen 133 is a ring screen, and a support frame of the primary separation cyclone 131 is configured to erect the bottom of the separation filter screen 133. The particulate waste filtered out by the separation filter screen 133 is gathered under the support frame of the primary separation cyclone 131, and an outer edge of the support frame of the primary separation cyclone 131 may extend downward to form a shape like a skirt's hemline so as to prevent the particulate waste subjected to primary cyclone separation from moving upward. Each secondary separation cyclone 132 forms an air-solid separation cyclone, and the separated solid particulate waste falls to the inside of the primary separation cyclone 131.

[0056] In an embodiment of the present disclosure, as shown in FIGs. 9 to 11, the first chamber 111 includes a first opening 1111, and the second chamber 112 includes a second opening 1121 and a third opening 1122 separated from each other. The second opening 1121 is communicated with a part of the second chamber 112 located outside the cyclone separator 13, and the third

opening 1122 is communicated with a part of the second chamber 112 located inside the cyclone separator 13. The first door body piece 121 releases or blocks the first opening 1111, and the second door body piece 122 releases or blocks the second opening 1121 and the third opening 1122 simultaneously.

[0057] Dust enters the second chamber 112 from the first chamber 111, and dust passing through the cyclone separator 13 enters and falls to the inside of the primary separation cyclone 131. Dust in the first chamber 111 may be discharged after the first door body piece 121 releases the first opening 1111. The second door body piece 122 may release the second opening 1121 and the third opening 1122 simultaneously, such that dust in the second chamber 112 can be discharged, i.e., dust falling outside the primary separation cyclone 131 and dust falling inside the primary separation cyclone 131 can be discharged through the second opening 1121 and the third opening 1122 respectively. Dust may include solid waste, and the primary separation cyclone 131 may separate coarse particles while the secondary separation cyclone 132 may separate fine particles, thereby ensuring the separation effect of the cyclone separator 13.

[0058] In an embodiment of the present disclosure, the dust storage chamber 11 includes a first chamber 111 and a second chamber 112, the first chamber 111 and the second chamber 112 respectively include a first opening 1111 and a second opening 1121 respectively, the door body 12 includes a first door body piece 121 and a second door body piece 122, and the first door body piece 121 and the second door body piece 122 correspond to the first opening 1111 and the second opening 1121 respectively to release or block the first opening 1111 and the second opening 1121. Therefore, after the cleaning robot is docked with the cleaning base station, the first door body piece 121 and the second door body piece 122 may release the first opening 1111 and/or the second opening 1121 to enable the first opening 1111 and/or the second opening 1121 to be communicated with the dust inlet of the cleaning base station, such that dust in the dust storage chamber 11 can be discharged into the cleaning base station.

[0059] In an embodiment of the present disclosure, the dust storage chamber 11 includes a first chamber 111 and a second chamber 112, the first chamber 111 and the second chamber 112 include a first opening 1111 and a second opening 1121 respectively, the door body 12 includes a first door body piece 121 and a second door body piece 122, and the first door body piece 121 and the second door body piece 122 correspond to the first opening 1111 and the second opening 1121 respectively to release or block the first opening 1111 and the second opening 1121. Therefore, when the cleaning robot is separated from the cleaning base station, the first door body piece 121 and the second door body piece 122 may block the first opening 1111 and the second opening 1121 to prevent dust from flowing out of the dust storage

chamber 11. For example, during the cleaning of the cleaning robot, it is necessary to ensure that the first door body piece 121 and the second door body piece 122 can block the first opening 1111 and the second opening 1121.

[0060] In an embodiment of the present disclosure, the area of the first opening 1111 may be greater than that of the second opening 1121, and the area of the second opening 1121 may be greater than that of the third opening 1122.

[0061] As an optional embodiment of the present disclosure, the area of the first opening 1111 may be greater than or equal to that of the second opening 1121, and the area of the second opening 1121 may be less than or equal to that of the third opening 1122.

[0062] In an embodiment of the present disclosure, as shown in FIGs. 7 and 8, the dust box 10 further includes a base 14 and a bottom cover 15, the bottom cover 15 is arranged on the base 14, the bottom cover 15 and the base 14 form a first chamber 111 and a second chamber 112, and the door body 12 is movably arranged on the bottom cover 15 to release or block the first chamber 111 and the second chamber 112.

[0063] At least one of the base 14 and the bottom cover 15 is connected to the main body 20, thereby achieving a fixed connection between the dust box 10 and the main body 20. The bottom cover 15 forms a part of the outer surface of the bottom of the cleaning robot. The base 14 and the bottom cover 15 form a closed first chamber 111 and a closed second chamber 112. The transition channel 113 is formed inside the base 14 for communicating the first chamber 111 with the second chamber 112.

[0064] At least one of the base 14 and the bottom cover 15 is connected to the main body 20. At least a part of the base 14 and the bottom cover 15 form a part of the outer surface of the cleaning robot, so as to form, together with the main body 20, at least a part of the outer surface of the cleaning robot.

[0065] The base 14 may be of an integral structure, i.e., a bottom opening of the base 14 may be closed by the bottom cover 15. Alternatively, the base 14 may include a main body structure and a top cover, while the top cover and the bottom cover 15 are arranged opposite to each other, and the top cover and the bottom cover 15 may close a top opening and the bottom opening of the base 14 respectively.

[0066] As shown in FIGs. 8 to 11, the bottom cover 15 is provided with a first opening 1111, a second opening 1121 and a third opening 1122, such that the first door body piece 121 may release or block the first opening 1111, and the second door body piece 122 may simultaneously release or block the second opening 1121 and the third opening 1122.

[0067] In an embodiment of the present disclosure, the first door body piece 121 and the second door body piece 122 are rotatably arranged on the bottom cover 15. For example, after the cleaning robot returns to the cleaning base station and the door body 12 is docked with the dust

inlet of the cleaning base station, at least one of the first door body piece 121 and the second door body piece 122 rotates relative to the bottom cover 15, such that the first opening 1111 and/or the second opening 1121 and the third opening 1122 can be released.

[0068] In an embodiment of the present disclosure, the bottom cover 15 is detachably arranged on the base 14, such that cleaning or maintenance of the inside of the base 14 can be realized. The inner space of the base 14 may be released after the bottom cover 15 is detached from the base 14, such that dust can be cleaned up, and components inside the base 14 can be maintained and cleaned. For example, the cyclone separator 13 in the second chamber 112 can be maintained.

[0069] The bottom cover 15 may be engaged with the base 14. The bottom cover 15 may be connected to the base 14 by means of a structural member.

[0070] In an embodiment of the present disclosure, as shown in FIGs. 7 and 17, the dust box further includes a locking member 16, and the locking member 16 is arranged on the base 14 and movably arranged relative to the bottom cover 15 to be disengaged from or connected to the bottom cover 15, such that the bottom cover 15 can be fixed or released.

[0071] Referring to FIG. 17, the locking member 16 may include a toggle part 161, a first snapping part 162 and a second snapping part 163. Two sides of the toggle part 161 are connected to the first snapping part 162 and the second snapping part 163 respectively. The toggle part 161 is movably arranged on the base 14, and a part of the toggle part 161 is exposed outside the base 14. Therefore, the first snapping part 162 and the second snapping part 163 can be driven to move relative to the bottom cover 15 by the toggle part 161. The bottom cover 15 is fixed to the base 14 when the first snapping part 162 and the second snapping part 163 are connected to the bottom cover 15, and the bottom cover 15 can be removed from the base 14 after the first snapping part 162 and the second snapping part 163 are disengaged from the bottom cover 15.

[0072] It should be noted that the bottom cover 15 may be removed from the base 14 as a whole, or the bottom cover 15 may be hinged to the base 14, and the bottom cover 15 may be caused to rotate relative to the base 14 after the first snapping part 162 and the second snapping part 163 are disengaged from the bottom cover 15, such that the bottom cover 15 may release the internal space of the base 14.

[0073] In an embodiment of the present disclosure, the dust box 10 is detachably arranged on the main body 20, thereby facilitating cleaning or maintenance of the dust box 10.

[0074] At least a part of the dust box 10 is located outside the main body 20, which not only facilitates installation and disassembly of the dust box 10, but also allows for adaptive adjustment of the specific structure of the dust box 10, facilitates the arrangement of the dust box 10 and can achieve the highest dust collection ca-

capacity of the dust box 10.

[0075] In an embodiment of the present disclosure, as shown in FIGs. 7 and 8, an avoidance space 141 is arranged on the base 14 and is adjacent to the bottom cover 15 to keep away from a hand holding space and prevent a hand from being in direct contact with the bottom cover 15, which facilitates the operation when the dust box 10 is installed or disassembled.

[0076] In an embodiment of the present disclosure, as shown in FIG. 10, the bottom cover 15 is provided with a rolling part 151, such that excessive wear on the bottom cover 15 can be prevented, and the rolling part 151 can reduce the resistance of contact between the bottom cover 15 and the ground or the cleaning base station. The rolling part 151 is rotatably arranged on the bottom cover 15. A bottom end of the rolling part 151 protrudes from a bottom surface of the bottom cover 15, such that the rolling part 151 may be in contact with a surface or the cleaning base station, thereby reducing the resistance of contact.

[0077] The rolling part 151 may be a roller, and there may be one or more rolling parts 151.

[0078] As an optional embodiment of the present disclosure, the bottom cover 15 may be fixed to the base 14, and further, the bottom cover 15 may not be detached from the base 14.

[0079] As an optional embodiment of the present disclosure, the dust box 10 may be fixed to the main body 20, and further, the dust box 10 may not be detached from the main body 20.

[0080] As an optional embodiment of the present disclosure, the dust box 10 may be entirely located inside the main body 20.

[0081] In the cleaning robot provided by the embodiment of the present disclosure, the cleaning module 30 is arranged on the main body 20, and the cleaning module 30 realizes cleaning of a surface to be cleaned.

[0082] In an embodiment of the present disclosure, the cleaning module 30 may be a dry cleaning module, and the dry cleaning module may include a roller brush. The roller brush having a certain interference with the ground sweeps up waste on the ground and rolls up the waste to the front of a waste inlet 1112 between the roller brush and the dust box 10, and then the waste is sucked into the dust box 10 by air having a suction force, which is generated by the fan assembly 40 and passes through the dust box 10. The dust removal capacity of the cleaning robot may be characterized by the dust pickup efficiency (DPU) of the waste. The DPU is affected by the structure and the material of the roller brush, the utilization rate of air in an air channel formed by the waste inlet 1112, the dust box 10, a fan 41, the air outlet and connecting components among the four, and the type and power of the fan, which is a complex systematic design problem. Compared with an ordinary plug-in vacuum cleaner, the improvement of the dust removal capacity is more meaningful for an automatic cleaning apparatus with limited energy because the improvement of the dust

removal capacity directly and effectively reduces requirements for energy, that is, an original machine that may clean 80 square meters of the ground on a single charge may be evolved to clean 180 square meters or more on a single charge. Furthermore, the service life of the battery with the reduced number of charging times will also be greatly prolonged, so that the frequency of replacing the battery by the user will also be decreased. More intuitively and importantly, the improvement of the dust removal capacity is the most obvious and important user experience, as the user will directly come to a conclusion of whether a thorough sweeping/wiping is achieved. The cleaning robot may further include a side brush 37 having a rotating shaft angled relative to the ground, for moving debris into a region of the roller brush of the cleaning system.

[0083] As an optional embodiment of the present disclosure, the cleaning module 30 may be a wet cleaning module, which may include a wet cleaning head, the cleaning module 30 further includes a liquid supply portion, and the liquid supply portion feeds a cleaning liquid to the wet cleaning head, such that the wet cleaning head performs wet cleaning on a plane to be cleaned. In other embodiments of the present disclosure, the cleaning liquid in the liquid supply portion may also be directly sprayed to the plane to be cleaned, and the wet cleaning head may clean the plane by uniformly spreading the cleaning liquid. By way of example, the wet cleaning module may be assembled for use in other types of cleaning apparatuses, which is not limited in the present disclosure.

[0084] The cleaning head is configured to clean the surface to be cleaned, and the driving system 50 is configured to drive the cleaning head to substantially reciprocate along a target surface, the target surface being a part of the surface to be cleaned. The cleaning head reciprocates along the surface to be cleaned, and a surface of the cleaning head in contact with the surface to be cleaned is provided with a cleaning cloth or a cleaning plate, which generates, through reciprocating motion, high-frequency friction against the surface to be cleaned, thereby removing stains on the surface to be cleaned. The cleaning head may be a mopping roller brush.

[0085] The higher the friction frequency is, the more friction times per unit time is. A high-frequency reciprocating motion, also referred to as reciprocating vibration, has a much higher cleaning capability than an ordinary reciprocating motion, e.g., rotational friction cleaning. Optionally, when the friction frequency approaches a sound wave, a cleaning effect will be much higher than that of the rotational friction cleaning of dozens of revolutions per minute. On the other hand, tufts on the surface of the cleaning head extend neatly in the same direction under the shaking of high-frequency vibration so as to achieve a more uniform overall cleaning effect, rather than being only applied with a down pressure to increase the frictional force in the case of low-frequency rotation so as to improve the cleaning effect, as only the down

pressure does not cause the tufts to extend in the nearly same direction. Therefore, in terms of the effect, water marks on the surface to be cleaned that is cleaned under the high-frequency vibration are more uniform without chaotic water stains.

[0086] The reciprocating motion may be a repeated motion along any one or more directions in the surface to be cleaned, or may be a vibrating motion perpendicular to the surface to be cleaned, which is not strictly limited. Optionally, the direction of the reciprocating motion of the cleaning module is substantially perpendicular to the traveling direction of the cleaning robot because the direction of the reciprocating motion being parallel to the traveling direction of the cleaning robot may cause the cleaning robot itself, which is traveling, to be unstable for the reason that thrust and resistance in the traveling direction make the driving wheel prone to skid, and the effect of skidding is more obvious when the wet cleaning module is included, as the wetness of the to-be-cleaned surface increases the possibility of skidding. Skidding not only affects the stable traveling of the cleaning robot for cleaning, but also causes sensors such as an odometer and a gyroscope to measure a distance inaccurately, thereby resulting in the inability of the navigation type automatic cleaning apparatus to locate and draw a map accurately. In the case of frequent skidding, the effect on the SLAM cannot be ignored. Therefore, it is necessary to avoid skidding of the cleaning robot as much as possible. In addition to skidding, a motion component of the cleaning head in the traveling direction of the cleaning robot causes the cleaning robot to be pushed forward and backward constantly during traveling, so the cleaning robot cannot travel stably and smoothly.

[0087] With reference to FIGs. 4 to 6, in the cleaning robot according to the embodiment of the present disclosure, at least a part of the cleaning module 30 is vertically and movably arranged relative to the main body 20, the dust box 10 is communicated with the cleaning module 30, and the cyclone separator 13 is arranged in the dust box 10. By communicating the fan assembly 40 with the dust box 10, the surface to be cleaned can be reliably cleaned by the cleaning module 30. Since at least a part of the cleaning module 30 is vertically and movably arranged relative to the main body 20, combined with the arrangement of the cyclone separator 13, the current of the cleaning robot may not be too high in the process of cleaning, such that time for cleaning the cleaning robot can be prolonged.

[0088] It should be noted that the cyclone separator 13 has a high air volume and a high negative pressure. When the cleaning robot cleans a carpet, at least a part of the cleaning module 30 is vertically and movably arranged relative to the main body 20, such that the current of the cleaning module 30 can be reduced, the burden of the cleaning module 30 can be lightened, and the cleaning robot can clean the carpet more permanently.

[0089] In an embodiment of the present disclosure, the cleaning robot further includes a raising and lowering

structure connected to the cleaning module 30 and configured to enable at least a part of the cleaning module 30 to move vertically relative to the main body 20. In practice, the raising and lowering structure may be independently connected to the cleaning module 30 to cause the cleaning module 30 to move vertically relative to the main body 20, and the raising and lowering structure may also be equipped with an additional power device to be endowed with the ability of active raising or lowering, such that at least a part of the cleaning module 30 can actively raise or lower relative to the main body 20.

[0090] As an optional embodiment of the present disclosure, the raising and lowering structure may be an elastic assembly, such that at least a part of the cleaning module 30 may be passively raised or lowered.

[0091] In an embodiment of the present disclosure, as shown in FIGs. 20A and 21, the cleaning module 30 includes: a cleaning casing 31; and a roller brush arranged in the cleaning casing 31. The raising and lowering structure is connected to the cleaning casing 31, such that the roller brush can be driven to move vertically, thereby ensuring that the roller brush can reliably clean the surface to be cleaned and adapt to different surfaces to be cleaned.

[0092] The raising and lowering structure may be connected to the main body 20, the raising and lowering structure may be connected to the cleaning casing 31, and the roller brush may be connected to the cleaning casing 31, such that the raising and lowering structure can drive, by means of the cleaning casing 31, the roller brush to move vertically relative to the main body 20.

[0093] In an embodiment of the present disclosure, as shown in FIGs. 20D and 20E, the raising and lowering structure includes a first connecting assembly 60 and a second connecting assembly 70. Two ends of the first connecting assembly 60 are connected to the main body 20 and the cleaning casing 31 respectively. The second connecting assembly 70 and the first connecting assembly 60 are arranged at an interval. Two ends of the second connecting assembly 70 are connected to the main body 20 and the cleaning casing 31 respectively. The first connecting assembly 60 and the second connecting assembly 70 may reliably connect the cleaning casing 31 to the main body 20, keep the cleaning module 30 pressed down under its own weight, and cause the cleaning module 30 to raise and lower vertically when the surface to be cleaned is uneven, thereby ensuring the cleaning performance of the cleaning module 30.

[0094] In an embodiment of the present disclosure, as shown in FIGs. 20D and 20E, the first connecting assembly 60 includes a first connecting rod 61 and a second connecting rod 62 parallel to each other, and both ends of each of the first connecting rod 61 and the second connecting rod 62 are hinged to the main body 20 and the cleaning casing 31 respectively. The second connecting assembly 70 includes a third connecting rod 71 and a fourth connecting rod 72 parallel to each other, and both ends of each of the third connecting rod 71 and the fourth

connecting rod 72 are hinged to the main body 20 and the cleaning casing 31 respectively. The first connecting rod 61 and the third connecting rod 71 are parallel to each other. The raising and lowering structure is a four-link mechanism, which can not only cause the cleaning module 30 to raise and lower vertically to ensure the cleaning performance of the cleaning module 30, but also limit the degree of freedom of the cleaning module 30 to ensure that the cleaning module 30 moves as required.

[0095] In an embodiment of the present disclosure, the main body 20 may be provided with a protective casing 28, the cleaning module 30 may be arranged in the protective casing 28, and the first connecting assembly 60 and the second connecting assembly 70 are connected to the protective casing 28, as shown in FIG. 20D. The protective casing 28 is detachably connected to the main body 20.

[0096] As an optional embodiment of the present disclosure, the raising and lowering structure may be connected to the main body 20, and the raising and lowering structure may be connected to the roller brush, such that the raising and lowering structure can drive the roller brush to move vertically, i.e., the roller brush can move vertically relative to the cleaning casing 31. At this time, the cleaning casing 31 may be fixedly connected to the main body 20. Alternatively, the cleaning casing 31 may be fixedly connected to the main body 20, the raising and lowering structure may be connected to the cleaning casing 31, and the raising and lowering structure may be connected to the roller brush, such that the raising and lowering structure can drive the roller brush to move vertically, i.e., the roller brush can move vertically relative to the cleaning casing 31.

[0097] The raising and lowering structure may include: a first connecting assembly 60 and a second connecting assembly 70. Two ends of the first connecting assembly 60 are connected to the roller brush and the cleaning casing 31 respectively. The second connecting assembly 70 and the first connecting assembly 60 are arranged at an interval. Two ends of the second connecting assembly 70 are connected to the roller brush and the cleaning casing 31 respectively. The cleaning casing 31 is fixedly connected to the main body 20. The first connecting assembly 60 and the second connecting assembly 70 may reliably connect the roller brush to the cleaning casing 31, keep the roller brush pressed down under its own weight, and cause the roller brush to raise and lower vertically when the surface to be cleaned is uneven, thereby ensuring the cleaning performance of the cleaning module 30.

[0098] The first connecting assembly 60 is connected to the roller brush by means of the driving structure 36, and the second connecting assembly 70 is connected to the roller brush by means of the driving structure 36, i.e., both the first connecting assembly 60 and the second connecting assembly 70 are connected to the driving structure 36, and the driving structure 36 is connected to the roller brush, such that the roller brush and the

driving structure 36 can be kept pressed down under their own weights, and the roller brush can raise and lower vertically when the surface to be cleaned is uneven, thereby ensuring the cleaning performance of the cleaning module 30.

[0099] In this embodiment, the first connecting assembly 60 and the second connecting assembly 70 may be of structures similar to those shown in FIGs. 20D and 20E, but their connecting positions are different.

[0100] In an embodiment of the present disclosure, the roller brush rotates to clean the surface to be cleaned. The cyclone separator 13 has a high air volume and a high negative pressure. When the cleaning robot cleans a carpet, at least a part of the cleaning module 30 is vertically and movably arranged relative to the main body 20, such that the driving current of the roller brush can be reduced, the driving burden of the roller brush can be lightened, and the cleaning robot can clean the carpet more permanently.

[0101] In an embodiment of the present disclosure, as shown in FIGs. 21, 24 and 25, the cleaning module 30 further includes a driving structure 36, the driving structure 36 includes a power part 361 and a transmission assembly, and the power part 361 drives the roller brush to rotate by means of the transmission assembly, thereby reliably cleaning the surface to be cleaned.

[0102] In an embodiment of the present disclosure, there are a plurality of roller brushes, and the power part 361 drives the plurality of roller brushes to rotate synchronously by means of the transmission assembly, such that the number of the power parts 361 can be reduced, and it can be ensured that the plurality of roller brushes can perform cleaning synchronously, thereby improving the cleaning capability of the cleaning robot.

[0103] In an embodiment of the present disclosure, as shown in FIGs. 20A, 22 and 23, the cleaning casing 31 is provided with an installation cavity 311, and the installation cavity 311 may include a main air duct 3111 and a secondary air duct 3112.

[0104] As shown in FIGs. 22 and 23, in the cleaning robot according to the embodiment of the present disclosure, the cleaning casing 31 includes a main air duct 3111 and a secondary air duct 3112, the secondary air duct 3112 is communicated with the dust storage chamber 11, and the roller brush is arranged in the main air duct 3111, such that the secondary air duct 3112 is at least partially idle. Therefore, dust entering the cleaning casing 31 can enter the dust storage chamber 11 through the secondary air duct 3112 to prevent a large amount of dust from sticking on the roller brush, thereby ensuring the cleaning capability of the cleaning robot.

[0105] It should be noted that the main air duct 3111 and the secondary air duct 3112 are arranged in the cleaning casing 31, the roller brush is arranged in the main air duct 3111, and the secondary air duct 3112 is at least partially idle, such that waste can move through the secondary air duct 3112 and hence the roller brush is unlikely to get stuck by the waste.

[0106] In an embodiment of the present disclosure, the main air duct 3111 and the secondary air duct 3112 are arranged along a width direction of the cleaning casing 31, such that the length of the roller brush in the main air duct 3111 can be ensured, thereby ensuring the cleaning area of the roller brush.

[0107] As an optional embodiment of the present disclosure, the main air duct 3111 and the secondary air duct 3112 may be arranged along a length direction of the cleaning casing 31.

[0108] In an embodiment of the present disclosure, the volume of the main air duct 3111 is greater than that of the secondary air duct 3112, such that the roller brush can be effectively accommodated. The volume of the cleaning casing 31 may not be too large, such that the cleaning module 30 can be prevented from taking up too much space of the cleaning robot on the basis of ensuring the cleaning capability of the cleaning robot.

[0109] According to the cleaning robot provided in embodiments of the present disclosure, the cleaning module 30 includes an air duct opening 312, and is communicated with the dust storage chamber 11 through the air duct opening 312. The air duct opening 312 is formed in a position deviating from the central position in a length direction of the cleaning module 30, so that the cleaning module 30 can discharge dust into the dust storage chamber 11 punctually, and dust sticking can be avoided to improve the cleaning capability of the cleaning robot.

[0110] In an embodiment of the present disclosure, as shown in FIG. 21, the cleaning casing 31 is provided with an air duct opening 312; and the secondary air duct 3112 and the dust storage chamber 11 are communicated with each other through the air duct opening 312. The air duct opening 312 is formed in a position deviating from the central position in a length direction of the cleaning casing 31, so that dust sticking can be avoided to ensure the cleaning capability of the cleaning robot.

[0111] The air duct opening 312 may be communicated with the waste inlet 1112 of the dust box 10.

[0112] In an embodiment of the present disclosure, in the length direction of the cleaning casing 31, the minimum vertical distance between the air duct opening 312 and the central position of the cleaning casing 31 is greater than the minimum vertical distance between the air duct opening 312 and an inner wall of the cleaning casing 31, so that the air duct opening 312 can deviate from the central position of the cleaning casing 31 as far as possible, to ensure that dust can be discharged reliably.

[0113] As an optional embodiment of the present disclosure, the air duct opening 312 may be formed in the central position in the length direction of the cleaning casing 31.

[0114] In an embodiment of the present disclosure, as shown in FIG. 22 and FIG. 23, the secondary air duct 3112 includes a first air duct section 3113 and a second air duct section 3114. The first air duct section 3113 and

the second air duct section 3114 are arranged in the length direction of the cleaning casing 31. The end of the second air duct section 3114 distal from the first air duct section 3113 is communicated with the air duct opening 312, so that the air duct opening 312 can be formed in a position deviating from the central position in the length direction of the cleaning casing 31.

[0115] It should be noted that the first air duct section 3113 and the second air duct section 3114 are arranged in the length direction of the cleaning casing 31. The key lies in that the secondary air duct 3112 extends in the length direction of the cleaning casing 31; and in the length direction of the cleaning casing 31, the secondary air duct 3112 may be divided into the first air duct section 3113 and the second air duct section 3114, and the end of the second air duct section 3114 distal from the first air duct section 3113 is communicated with the air duct opening 312, that is, the air duct opening 312 is approximately arranged on an end side of the secondary air duct 3112, to ensure that the air duct opening 312 is formed in the position deviating from the central position in the length direction of the cleaning casing 31.

[0116] In an embodiment of the present disclosure, the extending direction of the first air duct section 3113 is not parallel to the extending direction of the second air duct section 3114; the circulating direction of air in the first air duct section 3113 is the extending direction of the first air duct section 3113; the extending direction of the first air duct section 3113 may be the length direction of the cleaning casing 31; the circulating direction of air in the second air duct section 3114 is the extending direction of the second air duct section 3114; and the extending direction of the second air duct section 3114 may deviate from the length direction of the cleaning casing 31. Therefore, airflow may flow along a bent channel in the secondary air duct 3112; and on the basis of ensuring that dust can be reliably discharged into the dust box 10, arrangement of the air duct may be more reasonable.

[0117] In an embodiment of the present disclosure, the extending direction of the first air duct section 3113 may be substantially perpendicular to the extending direction of the second air duct section 3114, that is, the second air duct section 3114 forms an air duct section protruding from the first air duct section 3113.

[0118] As an optional embodiment of the present disclosure, the extending direction of the first air duct section 3113 is in coincidence with the extending direction of the second air duct section 3114. In this case, the air duct opening 312 is formed in the bottom wall of the second air duct section 3114.

[0119] In an embodiment of the present disclosure, the transition section between the first air duct section 3113 and the second air duct section 3114 is arc-shaped, so that it can be ensured that dust can smoothly enter the second air duct section 3114 from the first air duct section 3113, thereby improving the dust discharging capability of the secondary air duct 3112.

