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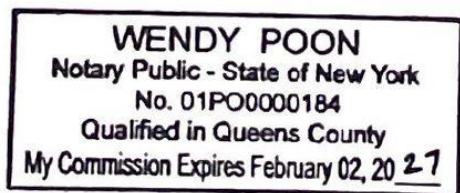


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(54) Title of the Invention: A cleaning apparatus

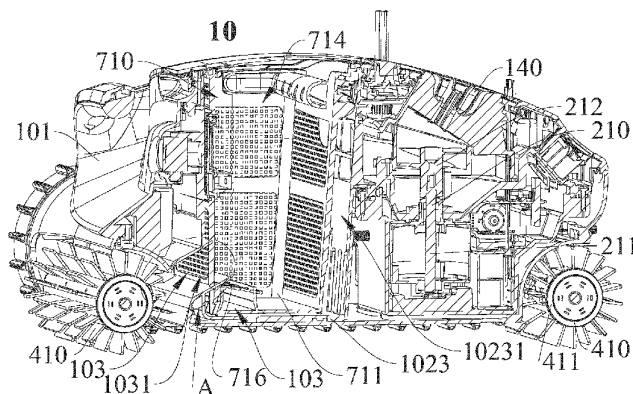


Figure 1

(57) **Abstract:** Provided in the present disclosure is a cleaning apparatus, comprising a cleaning apparatus body, a driving mechanism, a filtering mechanism, a liquid intake portion, a liquid output portion and a mode switching member, wherein the driving mechanism is arranged on the cleaning apparatus body; the filtering mechanism is arranged on the cleaning apparatus body; the liquid intake portion comprises at least a first water inlet, which is arranged in the cleaning apparatus body; the liquid output portion comprises at least a first water outlet, which is arranged in the cleaning apparatus body; the first water inlet, the filtering mechanism, the driving mechanism and the first water outlet are in communication in sequence to form a first water channel; the mode switching member is used for realizing switching between the position of the cleaning apparatus above the liquid level and the position of the cleaning apparatus below the liquid level; when the cleaning apparatus is positioned below the liquid level, the cleaning apparatus is completely immersed below the liquid level; and when the cleaning apparatus is positioned above the liquid level, at least part of the cleaning apparatus is positioned above the liquid level. The cleaning apparatus can adjust at least two working conditions including underwater cleaning and water-surface cleaning, so as to satisfy different usage requirements.

WO 2024/169737 A1

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- International Search Report (Article 21(3) of the Treaty).
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(57) Abstract: The present disclosure provides a cleaning apparatus, which includes a cleaning apparatus main body, a drive mechanism, a filtration mechanism, a liquid inlet section, a liquid outlet section, and a mode switching component. The drive mechanism is provided in the cleaning apparatus main body; the filtration mechanism is provided in the cleaning apparatus main body; the liquid inlet section at least includes a first water inlet, the first water inlet being provided in the cleaning apparatus main body; the liquid outlet section at least includes a first water outlet, the first water outlet being provided in the cleaning apparatus main body. The first water inlet, the filtration mechanism, the drive mechanism, and the first water outlet are connected in turn to form a first waterway; the mode switching component is used to realize position switching of the cleaning apparatus above and below the liquid level. When the cleaning apparatus is below the liquid level, the cleaning apparatus is completely submerged below the liquid level; when the cleaning apparatus is above the liquid level, at least part of the cleaning apparatus is above the liquid level. The cleaning apparatus can adjust at least two working conditions for underwater cleaning and water surface cleaning, thereby meeting different usage needs.

**A cleaning apparatus**

The present application claims priority to International Patent Application No. PCT/CN2023/091116, entitled "WALKING APPARATUS FOR USE IN LIQUID AND SWIMMING POOL CLEANING ROBOT," filed with the International Bureau on April 27, 2023, the entire contents of which are incorporated herein by reference;

The present application claims priority to Chinese Patent Application No. 2023202327597, entitled "TRANSMISSION DEVICE AND POOL CLEANING ROBOT," filed with the China National Intellectual Property Administration on February 16, 2023, the entire contents of which are incorporated herein by reference;

The present application claims priority to Chinese Patent Application No. 202311159683.0, entitled "FILTRATION ASSEMBLY AND UNDERWATER CLEANING APPARATUS," filed with the China National Intellectual Property Administration on September 8, 2023, the entire contents of which are incorporated herein by reference;

The present application claims priority to Chinese Patent Application No. 2023115405902, entitled "FILTRATION ASSEMBLY AND UNDERWATER CLEANING APPARATUS," filed with the China National Intellectual Property Administration on November 17, 2023, the entire contents of which are incorporated herein by reference;

The present application claims priority to Chinese Patent Application No. 2024100704304, entitled "A POOL ROBOT AND ITS CONTROL METHOD AND STORAGE MEDIUM," filed with the China National Intellectual Property Administration on January 17, 2024, the entire contents of which are incorporated herein by reference.

**[Technical Field]**

The present disclosure relates to the technical field of liquid working equipment, particularly to a cleaning apparatus.

**[Prior Art]**

The cleaning and maintenance of swimming pools are crucial for maintaining water quality and pool hygiene. Currently, swimming pool cleaning robots available on the market can be categorized into three types. The first type of cleaning robot can only clean the pool bottom. The second type can clean both the bottom and the vertical wall surfaces, but must operate below the water surface. The third type always floats on the water surface and can only clean the water surface. Each of these three types of swimming pool cleaning robots has its own characteristics, but all lack effective position adjustment within a liquid environment. They are unable to adjust their depth as needed to achieve comprehensive cleaning of the pool bottom, wall surfaces, and water surface, which limits their application scope and operational efficiency.

Therefore, there is a need for a cleaning apparatus for use in liquids, which can flexibly switch positions between above and below the liquid level, thereby improving the operational efficiency and application range of cleaning in water and reducing cleaning costs.

**[Summary of the Invention]**

The present disclosure provides a cleaning apparatus comprising a cleaning apparatus main body, the cleaning apparatus main body comprising: a liquid inlet section including at least a first water inlet; a liquid outlet section including at least a first water outlet; a filtration mechanism including at least a first entry and a first outlet, the first entry being in fluid communication with the first water inlet and the outlet being in fluid communication with the first water outlet; a drive mechanism for generating suction to form a first water flow channel in the liquid inlet section, the filtration mechanism, and the liquid outlet section; the cleaning apparatus main body further comprising: a mode switching component for switching between a first movement state and a third movement state. The cleaning apparatus can perform underwater cleaning work in the first movement state and the cleaning apparatus can perform water surface cleaning work in the third movement state.

Wherein, the mode switching component is further used to adjust the force received by the cleaning apparatus main body in the vertical direction.

Wherein, the force received by the cleaning apparatus main body in the vertical direction includes the buoyancy of the cleaning apparatus main body in the vertical direction, and the mode switching component includes: A buoyancy adjustment assembly used to adjust the magnitude of the buoyancy acting on the cleaning apparatus main body in the vertical direction.

Wherein, the cleaning apparatus further comprises: a first sensor for sensing the position of the cleaning apparatus main body; a processor, used for: acquiring the position of the cleaning apparatus main body when the cleaning apparatus main body needs to be switched from below to above the liquid level; when the position of the cleaning apparatus main body meets the preset conditions, controlling the buoyancy adjustment assembly to increase the volume of gas in the buoyancy chamber.

Wherein, the cleaning apparatus further comprises: a second sensor, configured to detect whether the air inlet of the buoyancy chamber is located in air; a processor, configured to: When the cleaning apparatus main body needs to switch from below to above the liquid level, obtain the detection results of whether the air inlet position is in the air; when the detection result indicates the air inlet position is in the air, control the buoyancy adjustment member to increase the volume of gas in the buoyancy chamber.

Wherein, the cleaning apparatus further comprises: a processor, configured to: When the cleaning apparatus main body needs to switch from above to below the liquid level, control the buoyancy adjustment member to reduce the volume of gas in the buoyancy chamber.

Wherein, the force received by the cleaning apparatus main body in the vertical direction includes a first driving force of the cleaning apparatus main body in the vertical direction, and the mode switching component comprises: a propulsion assembly used to adjust the first driving force received by the cleaning apparatus in the vertical direction.

Wherein, the propulsion assembly comprises: a first thruster, configured to drive liquid to move in a first predetermined direction, wherein when the liquid moves in the first predetermined direction, the cleaning apparatus main body receives the first driving force in the vertical direction, and the magnitude of the first driving force is positively correlated with the speed of the liquid moving in the first predetermined direction.

Wherein, the first thruster comprises: a first propulsion impeller used to rotate to drive liquid to move in the first preset direction. When the liquid moves in the first preset direction, the cleaning apparatus receives the first driving force in the vertical direction; a first propulsion motor used to provide power for the first propulsion impeller.

Wherein, the cleaning apparatus further comprises: a second thruster, configured to drive liquid to move in a second predetermined direction, wherein when the liquid moves in the second predetermined direction, the cleaning apparatus main body receives a second driving force in the horizontal direction, and the magnitude of the second driving force is positively correlated with the speed of the liquid moving in the second predetermined direction.

Wherein, the left and right sides of the cleaning apparatus in the horizontal direction are respectively provided with at least one second thruster.

Wherein, the drive mechanism comprises: A main water pump used to drive the cleaning apparatus to suck liquid from the liquid inlet section and discharge it from the water outlet section.

Wherein, the cleaning apparatus main body is used to move in a target area filled with liquid, the target area includes a target bottom wall and a target side wall, the liquid outlet section includes a main water pump outlet, and the main water pump outlet is a first water outlet; when the cleaning apparatus main body is located on the target side wall, the main water pump outlet faces the target area and is parallel to the horizontal direction or inclined downward in the vertical direction. When the cleaning apparatus main body needs to move on the target side wall, the main water pump is further used to: discharge liquid from the water outlet of the main water pump, thereby obtaining a third driving force to drive the cleaning apparatus main body to closely adhere to the target side wall.

Wherein, the cleaning apparatus is used to move in the target area filled with liquid, the target area includes a target bottom wall and a target side wall, the water inlet section includes the main water pump inlet, the main water pump inlet is the first water inlet, and the main water pump inlet is provided at the bottom of the cleaning apparatus main body. When the cleaning apparatus main body needs to move on the target side wall, the main water pump is further used to: suck liquid from the water inlet of the main water pump, thereby obtaining a fourth driving force to drive the cleaning apparatus main body to closely adhere to the target side wall.

Wherein, the cleaning apparatus main body is used to move in a target area filled with liquid, the target area comprising a target bottom wall and a target side wall and the cleaning apparatus comprising a traveling mechanism, the traveling mechanism further comprising: a track used to drive the cleaning apparatus main body to move and realize the conversion of the travel area of the cleaning apparatus main body from the target bottom wall to the target side wall.

Wherein, the apparatus device comprises a traveling mechanism, the traveling mechanism comprises a transmission assembly, and the transmission assembly comprises: a traveling drive member, wherein an output end of the traveling drive member is adapted to be drivingly connected with a wheel of the cleaning apparatus to enable the traveling drive member to rotate the wheel; a first driven member, wherein the first driven member is connected with the wheel, an output end of the first driven member is adapted to be connected with the first cleaning member of the cleaning apparatus, and the wheel drives the first driven member to rotate so that the first driven member drives the first cleaning member to rotate; a second driven member, wherein the second driven member is drivingly connected with the wheel, an output end of the second driven member is adapted to be connected with the second cleaning member of the cleaning apparatus, and the wheel drives the second driven member to rotate so that the second driven member drives the second cleaning member to rotate.

Wherein, the wheels comprise a first wheel, a second wheel, and a track, the first wheel and the second wheel are connected via a track transmission, and the output end of the traveling drive member is drivingly connected with the first wheel.

Wherein, it further comprises a first gear, the output end of the traveling drive member is connected with the first gear, and the first gear meshes with the first wheel.

Wherein, the second driven member comprises a second gear, a first rotating disk, a third gear, and a second rotating disk, the second gear is connected with the first rotating disk, the third gear is connected with the second rotating disk, the first rotating disk and the second rotating disk are driven by a conveyor belt, and the second gear meshes with the second wheel.

Wherein, the second gear is coaxially arranged with the first rotating disk and the third gear is coaxially arranged with the second rotating disk.

Wherein, the second driven member further comprises a fourth gear meshed with the third gear, and the fourth gear is connected with the second cleaning member.

Wherein, the second driven member further comprises a fifth gear, which is arranged between the third gear and the fourth gear and meshes with both the third gear and the fourth gear.

Wherein, the first driven member comprises a sixth gear and a seventh gear, the sixth gear meshes with the second wheel, the sixth gear meshes with the seventh gear, and the seventh gear is connected with the first cleaning member.

Wherein, the first driven member further comprises an eighth gear, which is arranged between the sixth gear and the seventh gear and meshes with both the sixth gear and the seventh gear.

Wherein, the first cleaning member is an underwater cleaning roller brush; the second cleaning member is a water surface roller brush.

Wherein, the cleaning apparatus comprises: a cleaning component arranged on the cleaning apparatus main body; a motion drive assembly arranged on the cleaning apparatus main body, and the motion drive assembly is connected with the cleaning component to drive the cleaning component to perform telescopic movement relative to the cleaning apparatus main body, and the telescopic movement includes at least one of the following: an extension movement in the direction away from the cleaning apparatus main body and a retraction movement in the direction close to the cleaning apparatus main body.

Wherein, when the cleaning component is in a retracted state, the entire cleaning component is located within the range of the cleaning apparatus main body, or at least a part of the cleaning component is located within the range of the cleaning apparatus main body, and the retracted state is a state formed by the motion drive assembly driving the cleaning component to perform a retraction movement, or is a state in which the motion drive assembly does not drive the cleaning component to perform an extension movement; and/or, when the cleaning component is in an extended state, at least a part of the cleaning component is located outside the range of the cleaning apparatus main body, and the extended state is a state formed by the motion drive assembly driving the cleaning component to perform an extension movement, or is a state in which the motion drive assembly does not drive the cleaning component to perform a retraction movement.

Wherein, the motion drive assembly comprises: a connecting section, through which the cleaning component is connected to the cleaning apparatus main body; and a first driving assembly, which is connected with the connecting section and is used to drive the cleaning component to perform telescopic movement relative to the cleaning apparatus main body.

Wherein, the connecting section is a telescopic structure, the first driving assembly includes a first power source, and the first power source is used to drive the connecting section to perform telescopic movement so as to drive the cleaning component to perform telescopic movement; or, the first driving assembly includes a first transmission mechanism and a first power source, the input end of the first transmission mechanism is connected with the first power source, the output end of the first transmission mechanism is connected with the cleaning component, and the first power source is used to provide power for the first transmission mechanism so that the first transmission mechanism drives the cleaning component to perform telescopic movement relative to the cleaning apparatus main body and the connecting section; or, the first end of the connecting section is connected to the cleaning component, the first driving assembly includes a first transmission mechanism and a first power source, the input end of the first transmission mechanism is connected with the first power source, the output end of the first transmission mechanism is connected with the second end of the connecting section or a component located between the second end and the cleaning apparatus main body, and the first power source is used to provide power for the first transmission mechanism so that the first transmission

mechanism drives the connecting section and the cleaning component to perform telescopic movement relative to the cleaning apparatus main body.

Wherein, the first transmission mechanism controls the component connected to it to rotate or translate so that the cleaning component telescopically moves relative to the cleaning apparatus main body.

Wherein, the motion drive assembly includes at least one set of second drive assemblies and the at least one set of second drive assemblies is used to drive the cleaning component to perform rotational motion relative to the cleaning apparatus main body.

Wherein, the first end of the connecting section is connected with the cleaning component; at least one set of second drive assemblies includes a first set of second drive assemblies and the first set of second drive assemblies is connected with the cleaning apparatus main body and the second end of the connecting section and is used to drive the connecting section to rotate around the first direction axis, thereby driving the cleaning component to rotate around the first direction axis; and/or, at least one set of second drive assemblies includes a second set of second drive assemblies, the first end of the connecting section is connected with the cleaning component through the second set of second drive assemblies, and the second set of second drive assemblies is used to drive the connecting section to rotate around the second direction axis, thereby driving the cleaning component to rotate around the second direction axis.

Wherein, there are several cleaning components, wherein the cleaning apparatus main body is provided with a liquid inlet section and at least one cleaning component is used to expand the cleaning range of the liquid inlet section.

Wherein, the liquid inlet section is arranged on the front wall or bottom of the cleaning apparatus main body and/or along the opening direction of the liquid inlet section, and at least one cleaning component is located in front of the liquid inlet section.

Wherein, the cleaning component is a side brush; and/or, the cleaning component is movably connected with the cleaning apparatus main body or the motion drive assembly; and/or, there are several cleaning components, among which several cleaning components are arranged on at least one of the left side wall, right side wall, and bottom of the cleaning apparatus main body; and/or, the cleaning components include a rotary brush and a rotary shaft, the rotary brush is arranged around the rotary shaft, the rotary shaft is rotatably connected to the cleaning apparatus main body through the motion drive assembly, and the rotary brush has at least one cleaning surface, which is used to make contact with and stir the water flow.

Wherein, it further comprises at least one of a trigger data acquisition unit and an in-place sensor. The trigger data acquisition unit is used to collect trigger data about the preset movement of the cleaning component and the in-place sensor is used to collect reference data on whether the preset movement of the cleaning component is in place.

Wherein, the cleaning component has a starting position and a telescopic position; the cleaning apparatus also includes a reset component, the reset component is arranged on the cleaning apparatus main body, the reset component is connected with the cleaning component, the reset component is used to provide a reset force for the cleaning component to remain in the starting position, and the cleaning component can reach the telescopic position when the motion drive assembly drives the cleaning component to perform a telescopic movement; when the cleaning component is in the starting position, the cleaning component is in a retracted state, and when the cleaning component is in the telescopic position, the cleaning component is in an extended state; or, when the cleaning component is in the starting position, the cleaning component is in an extended state, and when the cleaning component is in the telescopic position, the cleaning component is in a retracted state.

Wherein, the filtration mechanism comprises: A debris bin, comprising a debris bin water inlet section, which is connected to the liquid inlet section. The debris bin water inlet section is used to clean the liquid entering the debris bin.

Wherein, the debris bin water inlet section comprises: A water surface debris bin opening, which is set on the side of the debris bin and positioned at the floating location of the cleaning apparatus when floating on the water surface, so that debris or impurities on the water surface of the target area can enter the debris bin.

Wherein, the debris bin comprises: a debris bin roller brush assembly, provided at the water surface debris bin opening and configured to roll debris or impurities from the water surface of the swimming pool into the debris bin during water surface cleaning.

Wherein, the debris bin opening comprises: an underwater debris bin opening, provided below the floating position of the cleaning apparatus on the water surface, serving as an inlet for debris or impurities in the pool water to enter the debris bin.

Wherein, the debris bin further comprises: A water surface debris bin opening cover plate, which is a movable component used to adjust the opening and closing of the water surface debris bin opening; an underwater debris bin opening cover plate, which is a movable component used to adjust the opening and closing of the underwater debris bin opening.

Wherein, it further comprises: a debris guiding component, configured to guide debris on the pool liquid level into the water surface debris bin opening, wherein the debris guiding component is located outside the water surface debris bin opening and is hollow inside; the port size of a first port of the debris guiding component, which is remote from the water surface debris bin opening, is greater than the size of the water surface debris bin opening, and the port size of a second port of the debris guiding component, which is connected to the water surface debris bin opening, is not less than the size of the water surface debris bin opening.

Wherein, the filtration mechanism comprises a filtration assembly comprising: a debris bin, the debris bin is formed with a first chamber, and the debris bin includes a first movement state and a second movement state; a first filter layer is arranged on the side wall of the debris bin, and the first filter layer is connected with the first chamber; a flow guide port is arranged on the debris bin and/or the first filter layer, and the flow guide port is connected with the first chamber; a cover member, wherein, in the first movement state, the cover member covers the flow guide port; in the second movement state, the cover member opens the flow guide port.

Wherein, the cover member is pivotally connected to the debris bin; the cleaning apparatus further comprises an adjustment member mounted on the cover member, the adjustment member is away from the pivotal connection between the cover member and the debris bin; the adjustment member assists the cover member to close or open the flow guide port.

Wherein, the cover member includes a first side end and a second side end arranged opposite to each other; the first side end is located at the uppermost end of the cover member and the second side end is located at the lowermost end of the cover member; the first side end is pivotally connected to the debris bin, the second side end pivots around the first side end to open or close the guide port, and when the cleaning apparatus as a whole is located underwater, the gravity of the adjustment member is greater than the buoyancy; or, the second side end is pivotally connected to the debris bin, and the first side end pivots around the second side end to open or close the flow guide port, and when the cleaning apparatus as a whole is located underwater, the buoyancy of the adjustment member is greater than the gravity.

Wherein, first side end is pivotally connected to the debris bin and the ratio of the distance from the center of the adjustment member to the first side end to the distance from the center of the adjustment member to the second side end is less than 1.

Wherein, the first side end is pivotally connected to the debris bin and the adjustment member is protruded on the inner side of the cover member facing the first chamber. When the debris bin is in the first movement state, the line connecting the center of gravity of the adjustment member and the pivot center of the cover member forms an acute angle with the direction of gravity.

Wherein, the second side end is pivotally connected to the debris bin and the cleaning apparatus further includes a moving part; the cover member further includes an accommodating channel, the accommodating channel is arranged between the first side

end and the second side end, and the center line of the accommodating channel intersects with the plane where the first side end or the second side end is located; the moving part is accommodated in the accommodating channel and can move along the accommodating channel.

Wherein, the center line of the accommodating channel intersects perpendicularly with the plane where the first side end or the second side end is located.

Wherein, the cover member includes an inner side surface facing the first chamber;  
the accommodating channel extends from the second side end toward the direction close to the inner side surface and toward the first side end.

Wherein, a mounting bracket is provided on the side wall of the debris bin and the mounting bracket covers the flow guide port; a part of the mounting bracket covering the flow guide port is provided with a plurality of grille holes, the grille holes are connected with the flow guide port, and the cover is movably mounted on the mounting bracket.

Wherein, a side surface of the mounting bracket facing the first chamber is recessed with an accommodating chamber, and a side wall of the accommodating chamber is provided with a pivot mounting groove; the cover member is movably accommodated in the accommodating chamber, the cover member is convexly provided with a pivot section, and a stop-limit protrusion is provided below the pivot section; the pivot section is pivotally installed in the pivot mounting groove and the stop-limit protrusion rotates with the cover member until it stops on the side wall.

Wherein, the edge of the cover member is further extended with an overlapping section and the overlapping section abuts against the inner side surface of the mounting bracket when the cover member is accommodated in the accommodating chamber.

Wherein, the cleaning apparatus comprises a drive assembly connected to the cover member for driving the cover member to close or open the flow guide port.

Wherein, the cover member is movably connected to the cleaning apparatus.

Wherein, the debris bin forms a debris bin water inlet, which communicates with the first chamber; the cleaning apparatus comprises a main water pump, which is arranged outside the cleaning apparatus and communicates with the first chamber of the debris bin.

Wherein, the main water pump includes a main water pump impeller cover and the area of the flow guide port of the cleaning apparatus is larger than the water inlet cross-sectional area of the main water pump impeller cover.

Wherein, the cleaning apparatus includes a debris chamber, the debris chamber forms a second chamber, the debris bin is arranged in the second chamber, the main water pump is arranged outside the debris chamber, and a water inlet section is formed between the debris bin and the debris chamber; when the cleaning apparatus is in a first movement state, the main water pump is used to guide water to flow into the main water pump from the water inlet section, the first chamber, the first filter layer, and the second chamber in sequence, wherein the first movement state is the state of the debris bin when the cleaning apparatus moves in a direction perpendicular to gravity; when the cleaning apparatus is in a second movement state, the main water pump is used to guide at least part of the water to flow into the main water pump from the water inlet section, the first chamber, the flow guide port, and the second chamber in sequence.

Wherein, the cover member is pivotally connected to the debris chamber.

Wherein, the cleaning apparatus further comprises a flip cover, the debris chamber is formed with an opening, the flip cover covers the opening, and the cover member is movably connected to the flip cover for closing or opening the flow guide port of the debris bin.

Wherein, the cover member is provided with a second filter layer. When the cleaning apparatus is in the first movement state, the second filter layer communicates with the first chamber and the second chamber.