[0120] As an optional embodiment of the present dis-

closure, the transition section between the first air duct section 3113 and the second air duct section 3114 may be right-angled.

[0121] In an embodiment of the present disclosure, there are at least two main air ducts 3111, and the secondary air duct 3112 is arranged between adjacent main air ducts 3111, so that dust in the main air ducts 3111 can reliably enter the secondary air duct 3112, which causes dust in the secondary air duct 3112 to enter the dust box 10 through the air duct opening 312.

[0122] In an embodiment of the present disclosure, with reference to FIG. 23, there are two main air ducts 3111; there is one secondary air duct 3112 between the two main air ducts 3111; and the volume of the main air duct 3111 is greater than the volume of the secondary air duct 3112.

[0123] In an embodiment of the present disclosure, a portion of the main air duct 3111 in the length direction of the cleaning casing 31 is idle, so that dust on a roller brush can enter the secondary air duct 3112 from the idle position of the main air duct 3111 and be discharged, thereby improving the cleaning capability of the cleaning robot.

[0124] As an optional embodiment of the present disclosure, in the length direction of the cleaning casing 31, the length of the main air duct 3111 is equal to the length of the roller brush.

[0125] It should be noted that the transverse axis of the cleaning robot is approximately parallel to the roller brush. In this case, it may be considered that the length direction of the cleaning casing 31 is parallel to the transverse axis of the cleaning robot; and it may be considered that the width direction of the cleaning casing 31 is parallel to the longitudinal axis of the cleaning robot.

[0126] As an optional embodiment of the present disclosure, a preset included angle is formed between the transverse axis of the cleaning robot and the roller brush, so that when the cleaning robot transversally passes through a ground environment such as the tile gap, a probability that the roller brush is stuck in the tile gap can be decreased, thereby improving the cleaning efficiency of the cleaning robot, and improving the use performance of the cleaning robot. The preset included angle between the transverse axis and the roller brush may be an acute angle, and may range from 5 degrees to 70 degrees.

[0127] The cleaning module 30 may include a roller brush. The roller brush includes a cantilever structure that is a conical structure. The first end of the conical structure is connected to the cleaning casing 31. The second end of the conical structure is a cantilever end. The diameter of the first end is greater than the diameter of the second end.

[0128] As shown in FIG. 20A, the cleaning module 30 may include a first cleaning group and a second cleaning group; the first cleaning group includes a first roller brush 32 and a second roller brush 33; and the second cleaning group includes a third roller brush 34 and a fourth roller brush 35. The first roller brush 32 and the second roller

brush 33 may be the same roller brush, or may be different roller brushes. The third roller brush 34 and the fourth roller brush 35 may be the same roller brush, or may be different roller brushes. The first roller brush is of a conical structure; and/or the second roller brush is of a conical structure.

[0129] A first gap is formed between the first roller brush 32 and the second roller brush 33 of the first cleaning group; and a second gap is formed between the third roller brush 34 and the fourth roller brush 35 of the second cleaning group. The first roller brush 32 and the second roller brush 33 may be arranged in the length direction of the cleaning casing 31; the third roller brush 34 and the fourth roller brush 35 may be arranged in the length direction of the cleaning casing 31; and the first cleaning group and the second cleaning group may be arranged in the width direction of the cleaning casing 31. In this case, the first gap and the second gap may be arranged in the width direction of the cleaning casing 31.

[0130] As an optional embodiment of the present disclosure. The first roller brush 32 and the second roller brush 33 may be arranged in the width direction of the cleaning casing 31; the third roller brush 34 and the fourth roller brush 35 may be arranged in the width direction of the cleaning casing 31; and the first cleaning group and the second cleaning group may be arranged in the length direction of the cleaning casing 31. In this case, the first gap and the second gap may be arranged in the length direction of the cleaning casing 31.

[0131] In an embodiment of the present disclosure, the roller brush may include a first roller brush 32, a second roller brush 33, a third roller brush 34, and a fourth roller brush 35.

[0132] The second roller brush 33 and the first roller brush 32 are spaced from each other, and are arranged in the length direction of the cleaning casing 31, so that a first gap, through which dust can enter the secondary air duct 3112 conveniently, is formed between the second roller brush 33 and the first roller brush 32, thereby ensuring the cleaning capability of the first roller brush 32 and the second roller brush 33, and causing dust on the first roller brush 32 and the second roller brush 33 to be discharged punctually.

[0133] The third roller brush 34 and the first roller brush 32 are arranged in the width direction of the cleaning casing 31; the fourth roller brush 35 and the third roller brush 34 are spaced from each other in the length direction of the cleaning casing 31; and the fourth roller brush 35 and the second roller brush 33 are arranged in the width direction of the cleaning casing 31. Therefore, two rows and two columns of roller brushes are formed in the cleaning casing 31, thereby improving the cleaning capability of the cleaning module 30.

[0134] The fourth roller brush 35 and the third roller brush 34 are spaced from each other in the length direction of the cleaning casing 31, so that a second gap, through which dust can enter the secondary air duct 3112 conveniently, is formed between the fourth roller brush 35

and the third roller brush 34, thereby ensuring the cleaning capability of the fourth roller brush 35 and the third roller brush 34, and causing dust on the fourth roller brush 35 and the third roller brush 34 to be discharged punctually.

[0135] As an optional embodiment of the present disclosure, the first roller brush 32 and the second roller brush 33 may be of conical structures; and the third roller brush 34 and the fourth roller brush 35 may be of cylindrical structures. The conical structures may be used to wind hair; and the cylindrical structures have a better cleaning effect and can reduce costs. The first roller brush 32 and the second roller brush 33 may be of cylindrical structures; and the third roller brush 34 and the fourth roller brush 35 may be of conical structures.

[0136] As an optional embodiment of the present disclosure, all of the first roller brush 32, the second roller brush 33, the third roller brush 34, and the fourth roller brush are of conical structures or cylindrical structures.

[0137] In an embodiment of the present disclosure, in the width direction of the cleaning casing 31, the third roller brush 34 and the first roller brush 32 may be in contact with each other. The third roller brush 34 may be at least in point contact with the first roller brush 32, so that the cleaning capability of the third roller brush 34 and the first roller brush 32 is improved.

[0138] In an embodiment of the present disclosure, in the width direction of the cleaning casing 31, the fourth roller brush 35 and the second roller brush 33 may be in contact with each other. The fourth roller brush 35 may be at least in point contact with the second roller brush 33, so that the cleaning capability of the fourth roller brush 35 and the second roller brush 33 is improved.

[0139] The roller brush includes vanes in a circumferential direction. The vanes are used for cleaning. Due to the arrangement of the first roller brush 32, the second roller brush 33, the third roller brush 34, and the fourth roller brush 35, the cleaning capability can be improved by increasing the linear velocity and time of contact between the vanes of rear roller brushes and a carpet in a cleaning process of the cleaning robot. Compared with a single group of brushes in the prior art, the rear roller brushes are included in the cleaning robot in the present disclosure. The rotation direction of the rear roller brushes is opposite to that of front roller brushes, so that litter such as hair may be driven to move forward, thereby improving the effect of cleaning a carpet or the like.

[0140] In an embodiment of the present disclosure, the axis of the second roller brush 33 is not parallel to the axis of the first roller brush 32, so that an included angle may be formed between an end of the second roller brush 33 and an end of the first roller brush 32, thereby facilitating dust discharging.

[0141] The axis of the fourth roller brush 35 is not parallel to the axis of the third roller brush 34, so that an included angle may be formed between an end of the fourth roller brush 35 and an end of the third roller brush 34, thereby facilitating dust discharging.

[0142] The included angle formed between the end of the second roller brush 33 and the end of the first roller brush 32 is opposite to the included angle formed between the end of the fourth roller brush 35 and the end of the third roller brush 34, so that the problem of incomplete cleaning of the roller brush can be avoided on the basis that dust can be discharged conveniently.

[0143] In an embodiment of the present disclosure, with reference to FIG. 20A, a first gap 38 is formed between the second roller brush 33 and the first roller brush 32; a second gap 39 is formed between the fourth roller brush 35 and the third roller brush 34; and the first gap 38 and the second gap 39 are staggered. Therefore, the first roller brush 32, the second roller brush 33, the third roller brush 34, and the fourth roller brush 35 can define a closed cleaning space in a cleaning process, thereby avoiding the problem of incomplete sweeping, and causing dust to be reliably discharged from the first gap 38 and the second gap 39.

[0144] In an embodiment of the present disclosure, as shown in FIG. 20A, the length of the first roller brush 32 is less than the length of the second roller brush 33, and the length of the third roller brush 34 is greater than the length of the fourth roller brush 35, so that the first gap is formed between the second roller brush 33 and the first roller brush 32, the second gap is formed between the fourth roller brush 35 and the third roller brush 34, and the first gap and the second gap are staggered.

[0145] As an optional embodiment of the present disclosure, a first gap is formed between the second roller brush 33 and the first roller brush 32; a second gap is formed between the fourth roller brush 35 and the third roller brush 34; and the first gap and the second gap may be opposite to each other. However, the included angle formed between the end of the second roller brush 33 and the end of the first roller brush 32 is opposite to the included angle formed between the end of the fourth roller brush 35 and the end of the third roller brush 34, so that the problem that the roller brush misses cleaning can be avoided on the basis that dust can be discharged conveniently.

[0146] As an optional embodiment of the present disclosure, the length of the first roller brush 32 is approximately equal to the length of the third roller brush 34; and the length of the second roller brush 33 is approximately equal to the length of the fourth roller brush 35. However, the included angle formed between the end of the second roller brush 33 and the end of the first roller brush 32 may be opposite to the included angle formed between the end of the fourth roller brush 35 and the end of the third roller brush 34.

[0147] In an embodiment of the present disclosure, at least one of the first roller brush 32, the second roller brush 33, the third roller brush 34, and the fourth roller brush 35 is of a conical structure, so that dust can fall off the roller brush conveniently on the basis that the roller brush can perform cleaning reliably.

[0148] In an embodiment of the present disclosure, the

first end of the conical structure is connected to the cleaning casing 31, and the second end of the conical structure is a cantilever end, so that a gap may be formed between adjacent conical structures to ensure that dust can fall off the roller brush conveniently, and the dust can enter the secondary air duct 3112 through the gap and be finally discharged into the dust box 10.

[0149] In an embodiment of the present disclosure, the first roller brush 32, the second roller brush 33, the third roller brush 34, and the fourth roller brush 35 rotate synchronously, so that the roller brush can clean a to-be-cleaned surface fast, thereby improving the cleaning capability of the cleaning module 30.

[0150] In an embodiment of the present disclosure, the first roller brush 32 and the second roller brush 33 are arranged in one main air duct 3111; the third roller brush 34 and the fourth roller brush 35 are arranged in the other main air duct 3111; and a secondary air duct 3112 is arranged between the two main air ducts 3111.

[0151] The rotation directions of the first roller brush 32 and the second roller brush 33 are opposite to the rotation directions of the third roller brush 34 and the fourth roller brush 35, so that dust can be collected into the cleaning module 30 fast, thereby causing the dust to enter the dust box 10 through the secondary air duct 3112.

[0152] As an optional embodiment of the present disclosure, the rotation directions of the first roller brush 32 and the second roller brush 33 are the same as the rotation directions of the third roller brush 34 and the fourth roller brush 35.

[0153] It should be noted that the expression that the rotation directions are opposite to each other means that one direction is clockwise and the other direction is counterclockwise.

[0154] As shown in FIG. 20F, an air path apparatus provided in embodiments of the present disclosure includes a cleaning module 30, a dust storage chamber 11, and a dust suction duct 73. The cleaning module 30 includes a cleaning casing 31. It may be understood that the cleaning module 30 further includes a roller brush arranged in the cleaning casing 31. The dust storage chamber 11 may alternatively be a dust storage chamber 11 formed in the dust box 10, or may be a dust storage chamber 11 formed in the main body 20 of the cleaning robot. The dust suction duct 73 communicates the cleaning casing 31 with the dust storage chamber 11. The dust suction duct 73 includes an air inlet end and an air outlet end 733 that are communicated with each other. The air inlet end is connected to the cleaning casing 31. The air outlet end 733 is connected to the dust storage chamber 11. In other words, in the present disclosure, airflow flows to an external environment through the cleaning casing 31 of the cleaning module 30, the dust suction duct 73, and the dust storage chamber 11, thereby forming the air path apparatus. A third air duct 731 is arranged aslant to a horizontal plane. Due to the dust suction duct 73 that is arranged aslant, airflow that flows out of the cleaning casing 31 is shunted in the dust suction duct 73 that is

arranged aslant to the horizontal plane, so that noise generated by the airflow can be reduced, thereby reducing noise generated in a working process of the cleaning robot, and improving the comfort level of a user.

[0155] The dust suction duct 73 being arranged aslant to the horizontal plane may be the dust suction duct 73 being arranged aslant to the horizontal plane upwards from a side proximal to the cleaning casing 31 to a side distal from the cleaning casing 31, or may be the dust suction duct 73 being arranged aslant to the horizontal plane downwards from the side proximal to the cleaning casing 31 to the side distal from the cleaning casing 31. Specifically, the cleaning casing 31 is provided with an air duct opening 312 communicated with the dust suction duct 73. After air is discharged through the air duct opening 312 of the cleaning casing 31, part of the airflow acts on an inner wall of the dust suction duct 73 opposite to the air duct opening 312. Because the dust suction duct 73 is arranged aslant to the horizontal plane, that is, the inner wall of the dust suction duct 73 opposite to the air duct opening 312 is arranged aslant to the horizontal plane, the airflow is shunted after acting on the inner wall of the dust suction duct 73 opposite to the air duct opening 312, thereby reducing noise of the airflow.

[0156] According to the air path apparatus provided in the present disclosure, as shown in FIG. 20F, the dust suction duct 73 includes a third air duct 731 and a fourth air duct 732 that are communicated with each other. An air duct opening 312 is formed in the cleaning casing 31. The third air duct 731 is connected to the cleaning casing 31 through the air duct opening 312. The fourth air duct 732 is connected to the dust storage chamber 11. The third air duct 731 is arranged aslant or perpendicularly relative to the air duct opening 312. In this way, after being discharged through the air duct opening 312 of the cleaning casing 31, air is shunted by the third air duct 731 that is arranged aslant to the horizontal plane, and then flows into the dust storage chamber 11 through the fourth air duct 732, thereby achieving the purposes of air circulation and noise reduction.

[0157] The dust suction duct 73 includes a third air duct 731 and a fourth air duct 732. In this case, the third air duct 731 may be arranged aslant or perpendicularly relative to the air duct opening 312. Then, based on a position at which the third air duct 731 and the dust storage chamber 11 are connected, a structure of the fourth air duct 732 is set reasonably to connect the third air duct 731 to the dust storage chamber 11, thereby communicating the cleaning casing 31 with the dust storage chamber 11. Due to the arrangement of the fourth air duct 732, it can be ensured that when there is a large enough tilt angle between the third air duct 731 and the cleaning casing 31 to reduce noise of airflow, the third air duct 731 is in transitional communication with the dust storage chamber 11, which helps reduce the entire height of the dust suction duct 73, and thus meets the design requirements of relatively small size and compact structure of the cleaning robot.

[0158] Further, the included angle between the third air duct 731 and the air duct opening 312 may be smaller than, equal to, or greater than 90°, to meet requirements of setting the third air duct 731 in different directions relative to the air duct opening 312. Specifically, the included angle between the third air duct 731 and the air duct opening 312 may be set to be greater than 90°, so that it can be ensured that airflow flowing out of the cleaning casing 31 can flow through the third air duct 731 fast and smoothly to ensure a good air passing effect. In addition, the airflow is shunted in the third air duct 731, so that noise generated by the airflow can be reduced, thereby reducing noise generated in a working process of the cleaning robot and improving the comfort level of a user under the premise of ensuring good cleaning efficiency.

[0159] The third air duct 731 and the fourth air duct 732 may be of an integrated structure or a split-type structure. If the third air duct 731 and the fourth air duct 732 are of the integrated structure, mass production can be performed, so that the production efficiency is improved. If the third air duct 731 and the fourth air duct 732 are of the split-type structure, maintenance and part replacing costs can be reduced. Specifically, the third air duct 731 and the fourth air duct 732 that are of the split-type structure may be connected with each other in an inserting manner, or may be connected to each other via a bolt or another fastener. To ensure leakproofness of the connection between the third air duct 731 and the fourth air duct 732, a sealing member may be arranged at a position where the third air duct 731 and the fourth air duct 732 are connected.

[0160] The third air duct 731 and the cleaning casing 31 may be of an integrated structure or a split-type structure. If the third air duct 731 and the cleaning casing 31 are of the integrated structure, mass production can be performed, which facilitates improving the production efficiency. If the third air duct 731 and the cleaning casing 31 are of the split-type structure, maintenance and part replacing costs can be reduced. Specifically, the third air duct 731 and the cleaning casing 31 that are of the split-type structure may be connected to each other via a bolt or another fastener. To ensure leakproofness of the connection between the third air duct 731 and the cleaning casing 31, a sealing member may be arranged at a position where the third air duct 731 and the cleaning casing 31 are connected.

[0161] Specifically, the third air duct 731, the fourth air duct 732, and the cleaning casing 31 may be of an integrated structure, or may be of a split-type structure; or the third air duct 731 and the fourth air duct 732 are of an integrated structure, and the third air duct 731 and the fourth air duct 732, as a whole, form a split-type structure with the cleaning casing 31; or the third air duct 731 and the cleaning casing 31 are of an integrated structure, and the third air duct 731 and the cleaning casing 31, as a whole, form a split-type structure with the fourth air duct 732.

[0162] The third air duct 731 provided in the present disclosure is arranged aslant to the horizontal plane upwards in a direction from a position proximal to the cleaning casing 31 to a position distal from the cleaning casing 31. In this way, the design requirement that the cleaning robot has a relatively small bottom space can be met, so that there is a large enough tilt angle between the third air duct 731 and the cleaning casing 31 to reduce noise of airflow. In addition, the air passing effect is good, to ensure that the cleaning robot has good cleaning efficiency.

[0163] Further, the third air duct 731 is of an arc-shaped structure. Due to the third air duct 731 of the arc-shaped structure, it can be ensured that air can smoothly enter the fourth air duct 732 from the cleaning casing 31, and then enter the dust storage chamber 11 through the fourth air duct 732, so that the air circulating capability and air circulating efficiency of the dust suction duct 73 can be improved, and problems such as dust blocking can be decreased, thereby ensuring the cleaning efficiency of the cleaning robot. Specifically, the arc-shaped air duct is arranged aslant upwards in a direction from the cleaning casing 31 to the fourth air duct 732.

[0164] A side wall of the third air duct 731 includes a curved surface, so that airflow can flow smoothly in the third air duct 731, thereby avoiding problems such as dust blocking, and facilitating improvement on the circulation efficiency and circulation smoothness of the airflow.

[0165] In an embodiment provided in the present disclosure, the fourth air duct 732 is an approximately horizontal air duct. Because the approximately horizontal air duct does not increase the height of the air path apparatus in a vertical direction, the design requirements of relatively small size and compact structure of the cleaning robot can be met. In addition, it can be ensured that the air passing efficiency is high, thereby ensuring the cleaning efficiency of the cleaning robot.

[0166] It may be understood that in some possibly implemented embodiments, the fourth air duct 732 may be arranged aslant downwards in a direction from the third air duct 731 to the dust storage chamber 11; or without considering the entire height of the air path apparatus, the fourth air duct 732 may also be arranged aslant upwards in the direction from the third air duct 731 to the dust storage chamber 11.

[0167] A side wall of the fourth air duct 732 includes a curved surface, so that airflow can flow smoothly in the fourth air duct 732, thereby avoiding problems such as dust blocking, and facilitating improvement on the circulation efficiency and circulation smoothness of the airflow.

[0168] Optionally, the fourth air duct 732 is an air duct made of a soft material, and may be made of a material such as soft plastic or silica gel. The cleaning casing (including a roller brush therein) has an effect of floating vertically relative to the main body. When there is an obstacle on a to-be-cleaned surface, interaction between the obstacle and the roller brush or the like can be

reduced due to vertical floating of a main brush structure, thereby helping the automatic cleaning apparatus cross the obstacle easily. The dust suction duct is located between the dust storage chamber and the cleaning casing structure. It is required that the dust suction duct is flexible because a rigid air duct cannot absorb any floating change of the roller brush. When the fourth air duct is made of a soft material such as soft plastic, the dust suction duct deforms under pressing of a floating bracket in an obstacle crossing process, so that upward "floating" can be implemented smoothly. The third air duct (an inclined part) in the dust suction duct is made of a hard material (so that air flows more smoothly); and the fourth air duct is made of a soft material.

[0169] In an embodiment of the present disclosure, as shown in FIG. 21, the cleaning module further includes a driving structure 36; the driving structure 36 includes a power part 361 and a transmission assembly; and the power part 361 drives the first roller brush 32, the second roller brush 33, the third roller brush 34, and the fourth roller brush 35 to rotate synchronously through the transmission assembly, thereby implementing reliable cleaning of a to-be-cleaned surface. In addition, as the power part 361 drives the plurality of roller brushes to rotate synchronously through the transmission assembly, the number of the power parts 361 can be reduced, and it can be ensured that the plurality of roller brushes perform cleaning synchronously. Therefore, the cleaning capability of the cleaning robot is improved.

[0170] In an embodiment of the present disclosure, as shown in FIG. 24 and FIG. 25, the transmission assembly includes a first gear body 362, a second gear body 363, a third gear body 364, a fourth gear body 365, a fifth gear body 366, a sixth gear body 367, a seventh gear body 368, an eighth gear body 369, a transmission rod 3610, a ninth gear body 3611, a tenth gear body 3612, an eleventh gear body 3613, a twelfth gear body 3614, and a thirteenth gear body 3615.

[0171] The power part 361 may be connected to the first gear body 362, so that the power part 361 can drive the first gear body 362 to rotate. The first gear body 362 is meshed with the second gear body 363, thereby driving the third gear body 364 that is connected to the second gear body 363 to rotate. The third gear body 364 is meshed with the fourth gear body 365, and the fourth gear body 365 may be meshed with all of the fifth gear body 366, the sixth gear body 367, and the eighth gear body 369, so that the sixth gear body 367 can drive the third roller brush 34 to rotate in a first direction. The eighth gear body 369 may drive the transmission rod 3610 to rotate. Correspondingly, the fifth gear body 366 may drive the seventh gear body 368, so that the seventh gear body 368 drives the first roller brush 32 to rotate in a second direction, thereby causing the direction of rotation of the first roller brush 32 to be opposite to that of the third roller brush 34.

[0172] The transmission rod 3610 drives the ninth gear body 3611 connected thereto to rotate. The ninth gear

body 3611 is meshed with the tenth gear body 3612. The tenth gear body 3612 is meshed with both the eleventh gear body 3613 and the twelfth gear body 3614. The eleventh gear body 3613 drives the fourth roller brush 35 to rotate in the first direction. The twelfth gear body 3614 is meshed with the thirteenth gear body 3615. The thirteenth gear body 3615 drives the second roller brush 33 to rotate in the second direction. In this way, the direction of rotation of the second roller brush 33 is opposite to that of the fourth roller brush 35.

[0173] It should be noted that all the gear bodies may be gears, and the power part 361 may be a motor.

[0174] As an optional embodiment of the present disclosure, the cleaning module 30 may include at least two motors; and each motor may drive one or two roller brushes to rotate. For example, there may be four motors that can conveniently drive the first roller brush 32, the second roller brush 33, the third roller brush 34, and the fourth roller brush 35 to rotate. Rotational speeds of the first roller brush 32, the second roller brush 33, the third roller brush 34, and the fourth roller brush 35 may be the same as each other or different from each other.

[0175] In an embodiment of the present disclosure, a roller brush is detachably arranged on the cleaning casing 31. At least one of the first roller brush 32, the second roller brush 33, the third roller brush 34, and the fourth roller brush 35 is detachably arranged on the cleaning casing 31, so that the roller brush can be replaced and maintained conveniently.

[0176] In an embodiment of the present disclosure, the second roller brush 33 is movably arranged in its axial direction, so that the second roller brush 33 can be detached from the cleaning casing 31. The second roller brush 33 may be connected to the cleaning casing 31 through some components, and is reliably fixed to the cleaning casing 31 when in a normal use state. When the second roller brush 33 needs to be maintained or replaced, a position of the second roller brush 33 is adjusted, and then the second roller brush 33 can be detached from the cleaning casing 31.

[0177] With reference to FIG. 20A to FIG. 20C, the second roller brush 33 is used as an example.

[0178] As shown in FIG. 20B and FIG. 20C, the cleaning module further includes: a main body support 331 arranged on the cleaning casing 31; an adapter 332, wherein the second roller brush 33 is connected to the adapter 332, and the adapter 332 is movably arranged relative to the main body support 331, thereby having a first position where the adapter 332 is connected to the main body support 331 and a second position where the adapter 332 is detached from the main body support 331; and an elastic member 334 connected to the adapter 332 and arranged in the axial direction of the second roller brush 33, wherein when the second roller brush 33 moves along with the adapter 332 in its axial direction, and compresses the elastic member 334, the adapter 332 moves from the first position to the second position, then the adapter 332 is rotated, so that the second roller

brush 33 is disengageable from the main body support 331 in its axial direction along with the adapter 332.

[0179] The main body support 331 is provided with a clamping slot 3311. The adapter 332 is provided with a buckle 333. The buckle 333 can be disengaged from the clamping slot 3311 when the adapter 332 is moved from the first position to the second position. When the adapter 332 is located at the second position, the adapter 332 is rotated to cause the buckle 333 to disengage from the clamping slot 3311.

[0180] The second roller brush 33 may be connected to the adapter 332. The adapter 332 is provided with the buckle 333. One end of the adapter 332 is connected to the elastic member 334. The main body support 331 is connected to the cleaning casing 31 through a power adapter 335. The adapter 332 may be connected to the main body support 331 through the buckle 333. The elastic member 334 is clamped between the adapter 332 and the power adapter 335. The adapter 332 is driven to move in a length direction of the second roller brush 33, that is, to move in the axial direction of the second roller brush 33. In this way, the buckle 333 is disengaged from the main body support 331. The adapter 332 and the second roller brush 33 can be rotated. In this case, the buckle 333 is disengaged from the clamping slot 3311, so that the adapter 332 can be detached from the main body support 331, thereby detaching the second roller brush 33 from the cleaning casing 31.

[0181] A part of the adapter 332 may penetrate into the main body support 331; and the buckle 333 may be located in the clamping slot 3311, thereby being clamped on the main body support 331. In this case, the second roller brush 33 is reliably fixed to the cleaning casing 31. Snapping between the buckle 333 and the main body support 331 can be released by compressing the elastic member 334, so that the buckle 333 can be disengaged from the clamping slot 3311 by rotating the adapter 332. In this case, the main body support 331 may compress the buckle 333, so that no snapping relationship is formed between the buckle 333 and the main body support 331. Therefore, the adapter 332 can be drawn out from the main body support 331, thereby detaching the second roller brush 33 from the cleaning casing 31.

[0182] The main body support 331 has a structure of a tapered tube. Therefore, snapping between the buckle 333 and the main body support 331 can be released by compressing the elastic member 334, and the buckle 333 can be disengaged from the clamping slot 3311 during rotation of the adapter 332. Because the buckle 333 enters a large-diameter position from a small-diameter position, it can be disengaged from the clamping slot 3311.

[0183] A plurality of buckles 333 that can deform elastically may be arranged on the adapter 332. The elastic member 334 may be a spring, a rubber ring, or another structure. The thirteenth gear body 3615 may be connected to the power adapter 335, thereby driving the second roller brush 33 to rotate.