The present disclosure further provides a liquid cleaning control method, which is applied to the cleaning apparatus described above and executed by a control component comprising: obtaining a target task for cleaning a target pool, wherein the target task includes water surface cleaning and/or underwater cleaning; determining adjustment parameters of a traveling mechanism based on the target task and the current position of the cleaning apparatus; and controlling the traveling mechanism based on the adjustment parameters to drive the cleaning apparatus to move and perform cleaning to complete the target task.

The present disclosure further provides a control method for a cleaning apparatus, wherein, applied to the cleaning apparatus described above, the control method comprises: detecting that the cleaning apparatus satisfies the telescopic trigger condition; controlling the cleaning component of the cleaning apparatus to perform telescopic movement, the telescopic movement including at least one of the following: an extension movement in the direction away from the robot main body of the cleaning apparatus and a retraction movement in the direction close to the robot main body.

Wherein, the telescopic trigger condition includes at least one of: the distance between the cleaning apparatus and the target is within a preset distance range, the cleaning apparatus is in a trapped state, the cleaning apparatus receives a preset instruction, and the cleaning apparatus is in a preset working mode, wherein the target object includes at least one of a wall and an obstacle in the preset working mode.

Wherein, detecting that the cleaning apparatus satisfies the telescopic trigger condition includes at least one of the following: in response to the telescopic trigger condition including the distance between the cleaning apparatus and the target being within a preset distance range, determining, based on first sensor data collected by a first trigger sensor of the cleaning apparatus, that the distance between the cleaning apparatus and the target is within the preset distance range; and in response to the telescopic trigger condition including the cleaning apparatus being in a trapped state, performing any one or more of the following steps: based on the second sensor data collected by the second trigger sensor of the cleaning apparatus, determining that there is a preset deviation between the actual rotation angle of the cleaning apparatus and the preset rotation angle; detecting that the cleaning apparatus has not run the target distance after the first time of movement; detecting that the relative position difference between the cleaning apparatus and the reference point before and after the second time is within the preset difference range; the current of the drive motor of the cleaning apparatus increases and the current increase is consistent with the current change of being trapped, wherein the reference point is determined using the third trigger sensor; in response to the telescopic trigger condition including the cleaning apparatus receiving the preset instruction, detecting that the cleaning apparatus receives the preset instruction; in response to the telescopic trigger condition including the cleaning apparatus being in the preset working mode, detecting that the cleaning apparatus is in the preset working mode.

Wherein, the default state of the cleaning component of the cleaning apparatus is the retracted state and the telescopic trigger condition includes that the distance between the cleaning apparatus and the target object is within a preset distance range; controlling the cleaning component of the cleaning apparatus to perform the telescopic movement includes: controlling the cleaning component of the cleaning apparatus to perform an extension movement in a direction away from the robot main body of the cleaning apparatus.

Wherein, the default state of the cleaning component of the cleaning apparatus is an extended state, and the extension trigger condition includes at least one of the cleaning apparatus being in a trapped state, receiving a preset instruction, and being in a preset working mode; controlling the cleaning component of the cleaning apparatus to perform telescopic movement includes: controlling

the cleaning component of the cleaning apparatus to perform a retraction movement in a direction approaching the robot main body of the cleaning apparatus.

Wherein, controlling the telescopic movement of the cleaning component of the cleaning apparatus comprises: In the process of controlling the telescopic movement of the cleaning component, detecting whether the telescopic movement is in place using the in-place sensor; in response to detecting that the telescopic movement is in place, determining to stop the telescopic movement of the cleaning component.

Wherein, the method further comprises any one or more of: detecting that the cleaning apparatus currently meets the rotation trigger condition and controlling the cleaning component of the cleaning apparatus to rotate relative to the robot main body; detecting that the cleaning apparatus is in the target working state and controlling the cleaning component of the cleaning apparatus to rotate or reciprocate to make the cleaning component work.

#### [Description of attached drawings]

In order to more clearly illustrate the technical solutions in the embodiments of the present application, a brief introduction to the drawings required for describing the embodiments is provided below. It is obvious that the drawings described below are only some embodiments of the present application. For those of ordinary skill in the art, other drawings can also be obtained based on these drawings without creative efforts. Including:

In order to more clearly illustrate the technical solutions in the embodiments of the present disclosure, a brief introduction to the drawings required for describing the embodiments is provided below. It is obvious that the drawings described below are only some embodiments of the present disclosure. For those of ordinary skill in the art, other drawings can also be obtained based on these drawings without creative efforts. Including:

FIG. 1 is a cross-sectional schematic diagram from a first angle of a first embodiment of the cleaning apparatus of the present disclosure;

FIG. 2 is an enlarged schematic diagram of A shown in FIG. 1;

FIG. 3 is a cross-sectional schematic diagram from a second angle of a first embodiment of the cleaning apparatus of the present disclosure;

FIG. 4 is an exemplary module diagram of a second embodiment of the cleaning apparatus of the present disclosure;

FIG. 5 is a structural schematic diagram of a second embodiment of the cleaning apparatus of the present disclosure;

FIG. 6 is a partial schematic diagram of a second embodiment of the cleaning apparatus of the present disclosure;

FIG. 7 is a schematic diagram of a second embodiment of the cleaning apparatus of the present disclosure moving on the side wall of a target area;

FIG. 8 is a schematic diagram of a second embodiment of the cleaning apparatus of the present disclosure floating on a liquid level;

FIG. 9 is a structural schematic diagram of a second embodiment of the cleaning apparatus of the present disclosure;

FIG. 10 is a schematic diagram of a third embodiment of the cleaning apparatus of the present disclosure moving on the bottom wall of a target area;

FIG. 11 is a schematic diagram of a third embodiment of the cleaning apparatus of the present disclosure moving on the bottom wall and side wall of a target area;

FIG. 12 is a schematic diagram of a third embodiment of the cleaning apparatus of the present disclosure moving on the side wall of a target area;

FIG. 13 is a first cross-sectional schematic diagram of a third embodiment of the cleaning apparatus of the present disclosure;

FIG. 14 is a second cross-sectional schematic diagram of a third embodiment of the cleaning apparatus of the present disclosure;

FIG. 15 is a structural schematic diagram of a fourth embodiment of the cleaning apparatus of the present disclosure;

FIG. 16 is a cross-sectional schematic diagram of a fourth embodiment of the cleaning apparatus of the present disclosure;

FIG. 17 is a first simple diagram of a filtration mechanism of the cleaning apparatus of the present disclosure;

FIG. 18 is a second simple diagram of a filtration mechanism of the cleaning apparatus of the present disclosure;

FIG. 19 is a third simple diagram of a filtration mechanism of the cleaning apparatus of the present disclosure;

FIG. 20 is a structural schematic diagram of a filtration assembly in the cleaning apparatus of the present disclosure;

FIG. 21 is an enlarged schematic diagram of H in FIG. 9;

FIG. 22 is a cross-sectional schematic diagram of a filtration assembly of the cleaning apparatus of the present disclosure;

FIG. 23 is a first structural schematic diagram of a first sub-filter layer and a second sub-filter layer in the cleaning apparatus of the present disclosure;

FIG. 24 is a second structural schematic diagram of a first sub-filter layer and a second sub-filter layer in the cleaning apparatus of the present disclosure;

FIG. 25 is a third structural schematic diagram of a first sub-filter layer and a second sub-filter layer in the cleaning apparatus of the present disclosure;

FIG. 26 is a first structural schematic diagram of the cleaning apparatus of the present disclosure;

FIG. 27 is a second structural schematic diagram of the cleaning apparatus of the present disclosure;

FIG. 28 is an exemplary flow chart of a liquid cleaning control method of the present disclosure;

FIG. 29 is a structural schematic diagram of a fifth embodiment of the cleaning apparatus of the present disclosure;

FIG. 30 is an exploded schematic diagram of a fifth embodiment of the cleaning apparatus of the present disclosure;

FIG. 31 is a cross-sectional schematic diagram of a sixth embodiment of the cleaning apparatus of the present disclosure;

FIG. 32 is a structural schematic diagram of B in FIG. 31;

FIG. 33 is a structural schematic diagram of a connecting section in a sixth embodiment of the cleaning apparatus of the present disclosure;

FIG. 34 is a structural schematic diagram of a connecting section in a seventh embodiment of the cleaning apparatus of the present disclosure;

FIG. 35 is a structural schematic diagram of a first transmission section in a sixth embodiment of the cleaning apparatus of the present disclosure;

FIG. 36 is a structural schematic diagram of a seventh embodiment of the cleaning apparatus of the present disclosure;

FIG. 37 is a flow chart illustrating an embodiment of the cleaning apparatus control method of the present disclosure;

FIG. 38 is a schematic diagram of a framework of an embodiment of an electronic device of the present disclosure;

FIG. 39 is a schematic diagram of a framework of an embodiment of a computer-readable storage medium of the present disclosure;

FIG. 40 is a cross-sectional schematic diagram of a first movement state of a filtration assembly in an eighth embodiment of

the cleaning apparatus of the present disclosure;

FIG. 41 is an enlarged schematic diagram of C in FIG. 40;

FIG. 42 is a cross-sectional schematic diagram of a second movement state of a filtration assembly in an eighth embodiment of the cleaning apparatus of the present disclosure;

FIG. 43 is an enlarged schematic diagram of D in FIG. 42;

FIG. 44 is a cross-sectional schematic diagram of a first movement state of a filtration assembly in a ninth embodiment of the cleaning apparatus of the present disclosure;

FIG. 45 is an enlarged schematic diagram of E in FIG. 33;

FIG. 46 is a cross-sectional schematic diagram of a second movement state of a filtration assembly in a ninth embodiment of the cleaning apparatus of the present disclosure;

FIG. 47 is an enlarged schematic diagram of F in FIG. 46;

FIG. 48 is a partial schematic diagram of a first movement state of a filtration assembly in an eighth embodiment of the cleaning apparatus of the present disclosure;

FIG. 49 is a partial schematic diagram of a second movement state of a filtration assembly in an eighth embodiment of the cleaning apparatus of the present disclosure;

FIG. 50 is a partial schematic diagram of a second movement state of a filtration assembly in an eighth embodiment of the cleaning apparatus of the present disclosure;

FIG. 51 is a structural schematic diagram of a mounting bracket in a filtration assembly in a ninth embodiment of the cleaning apparatus of the present disclosure;

FIG. 52 is a partial schematic diagram of an eighth embodiment of the underwater cleaning apparatus of the present disclosure;

FIG. 53 is a partial exploded schematic diagram of an eighth embodiment of the underwater cleaning apparatus of the present disclosure;

FIG. 54 is a partial cross-sectional schematic diagram of an eighth embodiment of the underwater cleaning apparatus of the present disclosure.

Numbers in the drawings: 10. Cleaning apparatus; 101. Cleaning apparatus main body; 101a. Front wall; 101b. Left side wall; 101c. Right side wall; 1023. Debris chamber; 10232. Debris chamber opening; 10233. Debris chamber duct; 10231. Second chamber; 103. Liquid inlet section; 1031. First water inlet; 1032. Second water inlet; 104. Liquid outlet section; 106. Debris guiding component; 1061. First end; 1062. Second end; 100. Traveling propulsion mechanism; 111. Track; 112. Wheel; 1121. First wheel; 11211. Drive pattern; 1122. Second wheel; 120. Transmission assembly; 121. Traveling drive member; 122. First gear; 123. First driven member; 1231. Sixth gear; 1232. Seventh gear; 1233. Eighth gear; 124. Second driven member; 1241. Second gear; 1242. Third gear; 1243. Conveyor belt; 1244. Fourth gear; 1245. Fifth gear; 131. First thruster; 1311. First propulsion impeller; 1312. First propulsion motor; 1313. First propulsion opening; 132. Second thruster; 210. Main water pump; 211. Main water pump motor; 212. Main water pump impeller; 213. Main water pump inlet; 214. Main water pump outlet; 215. Main water pump impeller cover; 410. First cleaning member; 411. Underwater roller brush; 420. Second cleaning member; 421. Water surface roller brush; 430. Cleaning component; 431. Rotary brush; 432. Rotary shaft; 4311. Cleaning location; 43111. Cleaning surface; 440. Connecting section; 441. Fixed section; 442. Telescopic section; 450. First transmission mechanism; 451. Swing gear; 452. Worm gear; 453. Worm; 454. Transmission gear; 461. First direction axis; 462. Second direction axis; 510. Mode switching component; 511. Buoyancy adjustment assembly; 5111. Buoyancy chamber; 5112. Buoyancy chamber pump; 5113. Air inlet; 5114. Connecting pipeline; 710. Filtration assembly; 711. Debris bin; 7111a. First side surface; 7111b. Second side surface; 7111c. Third side surface; 7111d. Fourth side surface; 7111e. Fifth side surface; 714. First chamber; 715. Flow guide port; 716. Debris bin water inlet section; 7161. Water surface debris bin opening; 7162. Underwater debris bin opening; 717. Debris bin roller brush assembly; 718. Water surface debris bin opening cover plate; 719. Underwater debris bin opening cover plate; 720. Cover member; 720a. First side end; 720b. second side end; 721. Adjustment mounting section; 722. Accommodating channel; 723. Pivot section; 724. Overlapping section; 725. Inner side surface; 730a, 730b. Adjustment members; 731. Moving part; 740. Mounting bracket; 741. Grille hole; 742. Accommodating chamber; 743. Pivot mounting groove; 744. Mounting section; 745. Mounting buckle; 770. First filtration assembly; 780. Second filtration assembly; 790. Valve member; 30. Liquid level; 40. Target area; 401. Target bottom wall; 402. Target side wall; 50. Electronic device; 51. Memory; 52. Processor; 60. Computer-readable storage medium.