[0184] It should be noted that the axial direction of the second roller brush 33 may include a left-to-right direction and a right-to-left direction.

[0185] As an optional embodiment of the present disclosure, the roller brush of the cleaning module may include only the first roller brush 32 and the second roller brush 33, that is, the cleaning robot may be a two-brush cleaning robot. The first roller brush 32 and the second roller brush 33 may be arranged on the cleaning casing 31 in the length direction of the cleaning casing 31 at an interval.

[0186] As an optional embodiment of the present disclosure, the roller brush of the cleaning module may include only the first roller brush 32, the second roller brush 33, and the third roller brush 34, that is, the cleaning robot may be a three-brush cleaning robot. The first roller brush 32 and the second roller brush 33 may be arranged on the cleaning casing 31 in the length direction of the cleaning casing 31 at an interval; and the third roller brush 34 and the first roller brush 32 may be arranged on the cleaning casing 31 in the width direction of the cleaning casing 31. Two ends of the third roller brush 34 may be approximately flush with an end of the first roller brush 32 and an end of the second roller brush 33; or the length of the third roller brush 34 may be less than the sum of the length of the first roller brush 32 and the length of the second roller brush 33.

[0187] As an optional embodiment of the present disclosure, as shown in FIG. 26, the cleaning module 30 includes the cleaning casing 31, a first roller brush structure 301, and a second roller brush structure 302. The first roller brush structure 301 and the second roller brush structure 302 are arranged in the cleaning casing 31. Both the first roller brush structure 301 and the second roller brush structure 302 extend in the length direction of the cleaning casing 31. The first roller brush structure 301 and the second roller brush structure 302 are arranged in the width direction of the cleaning casing 31. In this way, the first roller brush structure 301 and the second roller brush structure 302 can clean a to-be-cleaned surface reliably.

[0188] The lengths of the first roller brush structure 301 and the second roller brush structure 302 may be substantially the same.

[0189] Rotation directions of the first roller brush structure 301 and the second roller brush structure 302 may be opposite, so that dust can be collected into the cleaning module 30 fast. The first roller brush structure 301 and the second roller brush structure 302 may be driven by two independent driving mechanisms, thereby implementing rotation; or the first roller brush structure 301 and the second roller brush structure 302 may be driven by one driving mechanism, thereby implementing rotation. A specific structure of the driving mechanism is not limited. For example, a motor and a driving wheel assembly may be used for driving. In this way, the first roller brush structure 301 and the second roller brush structure 302 may be driven synchronously by one motor; or the first

roller brush structure 301 and the second roller brush structure 302 may be driven conveniently by two motors to rotate.

[0190] With reference to FIG. 27A to FIG. 29, according to the cleaning robot in embodiments of the present disclosure, the fan assembly 40 includes a fan 41, an air duct 42, and a filter part 43; one end of the air duct 42 is communicated with the fan 41; the other end of the air duct 42 is communicated with the dust storage chamber 11; and the filter part 43 is arranged between the dust storage chamber 11 and air duct 42, so that the filter part 43 can reliably filter air discharged into a room. Because the air duct 42 is communicated with the fan 41 and the filter part 43, air can be discharged into a room reliably. Moreover, because arrangement of the air duct 42 can adapt to arrangement of an internal space of the cleaning robot, the utilization of the internal space of the cleaning robot can be improved to the most extent, thereby improving performance of the cleaning robot.

[0191] In an embodiment of the present disclosure, the dust box 10 includes a first chamber 111 and a second chamber 112 that are communicated with each other; the first chamber 111 is communicated with the cleaning module 30; the cyclone separator 13 is arranged in the second chamber 112; and the fan assembly 40 is communicated with the second chamber 112, so that the fan assembly 40 can reliably collect dust on a to-be-cleaned surface into the dust box 10 by using the cleaning module 30.

[0192] In an embodiment of the present disclosure, the dust box 10 is arranged adjacent to the fan assembly 40; and the dust box 10 and the fan assembly 40 are arranged in a circumferential direction of the main body 20. Therefore, structural distribution is relatively reasonable; and a communication path between the dust box 10 and the fan assembly 40 can be shortened.

[0193] It should be noted that the air duct 42, used as an airflow channel connecting the fan 41 with the filter part 43, may be subjected to structural adjustment based on a distribution condition of components in the internal space of the cleaning robot, thereby adapting to a position and a structural form of the internal space of the cleaning robot. For example, the fan 41 and the filter part 43 may be staggered, and may be arranged in the circumferential direction of the cleaning robot. In this case, the air duct 42 can effectively adapt to arrangement of the fan 41 and the filter part 43, thereby ensuring that the internal space of the cleaning robot is used to the most extent.

[0194] An air outlet 1123 of the dust storage chamber 11 is communicated with the filter part 43. The filter part 43 is pressed between the air duct 42 and the dust box 10. Under the action of the fan 41, dust may enter the waste inlet 1112 of the dust storage chamber 11 from the cleaning module 30, and enters the dust storage chamber 11 for particle separation. Finally, air enters the filter part 43 through the air outlet 1123 for filtering, thereby passing through the air duct 42, entering the fan 41, and being

discharged out of the cleaning robot. In this way, dust collection is realized.

[0195] In an embodiment of the present disclosure, the wall of the air duct 42 includes at least one of a curved surface and a plane. The wall of the air duct 42 including the curved surface can not only facilitate air circulation, but also allow mounting positions of the fan 41 and filter part 43 to be used, thereby improving space adaptability of the air duct 42.

[0196] In an embodiment of the present disclosure, as shown in FIG. 27A to FIG. 28, the air duct 42 includes a first air duct opening 421 and a second air duct opening 422; the first air duct opening 421 is communicated with the fan 41; and the second air duct opening 422 is communicated with the dust storage chamber 11. The second air duct opening 422 is a curved-surface opening, thereby matching the curved-surface filter part 43. This ensures reliable adaptability of the structure, and can enlarge a filtering area of the filter part 43, thereby increasing filtering capability of the filter part 43.

[0197] In an embodiment of the present disclosure, an area of the first air duct opening 421 is smaller than that of the second air duct opening 422, so that airflow in the dust storage chamber 11 can enter the filter part 43 fast for filtering, and the speed at which the airflow enters the fan 41 can be increased.

[0198] In an embodiment of the present disclosure, as shown in FIG. 29, the filter part 43 includes a plurality of superposed filter layers 431. The filter layer 431 is of a sheet-shaped structure. A plurality of the sheet-shaped structures being superposed can not only increase the filtering capability of the filter part 43, but also allow a size of the filter part 43 in a thickness direction to be not too large, thereby reducing occupation of the internal space of the cleaning robot.

[0199] With reference to FIG. 29, there may be three filter layers 431. The thicknesses of the filter layers 431 may be the same as each other or different from each other. Areas of the filter layers 431 may be the same as each other or different from each other.

[0200] In an embodiment of the present disclosure, the plurality of filter layers 431 are made of different materials, thereby improving the filtering capability of the filter part 43.

[0201] There may be three filter layers 431. The three filter layers 431 may form a structure including electrostatic cotton, filter cotton, and sponge.

[0202] As an optional embodiment of the present disclosure, the plurality of filter layers 431 may be made of the same material.

[0203] In an embodiment of the present disclosure, as shown in FIG. 29, the filter part 43 further includes a frame 432. The filter layer 431 is arranged in the frame 432. The frame 432 is clamped between the air duct 42 and the dust storage chamber 11. Therefore, the filter part 43 is fixed reliably; the filter part 43 is prevented from being crushed; and reliable filtering of the filter part 43 can be ensured.

[0204] In an embodiment of the present disclosure, there are three filter layers 431. An area of the middle filter layer 431 is the largest, so that the middle filter layer 431 can be reliably fixed to the frame 432. The three filter layers 431 may form a structure including electrostatic cotton, filter cotton, and sponge, so that a dust holding capacity of the filter part 43 can be increased. In addition, the frame 432 may be of a soft plastic structure, so that it can be effectively compressed by the air duct 42 and the dust storage chamber 11 to realize reliable filtering.

[0205] In an embodiment of the present disclosure, as shown in FIG. 27A to FIG. 28, the fan assembly 40 further includes a silencer part 44. The silencer part 44 is arranged on one side of the fan 41 distal from the air duct 42, to be communicated with an air outlet of the fan 41. The silencer part 44 includes a sound channel through hole 441 and a sound-absorbing hole 442, so that noise of the fan 41 and noise generated during air flowing can be reduced.

[0206] After air is discharged out of the fan 41 and enters the silencer part 44, one part of the air is directly radiated to the environment through the sound channel through hole 441, and the other part of the air enters the silencer part 44 for absorption through the sound-absorbing hole 442 in a wall of the sound channel through hole 441, so that the purpose of noise reduction is achieved. The silencer part 44 may be made of silencer cotton or a porous material.

[0207] In an embodiment of the present disclosure, there are a plurality of sound channel through holes 441. The plurality of sound channel through holes 441 are arranged at intervals in a height direction of the silencer part 44, so that it can be ensured that air can be discharged into a room, and the silencer part 44 can reduce noise reliably.

[0208] In an embodiment of the present disclosure, the sound channel through hole 441 includes a first port and a second port; an aperture of the first port is smaller than that of the second port; the first port of the sound channel through hole 441 is communicated with the air outlet of the fan 41; and the second port of the sound channel through hole 441 is communicated with the outside. Therefore, effective air discharging can be realized; and the noise reduction effect can be ensured. The aperture of the first port may be smaller than that of the second port.

[0209] In an embodiment of the present disclosure, as shown in FIG. 27B and FIG. 28, the fan assembly 40 further includes a filter member 45 and a protective casing 46; and the filter member 45 is arranged at an end of the silencer part 44 distal from the fan 41, so that air discharged from the silencer part 44 can be filtered again. The protective casing 46 may be connected to the main body 20, thereby effectively protecting the fan assembly 40. The protective casing 46 may be of a reticular structure, thereby ensuring that air can be discharged reliably.

[0210] As shown in FIG. 30 to FIG. 33, the cleaning base station includes a pile body 1, a dust bucket 4, a fan

structure 7, a stopper 9, and a driving member 93.

[0211] The pile body 1 includes a dust inlet channel 2. The dust inlet channel 2 has a dust inlet 3. The dust inlet 3 is communicated with the opening of the dust storage chamber 11, so that dust in the dust storage chamber 11 can enter the dust inlet channel 2 through the dust inlet 3. The dust bucket 4 is arranged on the pile body 1, and is communicated with the dust inlet channel 2, so that the dust bucket 4 can be used to collect dust in the dust box 10 of the cleaning robot.

[0212] In an embodiment of the present disclosure, the stopper 9 is arranged on the pile body 1, and is in contact with or separated from the door body 12. When being in contact with the door body 12, the stopper 9 can prevent the door body 12 on the dust storage chamber 11 from being opened. When the stopper 9 is separated from the door body 12, the door body 12 on the dust storage chamber 11 can be opened.

[0213] The stopper 9 may be in contact with both the first door body piece 121 and the second door body piece 122 of the door body 12; or the stopper 9 may be in contact with one of the first door body piece 121 and the second door body piece 122, and be separated from the other one.

[0214] In an embodiment of the present disclosure, a fan structure 7 is arranged on the pile body 1, and is communicated with the dust bucket 4, so that dust in the dust box 10 can be sucked into the dust bucket 4 through the fan structure 7.

[0215] The fan structure 7 is arranged on the pile body 1. An air inlet of the fan structure 7 is communicated with an airflow outlet end of the dust bucket 4. The fan structure 7 generates a negative pressure, to ensure that dust in the dust box 10 can enter the dust inlet channel 2 through the dust inlet 3, and airflow can be circulated. The dust in the dust box 10 herein includes litter in the dust box. The fan structure 7 may open the door body 12 of the dust box 10 via sucking.

[0216] Specifically, when situations such as cleaning being completed, a battery of the cleaning robot being low, or the dust box of the cleaning robot being filled with waste are triggered, the cleaning robot may move back to the cleaning base station for completing recharging or unloading the waste in the dust box into the cleaning base station.

[0217] In a process of moving back to the cleaning base station, the cleaning robot may constantly search for a dust collection apparatus by using a signal receiving device. The cleaning base station includes a signal transmission apparatus. For example, the signal transmission apparatus constantly transmits communication signals in a specified angle range for capture by the cleaning robot. When the cleaning robot captures the communication signal, a position of the cleaning base station can be determined, so that the cleaning robot can move to the cleaning base station by using a navigation function.

[0218] Further, if the cleaning robot starts cleaning when it is at the cleaning base station, a position of the

cleaning base station may be recorded on a map, so that in a process of moving back to the cleaning base station, the cleaning robot preferentially moves back to the position of the cleaning base station that has been recorded on the map, determines a position of the cleaning base station based on signals transmitted by the signal transmission apparatus of the cleaning base station, and moves to the cleaning base station by using the navigation function. Therefore, time spent in finding the cleaning base station is shortened, and efficiency of moving back to the cleaning base station is improved.

[0219] In an embodiment of the present disclosure, the stopper 9 is arranged on the pile body 1, and is arranged movably relative to the pile body 1, thereby having a first position and a second position. When the stopper 9 is at the first position, the stopper 9 prevents the door body 12 from releasing the dust storage chamber 11. When the stopper 9 is at the second position, the door body 12 can release an opening, so that the dust inlet 3 can be communicated with the opening. The door body 12 can release the opening, that is, the dust storage chamber 11 is in an open state.

[0220] The stopper 9 can control a time when the door body 12 is opened. After the cleaning robot is docked with the cleaning base station, the stopper 9 may move from the first position where the stopper 9 is in contact with the door body 12 to the second position the stopper 9 is separated from the door body 12, that is, the stopper 9 moves from a position at which it prevents the door body 12 on the dust storage chamber 11 from being opened to a position at which it does not prevent the door body 12 on the dust storage chamber 11 from being opened. In this case, the door body 12 on the dust storage chamber 11 may be opened by enabling the fan structure 7, so that dust in the dust box 10 is sucked into the dust bucket 4.

[0221] In an embodiment of the present disclosure, as shown in FIG. 32 and FIG. 33, the stopper 9 includes a first stopper 91 and a second stopper 92 that correspond to the first door body piece 121 and the second door body piece 122 respectively, so that the first door body piece 121 and the second door body piece 122 can independently open the first opening 1111 of the first chamber 111, and the second opening 1121 and the third opening 1122 of the second chamber 112 respectively.

[0222] After the cleaning robot is docked with the cleaning base station, the first stopper 91 may move from the first position to the second position, but the second stopper 92 may stay at the first position. In this case, the first door body piece 121 on the first chamber 111 may be opened by enabling the fan structure 7, so that dust in the first chamber 111 can be discharged into the dust bucket 4. The second stopper 92 may move from the first position to the second position, but the first stopper 91 may move from the second position to the first position. In this case, the second door body piece 122 on the second chamber 112 is opened by enabling the fan structure 7, so that dust in the second chamber 112 can be discharged into the dust bucket 4.

[0223] The first chamber 111 and the second chamber 112 are opened at different times, so that dust in the cleaning robot can be sucked into the dust bucket 4 reliably.

[0224] In an embodiment of the present disclosure, as shown in FIG. 32 and FIG. 33, the cleaning base station further includes a driving member 93. The driving member 93 is in driving connection with the first stopper 91 and the second stopper 92, so that when the first stopper 91 is at the first position, and the second stopper 92 is at the second position; or when the first stopper 91 is at the second position, the second stopper 92 is at the first position. Therefore, the first chamber 111 and the second chamber 112 can be opened at different times, thereby conveniently sucking dust in the cleaning robot into the dust bucket 4 reliably.

[0225] The driving member 93 may include a motor 931, a first gear 932, and a second gear 933. The motor 931 may be connected to the first gear 932 and the second gear 933 through a driving shaft. The first gear 932 is meshed with a first rack 911 of the first stopper 91, and the second gear 933 is meshed with a second rack 921 of the second stopper 92, so that when the motor 931 runs, the first gear 932 and the second gear 933 rotate in the same direction, but the first rack 911 and the second rack 921 may rotate in different directions. Therefore, when the first stopper 91 is at the first position, the second stopper 92 is at the second position; or when the first stopper 91 is at the second position, the second stopper 92 is at the first position.

[0226] The motor 931 is connected to both the first gear 932 and the second gear 933; the first stopper 91 includes a first rack 911; the second stopper 92 includes a second rack 921; and the first gear 932 and the second gear 933 are meshed with the first rack 911 and the second rack 921 respectively, so that when the first stopper 91 is in contact with the first door body piece 121, the second stopper 92 is separated from the second door body piece 122; or when the first stopper 91 is separated from the first door body piece 121, the second stopper 92 is in contact with the second door body piece 122. Therefore, the first stopper 91 and the second stopper 92 can correspond to the first door body piece 121 and the second door body piece 122 respectively; and the first chamber 111 and the second chamber 112 of the dust storage chamber 11 can be opened selectively.

[0227] In an embodiment of the present disclosure, the dust storage chamber 11 includes a first chamber 111 and a second chamber 112; the first chamber 111 includes a first opening 1111; the second chamber 112 includes a second opening 1121 and a third opening 1122 that are separated from each other; the second opening 1121 is communicated with a part of the second chamber 112 outside the cyclone separator 13; and the third opening 1122 is communicated with a part of the second chamber 112 inside the cyclone separator 13. In other words, it may be considered that the dust storage chamber 11 includes three chambers. However, the door body 12

includes a first door body piece 121 and a second door body piece 122. The first door body piece 121 corresponds to the first opening 1111. The second door body piece 122 corresponds to both the second opening 1121 and the third opening 1122.

[0228] After the cleaning robot is docked with the cleaning base station, the first stopper 91 may be propped against the first door body piece 121, and the cleaning base station may suck dust in the second chamber 112 into the dust bucket 4. When the motor 931 operates, the second stopper 92 may be propped against the second door body piece 122, and the cleaning base station may suck waste in the first chamber 111 into the dust bucket 4. Alternatively, after the cleaning robot is docked with the cleaning base station, the second stopper 92 may be propped against the second door body piece 122, and the cleaning base station may suck dust in the first chamber 111 into the dust bucket 4. When the motor 931 operates, the first stopper 91 may be propped against the first door body piece 121, and the cleaning base station may suck waste in the second chamber 112 into the dust bucket 4. Because the first chamber 111 and the second chamber 112 are opened separately, in a case that an area is relatively small and a negative keeps unchanged, a suction force is increased. Therefore, the cleaning base station can collect dust in the cleaning robot more completely.

[0229] In an embodiment of the present disclosure, the stopper 9 may further include a first microswitch and a second microswitch. The first microswitch and the second microswitch are arranged in the pile body 1. When the first stopper 91 moves in place, that is, when the first stopper 91 moves to the first position, the first stopper 91 may trigger the first microswitch, thereby causing the motor 931 to stop operating. However, when the first stopper 91 moves to the second position, the first stopper 91 may trigger the second microswitch, thereby causing the motor 931 to stop operating. In this way, it can be ensured that the stopper 9 can block and release the door body 12 reliably. Alternatively, the second stopper 92 may correspond to the first microswitch and the second microswitch. This is not limited herein.

[0230] As an optional embodiment of the present disclosure, the first stopper 91 and the second stopper 92 may be driven by two independent driving mechanisms.

[0231] In an embodiment of the present disclosure, as shown in FIG. 30 and FIG. 31, the adsorption member 94 is arranged on the pile body 1, so that after the door body 12 on the dust storage chamber 11 is opened, the adsorption member 94 is used to adsorb the door body 12, thereby fixing the door body 12, and ensuring that the dust box 10 can be opened reliably.

[0232] In an embodiment of the present disclosure, the adsorption member 94 is used to magnetically adsorb the door body 12, thereby fixing the door body 12. The door body 12 may be provided with a magnetic structure thereon, or the door body 12 itself may be a magnetic structure. There may be at least two adsorption members

94. The first door body piece 121 and the second door body piece 122 may conveniently correspond to at least one adsorption member 94.

[0233] The dust box, the cleaning apparatus, and the cleaning system provided in embodiments of the present disclosure can improve dust collection performance of the dust box, and improve the cleaning effect of the cleaning apparatus.

[0234] According to an aspect of the present disclosure, a dust box is provided. The dust box includes:

- a first chamber including a waste inlet;
- a second chamber including an air outlet; and
- a transition channel through which the first chamber is communicated with the second chamber.

[0235] In some embodiments, the transition channel is approximately tangent to the second chamber.

[0236] In some embodiments, a side wall of the transition channel includes a curved surface.

[0237] In some embodiments, an extension length of the transition channel is larger than a minimum thickness of a wall between the first chamber and the second chamber.

[0238] In some embodiments, the dust box further includes a cyclone separator arranged inside the second chamber.

[0239] In some embodiments, the dust box further includes:

- a base;
- a bottom cover arranged on the base and forming the first chamber and the second chamber together with the base; and
- a door body movably arranged on the bottom cover to release or block the first chamber and the second chamber.

[0240] In some embodiments, the bottom cover is detachably arranged on the base.

[0241] In some embodiments, the dust box further includes: a locking member which is arranged on the base and which is movably arranged relative to the bottom cover so as to be disengaged from or connected with the bottom cover.

[0242] In some embodiments, an avoidance space is arranged on the base and is adjacent to the bottom cover.

[0243] In some embodiments, the bottom cover includes a rolling part.

[0244] According to another aspect, a dust box is provided. The dust box includes:

- a first chamber including a waste inlet;
- a second chamber including an air outlet; and
- a transition channel through which the first chamber is communicated with the second chamber, and
- a cyclone separator arranged inside the second chamber,

wherein an extension length of the transition channel is larger than a minimum thickness of a wall between the first chamber and the second chamber.

[0245] In some embodiments, the transition channel is approximately tangent to the second chamber.

[0246] In some embodiments, a side wall of the transition channel includes a curved surface.

[0247] In some embodiments, the dust box further includes:

- a base;
- a bottom cover arranged on the base and forming the first chamber and the second chamber together with the base; and
- a door body movably arranged on the bottom cover to release or block the first chamber and the second chamber.

[0248] In some embodiments, the bottom cover is detachably arranged on the base.

[0249] In some embodiments, the dust box further includes: a locking member which is arranged on the base and which is movably arranged relative to the bottom cover so as to be disengaged from or connected with the bottom cover.

[0250] In some embodiments, an avoidance space is arranged on the base and is adjacent to the bottom cover.

[0251] In some embodiments, the bottom cover includes a rolling part which is rotatably arranged on the bottom cover,

wherein a bottom end of the rolling part protrudes from a bottom surface of the bottom cover.

[0252] According to yet another aspect, a dust box is provided. The dust box includes:

- a base;
 - a bottom cover arranged on the base and forming, together with the base, a first chamber and a second chamber which connected to each other; and
 - a door body movably arranged on the bottom cover to release or block the first chamber and the second chamber,
- wherein the door body includes a first door body piece and a second door body piece which are separated from each other and correspond to the first chamber and the second chamber respectively.

[0253] In some embodiments, the bottom cover and the base form a transition channel through which the first chamber is communicated with the second chamber.

[0254] In some embodiments, the transition channel is approximately tangent to the second chamber.

[0255] In some embodiments, a side wall of the transition channel includes a curved surface.

[0256] In some embodiments, an extension length of the transition channel is larger than a minimum thickness of a wall between the first chamber and the second

chamber.

[0257] In some embodiments, the dust box further includes a cyclone separator arranged inside the second chamber.

[0258] In some embodiments, the bottom cover is detachably arranged on the base.

[0259] In some embodiments, the dust box further includes: a locking member which is arranged on the base and which is movably arranged relative to the bottom cover so as to be disengaged from or connected with the bottom cover.

[0260] In some embodiments, an avoidance space is arranged on the base and is adjacent to the bottom cover.

[0261] In some embodiments, the bottom cover includes a rolling part which is rotatably arranged on the bottom cover,

wherein a bottom end of the rolling part protrudes from a bottom surface of the bottom cover.

[0262] According to still yet another aspect, a cleaning apparatus is provided. The cleaning apparatus includes the above dust box and a main body on which the dust box is arranged.

[0263] In some embodiments, the dust box is detachably arranged on the main body.

[0264] In some embodiments, at least a part of the dust box is located outside the main body.

[0265] According to still yet another aspect of the present disclosure, a cleaning apparatus is provided. The cleaning apparatus includes: a main body; and a cleaning module arranged on the main body. The cleaning module includes: a cleaning casing; a first roller brush; a second roller brush, wherein the second roller brush and the first roller brush are arranged on the cleaning casing at an interval along a length direction of the cleaning casing; a third roller brush arranged on the cleaning casing, wherein the third roller brush and the first roller brush are arranged along a width direction of the cleaning casing; and a fourth roller brush arranged on the cleaning casing, wherein the fourth roller brush and the third roller brush are arranged at an interval along the length direction of the cleaning casing, and the fourth roller brush and the second roller brush are arranged along the width direction of the cleaning casing. A first gap is formed between the second roller brush and the first roller brush, a second gap is formed between the fourth roller brush and the third roller brush, and the first gap and the second gap are staggered.

[0266] In some embodiments, the length of the first roller brush is less than the length of the second roller brush, and the length of the third roller brush is greater than the length of the fourth roller brush.

[0267] In some embodiments, at least one of the first roller brush, the second roller brush, the third roller brush and the fourth roller brush is of a conical structure.

[0268] In some embodiments, an axis of the second roller brush is not parallel to an axis of the first roller brush; and/or an axis of the fourth roller brush is not parallel to an axis of the third roller brush.

[0269] In some embodiments, a first end portion of the conical structure is connected to the cleaning casing, and a second end portion of the conical structure is a cantilever end; and

the diameter of the first end portion is greater than the diameter of the second end portion.

[0270] In some embodiments, the first roller brush, the second roller brush, the third roller brush and the fourth roller brush rotate synchronously.

[0271] In some embodiments, rotation directions of the first roller brush and the second roller brush are opposite to rotation directions of the third roller brush and the fourth roller brush.

[0272] In some embodiments, the cleaning module further includes a driving structure, wherein the driving structure includes a power part and a transmission assembly, and the power part drives, by the transmission assembly, the first roller brush, the second roller brush, the third roller brush and the fourth roller brush to rotate synchronously.

[0273] In some embodiments, at least one of the second roller brush and the first roller brush is detachably arranged on the cleaning casing.

[0274] In some embodiments, the second roller brush is movably arranged along an axis direction thereof so as to be detachable from the cleaning casing.

[0275] In some embodiments, the cleaning module further includes:

a main body support arranged on the cleaning casing;

an adapter, wherein the second roller brush is connected to the adapter, and the adapter is movably arranged relative to the main body support to have a first position where the adapter is connected to the main body support and a second position where the adapter is disengaged from the main body support; and

an elastic member connected to the adapter and arranged along the axis direction of the second roller brush;

wherein when the second roller brush moves along the axis direction thereof with the adapter and compresses the elastic member, the adapter moves from the first position to the second position, and the adapter is rotated, so that the second roller brush is disengageable, with the adapter, from the main body support along the axis direction thereof.

[0276] In some embodiments, the main body support is provided with a clamping slot, the adapter is provided with a buckle, and the buckle is disengageable from the clamping slot when the adapter moves from the first position to the second position; and

the adapter is rotated to cause the buckle to be disengaged from the clamping slot when the adapter is located at the second position.

[0277] According to still yet another aspect of the pre-

sent disclosure, a cleaning module is provided. The cleaning module includes:

a cleaning casing;

a first cleaning group arranged on the cleaning casing; and

a second cleaning group, wherein the second cleaning group and the first cleaning group are arranged on the cleaning casing along a width direction of the cleaning casing;

wherein a direction of rotation of the first cleaning group is opposite to a direction of rotation of the second cleaning group.