### [Detailed Description]

The technical solutions of the embodiments of the present disclosure will be clearly and completely described below with reference to the accompanying drawings in the embodiments of the present disclosure. It is apparent that the described embodiments are only a part of the embodiments of the present disclosure, rather than all embodiments. Based on the embodiments in the present disclosure, all other embodiments obtained by those of ordinary skill in the art without creative efforts shall fall within the protection scope of the present disclosure.

Please refer to FIG. 1, FIG. 2, and FIG. 3. FIG. 1 is a cross-sectional schematic diagram from a first angle of a first embodiment of the cleaning apparatus of the present disclosure; FIG. 2 is an enlarged schematic diagram of A shown in FIG. 1; and FIG. 3 is a cross-sectional schematic diagram from a second angle of a first embodiment of the cleaning apparatus of the present disclosure.

Currently available cleaning apparatuses 10 lack effective position adjustment in liquid environments and cannot adjust depth as needed to achieve comprehensive cleaning of the pool bottom, wall surfaces, and water surface, thereby limiting their application scope and operational efficiency. The present disclosure provides a cleaning apparatus 10. The cleaning apparatus 10 is used to clean stains and suspended matter in the target area 40. The target area 40 may be a pool, swimming pool, or the like. The cleaning apparatus 10 may be a pool cleaning robot, swimming pool cleaning robot, underwater cleaning apparatus, etc., and is not limited thereto. The cleaning apparatus 10 of the present disclosure is capable of flexibly switching positions between above and below the liquid level 30 so that the cleaning apparatus 10 can carry out a full range of cleaning of the target area 40, thereby improving the efficiency and application range of liquid cleaning in the target area 40 and reducing the cleaning cost of the target area 40.

The cleaning apparatus main body 101 may be used to move within a target area 40 filled with liquid, and is capable of switching its position above and below the liquid level 30. The target area 40 may be a region filled with liquid in which the cleaning apparatus main body 101 is able to move. The target area 40 may include a swimming pool. For example, the cleaning apparatus main body 101 can move within the water of a swimming pool and switch its position between above and below the water surface. In some embodiments, the target area 40 may also be other regions, such as oil wells, sewers, etc. The target area 40 may include a target bottom wall 401 and a target side wall 402. In some embodiments, the cleaning apparatus main body 101 may also move on the target bottom wall 401 and the target side wall 402 of the target area 40. For example, the cleaning apparatus main body 101 may move on the target bottom wall 401 and the target side wall 402 of the pool. See below for more details about the movement of the cleaning apparatus main body 101 on the target bottom wall 401 and the target side wall 402 of the target area

40.

The cleaning apparatus 10 comprises a cleaning apparatus main body 101, a drive mechanism, a filtration mechanism, a liquid inlet section 103, and a liquid outlet section 104. The drive mechanism is provided in the cleaning apparatus main body 101. The drive mechanism is used to create a suction force that directs the flow direction of the liquid. The filtration mechanism is provided on the cleaning apparatus main body 101 and is used to collect dirt and suspended matter, filter liquid, etc. in the target area 40. The liquid inlet section 103 is used for liquid to enter the cleaning apparatus main body 101. The liquid inlet section 103 includes at least a first water inlet 1031. The first water inlet 1031 is provided on the cleaning apparatus main body 101. That is, liquid enters the interior of the cleaning apparatus main body 101 through the first water inlet 1031. The liquid outlet section 104 is used to drain water within the cleaning apparatus main body 101. The liquid outlet section 104 comprises at least a first water outlet. The first water outlet is provided on the cleaning apparatus main body 101. That is, liquid is discharged from the cleaning apparatus main body 101 through the first water outlet. The filtration mechanism includes at least a first entry and an outlet. The first entry and the first water inlet 1031 are in fluid communication. The outlet and the first water outlet are in fluid communication. The first water inlet 1031, filtration mechanism, drive mechanism, and first water outlet are sequentially connected to form a first water flow path. Under the guidance of the drive mechanism, liquid enters the cleaning apparatus main body 101 from the first water inlet 1031, flows toward the first entry, filtration mechanism, outlet, and drive mechanism, and is then discharged from the first water outlet. In the actual process, the liquid may also flow in reverse, i.e., the liquid flows from the first water outlet, the drive mechanism, the filtration mechanism, the first water inlet 1031, etc., which is not limited here.

Please refer to FIG. 4 and FIG. 5. FIG. 4 is an exemplary module diagram of a second embodiment of the cleaning apparatus of the present disclosure; and FIG. 5 is a structural schematic diagram of a second embodiment of the cleaning apparatus of the present disclosure. In conjunction with FIGS. 1-3, the cleaning apparatus main body 101 comprises a mode switching component 510. The mode switching component 510 may be used to enable switching of the position of the cleaning apparatus 10 above and below the liquid level 30. The mode switching component 510 can move in the vertical direction of the target area 40, thereby enabling the cleaning apparatus 10 to switch its position above and below the liquid level 30. When the cleaning apparatus 10 is below the liquid level 30, the cleaning apparatus 10 is completely submerged below the liquid level 30. When the cleaning apparatus 10 is above the liquid level 30, at least part of the cleaning apparatus 10 is above the liquid level 30. As such, by providing the first water inlet 1031 and the mode switching member 510 on the cleaning apparatus main body 101, the cleaning apparatus 10 can be adjusted for at least two operating conditions of underwater cleaning and water surface cleaning, thereby meeting different usage needs.

In conjunction with FIG. 7, FIG. 8, FIG. 10, FIG. 11, and FIG. 12, when the cleaning apparatus 10 moves on the target bottom wall 401 or the overall direction of the cleaning apparatus 10 is at an angle less than  $90^\circ$  to the target bottom wall 401 and is away from the liquid level 30, this is defined as the first movement state. As shown in FIG. 10, away from the liquid level 30 can be understood as the cleaning apparatus 10 cleaning the pool bottom, performing actions in the water, etc. When the cleaning apparatus 10 moves on the target side wall 402 or the overall direction of the cleaning apparatus 10 is substantially parallel to the target side wall 402, this is defined as the second movement state, as shown in FIG. 7 and FIG. 12. When the cleaning apparatus 10 is moving on the liquid level 30, or the cleaning apparatus 10 is at least partially exposed from the liquid level 30, or the cleaning apparatus 10 is located as a whole below the liquid level 30 and close to the liquid level 30, this is defined as the third movement state, where being close to the liquid level 30 can be understood as the distance between the cleaning apparatus 10 and the liquid level 30 being less than a threshold value, and it can perform water surface cleaning work etc. In the above description, the plane where the propulsion mechanism 100 of the cleaning apparatus 10, such as the track 111 or the wheel 112, contacts the surface to be cleaned can be defined as the overall direction of the cleaning apparatus 10.

As such, under the action of the mode switching component 510, the cleaning apparatus 10 can be switched between positions above and below the liquid level 30, enabling the switching of the cleaning apparatus 10 between the first movement state and the third movement state. The cleaning apparatus may perform underwater cleaning tasks in the first movement state. The cleaning apparatus can perform water surface cleaning tasks in the third movement state, and the cleaning apparatus 10 can be adjusted to perform at least two working conditions: underwater cleaning and water surface cleaning, thereby meeting different usage needs.

In some embodiments, the cleaning apparatus 10 further comprises a second movement state. The cleaning apparatus may perform wall or waterline cleaning tasks in the second movement state. The switching of the cleaning apparatus 10 between the first and third movement states includes or does not include a second movement state. That is, the cleaning apparatus may comprise a first movement state and a third movement state. Alternatively, the cleaning apparatus may comprise a first movement state, a second movement state, and a third movement state. Wherein, the second movement state may be selected according to actual needs and is not limited here.

In some embodiments, the liquid inlet section 103 includes a first water inlet 1031. The first water inlet 1031 is located at the lower front part of the cleaning apparatus main body 101. The first water inlet 1031 is used for both underwater and water surface cleaning. When the cleaning apparatus 10 performs underwater cleaning, the first water inlet 1031 is below the liquid level 30 and can suction debris below the liquid level 30. When the cleaning apparatus 10 performs water surface cleaning, at least part of the first water inlet 1031 is exposed above the liquid level 30 and can suction debris floating on the liquid level 30. That is, the cleaning apparatus main body 101, through the first water inlet 1031 and by adjusting the attitude of the cleaning apparatus 10 in the target area 40, can achieve both underwater and water surface cleaning operations, thereby improving cleaning efficiency. Liquid sequentially flows through the first water inlet 1031, first entry, filtration mechanism, outlet, drive mechanism, and liquid outlet section. In the above embodiment, when the cleaning apparatus 10 performs underwater cleaning, its attitude is in a normal state. When performing water surface cleaning, the front part of the cleaning apparatus 10 is lifted above the liquid level 30, causing at least part of the first water inlet 1031 to be exposed above the liquid level 30.

In other embodiments, the liquid inlet section 103 includes a first water inlet 1031. The first water inlet 1031 is located at the bottom of the cleaning apparatus main body 101. The first water inlet 1031 is used for both underwater and water surface cleaning. When the cleaning apparatus 10 performs underwater cleaning, the first water inlet 1031 is below the liquid level 30 and faces the surface to be cleaned. When the cleaning apparatus 10 performs water surface cleaning work, the first water inlet 1031 is located below but adjacent to and towards the liquid level 30. That is, the cleaning apparatus main body 101, through the first water inlet 1031 and by adjusting the attitude of the cleaning apparatus 10 in the target area 40, can achieve both underwater and water surface cleaning operations, thereby improving cleaning efficiency. Liquid sequentially flows through the first water inlet 1031, first entry, filtration mechanism, outlet, drive mechanism, and liquid outlet section. In the above embodiment, when the cleaning apparatus 10 performs underwater cleaning, its attitude is in a normal state. When performing water surface cleaning, the cleaning apparatus 10 may flip, i.e., the bottom of the cleaning apparatus 10 faces upward. During the process of the bottom facing upward, the filtration mechanism may be in a closed state, reducing the risk of debris leaking from the filtration mechanism.

In some embodiments, the liquid inlet section 103 includes a first water inlet 1031 and a second water inlet 1032. The first water inlet 1031 is provided at the bottom of the cleaning apparatus main body 101. When the cleaning apparatus 10 performs pool bottom or pool wall cleaning, the first water inlet 1031 is adjacent to the pool bottom or wall to suction water into the interior of

the cleaning apparatus 10. The liquid inlet section 103 includes a second water inlet 1032. That is, liquid enters the cleaning apparatus main body 101 through the second water inlet 1032. The second water inlet 1032 is provided at the front side of the cleaning apparatus main body 101. When the cleaning apparatus 10 performs water surface cleaning, at least part of the second water inlet 1032 is exposed above the liquid level 30 and can suction debris floating on the liquid level 30. The second water inlet 1032 enables the cleaning apparatus 10 to perform water surface cleaning. Additionally, the first and second water inlets 1031 and 1032 can function together to improve the cleaning efficiency of the cleaning apparatus 10.