[0278] In some embodiments, the cleaning module further includes a driving structure, wherein the driving structure includes a power part and a transmission assembly, and the power part drives, by the transmission assembly, the first cleaning group and the second cleaning group to rotate synchronously.

[0279] In some embodiments, the first cleaning group includes:

a first roller brush; and

a second roller brush, wherein the second roller brush and the first roller brush are arranged on the cleaning casing at an interval along a length direction of the cleaning casing.

[0280] In some embodiments, the second cleaning group includes:

a third roller brush; and

a fourth roller brush, wherein the fourth roller brush and the third roller brush are arranged at an interval along the length direction of the cleaning casing; wherein the third roller brush and the first roller brush are arranged along the width direction of the cleaning casing, and the fourth roller brush and the second roller brush are arranged along the width direction of the cleaning casing.

[0281] In some embodiments, the first roller brush is of a conical structure, and/or the second roller brush is of a conical structure.

[0282] In some embodiments, a first end portion of the conical structure is connected to the cleaning casing, and a second end portion of the conical structure is a cantilever end.

[0283] In some embodiments, the first cleaning group forms a first gap, the second cleaning group forms a second gap, and the first gap and the second gap are staggered.

[0284] According to still yet another aspect, a cleaning module is provided. The cleaning module includes:

a cleaning casing; and

a roller brush arranged on the cleaning casing and

including a cantilever structure.

[0285] In some embodiments, the cantilever structure is of a conical structure.

[0286] In some embodiments, a first end portion of the conical structure is connected to the cleaning casing, and a second end portion of the conical structure is a cantilever end.

[0287] In some embodiments, the roller brush includes:

a first roller brush; and
a second roller brush, wherein the second roller brush and the first roller brush are arranged on the cleaning casing at an interval along a length direction of the cleaning casing;
wherein both the first roller brush and the second roller brush are of conical structures.

[0288] In some embodiments, the roller brush further includes:

a third roller brush of a conical structure; and
a fourth roller brush of a conical structure, wherein the fourth roller brush and the third roller brush are arranged at an interval along the length direction of the cleaning casing;
wherein the third roller brush and the first roller brush are arranged along a width direction of the cleaning casing, and the fourth roller brush and the second roller brush are arranged along the width direction of the cleaning casing.

[0289] In some embodiments, a first gap is formed between the second roller brush and the first roller brush, a second gap is formed between the fourth roller brush and the third roller brush, and the first gap and the second gap are staggered.

[0290] In some embodiments, the length of the first roller brush is less than the length of the second roller brush, and the length of the third roller brush is greater than the length of the fourth roller brush.

[0291] In some embodiments, the length of the first roller brush is approximately equal to the length of the third roller brush, and the length of the second roller brush is approximately equal to the length of the fourth roller brush.

[0292] According to still yet another aspect of the present disclosure, a cleaning apparatus is provided. The cleaning apparatus includes the cleaning module as described above and further including a main body, wherein the cleaning module is arranged on the main body.

[0293] According to still yet another aspect of the present disclosure, a cleaning system is provided. The cleaning system includes the cleaning apparatus as described above and further including a cleaning base station.

[0294] In some embodiments, the cleaning base station includes:

a pile body including a dust inlet channel, wherein the dust inlet channel is provided with a dust inlet, and the dust inlet is configured to be communicated with a first chamber and a second chamber to enable dust in the first chamber and the second chamber to enter the dust inlet channel through the dust inlet; and

a dust bucket arranged on the pile body and communicated with the dust inlet channel.

[0295] In some embodiments, the cleaning base station further includes a power assembly arranged on the pile body and communicated with the dust bucket.

[0296] In some embodiments, the cleaning base station further includes a stopper arranged on the pile body, wherein the stopper includes a first stopper and a second stopper, and the first stopper and the second stopper correspond to a first door body piece and a second door body piece respectively; and

the cleaning base station further includes a driving member. The driving member is connected to the first stopper in a driving manner, and the driving member is connected to the second stopper in a driving manner, so that the second stopper is located in a second position when the first stopper is in a first position, or the second stopper is located in the first position when the first stopper is in the second position;

wherein the first door body piece releases the first chamber when the first stopper is in the first position, to enable the dust inlet to be communicated with the first chamber; the first door body piece blocks the first chamber when the first stopper is in the second position; the second door body piece releases the second chamber when the second stopper is in the first position, to enable the dust inlet to be communicated with the second chamber; and the second door body piece blocks the second chamber when the second stopper is in the second position.

[0297] In some embodiments, the cleaning base station further includes an adsorption member arranged on the pile body, wherein the adsorption member is configured to adsorb the door body so as to fix the door body after the door body opens the first chamber or the second chamber.

[0298] In some embodiments, the adsorption member is configured to magnetically adsorb the door body.

[0299] Other embodiments of the present disclosure will be easily conceivable by those skilled in the art upon consideration of the description and practice of the present disclosure disclosed herein. The present disclosure is intended to cover any variations, uses, or adaptations of the present disclosure following general principles of

the present disclosure and including the common general knowledge or customary technical means in the art that is not disclosed by the present disclosure. The description and the exemplary embodiments are considered as exemplary only, with the true scope and spirit of the present disclosure being indicated by the appended claims.

[0300] It will be appreciated that the present disclosure is not limited to the exact structures that have been described above and illustrated in the accompanying drawings, and that various modifications and changes can be made without departing from the scope thereof. It is intended that the scope of the present disclosure is only subject to the appended claims.

Claims

1. A dust box, comprising:

a first chamber (111), comprising a waste inlet (1112);
a second chamber (112), comprising an air outlet (1123); and
a transition channel (113), the first chamber (111) being communicated with the second chamber (112) through the transition channel (113);
wherein the transition channel (113) is approximately tangent to the second chamber (112).

2. The dust box according to claim 1, wherein a side wall of the transition channel (113) includes a curved surface.

3. The dust box according to claim 1, wherein an extension length of the transition channel (113) is greater than a minimum thickness of a wall between the first chamber (111) and the second chamber (112).

4. The dust box according to claim 1, further comprising a cyclone separator (13) arranged inside the second chamber (112).

5. The dust box according to any of claims 1 to 4, further comprising:

a base (14);
a bottom cover (15), arranged on the base (14) and forming the first chamber (111) and the second chamber (112) together with the base (14); and
a door body (12), movably arranged on the bottom cover (15) to release or block the first chamber (111) and the second chamber (112).

6. The dust box according to claim 5, wherein the bottom cover (15) is detachably arranged on the base (14).

7. The dust box according to claim 6, further comprising a locking member (16), wherein the locking member (16) is arranged on the base (14) and is movably arranged relative to the bottom cover (15) so as to be disengaged from or connected to the bottom cover (15).

8. The dust box according to claim 5, wherein an avoidance space (141) is arranged on the base (14) and is adjacent to the bottom cover (15).

9. The dust box according to claim 5, wherein a rolling part (151) is arranged on the bottom cover (15) and is rotatably arranged on the bottom cover (15); and a bottom end of the rolling part (151) protrudes from a bottom surface of the bottom cover (15).

10. A cleaning apparatus, comprising the dust box according to any of claims 1 to 9, wherein the cleaning apparatus further comprises a main body (20), and the dust box is arranged on the main body (20).

11. The cleaning apparatus according to claim 10, wherein the dust box is detachably arranged on the main body (20).

12. The cleaning apparatus according to claim 11, wherein at least a part of the dust box is located outside the main body (20).

13. The cleaning apparatus according to claim 10, further comprising a cleaning module (30) arranged on the main body (20), wherein the cleaning module (30) comprises:

a cleaning casing (31);
a first roller brush (32);
a second roller brush (33), wherein the second roller brush (33) and the first roller brush (32) are arranged on the cleaning casing (31) at an interval along a length direction of the cleaning casing (31);
a third roller brush (34), arranged on the cleaning casing (31), wherein the third roller brush (34) and the first roller brush (32) are arranged along a width direction of the cleaning casing (31); and
a fourth roller brush (35), arranged on the cleaning casing (31), wherein the fourth roller brush (35) and the third roller brush (34) are arranged at an interval along the length direction of the cleaning casing (31), and the fourth roller brush (35) and the second roller brush (33) are arranged along the width direction of the cleaning casing (31);
wherein a first gap is formed between the second roller brush (33) and the first roller brush (32), a second gap is formed between the fourth

roller brush (35) and the third roller brush (34), and the first gap and the second gap are staggered.

14. The cleaning apparatus according to claim 13, wherein a length of the first roller brush (32) is less than a length of the second roller brush (33), and a length of the third roller brush (34) is greater than a length of the fourth roller brush (35). 5
15. The cleaning apparatus according to claim 14, wherein at least one of the first roller brush (32), the second roller brush (33), the third roller brush (34) and the fourth roller brush (35) is of a conical structure. 10
16. The cleaning apparatus according to claim 15, wherein an axis of the second roller brush (33) is not parallel to an axis of the first roller brush (32), and/or an axis of the fourth roller brush (35) is not parallel to an axis of the third roller brush (34). 15
17. The cleaning apparatus according to claim 16, wherein a first end portion of the conical structure is connected to the cleaning casing (31), and a second end portion of the conical structure is a cantilever end; and a diameter of the first end portion is greater than a diameter of the second end portion. 20
18. The cleaning apparatus according to any one of claims 13 to 17, wherein the first roller brush (32), the second roller brush (33), the third roller brush (34) and the fourth roller brush (35) rotate synchronously. 25
19. The cleaning apparatus according to claim 18, wherein rotation directions of the first roller brush (32) and the second roller brush (33) are opposite to rotation directions of the third roller brush (34) and the fourth roller brush (35). 30
20. The cleaning apparatus according to claim 19, wherein the cleaning module further comprises a driving structure (36), wherein the driving structure (36) comprises a power part (361) and a transmission assembly, and the power part (361) drives the first roller brush (32), the second roller brush (33), the third roller brush (34) and the fourth roller brush (35) to rotate synchronously through the transmission assembly. 35
21. The cleaning apparatus according to any one of claims 13 to 20, wherein at least one of the second roller brush (33) and the first roller brush (32) is detachably arranged on the cleaning casing (31). 40
22. The cleaning apparatus according to claim 21, wherein the second roller brush (33) is movably ar- 45

ranged along an axis direction of the second roller brush (33) so as to be detachable from the cleaning casing (31).

23. The cleaning apparatus according to claim 22, wherein the cleaning module further comprises:
a main body support (331), arranged on the cleaning casing (31);
an adapter (332), wherein the second roller brush (33) is connected to the adapter (332), and the adapter (332) is movably arranged relative to the main body support (331) to have a first position in which the adapter (332) is connected to the main body support (331) and a second position in which the adapter (332) is disengaged from the main body support (331); and
an elastic member (334), connected to the adapter (332) and arranged along the axis direction of the second roller brush (33);
wherein, when the second roller brush (33) moves along the axis direction of the second roller brush (33) with the adapter (332) and compresses the elastic member (334), the adapter (332) moves from the first position to the second position and the adapter (332) is rotated, so that the second roller brush (33) is able to be disengaged from the main body support (331) along the axis direction of the second roller brush (33) with the adapter (332). 50
24. The cleaning apparatus according to claim 23, wherein the main body support (331) is provided with a clamping slot (3311), the adapter (332) is provided with a buckle (333), and the buckle (333) is able to be disengaged from the clamping slot (3311) when the adapter (332) moves from the first position to the second position; and the adapter (332) is rotated to cause the buckle (333) to be disengaged from the clamping slot (3311) when the adapter (332) is located at the second position. 55
25. A cleaning system, comprising the cleaning apparatus according to any one of claims 10 to 24 and further comprising a cleaning base station.