In some embodiments, the liquid inlet section 103 includes a first water inlet 1031 and a second water inlet 1032. The first water inlet 1031 is provided at the bottom of the cleaning apparatus main body 101. The second water inlet 1032 is provided at the top or side of the cleaning apparatus main body 101. The first water inlet 1031 is used for pool bottom or wall cleaning. The second water inlet 1032 is used for water surface cleaning. When the second water inlet 1032 is set on the top of the cleaning apparatus main body 101, the cleaning apparatus 10 floats to near the liquid level 30 and the posture of the cleaning apparatus 10 is the same as when traveling on the bottom of the pool. The second water inlet 1032 is opened, and under the action of a drive mechanism, such as the main water pump, the second water inlet 1032 is located near below the liquid level and debris on the liquid level enters the cleaning apparatus 10 through the second water inlet 1032. When the second water inlet 1032 is provided on the side of the cleaning apparatus main body 101, the cleaning apparatus 10 can adjust its posture so that the second water inlet 1032 faces the liquid level 30 and is located below the liquid level 30 during the process of floating to the vicinity of the liquid level 30.

In some embodiments, the liquid inlet section 103 includes a first water inlet 1031 and a second water inlet 1032. In addition to being provided at the lower front part of the cleaning apparatus main body 101, the first water inlet 1031 may also be provided at the lower rear part or at the side of the cleaning apparatus main body 101. It should be noted that the position of the liquid inlet section 103 is related to the position of the filtration mechanism. When the filtration mechanism is provided at the front of the cleaning apparatus 10, the liquid inlet section 103 is provided at the front. When the filtration mechanism is provided at the rear, the liquid inlet section 103 is provided at the rear.

In some embodiments, the filtration mechanism comprises a filtration assembly 710. The filtration assembly has a filtering function. The filtration assembly 710 comprises a first entry. Wherein, both the first water inlet 1031 and the second water inlet 1032 are in fluid communication with the first entry of the filtration assembly 710. Driven by the drive mechanism, at least part of the liquid sequentially passes through the first water inlet 1031, first entry, inside the filtration assembly 710, drive mechanism, and liquid outlet section 104. At least part of the liquid sequentially passes through the second water inlet 1032, first entry, inside the filtration assembly 710, drive mechanism, and liquid outlet section 104. By connecting the first and second water inlets 1031 and 1032 to the first entry, the cleaning efficiency of the cleaning apparatus 10 is increased. Wherein, the second water inlet 1032 and the first entry may be in communication through a pipeline or the like.

The filtration mechanism may comprise one, two, three, or more filtration assemblies 710, the number of which can be determined according to actual needs. When the number of filtration assemblies 710 is two, three, or more, the adjacent filtration assemblies 710 may be connected in series or in parallel, etc., and the configuration can be set according to different usage requirements of the cleaning apparatus 10, without limitation herein.

In some embodiments, the filtration mechanism comprises a filtration assembly 710. The filtration assembly 710 includes a first entry and a second entry. The first water inlet 1031 is in fluid communication with the first entry of the filtration assembly 710. The second entry and the first entry are located on different surfaces of the filtration mechanism. At least part of the liquid sequentially passes through the first water inlet 1031, first entry, inside the filtration assembly 710, drive mechanism, and liquid outlet section 104. The second water inlet 1032 is in communication with the second entry of the filtration assembly 710. That is, at least part of the liquid sequentially passes through the second water inlet 1032, second entry, inside the filtration assembly 710, drive mechanism, and liquid outlet section 104. The first water inlet 1031 is in fluid communication with the first entry, and the second water inlet 1032 is in fluid communication with the second entry, thereby increasing the liquid flow paths to meet at least two cleaning requirements: underwater cleaning and water surface cleaning, thus satisfying different usage needs.

In some embodiments, the filtration mechanism comprises two filtration assemblies 710. The two filtration assemblies 710 are a first filtration assembly 770 and a second filtration assembly 780. The first filtration assembly 770 is provided with a first entry. The second filtration assembly 780 is provided with a second entry. The first water inlet 1031 is in fluid communication with the first entry of the first filtration assembly 770. That is, at least part of the liquid sequentially passes through the first water inlet 1031, first entry, inside the first filtration assembly 770, drive mechanism, and liquid outlet section 104. The second water inlet 1032 is in fluid communication with the second entry of the second filtration assembly 780. That is, at least part of the liquid sequentially passes through the second water inlet 1032, second entry, inside the second filtration assembly 780, drive mechanism, and liquid outlet section 104. By means of two filtration assemblies 710, different liquid flow paths can be achieved, thereby improving the cleaning efficiency of the cleaning apparatus 10.

Please refer to FIG. 17, FIG. 18, and FIG. 19. FIG. 17 is a first simple diagram of a filtration mechanism of the cleaning apparatus of the present disclosure; FIG. 18 is a second simple diagram of a filtration mechanism of the cleaning apparatus of the present disclosure; and FIG. 19 is a third simple diagram of a filtration mechanism of the cleaning apparatus of the present disclosure. In some embodiments, the liquid inlet section 103 includes a first water inlet 1031 and a second water inlet 1032. The filtration mechanism comprises a first filtration assembly 770 and a second filtration assembly 780. The second filtration assembly 780 is sleeved inside the first filtration assembly 770. The first water inlet 1031 is in communication with the first entry 7123 of the first filtration assembly 770. The first water inlet 1031 is for liquid to enter the first filtration assembly 770 through the first entry 7123. The second water inlet 1032 is in communication with the second entry 7133 of the second filtration assembly 780. The second water inlet 1032 is for liquid to enter the second filtration assembly 780 through the second entry 7133. When the cleaning apparatus 10 performs underwater cleaning, the liquid sequentially passes through the first water inlet 1031, first entry 7123, first filtration assembly 770, and main water pump 210, thereby achieving underwater cleaning. When the cleaning apparatus 10 performs water surface cleaning, the liquid sequentially passes through the second water inlet 1032, second entry 7133, second filtration assembly 780, first filtration assembly 770, and main water pump 210, thereby achieving water surface cleaning. During water surface cleaning, the cleaning apparatus 10 passes through a double-layer debris bin, thereby improving the cleaning efficiency on the water surface.

By connecting two filtration assemblies 710 in series, with the first water inlet 1031 in communication with the first entry 7123 of the first filtration assembly 770 and the second water inlet 1032 in communication with the second entry 7133 of the second filtration assembly 780, the cleaning apparatus 10 can perform both underwater and water surface cleaning, expanding its application scenarios and enhancing user experience. The structures of the above-mentioned first and second filtration assemblies 770 and 780 may be substantially the same or different, and are not limited herein.

When the cleaning apparatus 10 performs underwater cleaning, in order to prevent the second water inlet 1032, the second filtration assembly 780, and the main water pump 210 from diverting the liquid and to ensure the suction effect at the first water inlet 1031 and the first entry 7123, the second water inlet 1032 or the second entry 7133 may be closed. In practice, if the main water pump 210 has sufficient power, it is also possible not to close the second water inlet 1032 or the second entry 7133. Similarly, when the cleaning apparatus 10 performs water surface cleaning, in order to prevent the first water inlet 1031, the first filtration assembly 770, and the main water pump 210 from diverting the liquid and to ensure the suction effect at the second water inlet 1032 and the second entry 7133, the first water inlet 1031 or the first entry 7123 may be closed. In practice, if the main water pump 210 has sufficient power, it is also possible not to close the first water inlet 1031 or the first entry 7123.

In some embodiments, the cleaning apparatus main body 101 comprises a first debris chamber, a second debris chamber, and a liquid inlet section 103. The first and second debris chambers are arranged side by side, i.e., the first and second debris chambers are arranged independently. The liquid inlet section 103 is used for liquid to enter the cleaning apparatus main body 101. The liquid inlet section 103 includes a first water inlet 1031 and a second water inlet 1032. The filtration mechanism comprises a first filtration assembly 770 and a second filtration assembly 780. The first filtration assembly 770 is disposed within the first debris bin. The second filtration assembly 780 is disposed within the second debris bin. The first water inlet 1031 is in communication with the first entry 7123 of the first filtration assembly 770. The first water inlet 1031 is for liquid to enter the first filtration assembly 770 through the first entry 7123. The second water inlet 1032 is in communication with the second entry 7133 of the second filtration assembly 780. The second entry is for liquid to enter the second filtration assembly 780 through the second entry 7133. The main water pump 210 is connected to the first debris chamber and the second debris chamber.

When the cleaning apparatus 10 performs underwater cleaning, under the action of the main water pump 210, the liquid flows through the first water inlet 1031, the first entry 7123, the first filtration assembly 770, and the main water pump 210 sequentially. When the cleaning apparatus 10 performs water surface cleaning, under the action of the main water pump 210, the liquid flows through the second water inlet 1032, the second entry 7133, the second filtration assembly 780, and the main water pump 210 sequentially. The two filtrations assemblies 710 are connected in parallel to each other to ensure that the two waterways are independently controlled and do not affect each other. Independent waterway flow is achieved by setting corresponding closed structures on the two waterways. The closed structure may be provided where closure is required, such as the junction of the first debris chamber and the second debris chamber, etc., which is not limited here. The number of main water pumps 210 may be one or two. When the one main water pump 210 is included, the first filtration assembly 770 and the second filtration assembly 780 share a main water pump 210. When two main water pumps 210 are included, a main water pump 210 is in communication with the first filtration assembly 770. Another main water pump 210 is in communication with the second filtration assembly 780.

In some embodiments, as shown in FIG. 19, the first debris chamber and the second debris chamber are isolated from each other. The main water pump 210 acts on the first debris chamber. A debris chamber opening 10232 is provided at the second debris chamber. The debris chamber opening 10232 can be fluidly connected to the first entry 7123 of the first filtration assembly 770 set in the first debris chamber through a debris chamber duct 10233, so that the water flow during water surface cleaning flows through the second filtration assembly 780 and the first filtration assembly 770 in sequence, achieving a better water surface cleaning effect.

In some embodiments, the cleaning apparatus main body 101 comprises a first debris chamber, a second debris chamber, and a liquid inlet section 103. The first and second debris chambers are arranged side by side, i.e., the first and second debris chambers are arranged independently. The liquid inlet section 103 is used for liquid to enter the cleaning apparatus main body 101. The liquid inlet section 103 includes a first water inlet 1031 and a second water inlet 1032. The filtration mechanism includes a first filtration assembly 770, a second filtration assembly 780, and a valve member 790. The first filtration assembly 770 is disposed within the first debris chamber. The second filtration assembly 780 is disposed within the second debris chamber. The valve member 790 can be connected to the first debris chamber and the second debris chamber in an openable and closable manner. When the valve member 790 is open, the first debris chamber and the second debris chamber are connected. When the valve member 790 is closed, the first debris chamber and the second debris chamber are disconnected.

In particular, the valve member 790 is closed while the cleaning apparatus 10 is performing underwater cleaning. The liquid flows sequentially through the first water inlet 1031, the first entry 7123 of the first filtration assembly 770, the first filtration assembly 770, the first debris chamber, and the main water pump 210 and is discharged from the cleaning apparatus 10 so that the cleaning apparatus 10 can realize the underwater cleaning function. The valve member 790 opens when the cleaning apparatus 10 is performing water surface cleaning. The liquid flows sequentially through the second water inlet 1032, the second entry 7133 of the second filtration assembly 780, the second filtration assembly 780, the space between the second filtration assembly 780 and the second debris chamber, the valve member 790, the first filtration assembly 770, and the main water pump 210 and is discharged from the cleaning apparatus 10 so that the cleaning apparatus 10 can realize the water surface cleaning function. By the above method, the two waterways are independently controlled and do not affect each other; at the same time, the cleaning apparatus 10 increases the waterway path through the second filtration assembly 780 and the first filtration assembly 770 during water surface cleaning work, thereby improving the cleaning efficiency of the cleaning apparatus 10 during water surface cleaning. The specific structure of the above valve member 790 is not limited, as long as it can be opened and closed. Of course, in other embodiments, the filtration mechanism may not include the valve member 790. The first and second filtration assemblies 770 and 780 are in communication directly via a pipeline or the like. The second entry of the second filtration assembly 780 is provided with a cover plate or other structure which can open and close the second entry.

The above first and second filtration assemblies 770 and 780 may be disposed extending along the direction of movement of the cleaning apparatus 10, i.e., the first and second filtration assemblies 770 and 780 are disposed before and after. Alternatively, the first and second filtration assemblies 770 and 780 are disposed in a direction perpendicular to the movement of the cleaning apparatus 10, i.e., the first filtration assembly 770 and the second process assembly are disposed left and right. Alternatively, the first and second filtration assemblies 770 and 780 are arranged vertically. Of course, the first and second filtration assemblies 770 and 780 may also be disposed in other ways, which are not limited here.