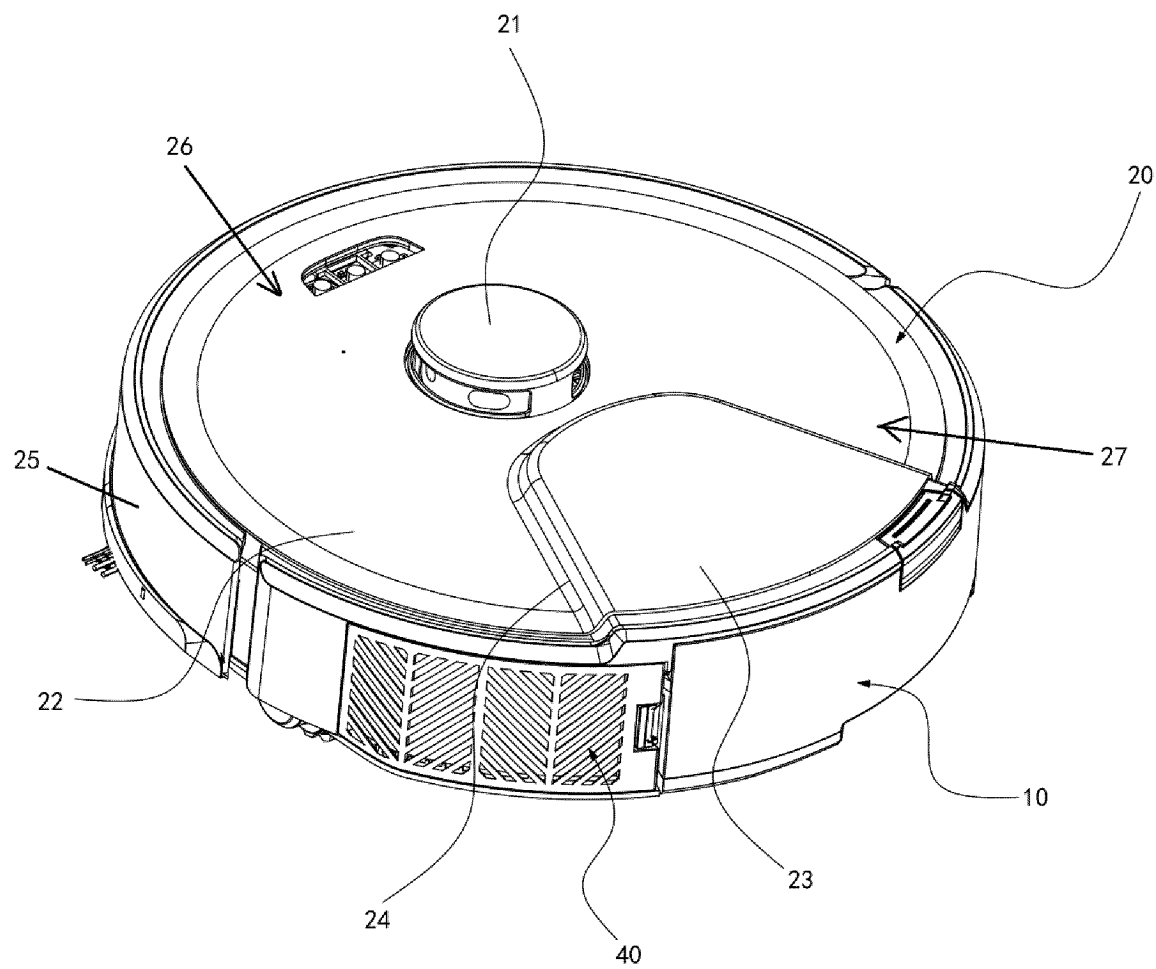


FIG. 1

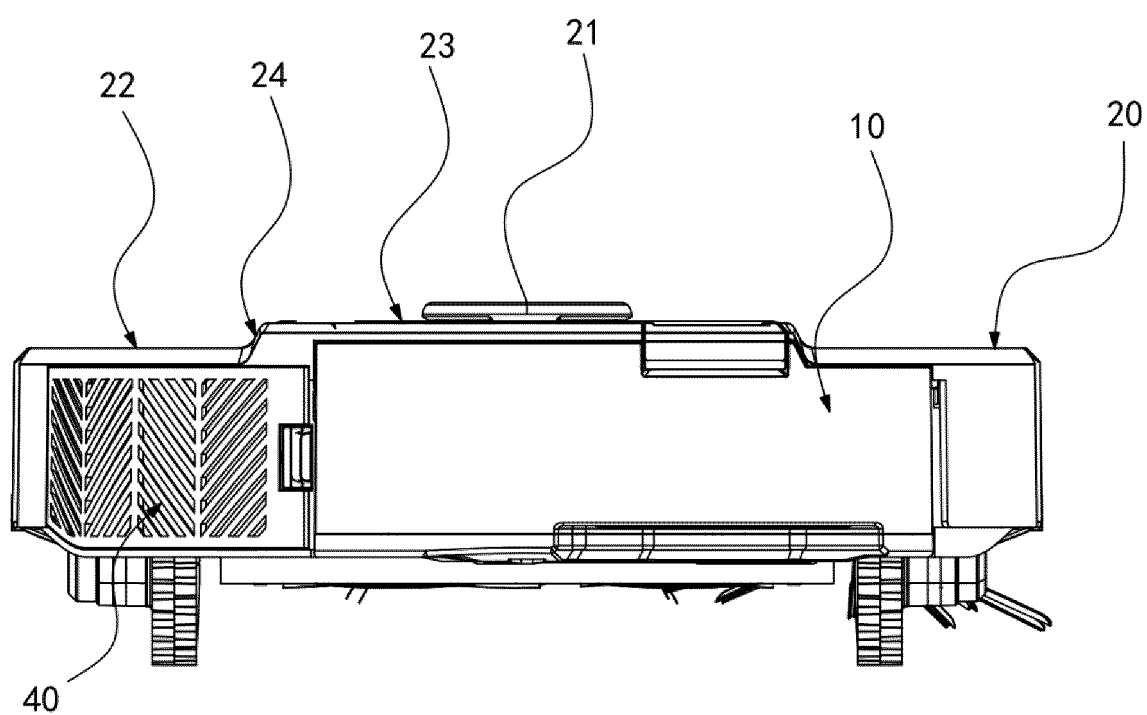


FIG. 2

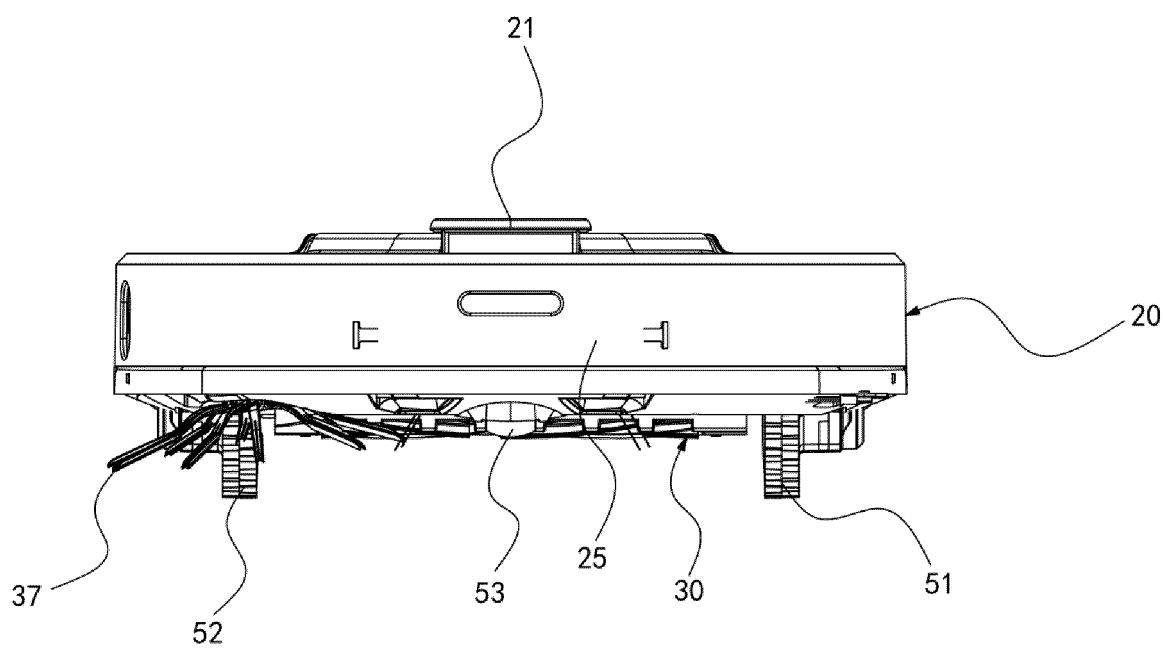


FIG. 3

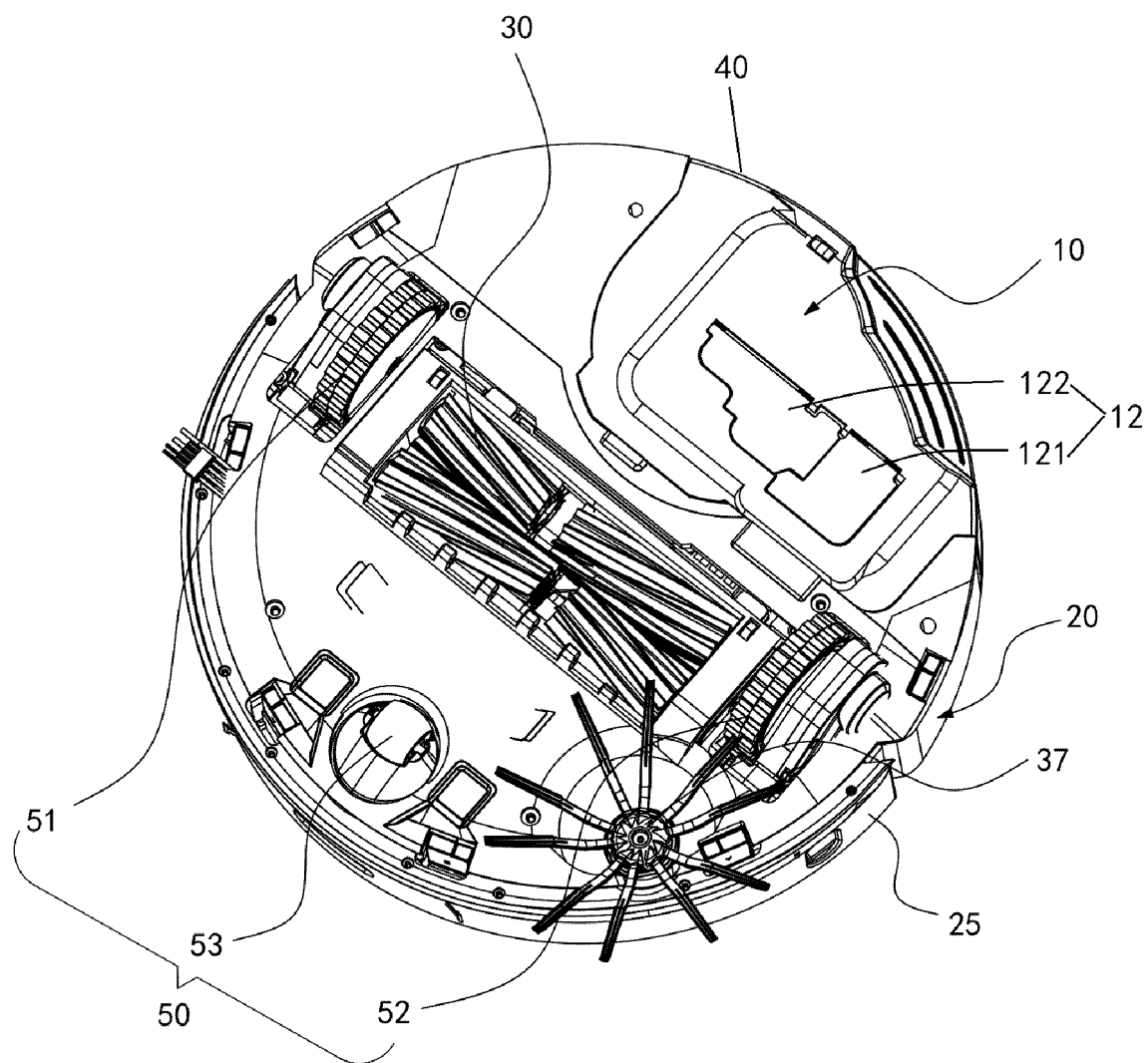


FIG. 4

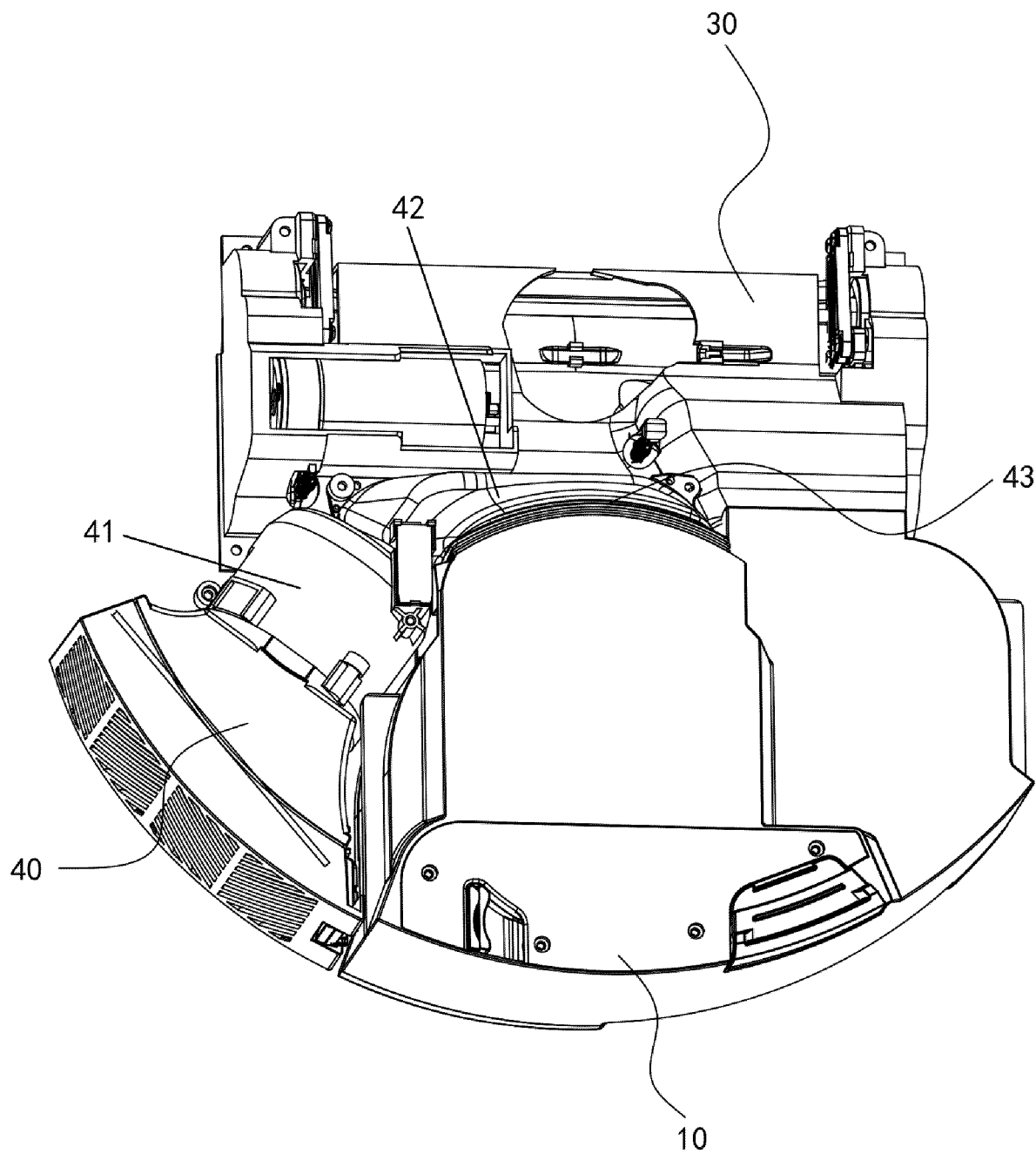


FIG. 5

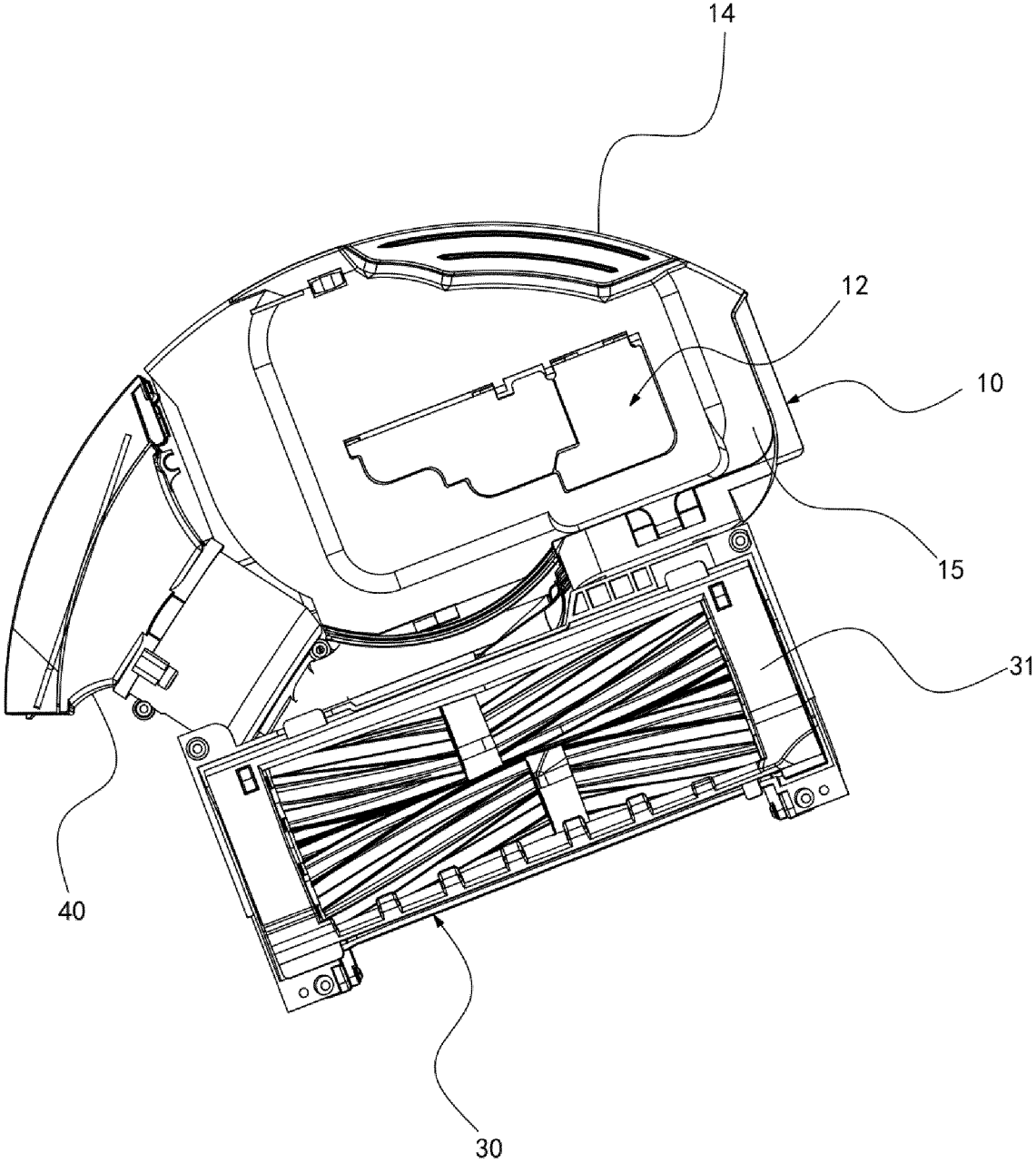


FIG. 6

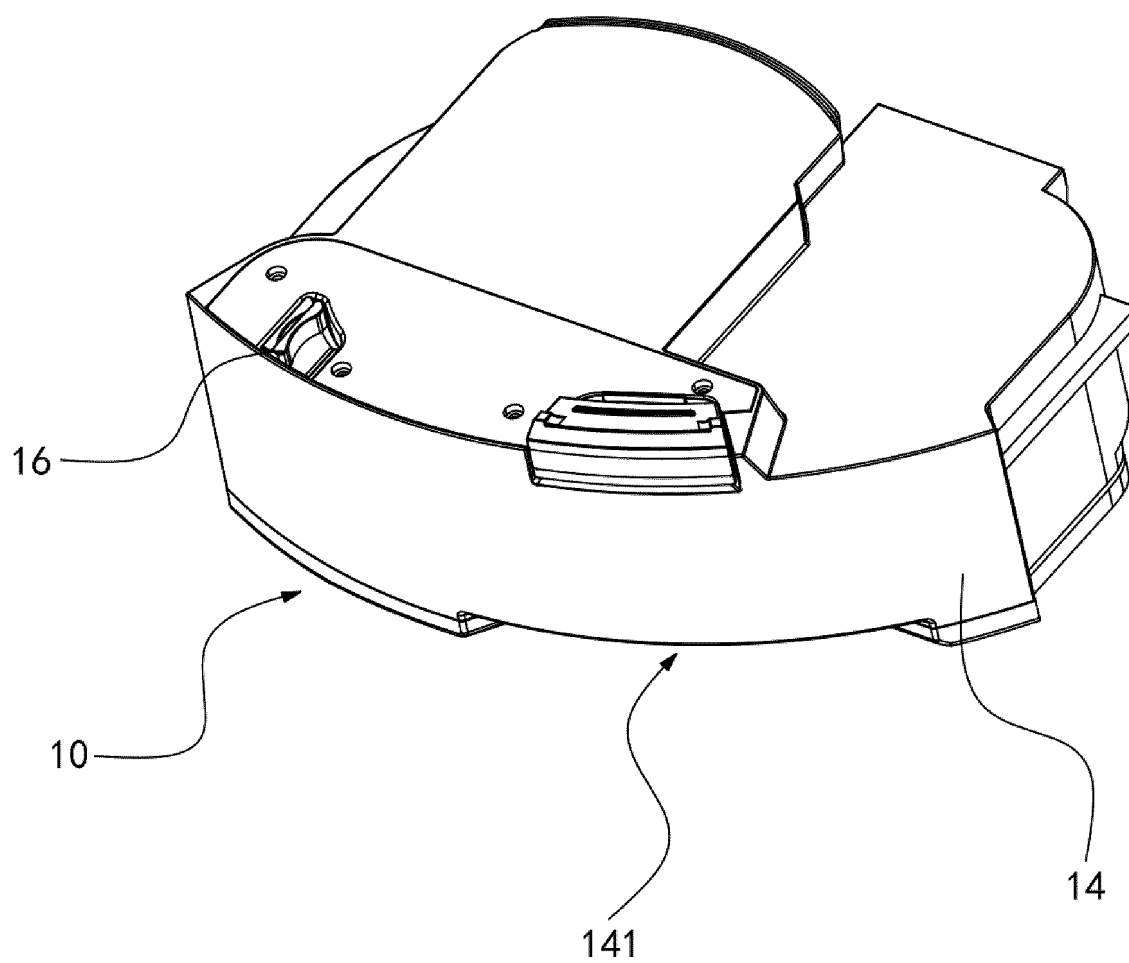


FIG. 7

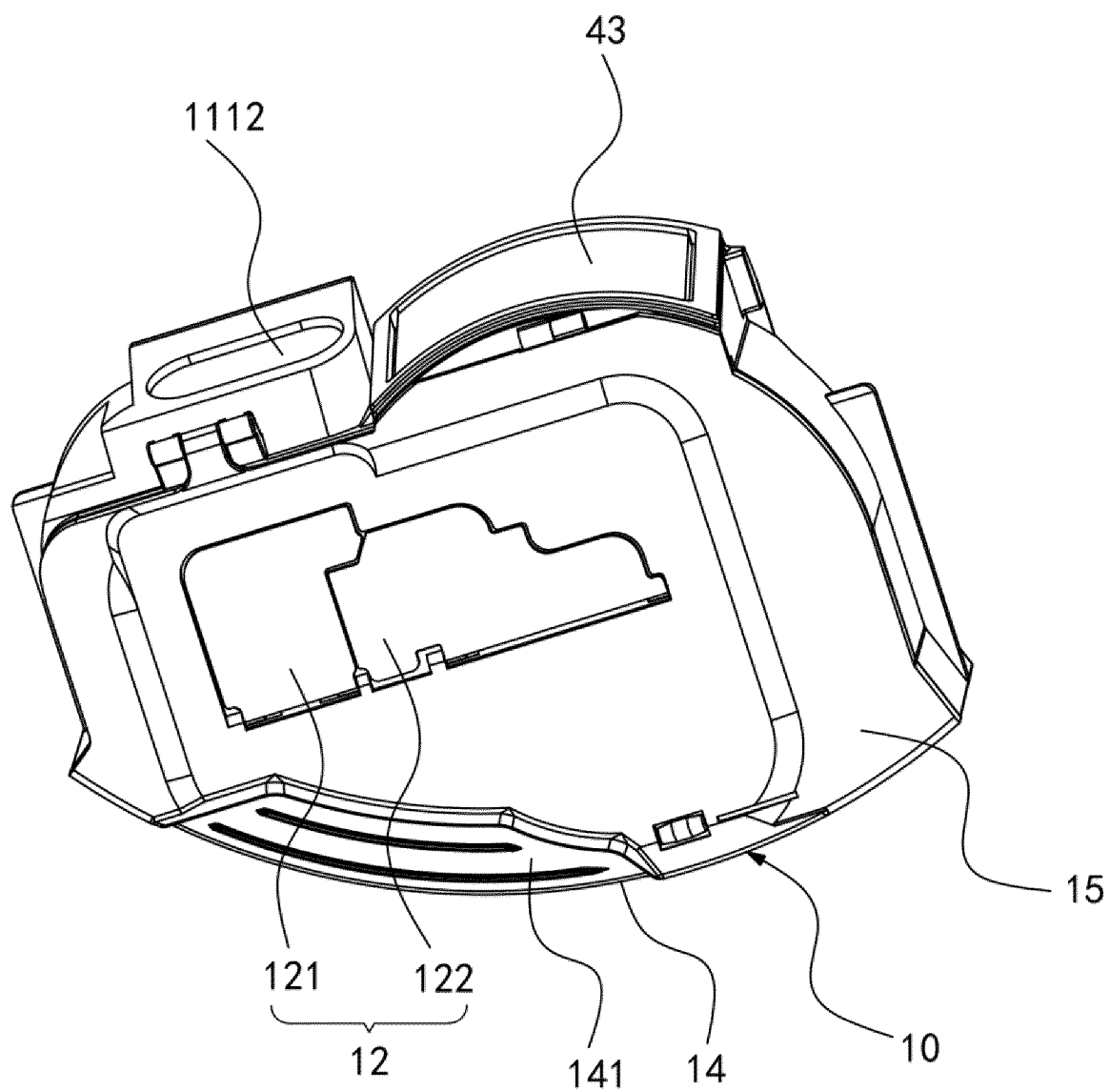


FIG. 8

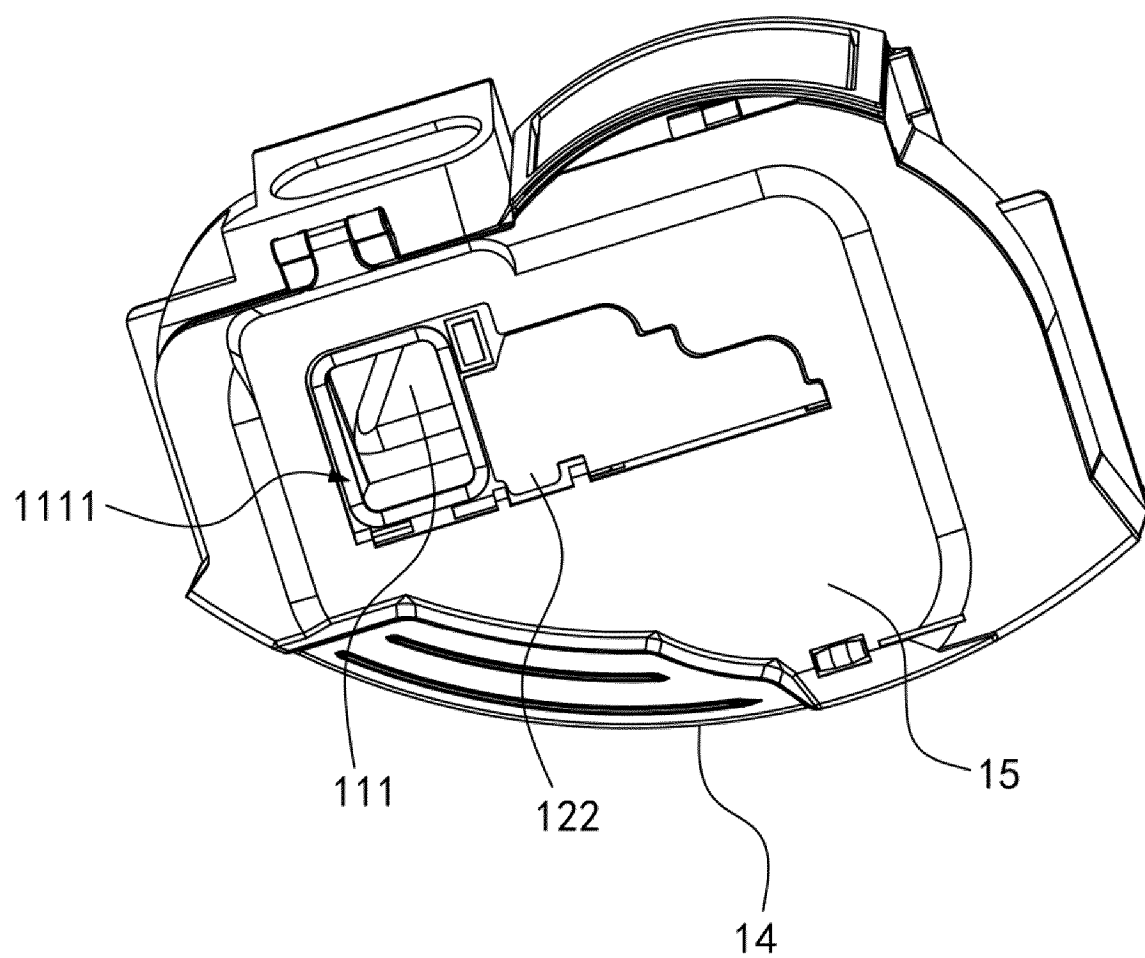


FIG. 9

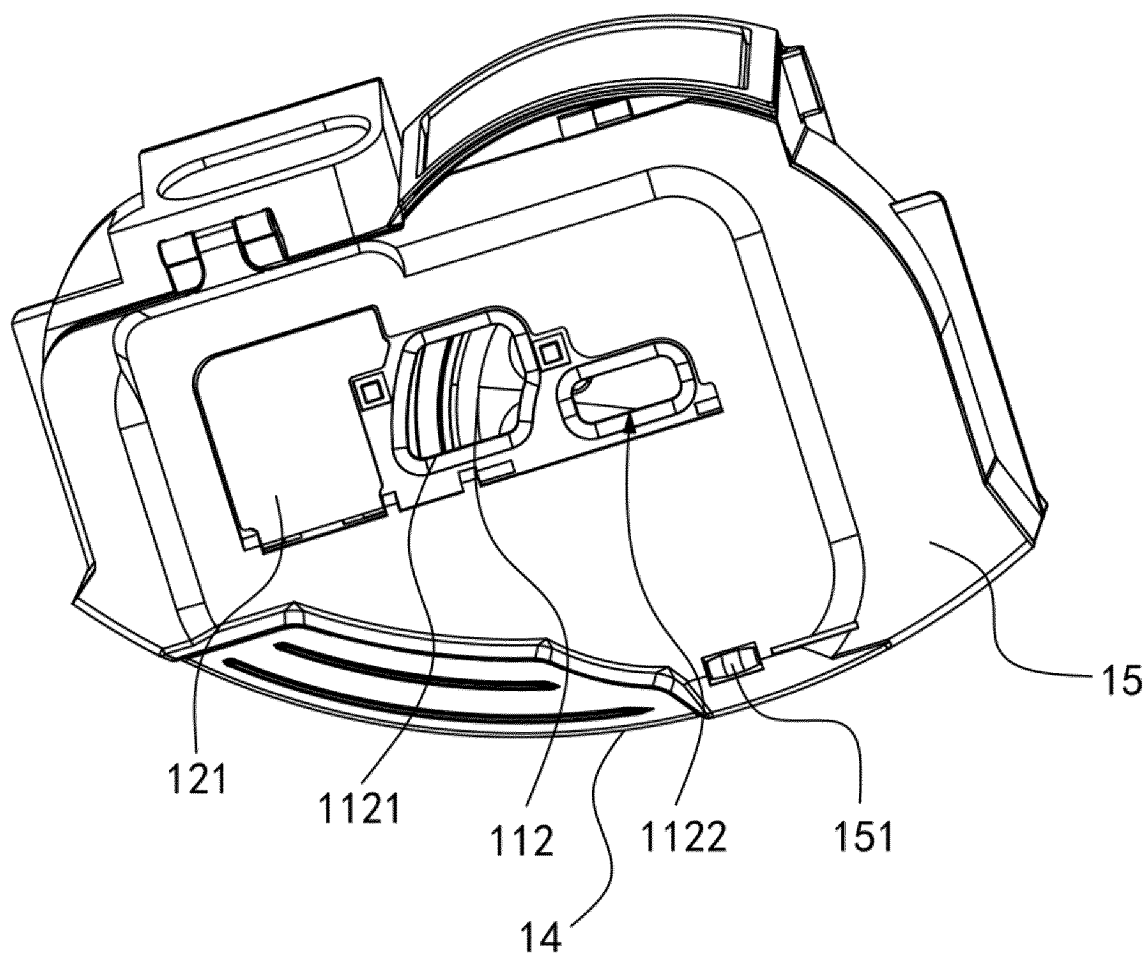


FIG. 10

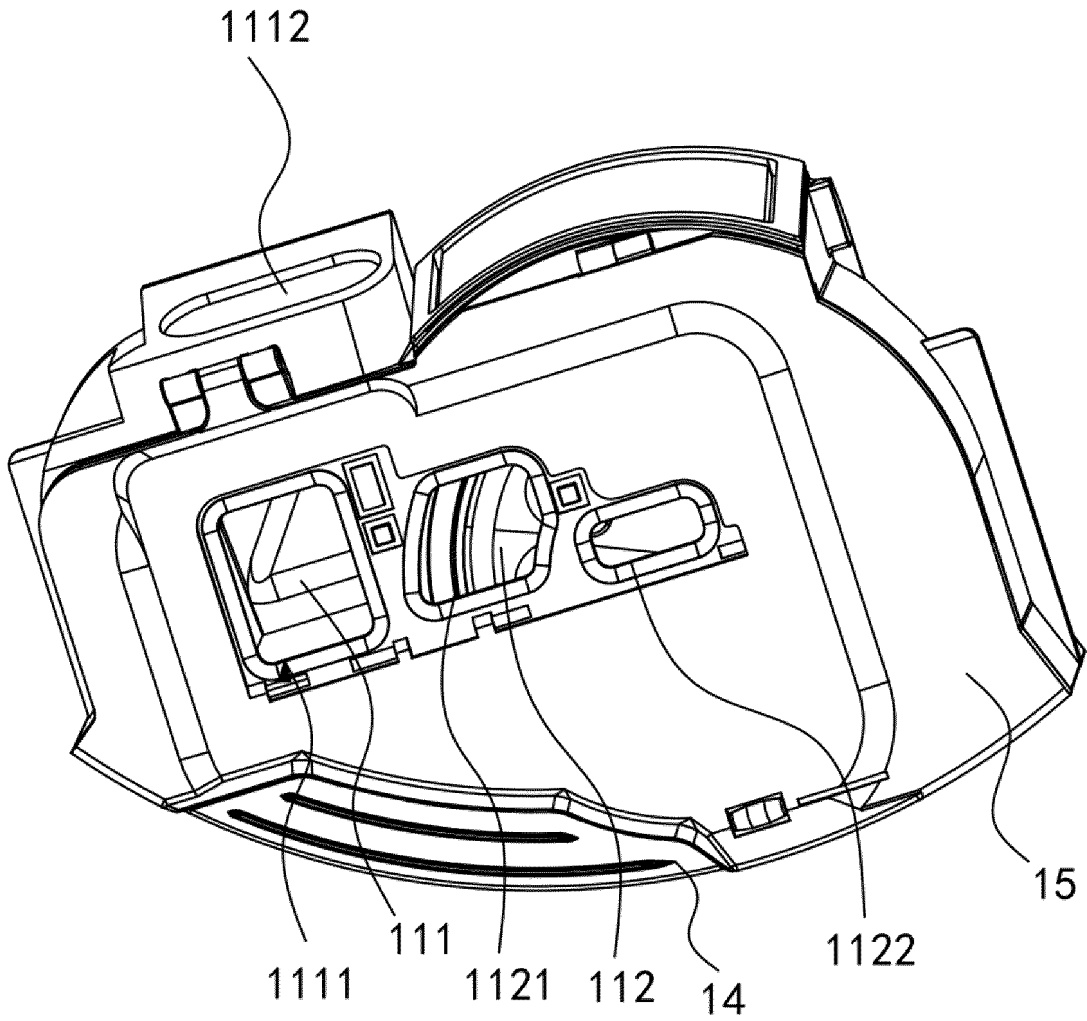


FIG. 11

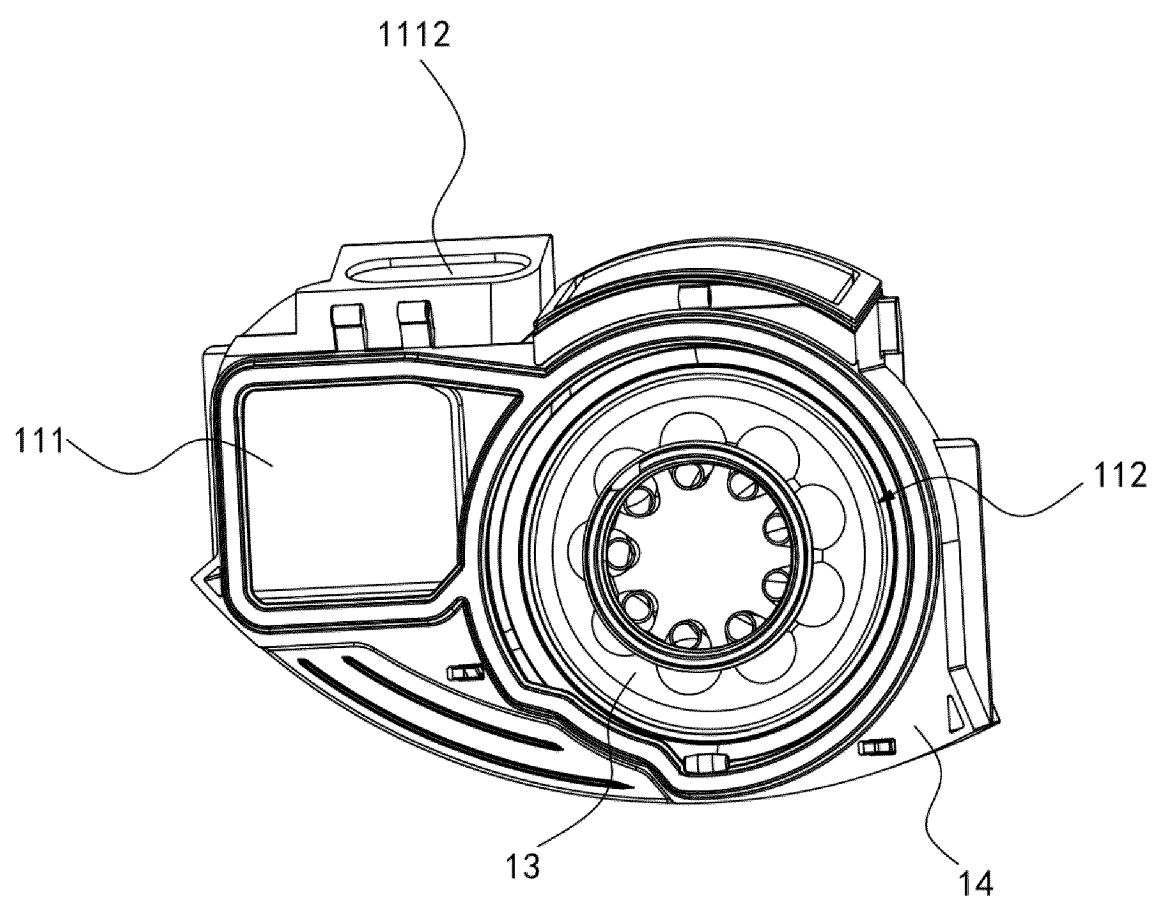


FIG. 12

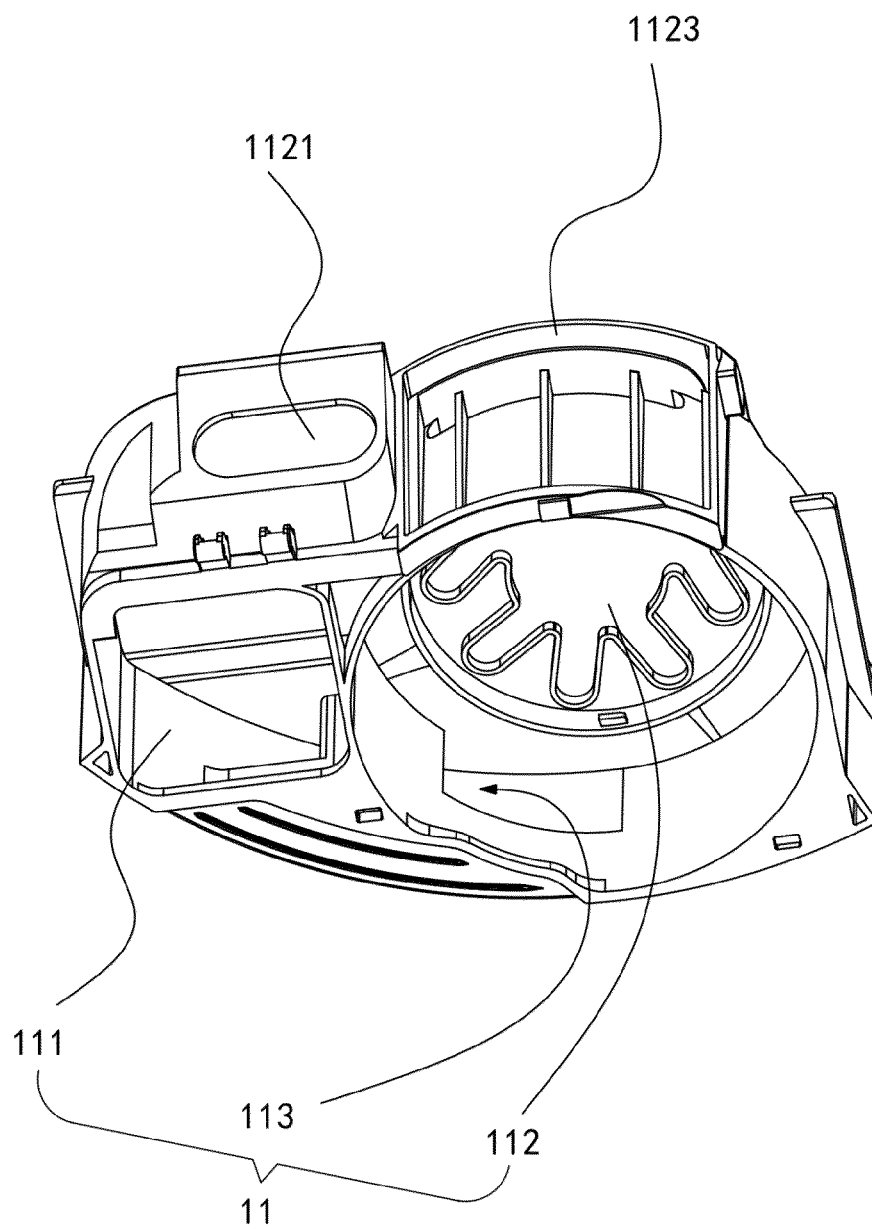


FIG. 13

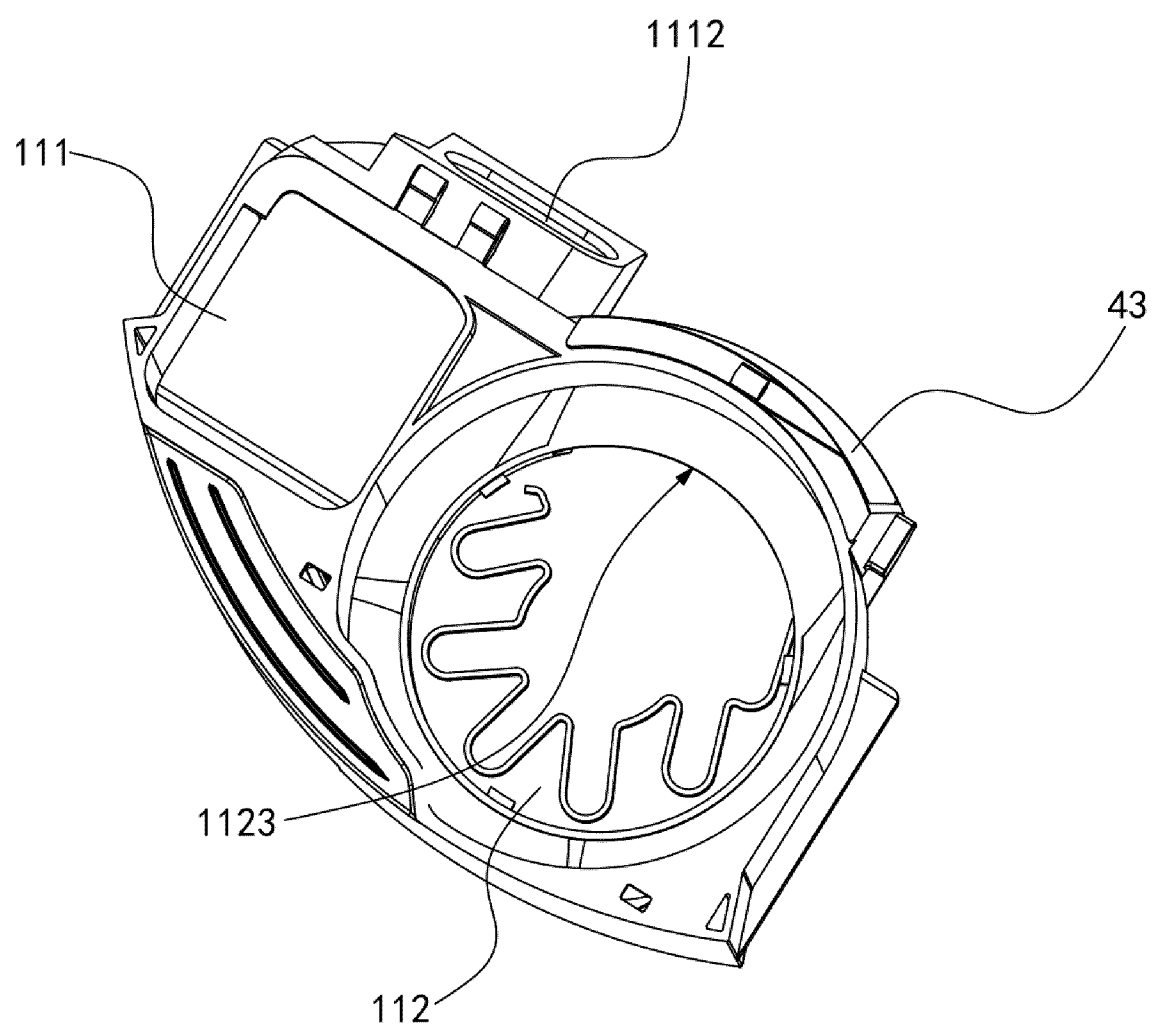


FIG. 14

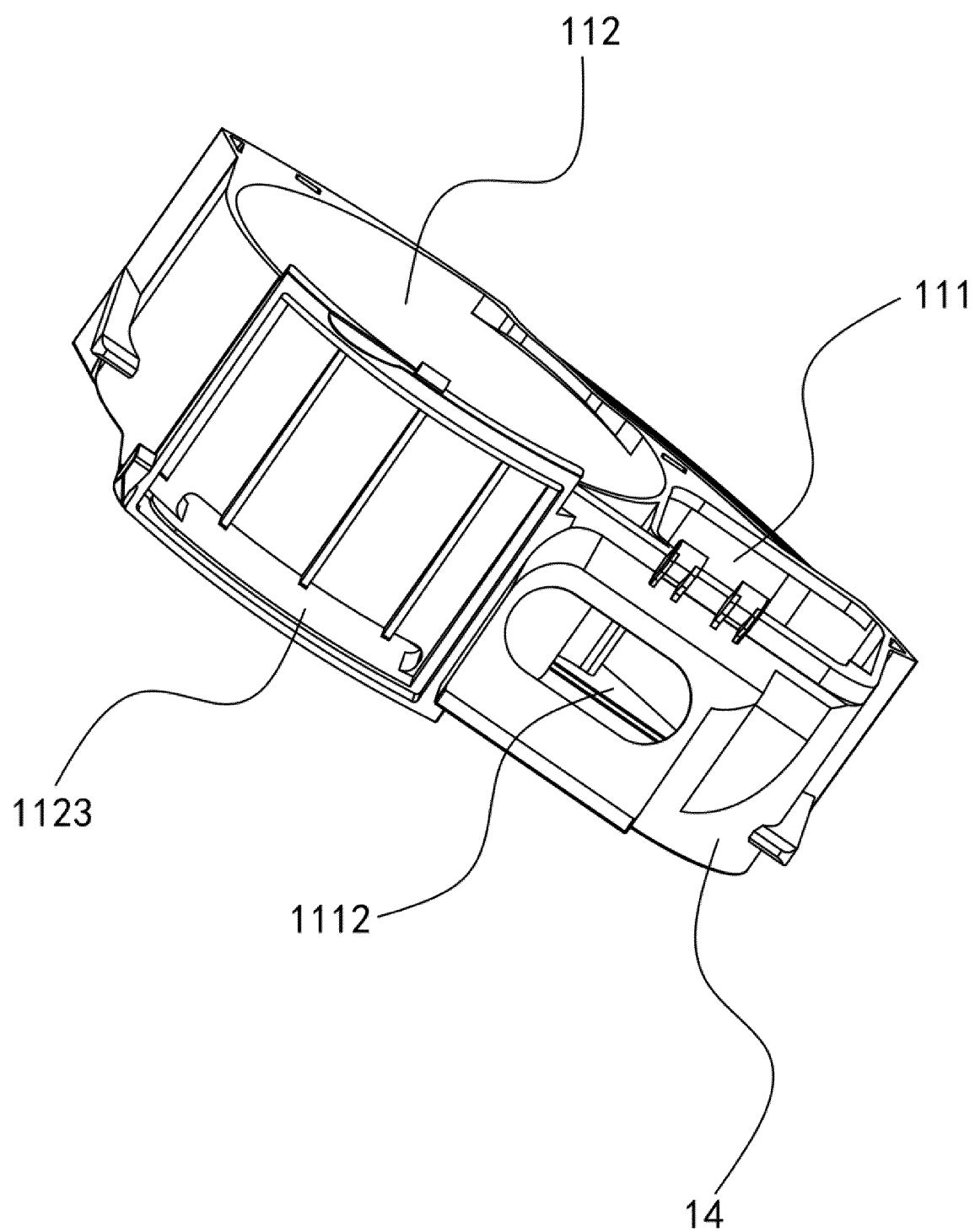


FIG. 15

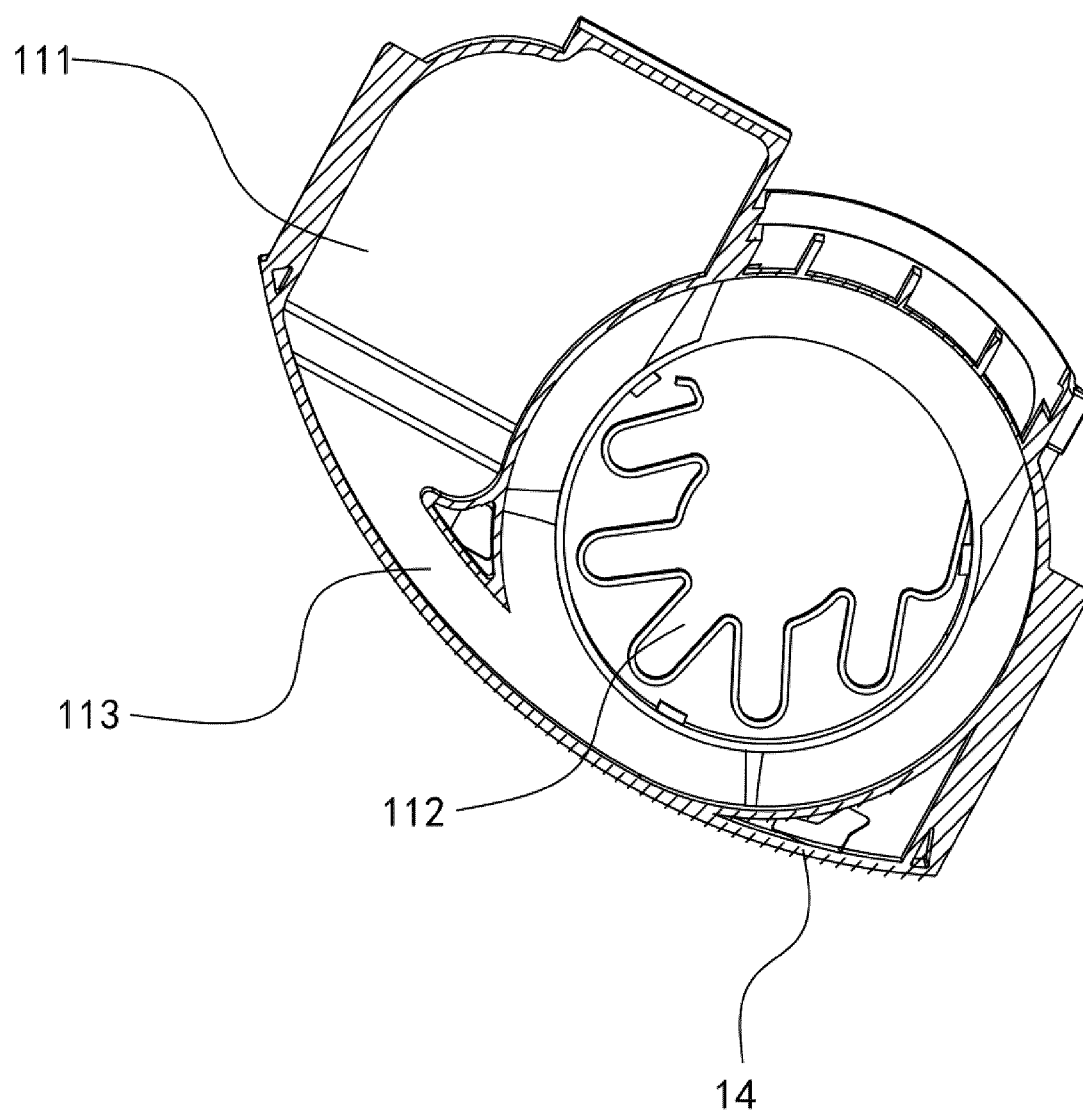


FIG. 16

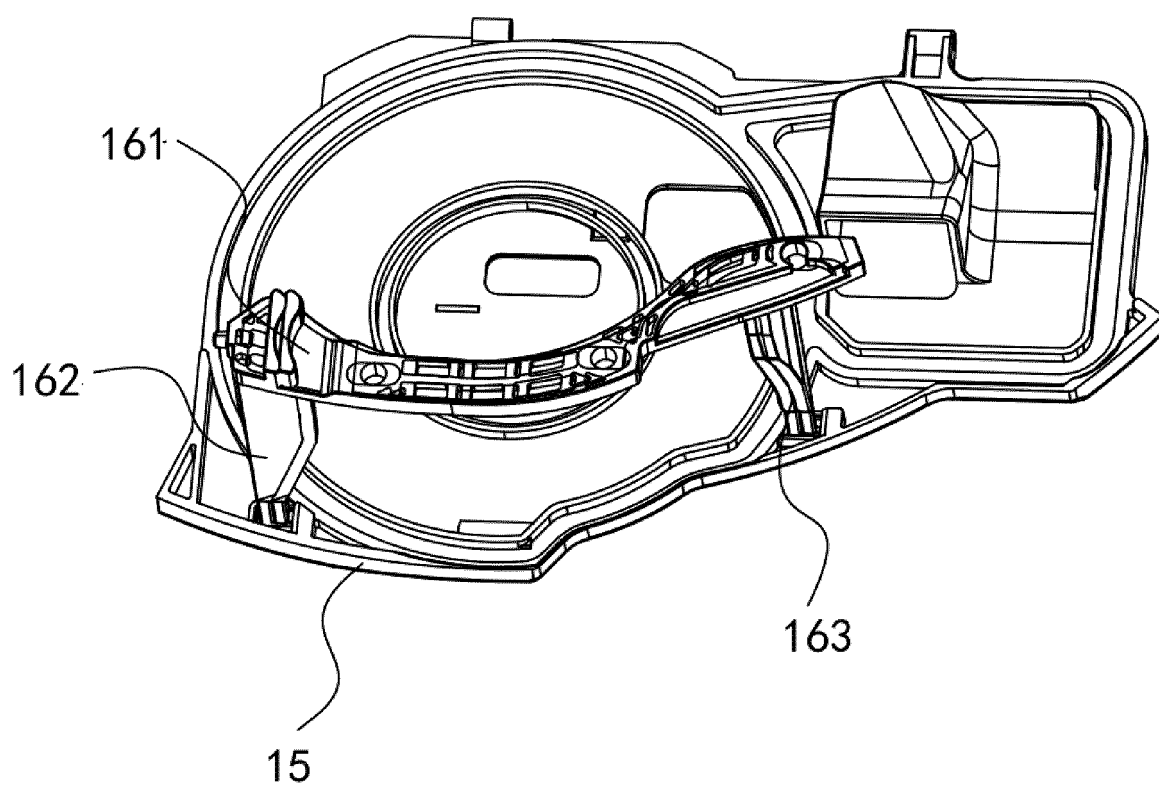


FIG. 17

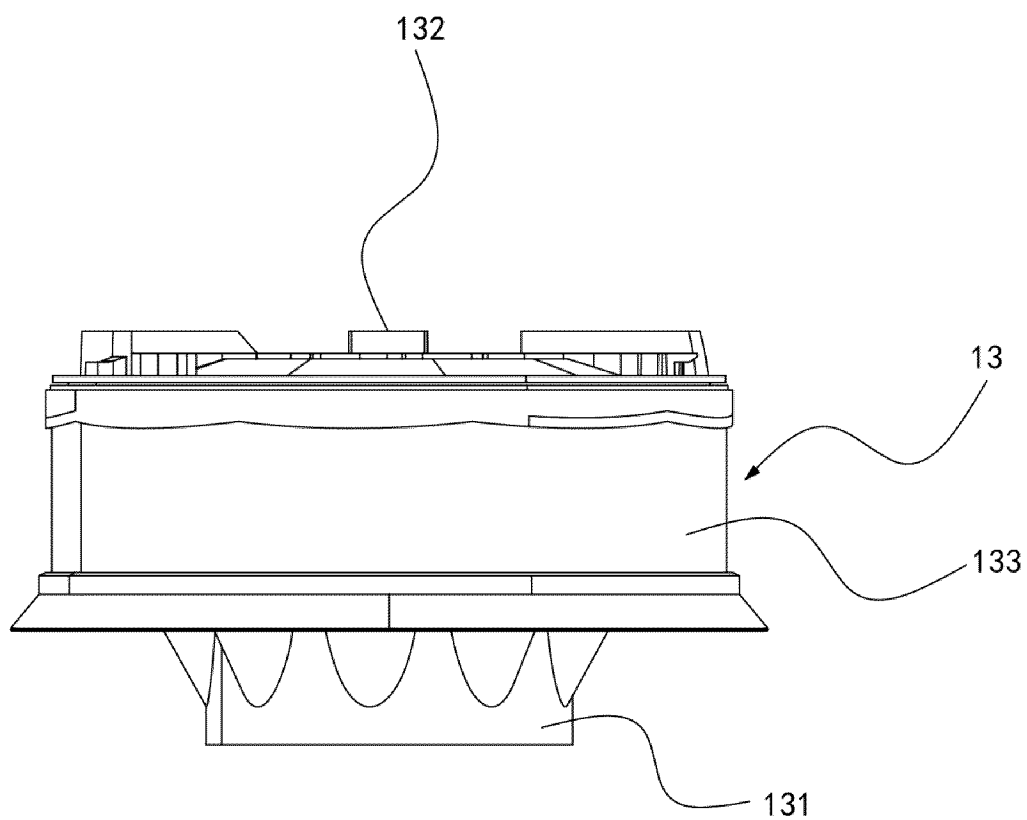


FIG. 18

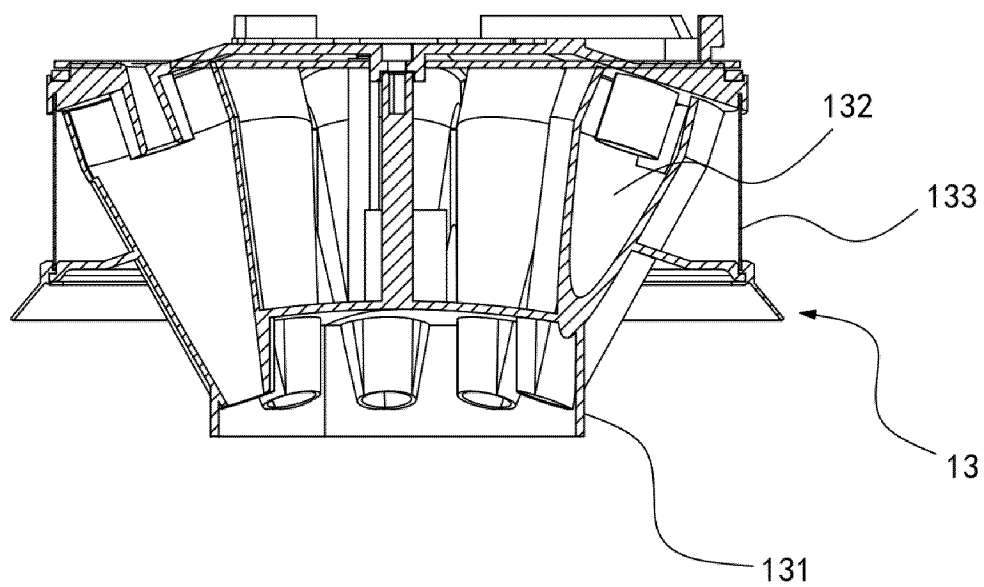


FIG. 19

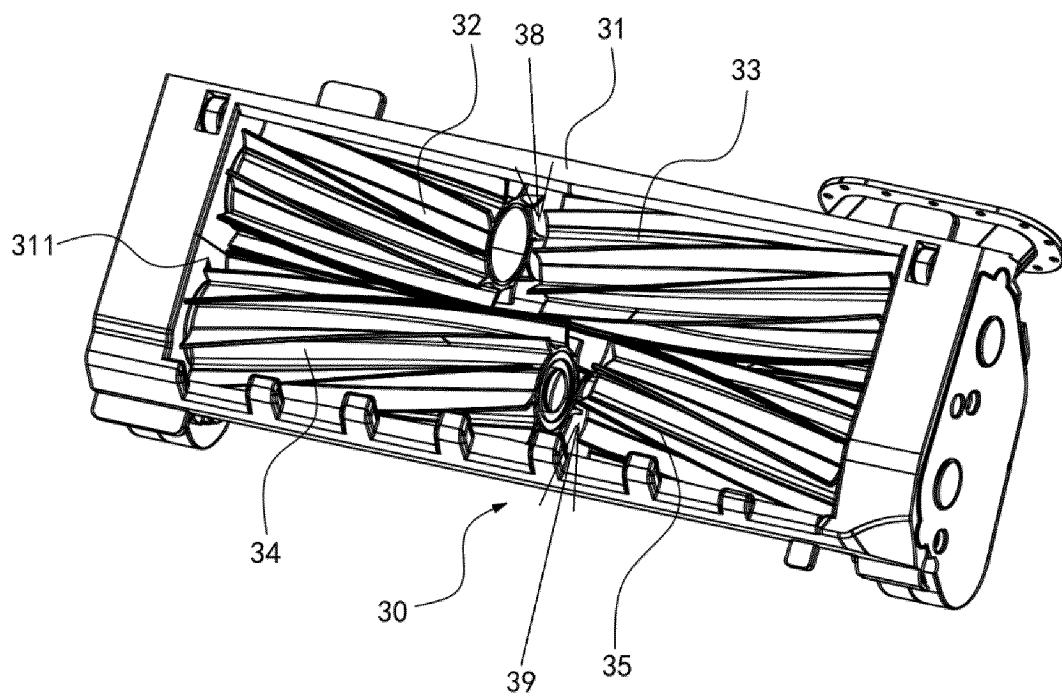


FIG. 20A

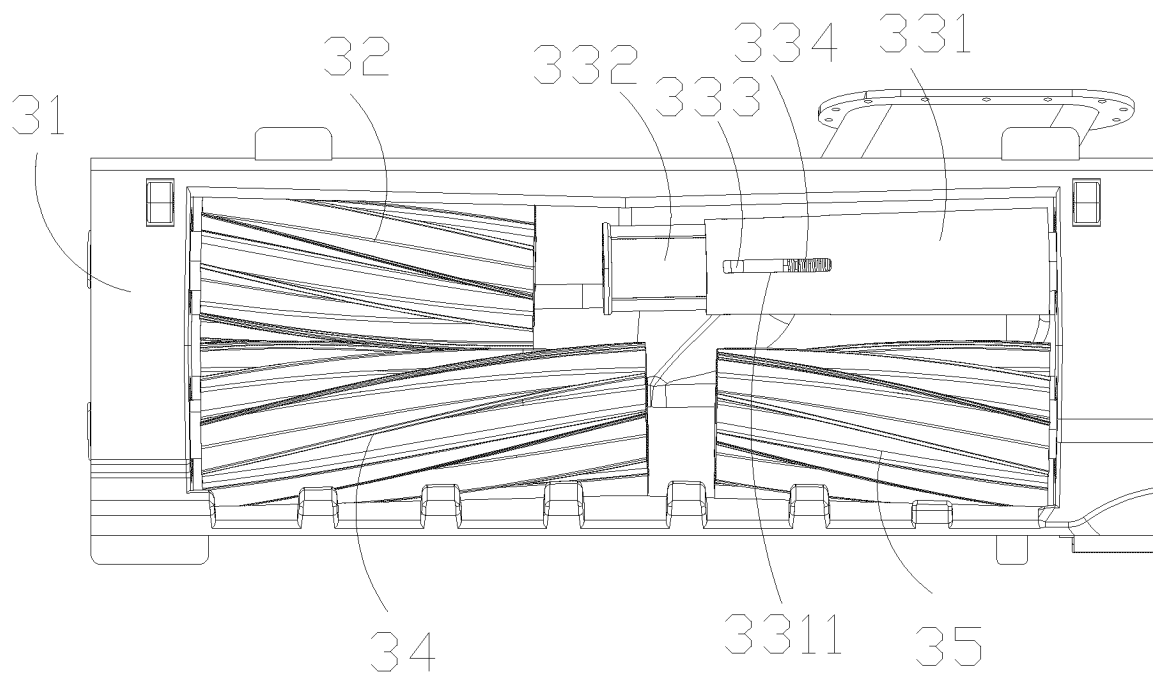


FIG. 20B

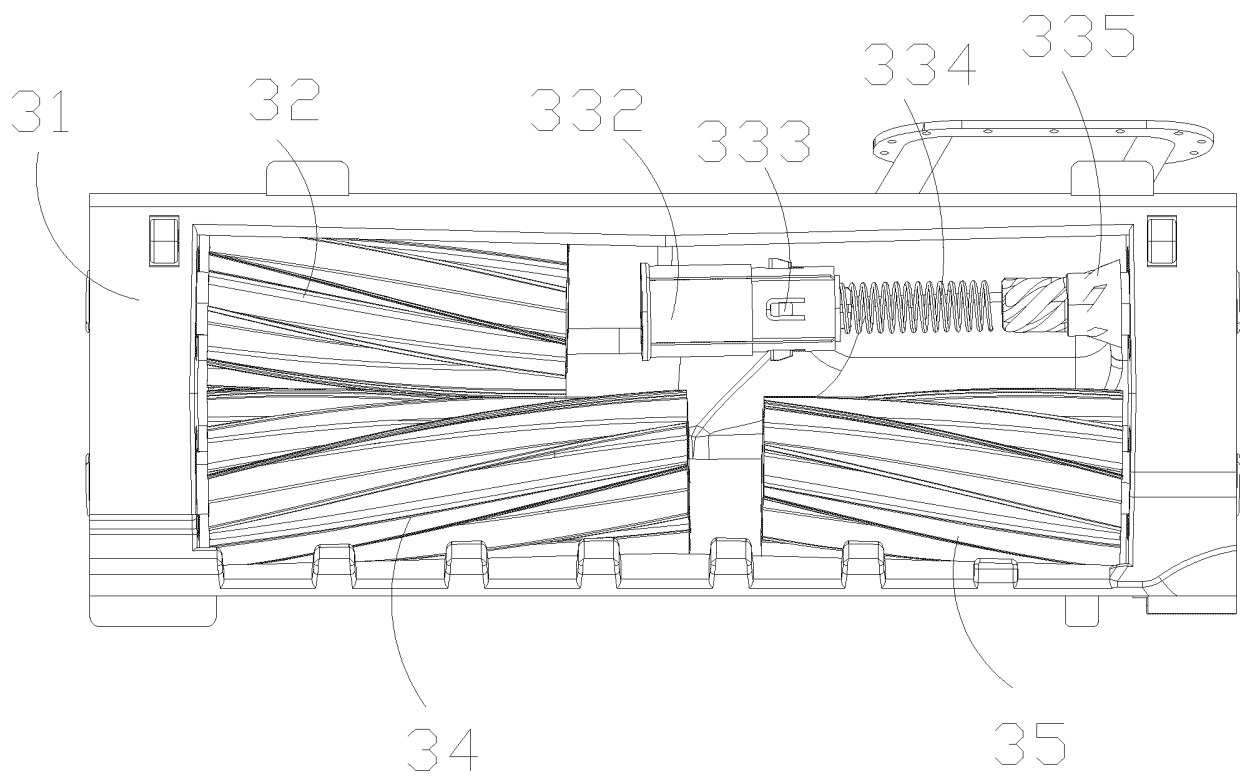


FIG. 20C

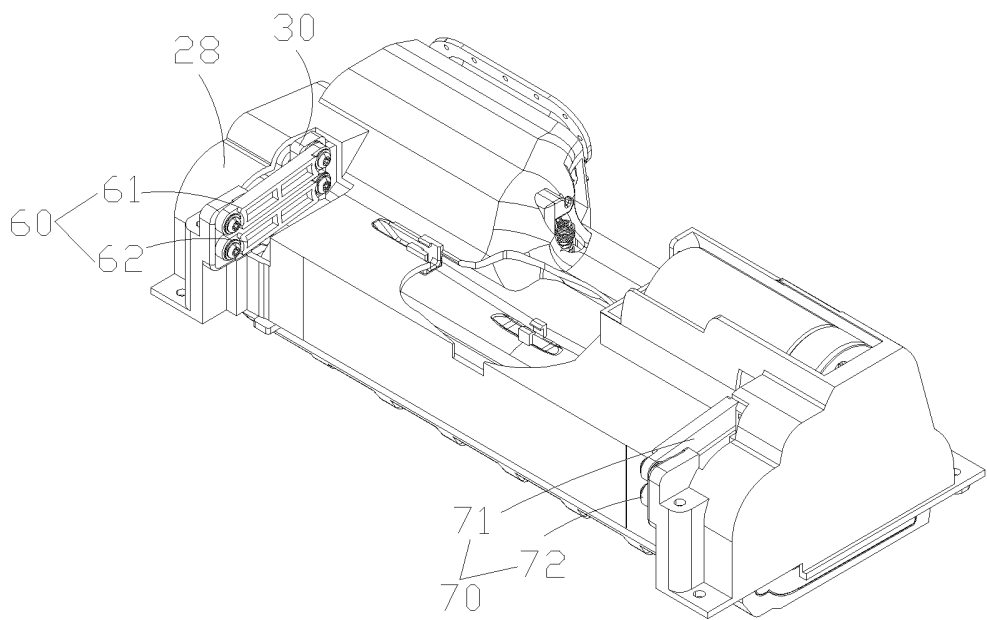


FIG. 20D