Please refer to FIG. 20, FIG. 21, and FIG. 22. FIG. 20 is a structural schematic diagram of a filtration assembly in the cleaning apparatus of the present disclosure; FIG. 21 is an enlarged schematic diagram of H in FIG. 9; and FIG. 22 is a cross-sectional schematic diagram of a filtration assembly of the cleaning apparatus of the present disclosure. The debris bin 711 in the filtration mechanism plays a crucial role in filtration. Wherein, the more meshes of the first filter layer provided on the side wall of the debris bin 711, the better the filtering effect of the debris bin 711. However, when the number of meshes of the first filter layer increases, the debris bin 711 is more likely to clog and the first filter layer is more difficult to clean. Therefore, the present disclosure sets a double-layer or multi-layer debris bin 711 structure, for example, two layers, and the corresponding filters in the two-layer debris bin 711 are staggered, which not only improves the filtering effect of the filtration mechanism, but also can effectively reduce the number of meshes of the corresponding filter through the double-layer filtration, thereby facilitating the cleaning of the filter layer.

Please refer to FIG. 23, FIG. 24, and FIG. 25. FIG. 23 is a first structural schematic diagram of a first sub-filter layer and a second sub-filter layer in the cleaning apparatus of the present disclosure; FIG. 24 is a second structural schematic diagram of a first sub-filter layer and a second sub-filter layer in the cleaning apparatus of the present disclosure; and FIG. 25 is a third structural schematic diagram of a first sub-filter layer and a second sub-filter layer in the cleaning apparatus of the present disclosure. In conjunction with FIG. 20, FIG. 21, and FIG. 22, in some embodiments, the debris bin 711 comprises a first sub-debris bin 712 and a second sub-debris bin 713. A first sub-filter layer 7121 is provided on the side wall of the first sub-debris bin 712. The first sub-filter layer 7121 functions as a filter. The first sub-filter layer 7121 includes a number of first filter holes 7122. A second sub-filter layer 7131 is provided on the side wall of the second sub-debris bin 713. The second sub-filter layer 7131 includes a number of second filter holes 7132. The material of the first sub-filter layer 7121 and the material of the second sub-filter layer 7131 may be the same or different, which is not limited here. The second sub-debris bin 713 is nested within the first sub-debris bin 712. The first filter holes 7122 of the first sub-filter layer 7121 and the second filter holes 7132 of the second sub-filter layer 7131 are at least partially staggered.

The present disclosure stacks the first sub-debris bin 712 and the second sub-debris bin 713, and the first filter holes 7122 and the second filter holes 7132 are at least partially staggered. When the gap between the first sub-debris bin 712 and the second sub-debris bin 713 is small, the two staggered sub-filter layers with lower mesh counts form the filtering effect of a higher mesh count. Compared with the prior art in which only one debris bin 711 is used for filtering, the present disclosure has two filter layers to achieve the filtering effect of a high filter mesh count under the same filtering effect; the debris bin 711 is disassembled into the first sub-debris bin 712 and the second sub-debris bin 713, and it is easier to clean the first sub-debris bin 712 and the second sub-debris bin 713 with low filter mesh counts.

In some embodiments, the first filter holes 7122 and the second filter holes 7132 are staggered by movement or rotation so that the first filter holes 7122 and the second filter holes 7132 are at least partially staggered. The movement staggering can be set along a straight line direction, such as left-right direction staggering, up-down direction staggering, etc. The number of the first filter holes 7122 and the number of the second filter holes 7132 may be the same or different.

Alternatively, in some embodiments, the first filter holes 7122 and the second filter holes 7132 are staggered by rotation so that the first filter holes 7122 and the second filter holes 7132 are at least partially staggered. The rotational staggering includes the first sub-filter layer 7121 rotating, the second sub-filter layer 7131 rotating, or both the first sub-filter layer 7121 and the second sub-filter layer 7131 rotating so that the first filter holes 7122 and the second filter holes 7132 are at least partially staggered. The number of the first filter holes 7122 and the number of the second filter holes 7132 may be the same or different.

And/or, in some embodiments, the first filter holes 7122 and the second filter holes 7132 are different in size, for example, the size of the first filter holes 7122 is larger or smaller than the size of the second filter holes 7132, which can also achieve at least partial staggering of the first filter holes 7122 and the second filter holes 7132. The number of the first filter holes 7122 and the number of the second filter holes 7132 is different. Of course, there are other methods of staggering for the first filter holes 7122 and the second filter holes 7132, which are not limited here.

When the above second sub-debris bin 713 is installed in the first sub-debris bin 712, the first sub-filter layer 7121 in the first sub-debris bin 712 and the second sub-filter layer 7131 in the second sub-debris bin 713 are attached to each other or form a small gap. The gap is less than or equal to the filter hole size. Wherein, the filter holes may be the first filter holes 7122 or the second filter holes 7132. The size of the filter holes may be diameter, length, width, etc., which is not limited here.

In some embodiments, when the filtration mechanism comprises a filtration assembly 710, the filtration assembly 710 may comprise a single-layer, double-layer, or multi-layer debris bin 711. When the filtration mechanism comprises a first filtration assembly 770 and a second filtration assembly 780, the first filtration assembly 770 may comprise a single-layer, double-layer, or multi-layer debris bin 711. The second filtration assembly 780 may comprise a single-layer, double-layer, or multi-layer debris bin 711. The filtration mechanism comprises a first filtration component 770 and a second filtration component 780. When the first filtration component 770 and the second filtration component 780 are arranged side by side, the filter hole size of the first filtration component 770 is smaller than the filter hole size of the second filtration component 780, so that the first filtration component 770 is more suitable for cleaning underwater debris etc., while the second filtration component 780 is more suitable for cleaning surface debris etc. By at least partially staggering the filter holes in the double-layer or multi-layer debris bin 711, the cleaning efficiency of the filtration mechanism is improved.

In some embodiments, when the filtration mechanism is a filtration assembly 710, the filtration assembly 710 may comprise a single-layer, double-layer, or multi-layer debris bin 711. When the filtration mechanism comprises a first filtration assembly 770 and a second filtration assembly 780, the first filtration assembly 770 may comprise a single-layer, double-layer, or multi-layer debris bin 711. The second filtration assembly 780 may comprise a single-layer, double-layer, or multi-layer debris bin 711. The filtration mechanism comprises a first filtration component 770 and a second filtration component 780. When the first filtration component 770 and the second filtration component 780 are arranged side by side, the filter hole size of the first filtration component 770 is smaller than the filter hole size of the second filtration component 780, so that the first filtration component 770 is more suitable for cleaning underwater debris etc., while the second filtration component 780 is more suitable for cleaning surface debris etc. By at least partially staggering the filter holes in the double-layer or multi-layer debris bin 711, the cleaning efficiency of the filtration mechanism is improved.

In some embodiments, the mode switching component 510 can adjust the force received by the cleaning apparatus 10 in the vertical direction, so as to move the cleaning apparatus 10 vertically, thereby realizing the switching of the position of the cleaning apparatus 10 above and below the liquid level 30. The aforementioned vertical direction may be the vertical direction of the target area 40, for example, the vertical direction of a swimming pool, i.e., the direction of gravity. The horizontal direction may be the horizontal direction of the target area 40, for example, the horizontal direction of a swimming pool, i.e., the direction perpendicular to gravity. By providing the mode switching component 510, the cleaning apparatus 10 can achieve position switching above and below the liquid level 30, thereby enabling adjustment of its position above and below the liquid level 30 according to different liquid environments and requirements, and allowing more flexible execution of corresponding operations at different positions within the liquid.

In some embodiments, the force received by the cleaning apparatus 10 in the vertical direction may include the buoyancy

acting on the cleaning apparatus 10 in the vertical direction. When the aforementioned force includes the buoyancy acting on the cleaning apparatus 10 in the vertical direction, the mode switching component 510 may include a buoyancy adjustment assembly 511. The buoyancy adjustment assembly 511 can be used to adjust the magnitude of the buoyancy acting on the cleaning apparatus 10 in the vertical direction.

In some embodiments, the buoyancy adjustment assembly 511 may include a buoyancy chamber 5111 and a buoyancy adjustment member. The buoyancy chamber 5111 may be used to accommodate liquid and/or gas. The buoyancy chamber 5111 may include, but is not limited to, an inflatable buoyancy chamber, a liquid container-type buoyancy chamber, a partitioned buoyancy chamber, etc. The volume of the buoyancy chamber 5111 may be preset. The buoyancy chamber 5111 may be made of flexible materials and/or rigid materials. The flexible materials may include, but are not limited to, polyvinyl alcohol resin, polyethylene terephthalate, rubber, etc. The rigid materials may include, but are not limited to, glass, ceramics, phenolic plastics, polyurethane plastics, epoxy plastics, unsaturated polyester plastics, etc. For example, the buoyancy chamber 5111 may be a double-layer structure comprising an inner layer and an outer layer. The inner layer may be made of a flexible material for containing gas and/or liquid, while the outer layer is a rigid protective shell, providing protection and stability for the inner layer.

In some embodiments, the buoyancy chamber 5111 may be provided at any location of the cleaning apparatus 10. For example, the buoyancy chamber 5111 may be provided at the front end and/or rear end and/or middle position of the cleaning apparatus 10.

In some embodiments, the cleaning apparatus 10 may include only one buoyancy chamber 5111. When there is only one buoyancy chamber 5111 in the cleaning apparatus 10, the buoyancy chamber 5111 may be provided in the central position of the cleaning apparatus 10 to keep the cleaning apparatus 10 stable when the liquid and/or gas volume in the buoyancy chamber 5111 changes.

Please refer to FIG. 6. FIG. 6 is a partial schematic diagram of a second embodiment of the cleaning apparatus of the present disclosure. In conjunction with FIGS. 4-5, in some embodiments, a plurality of buoyancy chambers 5111 may be included within the cleaning apparatus 10. As shown in FIG. 6, the cleaning apparatus 10 may have two buoyancy chambers 5111, and the two buoyancy chambers 5111 may be symmetrically provided in the cleaning apparatus 10. It should be understood that the symmetrical arrangement of the two buoyancy chambers 5111 helps maintain stability when providing buoyancy to the cleaning apparatus 10, preventing tilting or deflection caused by uneven buoyancy when the cleaning apparatus 10 is above or below the liquid level 30.

It should be noted that the size and arrangement of the buoyancy chamber 5111 can be adjusted according to the weight and position of each component in the cleaning apparatus 10 to ensure that the cleaning apparatus 10 remains in its preset state regardless of the volume of liquid and/or gas contained therein.

The buoyancy adjustment member can be used to adjust the volume of gas inside the buoyancy chamber 5111. The cleaning apparatus 10 can adjust the volume of gas inside the buoyancy chamber 5111 via the buoyancy adjustment member, thereby changing the magnitude of the buoyancy acting on the cleaning apparatus 10 in the vertical direction. For example, when the buoyancy chamber 5111 made of flexible material is in a deflated state, the buoyancy adjustment member can inject air into the buoyancy chamber 5111 through the air inlet 5113, thereby increasing the volume of gas in the buoyancy chamber 5111 and increasing the buoyancy acting on the cleaning apparatus 10 in the vertical direction. It should be understood that the upward buoyancy received by the entire cleaning apparatus 10 in the vertical direction is positively correlated with the volume of gas in the buoyancy chamber 5111.

The gas in the above buoyancy chamber 5111 may come from a variety of sources. The first gas source is that the gas is obtained directly from the outside. As the cleaning apparatus 10 moves along the target side wall 402 of the target area 40 to the liquid level 30 position, external gas is acquired. For example, the external gas enters the buoyancy chamber 5111 through the air inlet 5113, thereby changing the volume of the gas in the buoyancy chamber 5111.

The second gas source is that the gas is obtained from the outside via a gap. That is, the cleaning apparatus 10 is provided with an extending pipeline (not shown). The extending pipeline is in communication with the air inlet 5113. The end of the protruding pipeline away from the air inlet 5113 extends out of the water surface, directly discharging and taking in air to change the volume of the gas in the buoyancy chamber 5111, thereby avoiding the cleaning apparatus 10 climbing the wall from the target area 40 to the liquid level 30 before changing the volume of the gas in the buoyancy chamber 5111.

The third gas source is to set a gas-generating assembly (not shown) in the cleaning apparatus 10. The gas-generating assembly can generate a certain amount of gas, which changes the volume of the gas in the buoyancy chamber 5111, thereby avoiding the cleaning apparatus 10 climbing the wall from the target area 40 to the liquid level 30 before changing the volume of the gas in the buoyancy chamber 5111 and improving convenience. The above gas-generating assembly may generate gas by itself through chemical reaction, electrolysis, boiling water, etc., thereby increasing the volume of gas in the buoyancy chamber 5111 or reducing the volume of liquid in the buoyancy chamber 5111.

In addition to being discharged through the air inlet 5113, the gas in the buoyancy chamber 5111 can also be compressed by a compression cylinder (not shown) to reduce the volume of the gas in the buoyancy chamber 5111, thereby enabling the cleaning apparatus 10 to dive. In the actual process, the buoyancy adjustment assembly 511 may not include the air inlet 5113, and the gas volume inside the buoyancy adjustment assembly 511 may be changed, such as the gas-generating assembly increasing the volume of gas in the buoyancy chamber 5111, while the volume of gas in the buoyancy chamber 5111 is reduced by the compression cylinder. In other embodiments, other methods of increasing or decreasing the volume of gas may be used, which are not limited here.

The buoyancy adjustment member can be used to adjust the volume of liquid inside the buoyancy chamber 5111. The cleaning apparatus 10 can adjust the volume of liquid inside the buoyancy chamber 5111 via the buoyancy adjustment member, thereby adjusting the volume of liquid within the buoyancy chamber 5111 and consequently changing the magnitude of buoyancy acting on it in the liquid. For example, when the buoyancy cavity 5111 made of a rigid material contains liquid, the buoyancy adjustment member can extract the liquid from the buoyancy cavity 5111 to increase the buoyancy of the cleaning apparatus 10 in the vertical direction. It should be understood that the upward buoyancy received by the entire cleaning apparatus 10 in the vertical direction is negatively correlated with the volume of liquid in the buoyancy chamber 5111. Wherein, the liquid in the buoyancy chamber 5111 can be discharged through the air inlet 5113 or other inlets and outlets. The air inlet 5113 may or may not be connected to the gas. When the air inlet 5113 is not connected to the gas, a one-way valve may be provided at the air inlet 5113. The one-way valve can prevent external water from the cleaning apparatus main body 101 from entering the buoyancy chamber 5111 through the air inlet 5113. The air inlet 5113 may also be connected to the gas. For example, the air inlet 5113 can be connected to the gas above the liquid level 30. Alternatively, the air inlet 5113 can be connected to a gas tank or a gas-generating device. The gas tank is filled with gas. The gas-generating device can automatically generate gas. The above gas enters the buoyancy chamber through the air inlet 5113, which can change the pressure in the buoyancy chamber 5111 so that the pressure in the buoyancy chamber 5111 is in a stable state, making it easier for the liquid to be discharged from the buoyancy chamber 5111. The buoyancy adjustment member may be any structure capable of adjusting the volume of gas and/or liquid within the buoyancy chamber 5111. As shown in FIG. 6, the buoyancy adjustment member may include a buoyancy chamber pump 5112, which can drive the discharge of liquid from

the buoyancy chamber 5111. The buoyancy chamber pump 5112 may include, but is not limited to, pneumatic pumps, hydraulic pumps, or electric pumps, among others. When the buoyancy chamber pump 5112 is in the operating state, it is able to adjust the liquid and/or gas within the buoyancy chamber 5111. When the buoyancy chamber pump 5112 is in the non-working state, liquid and/or liquid outside the cleaning apparatus 10 can be prevented from entering the buoyancy chamber 5111 so that the buoyancy chamber 5111 is not affected by external liquid and/or gas. The buoyancy adjustment member may also be of other structures. For example, it may be a piston assembly arranged inside the buoyancy chamber 5111, which adjusts the volume of gas and/or liquid in the buoyancy chamber 5111 by moving within the chamber.

In some embodiments, the buoyancy adjustment assembly 511 may further include an air inlet 5113. The aforementioned air inlet 5113 is used to allow gas to enter the buoyancy chamber 5111. In some embodiments, the air inlet 5113 may also be used for gas to exit the buoyancy chamber 5111 or for liquid to enter or exit the buoyancy chamber 5111. In some embodiments, the buoyancy adjustment assembly 511 may further include other inlets and outlets to facilitate the entry or exit of gas or liquid. The air inlet 5113 may be provided directly on the buoyancy chamber 5111, or it may be independent of the buoyancy chamber 5111. The air inlet 5113 may be provided on the housing of the cleaning apparatus 10 to facilitate communication with the external environment (e.g., external liquid or external air) for gas and/or liquid exchange. As shown in FIG. 5, the air inlet 5113 may be provided above the front end rear portion of the cleaning apparatus 10, so that during the ascent of the cleaning apparatus 10, the air inlet 5113 can more quickly communicate with the external air above the liquid level 30.

In some embodiments, the buoyancy adjustment assembly 511 may further include a connecting pipeline 5114, which is used for transporting gas or liquid. The connecting pipeline 5114 may connect one or more of the buoyancy chamber 5111, the buoyancy adjustment member, and the air inlet 5113. As shown in FIG. 6, the buoyancy adjustment assembly 511 may include two buoyancy chambers 5111, a buoyancy chamber pump 5112, an air inlet 5113, and a connecting pipeline 5114. The buoyancy chambers 5111 may be connected to the buoyancy chamber pump 5112 via the connecting pipeline 5114, and the buoyancy chamber pump 5112 may be connected to the air inlet 5113 via the connecting pipeline 5114. When the buoyancy chamber pump 5112 is in a non-working state, it acts like the one-way valve, and can prevent external liquid and/or liquid from entering the buoyancy chambers 5111 through the air inlet 5113. In some other embodiments, when the buoyancy adjustment member is a structure such as a centrifugal pump, a one-way valve is provided at the connecting pipeline 5114 to prevent external liquid and/or liquid from entering the buoyancy chamber 5111 through the air inlet 5113.

Based on the cleaning apparatus 10 shown in FIGS. 5 and 6, when the cleaning apparatus 10 needs to switch from below the liquid level 30 to above the liquid level 30, it can move to a position near the liquid level 30 and determine when to control the buoyancy chamber pump 5112 to inject gas into the buoyancy chamber 5111. For details on when the cleaning apparatus 10 needs to switch from below the liquid level 30 to above the liquid level 30, refer to FIG. 17 and the related description. As shown in FIG. 7, when the cleaning apparatus 10 needs to switch from below the liquid level 30 to above the liquid level 30, it may move closely along the target side wall 402 of the target area 40 to a position near the liquid level 30 and determine when to control the buoyancy adjustment member to increase the volume of gas in the buoyancy chamber 5111. More details about the movement of the cleaning apparatus 10 against the target side wall 402 of the target area 40 can be found below. In some embodiments, when the cleaning apparatus 10 needs to switch from below the liquid level 30 to above the liquid level 30, it may also move to a position near the liquid level 30 based on the first driving force generated by the first thruster 131 and determine when to control the buoyancy adjustment member to increase the volume of gas in the buoyancy chamber 5111. For more details on the first thruster 131 and the first driving force, refer to subsequent sections.

In some embodiments, the cleaning apparatus 10 may include a first sensor (not shown). The first sensor may be used to determine the location of the cleaning apparatus 10 in real time. The position may include the vertical position (or depth) of the cleaning apparatus 10 in the liquid. For example, the first sensor may be provided at the center position of the cleaning apparatus 10, and the position may be the depth of the center position of the cleaning apparatus 10 in the liquid. The first sensor may include, but is not limited to, a pressure sensor, an ultrasonic sensor, or an optical sensor, among others. Through the first sensor and the mode switching component 510, the cleaning apparatus 10 can also be controlled to move at a preset depth, for example, to perform underwater cleaning at a preset depth, or to move toward a charging device provided at the pool wall at a preset depth.

In some embodiments, the cleaning apparatus 10 may further include a processor 52 (not shown). The processor 52 may be a microcontroller, embedded processor 52, or application-specific integrated circuit (ASIC), among others. The processor 52 may acquire various data information of the cleaning apparatus 10 and analyze and process it to control various components in the cleaning apparatus 10. When the cleaning apparatus 10 needs to switch from below the liquid level 30 to above the liquid level 30, the processor 52 can obtain the position of the cleaning apparatus 10 in real time from the first sensor. When the position of the cleaning apparatus 10 meets the preset conditions, the processor 52 can control the buoyancy adjustment member to increase the volume of the gas in the buoyancy chamber 5111. The preset condition may include the position of the cleaning apparatus 10 being higher than a preset height. When the depth of the liquid in the target area 40 is fixed, the processor 52 may determine whether the position of the cleaning apparatus 10 meets the preset condition to determine whether the air inlet 5113 of the cleaning apparatus 10 is above the liquid level 30. When the position of the cleaning apparatus 10, as shown in FIG. 7, satisfies a preset condition, the processor 52 may determine that the air inlet 5113 on the cleaning apparatus 10 is above the liquid level 30. The processor 52 may control the buoyancy chamber pump 5112 to discharge the liquid from the buoyancy chamber 5111, allowing air to enter the buoyancy chamber 5111 through the air inlet 5113, thereby increasing the volume of gas within the buoyancy chamber 5111 and enhancing the buoyancy of the cleaning apparatus 10. When the buoyancy of the cleaning apparatus 10 in the vertical direction is greater than its gravity, the cleaning apparatus 10 as shown in FIG. 7 may be switched to the cleaning apparatus 10 as shown in FIG. 8.

In some embodiments, the cleaning apparatus 10 may further include a second sensor (not shown). The second sensor may be used to detect in real time whether the air inlet 5113 of the buoyancy chamber 5111 is located in air. For example, the second sensor may be an ultrasonic sensor. The second sensor may be provided at the location of the air inlet 5113 of the buoyancy chamber 5111.

In some embodiments, the second sensor may also be provided at other locations of the cleaning apparatus 10 and, through positional conversion, obtain a detection result as to whether the air inlet 5113 is in air.

In some embodiments, when the cleaning apparatus 10 needs to switch from below the liquid level 30 to above the liquid level 30, the processor 52 may obtain a detection result indicating whether the air inlet 5113 of the buoyancy chamber 5111 is in air. When the detection result indicates that the air inlet 5113 is in air, the processor controls the buoyancy adjustment member to increase the volume of gas in the buoyancy chamber 5111, thereby enabling the cleaning apparatus 10 to switch from below the liquid level 30 to above the liquid level 30. Further details regarding the processor 52 controlling the buoyancy adjustment member to increase the gas volume in the buoyancy chamber 5111, thereby enabling the cleaning apparatus 10 to switch from below to above the liquid level 30, can be found in the foregoing sections.

When the cleaning apparatus 10 needs to switch from above the liquid level 30 to below the liquid level 30, the processor 52 can control the buoyancy adjustment member to reduce the volume of the gas in the buoyancy chamber 5111. For details on when the cleaning apparatus 10 needs to switch from above the liquid level 30 to below the liquid level 30, refer to FIG. 17 and the related description. As shown in FIGS. 5 and 6, the buoyancy chamber 5111 may discharge gas from the buoyancy chamber 5111 via the connecting pipeline 5114, thereby reducing the gas volume in the buoyancy chamber 5111 to decrease buoyancy, so that the cleaning apparatus 10 switches from above the liquid level 30 to below the liquid level 30. By setting the buoyancy adjustment assembly 511, the buoyancy of the cleaning apparatus 10 in the vertical direction can be adjusted, thereby achieving flexible switching of the cleaning apparatus 10 above and below the liquid level 30 and improving the working efficiency and reliability of the cleaning apparatus 10 in the liquid environment. By providing a first sensor or a second sensor, the cleaning apparatus 10 can automatically determine the environment of the air inlet 5113, thereby improving the usage efficiency of the cleaning apparatus 10.

In some embodiments, the switching of the cleaning apparatus 10 above and below the liquid level includes running from the first movement state to the third movement state and running from the third movement state to the first movement state. It can be understood that during the switching between the first movement state and the third movement state, the cleaning apparatus 10 may rely on the mode switching component 510, the first sensor, the second sensor, etc. provided therein.