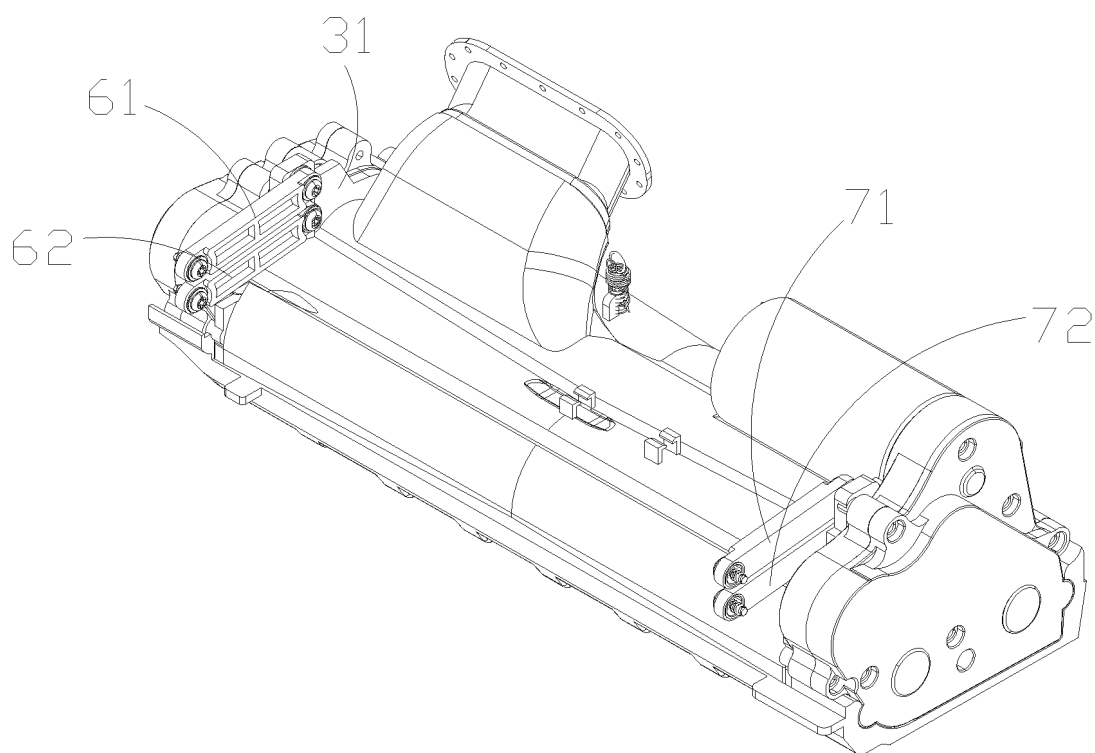


FIG. 20E

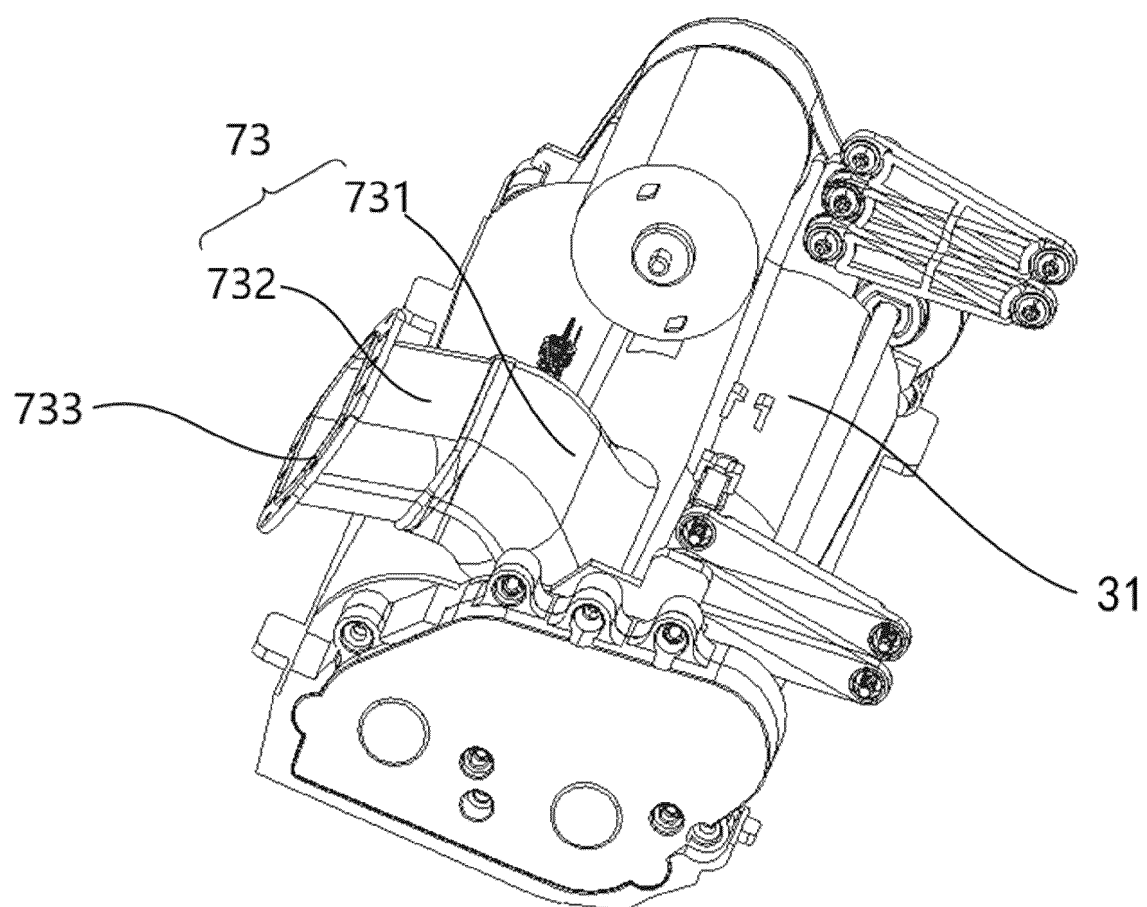


FIG. 20F

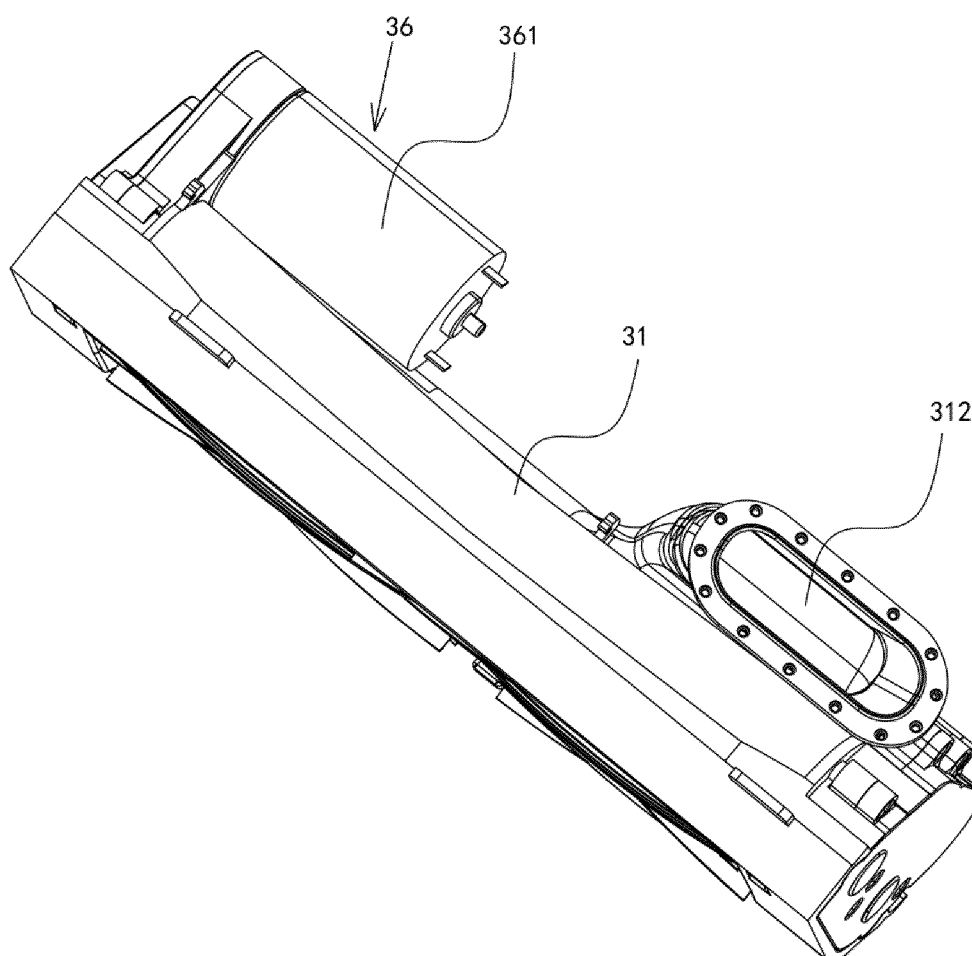


FIG. 21

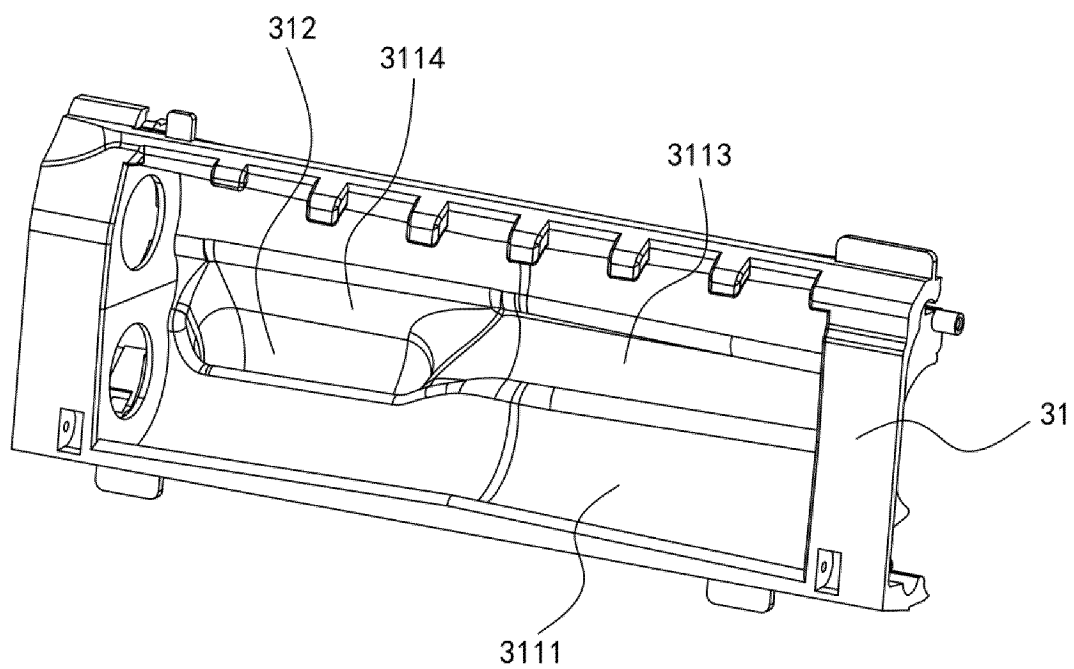


FIG. 22

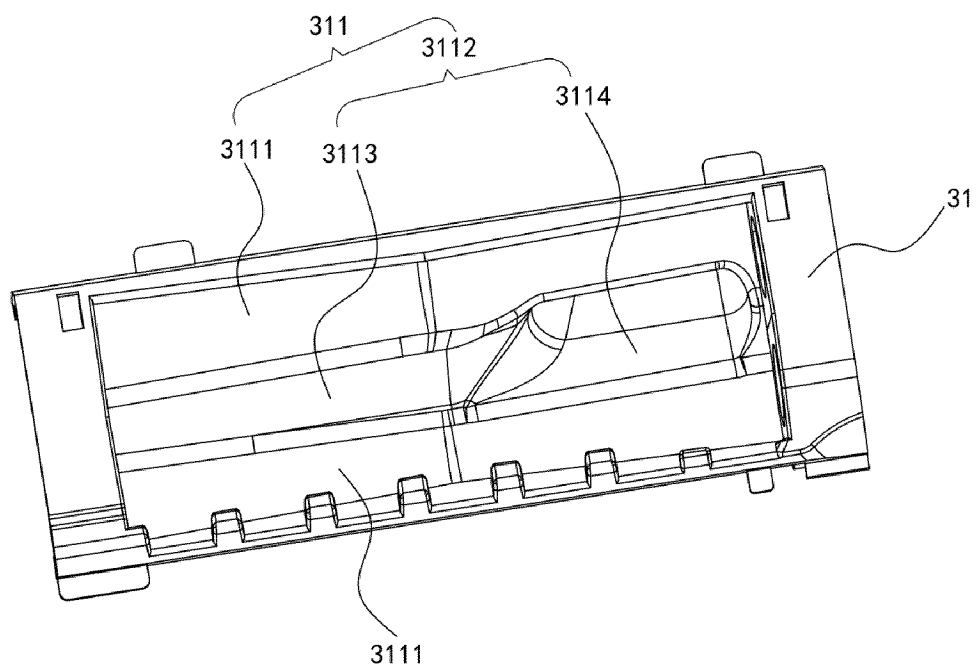


FIG. 23

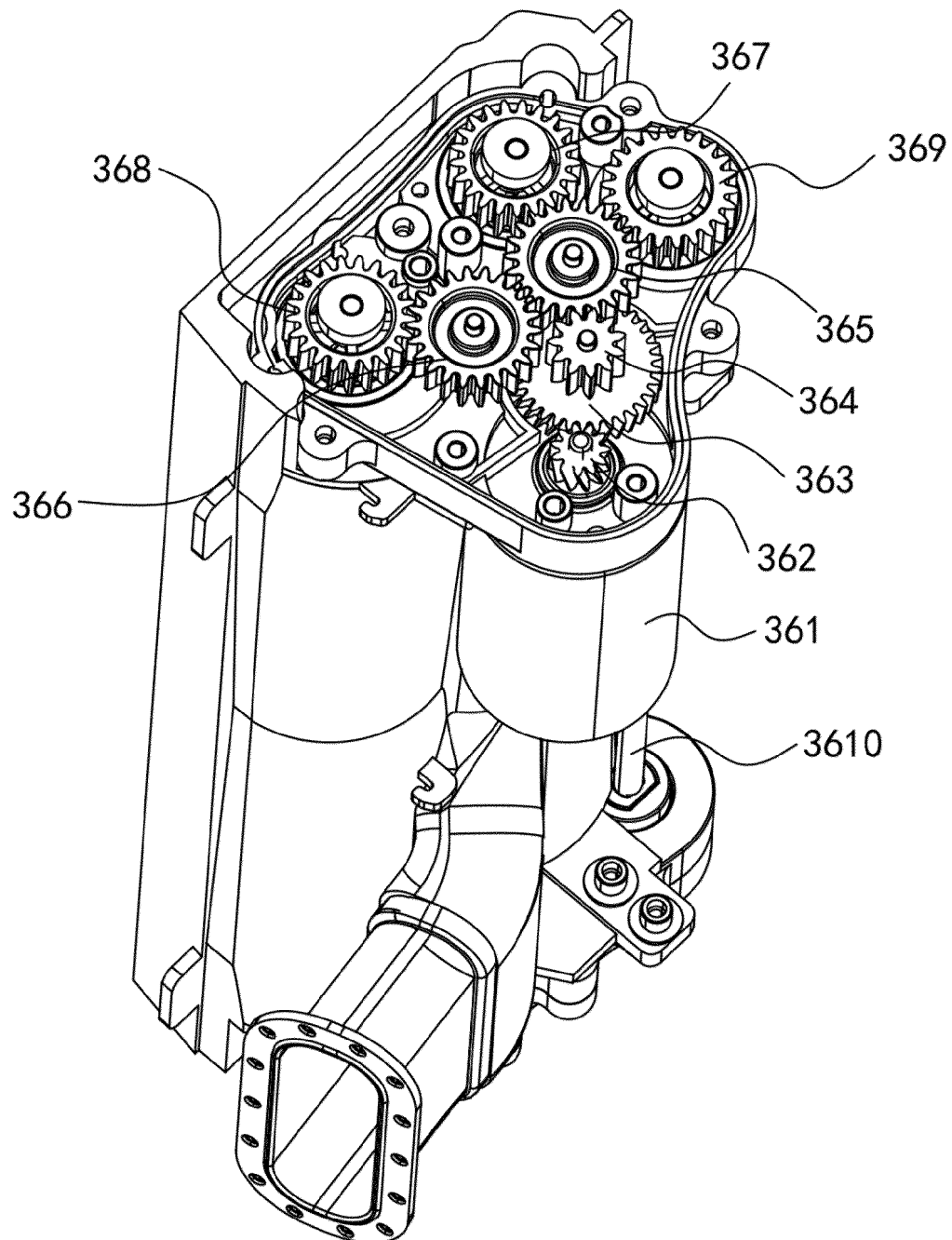


FIG. 24

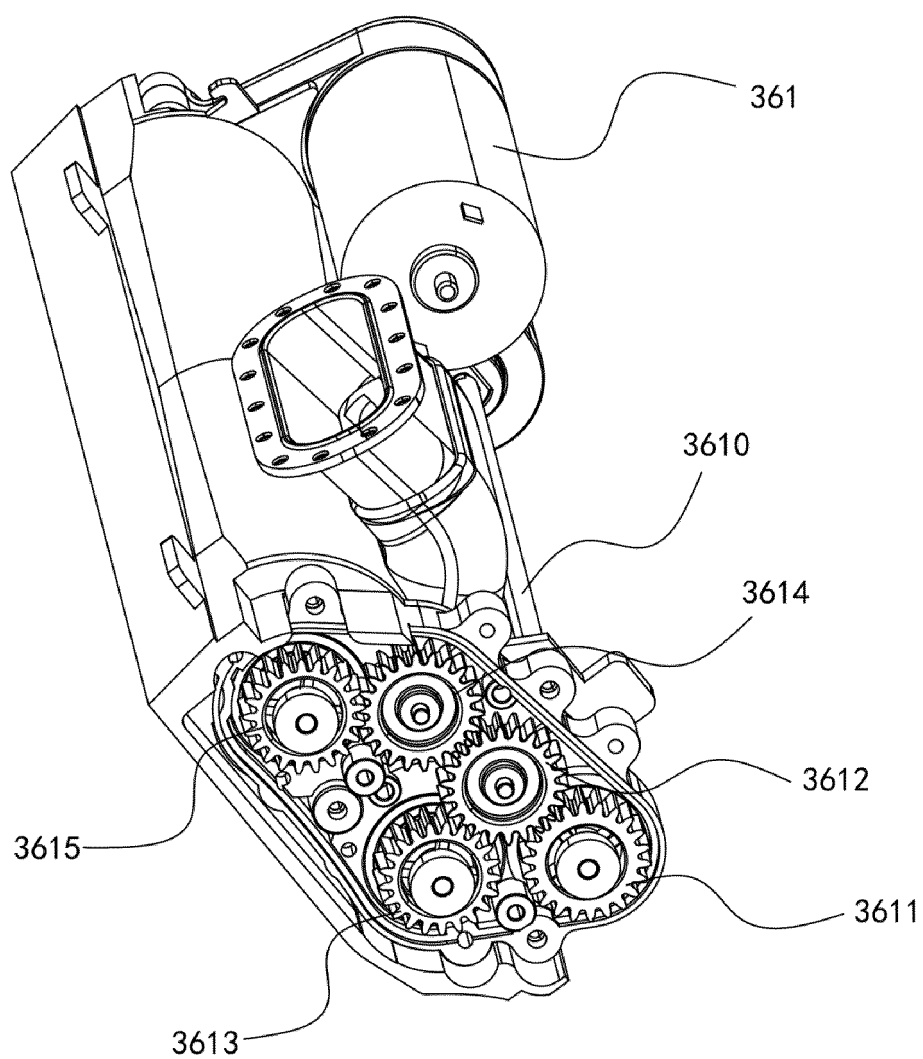


FIG. 25

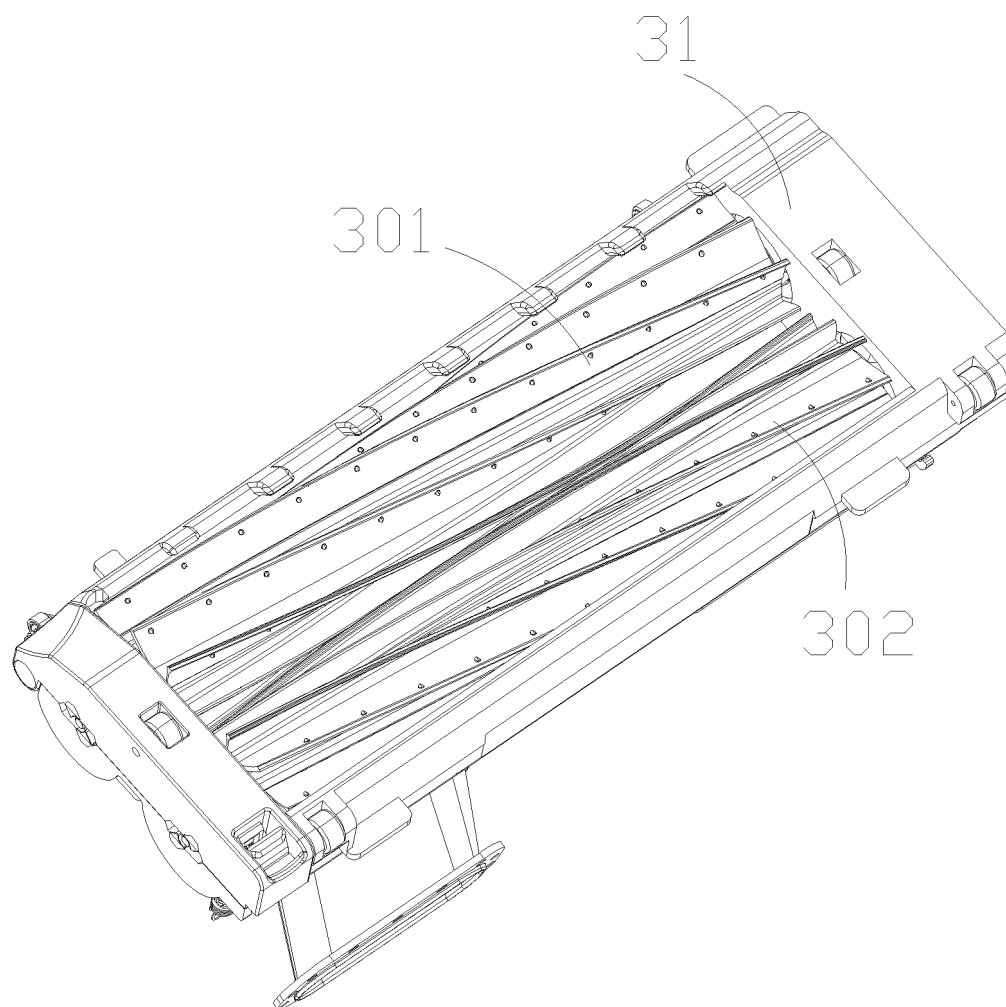


FIG. 26

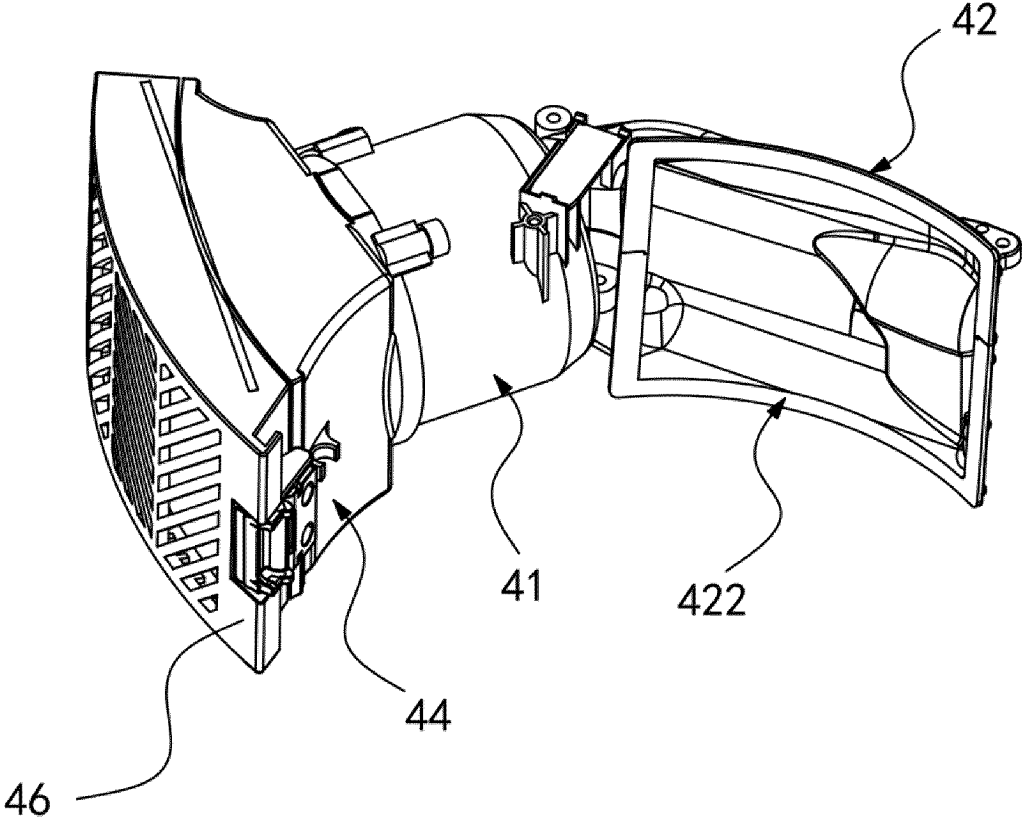


FIG. 27A

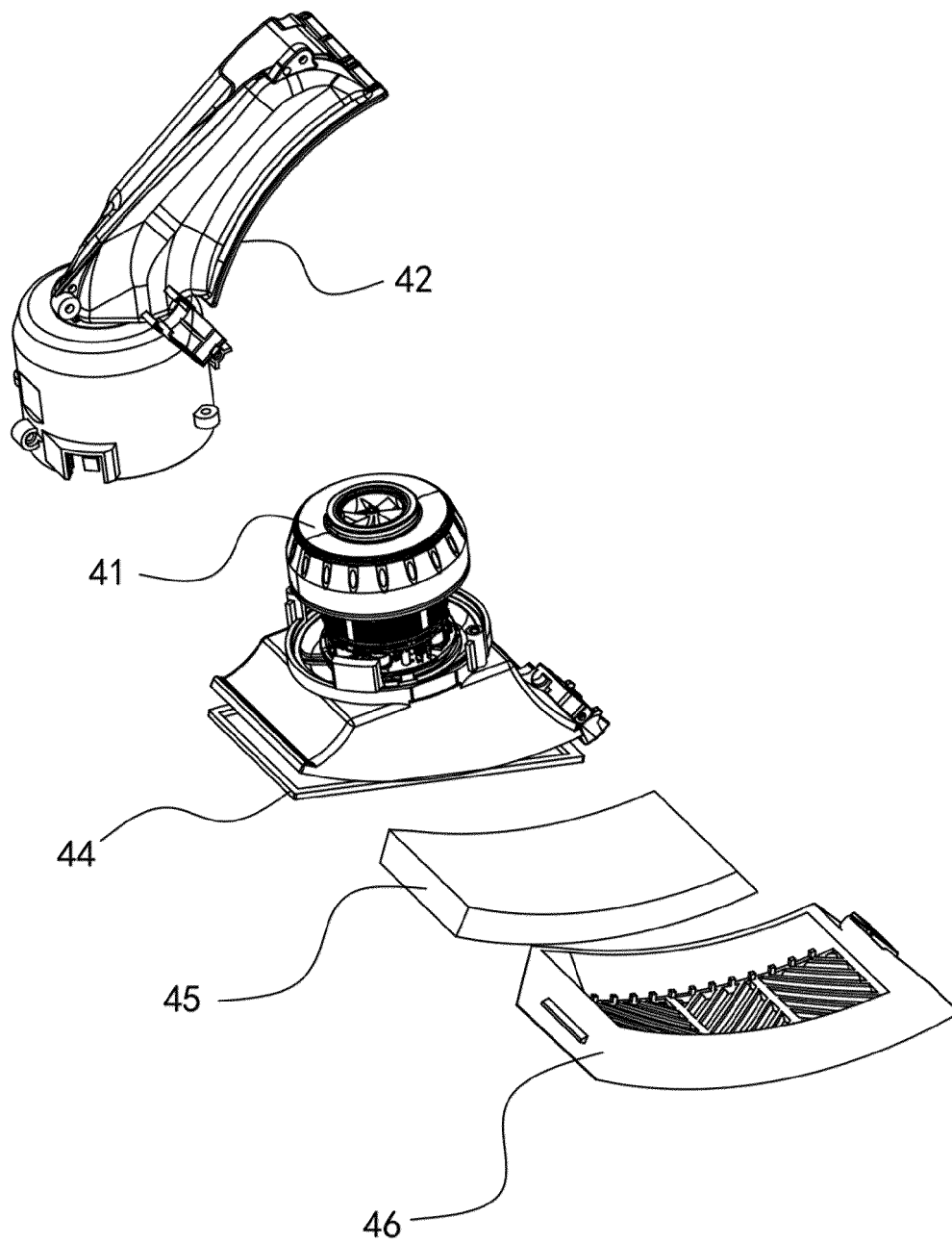


FIG. 27B

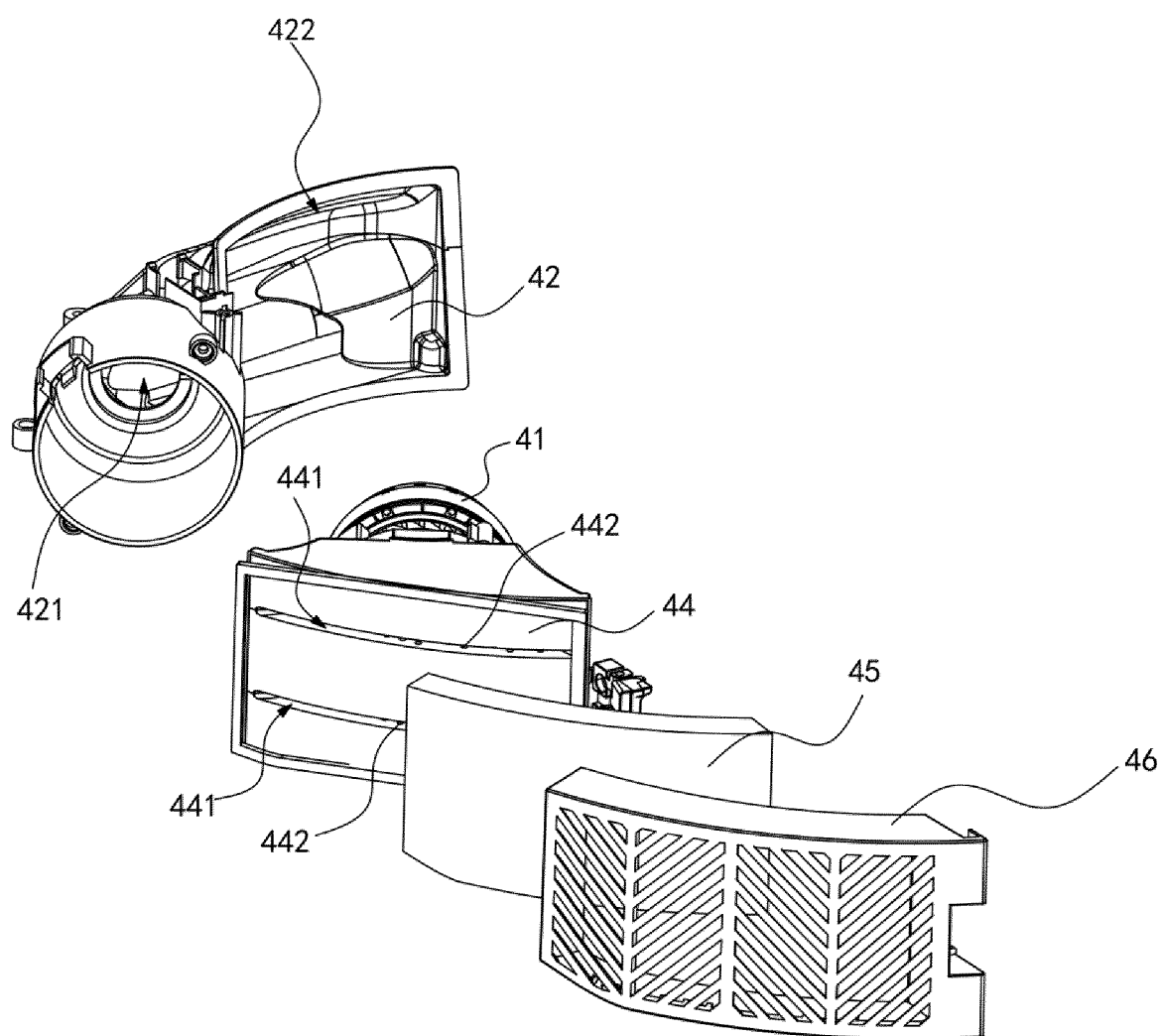


FIG. 28

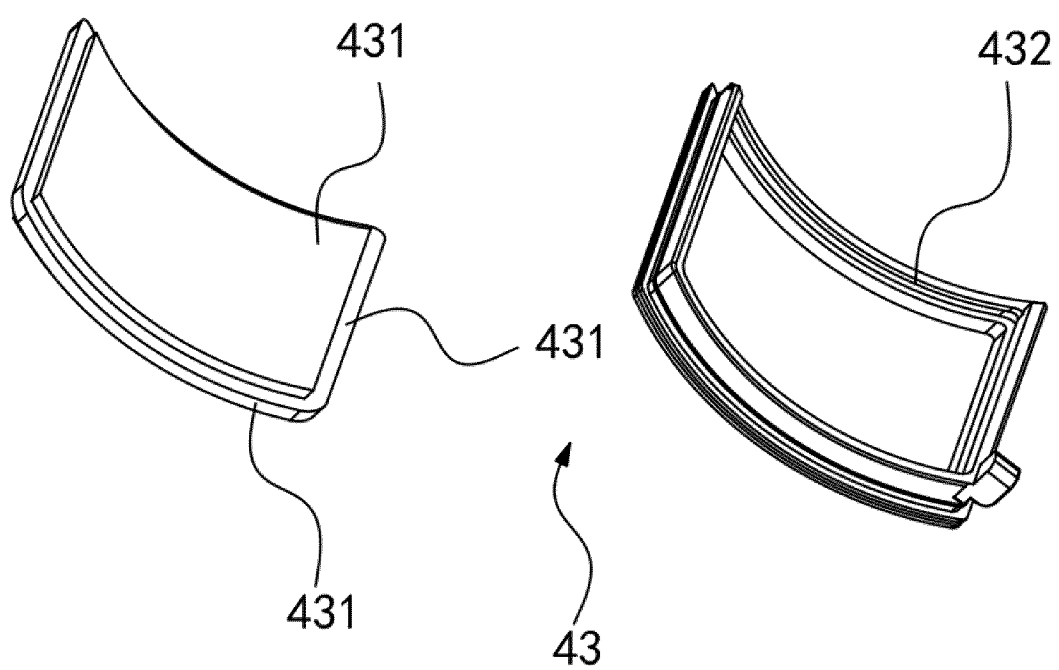


FIG. 29

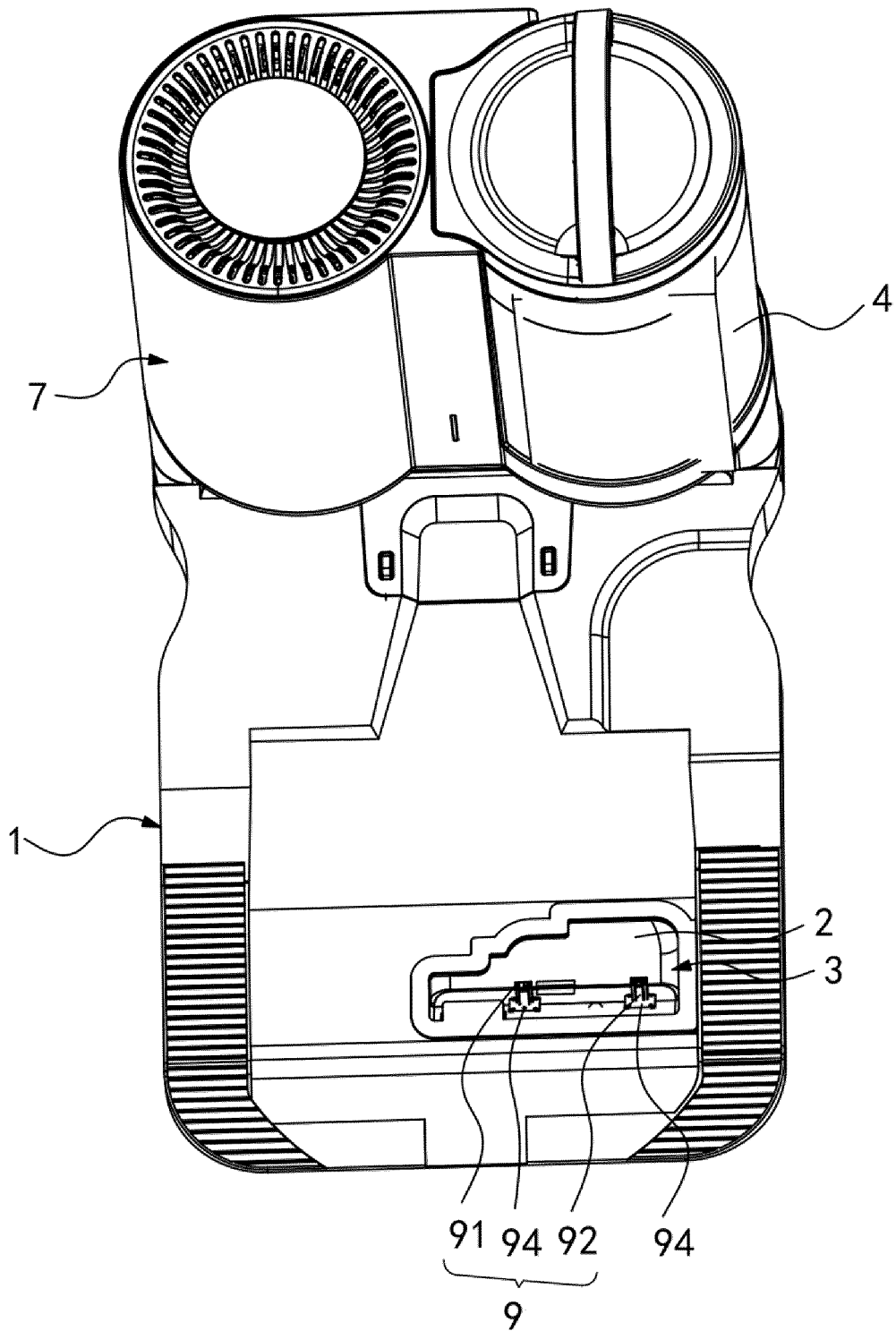


FIG. 30

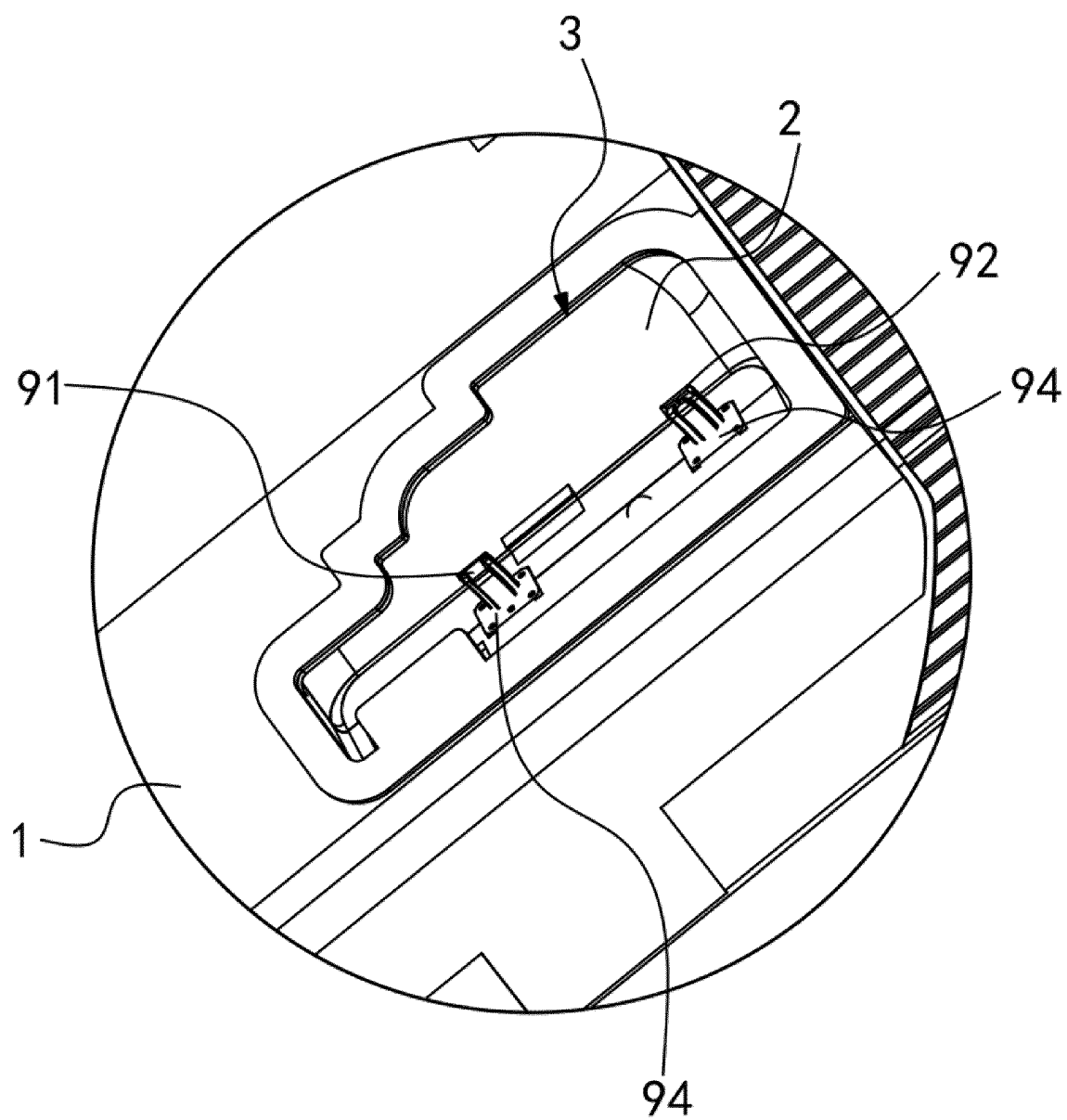


FIG. 31

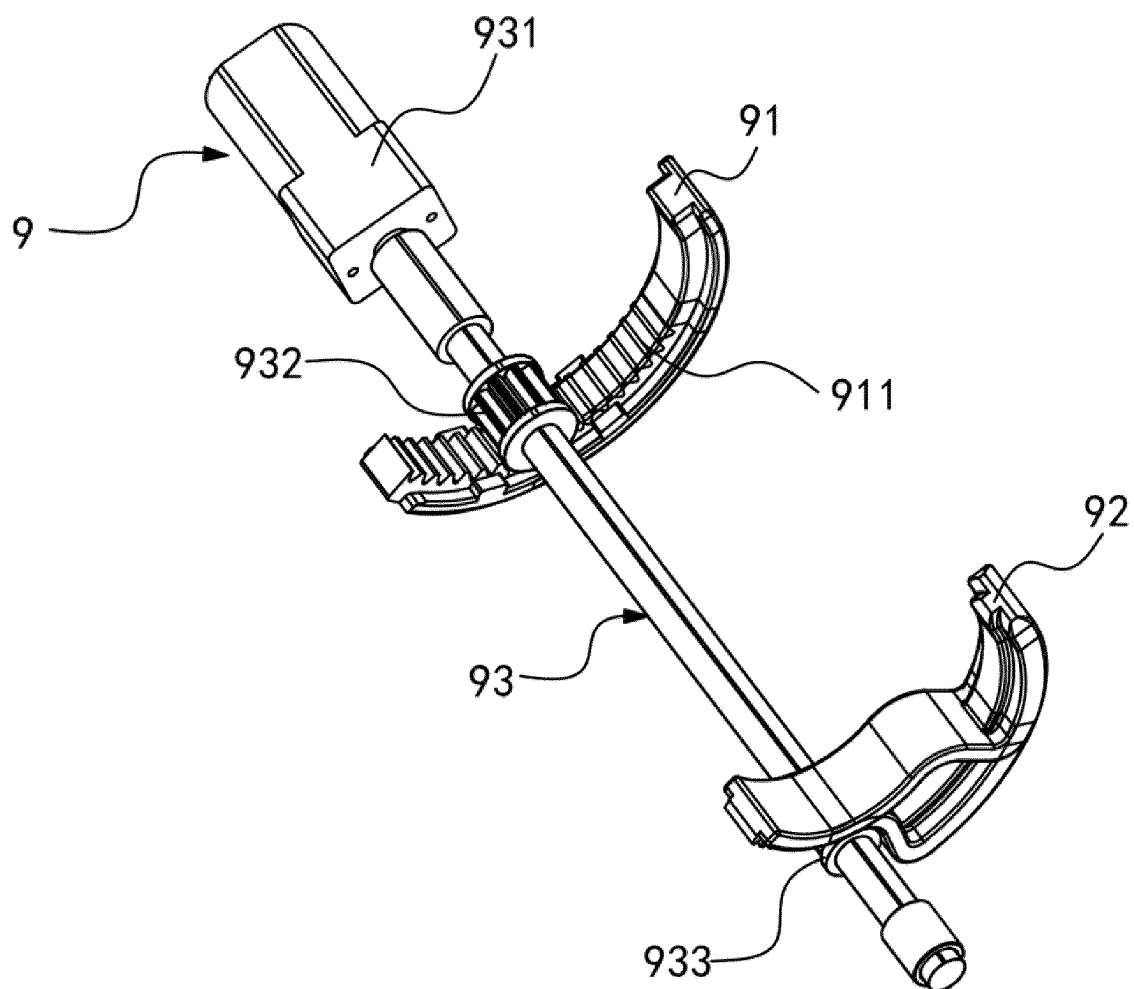


FIG. 32

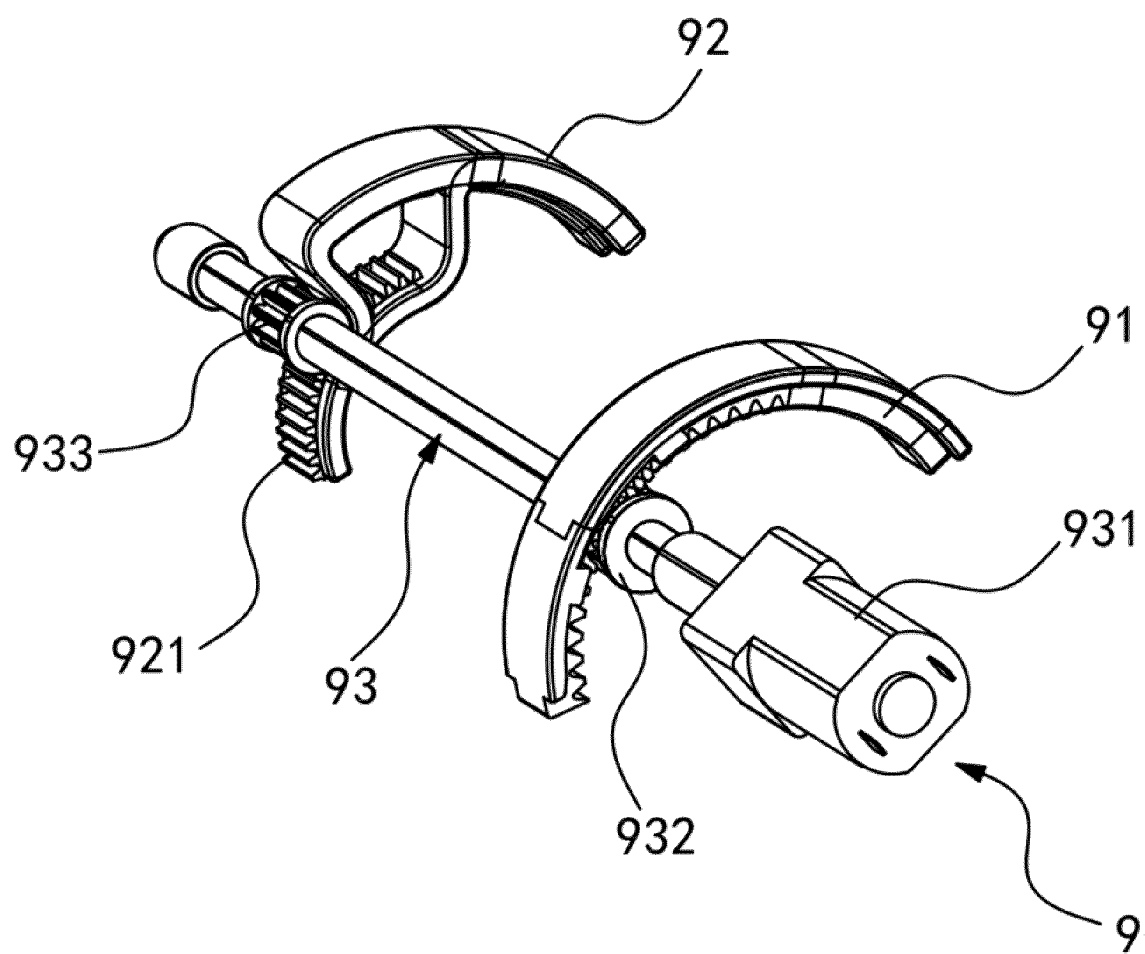


FIG. 33

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2022/128344

A. CLASSIFICATION OF SUBJECT MATTER

A47L11/30(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: A47L

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

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

CNTEXT, ENTXT, ENTXTC, VEN: 尘盒, 储尘, 第一腔室, 第二腔室, 一级过滤, 初级过滤, 初次过滤, 二级过滤, 二次过滤, 再过滤, 再次过滤, 第一滚刷, 第二滚刷, 第三滚刷, 第四滚刷, 锥型, 气旋分离器, dust storage cavity, first chamber, second chamber, primary filtration, secondary filtration, first rolling brush, second rolling brush, third rolling brush, forth rolling brush, cone type, cyclonic separator

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 112869658 A (SUZHOU 360 ROBOT TECHNOLOGY CO., LTD.) 01 June 2021 (2021-06-01) description, paragraphs 2-67, and figures 1-3	1-12
Y	CN 112869658 A (SUZHOU 360 ROBOT TECHNOLOGY CO., LTD.) 01 June 2021 (2021-06-01) description, paragraphs 2-67, and figures 1-3	13-25
Y	CN 114246518 A (ANKER INNOVATIONS LTD.) 29 March 2022 (2022-03-29) description, paragraphs 69-74, and figures 1-8	13-25
Y	CN 114027730 A (SHENZHEN 3IROBOTIX CO., LTD.) 11 February 2022 (2022-02-11) description, paragraphs 2-115, and figures 1-4	15-25
Y	CN 114403747 A (YUNJING INTELLIGENCE TECHNOLOGY (DONGGUAN) CO., LTD. et al.) 29 April 2022 (2022-04-29) entire document	15-25

☒ 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

“P” document published prior to the international filing date but later than the priority date claimed

“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

“X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

“&” document member of the same patent family

Date of the actual completion of the international search

24 March 2023

Date of mailing of the international search report

24 March 2023

Name and mailing address of the ISA/CN

China National Intellectual Property Administration (ISA/
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Beijing 100088

Facsimile No. (86-10)62019451

Authorized officer

Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2022/128344

C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	CN 216060340 U (KINGCLEAN ELECTRIC CO., LTD. et al.) 18 March 2022 (2022-03-18) entire document	15-25
A	WO 2021218326 A1 (DREAME INNOVATION TECHNOLOGY (SUZHOU) CO., LTD.) 04 November 2021 (2021-11-04) entire document	1-25

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2022/128344

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN	112869658	A	01 June 2021	None	
CN	114246518	A	29 March 2022	None	
CN	114027730	A	11 February 2022	None	
CN	114403747	A	29 April 2022	None	
CN	216060340	U	18 March 2022	None	
WO	2021218326	A1	04 November 2021	None	

REFERENCES CITED IN THE DESCRIPTION

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- CN 202210731460 [0001]
- CN 202210730487 [0001]