In the case where the buoyancy chamber 5111 uses gas to adjust the buoyancy, when the air inlet 5113 or the air outlet of the buoyancy chamber 5111 is located above the liquid level, the buoyancy chamber pump 5112 is started to adjust the amount of gas in the buoyancy chamber 5111. In this case, the mode switching of the cleaning apparatus 10 may be switching from the first movement state to the third movement state until the air inlet 5113 is exposed from the water surface, and then the posture of the cleaning apparatus 10 is adjusted to the third movement state, thereby completing the switching from below the liquid level to above the liquid level. After the cleaning apparatus 10 completes cleaning the water surface or cleaning the debris bin 711 on the water surface or charging on the water surface, it needs to switch from the third movement state to the first movement state to continue cleaning the pool bottom. At this time, the buoyancy chamber pump 5112 can be started in the third movement state or the amount of gas in the buoyancy chamber 5111 can be adjusted to reduce its buoyancy. The cleaning apparatus 10 switches from the third movement state to the first movement state under the action of gravity. At the same time, the posture sensor provided on the cleaning apparatus 10 can be combined with the controller to control the posture stability of the cleaning apparatus 10 during the state switching process.

In the case where the buoyancy chamber 5111 adopts liquid to adjust the buoyancy, the buoyancy chamber 5111 may be a hard and closed space, and water is injected into or discharged from the buoyancy chamber 5111 through the buoyancy adjustment member. When the buoyancy adjustment member injects water into the buoyancy chamber 5111, the gas in the buoyancy chamber 5111 is discharged, thereby helping the cleaning apparatus 10 to dive. When the buoyancy adjustment member drains water from the buoyancy chamber 5111, the liquid in the buoyancy chamber 5111 is discharged, so that the overall gravity of the cleaning apparatus 10 is reduced, thereby helping the cleaning apparatus 10 to float. When the cleaning apparatus 10 switches from the first movement state to the third movement state, the switching can be achieved by means of the drainage operation of the buoyancy chamber 5111 and other upward forces. At this time, the cleaning apparatus 10 does not need to go through the second movement state. When the cleaning apparatus 10 is switched from the third movement state to the first movement state, the switching can be achieved by means of the water injection operation of the buoyancy chamber 5111 and other downward forces.

When the buoyancy chamber 5111 uses gas to adjust the buoyancy, the amount of gas in the buoyancy chamber 5111 is adjusted to a gas threshold value so that the cleaning apparatus 10 is subjected to balanced force in the vertical direction. When the cleaning apparatus 10 is cleaning the pool wall, it is not in the vertical direction so that the cleaning apparatus 10 can fit the pool wall and can better clean the pool wall. When the cleaning apparatus 10 is in the third movement state, the buoyancy chamber 5111 has a first gas amount within it. When the cleaning apparatus 10 is in the first movement state, the buoyancy chamber 5111 has a second gas amount within it. Wherein, the gas threshold value is between the second gas amount and the first gas amount.

Similarly, when the buoyancy chamber 5111 uses liquid to adjust the buoyancy, the amount of liquid in the buoyancy chamber 5111 is adjusted to a liquid threshold value so that the cleaning apparatus 10 is subjected to balanced force in the vertical direction. When the cleaning apparatus 10 is cleaning the pool wall, it is not in the vertical direction so that the cleaning apparatus 10 can fit the pool wall and clean the pool wall. When the cleaning apparatus 10 is in the third movement state, the buoyancy chamber 5111 has a first liquid amount within it. When the cleaning apparatus 10 is in the first movement state, the buoyancy chamber 5111 has a second liquid amount within it. Wherein, the liquid threshold value is between the second liquid amount and the second liquid amount.

In some embodiments, the mode switching component 510 may further include a propulsion assembly. The propulsion assembly may be used to adjust the first driving force received by the cleaning apparatus 10 in the vertical direction. The propulsion assembly may be any structure capable of providing a first driving force. For example, the propulsion assembly may be a propeller, which may be vertically arranged on the cleaning apparatus 10. By rotating the propeller, the cleaning apparatus 10 can obtain a first driving force in the vertical direction. The first driving force in the vertical direction may be upward or downward. Under the action of the first driving force, the cleaning apparatus 10 can move upward or downward in the vertical direction, or be suspended at a certain position in the liquid.

In some embodiments, as shown in FIG. 9, the propulsion assembly may include a first thruster 131. The first thruster 131 may be used to propel liquid to move in a first preset direction. The first preset direction may be the direction in which the first thruster 131 discharges liquid. When the first thruster 131 propels liquid in the first preset direction, the cleaning apparatus 10 may be subjected to a reaction force opposite to the first preset direction, which may include the first driving force. It should be understood that, since the cleaning apparatus 10 needs to obtain a first driving force in the vertical direction, the first preset direction at least includes an inclination in the vertical direction, so as to ensure that the obtained reaction force has a vertical component, i.e., the first driving force. Therefore, the angle between the first preset direction and the vertical direction may be  $[0^\circ, 90^\circ]$ .

The magnitude of the first driving force may be positively correlated with the speed at which the liquid moves in the first preset direction. The greater the speed of the liquid in the first preset direction, the greater the reaction force opposite to the first preset direction acting on the cleaning apparatus 10, and the greater the first driving force in the vertical direction.

The magnitude of the first driving force may also be negatively correlated with the angle between the first preset direction and the vertical direction. When the speed of the liquid in the first preset direction is the same, the greater the angle between the first preset direction and the vertical direction, the smaller the first driving force in the vertical direction acting on the cleaning apparatus 10. As shown in FIG. 13, when the angle between the first preset direction and the vertical direction is  $0^\circ$ , the aforementioned reaction force acting on the cleaning apparatus 10 can be completely converted into the first driving force in the vertical direction.

The cleaning apparatus 10 may include one or more first thrusters 131. The first thruster 131 may be provided at various locations in the cleaning apparatus 10. As shown in FIG. 9 and FIG. 13, the first thruster 131 may be disposed vertically in the central position of the cleaning apparatus 10 to ensure balance during movement of the cleaning apparatus 10. The first thruster 131 may comprise a first propulsion impeller 1311 and a first propulsion motor 1312. The first propulsion impeller 1311 may rotate to drive liquid to move in the first preset direction. When the liquid moves in the first preset direction, the cleaning apparatus 10 receives the first driving force in the vertical direction. The first propulsion motor 1312 may power the above first propulsion impeller 1311. As shown in FIG. 13, the first thruster 131 in the cleaning apparatus 10 may include two first propulsion openings 1313. One first propulsion opening 1313 of the first thruster 131 may be located at the top of the cleaning apparatus 10 and another first propulsion opening 1313 of the first thruster 131 may be located at the bottom of the cleaning apparatus 10. Driven by the first propulsion motor 1312, the first propulsion impeller 1311 can suck liquid from one of the two first propulsion openings 1313 and discharge it from the other first propulsion opening 1313, thereby enabling the cleaning apparatus 10 to obtain the first driving force in the vertical direction. When the cleaning apparatus 10 is located in the liquid, the cleaning apparatus 10 may also adjust the first preset direction by adjusting the rotation direction of the first propulsion impeller 1311 (e.g., forward rotation, counter-rotation), thereby adjusting the direction of the first driving force and achieving position switching of the cleaning apparatus 10 above and below the liquid level 30. By providing the first thruster 131, the cleaning apparatus 10 can quickly and conveniently switch its position above and below the liquid level 30.

In some embodiments, the cleaning apparatus 10 may also move in the horizontal direction of the target area 40. As shown in FIG. 5 and FIG. 9, the cleaning apparatus 10 may further include a second thruster 132. The second thruster 132 can propel the liquid in a second preset direction to generate a second driving force in the horizontal direction, enabling the cleaning apparatus 10 to move horizontally under the action of the second driving force. The second preset direction may be the direction in which the second thruster 132 discharges liquid. Similar to the first thruster 131, since the cleaning apparatus 10 needs to obtain a second driving force in the horizontal direction, the second preset direction at least includes an inclination in the horizontal direction to ensure that the resulting reaction force has a horizontal component, i.e., the second driving force. Therefore, the angle between the second preset direction and the horizontal direction may be within the range of  $[0^\circ, -90^\circ)$ .

Similar to the first thruster 131, the magnitude of the second driving force may be positively correlated with the speed of the liquid moving in the second preset direction. The greater the speed of the liquid in the second preset direction, the greater the reaction force opposite to the second preset direction acting on the cleaning apparatus 10, and the greater the first driving force in the horizontal direction. The magnitude of the second driving force may also be negatively correlated with the angle between the second preset direction and the horizontal direction. When the speed of the liquid in the second preset direction is the same, the greater the angle between the second preset direction and the horizontal direction, the smaller the second driving force in the horizontal direction acting on the cleaning apparatus 10. As shown in FIG. 13, when the angle between the second preset direction and the horizontal direction is  $0^\circ$ , the aforementioned reaction force can be completely converted into the second driving force acting on the cleaning apparatus 10 in the horizontal direction.

Like the first thruster 131, the second thruster 132 may also include a second propulsion impeller (not shown) and a second propulsion motor (not shown). More details about the second propulsion impeller and the second propulsion motor can be found above. From the above description, with respect to the direction in which the cleaning apparatus 10 as a whole is located, the first preset direction is approximately perpendicular to the direction in which the cleaning apparatus 10 as a whole is located, that is, perpendicular to the planar direction in which the cleaning apparatus 10 contacts the surface to be cleaned; the second preset direction is approximately parallel to the direction in which the cleaning apparatus 10 as a whole is located, that is, parallel to the planar direction in which the cleaning apparatus 10 contacts the surface to be cleaned, and is consistent with the direction of travel of the cleaning apparatus 10. The cleaning apparatus 10 may include one or more second thrusters 132. The second thruster 132 may be disposed at the bottom of the cleaning apparatus 10. For example, when the cleaning apparatus 10 includes only one second thruster 132, the second thruster 132 may be horizontally disposed at the center of the bottom of the cleaning apparatus 10 to ensure the balance of the cleaning apparatus 10.

In some embodiments, the second thruster 132 may also be provided on the side of the cleaning apparatus 10. It should be noted that when the second thruster 132 is provided on the side of the cleaning apparatus 10, its installation position should be at least partially below the floating position of the cleaning apparatus 10 on the liquid level 30, so that when the cleaning apparatus 10 is floating on the liquid level 30, the second propulsion impeller in the second thruster 132 can rotate to propel the liquid in the second preset direction, thereby providing the cleaning apparatus 10 with the second driving force in the horizontal direction.

In some embodiments, when the second thruster 132 is provided on the side of the cleaning apparatus 10, its installation position may be entirely below the floating position of the cleaning apparatus 10 on the liquid level 30.

In some embodiments, at least one second thruster 132 may be provided on each of the left and right sides of the cleaning apparatus 10. As shown in FIG. 9, one second thruster 132 may be provided on each of the left and right sides of the cleaning apparatus 10. When the cleaning apparatus 10 moves in the liquid, it can respectively adjust the power of the first propulsion motors 1312 of the left and right second thrusters 132 to adjust the speed at which the left and right second thrusters 132 propel the liquid in the second preset direction, thereby enabling the cleaning apparatus 10 to turn. For example, when the speed at which the left second thruster 132 propels the liquid in the second preset direction is greater than that of the right second thruster 132, the cleaning apparatus 10 can turn to the right under the action of the left second thruster 132. By providing the second thruster 132, the position switching of the cleaning apparatus 10 in the horizontal direction can be achieved, e.g., moving straight or turning in the horizontal direction, thereby expanding the functions of the cleaning apparatus 10 to make it suitable for more usage scenarios.

Please refer to FIG. 26 and FIG. 27. FIG. 26 is a first structural schematic diagram of the cleaning apparatus of the present disclosure; and FIG. 27 is a second structural schematic diagram of the cleaning apparatus of the present disclosure. In some embodiments, the traveling propulsion mechanism 100 includes first wheels 1121 and second wheels 1122. There are two first wheels 1121. There are two second wheels 1122. The two first wheels 1121 are arranged at the front end of the bottom of the cleaning apparatus main body 101, and the two second wheels 1122 are arranged at the rear end of the bottom of the cleaning apparatus main body 101. A drive pattern 11211 is provided on the outer side surfaces of the first wheels 1121. The drive pattern 11211 can be detachably or fixedly connected to the outer side surfaces of the first wheels 1121. When the cleaning apparatus 10 moves on the liquid level 30, the drive pattern 11211 is at least partially located below the liquid level 30 and is used to adjust the second driving force applied to the cleaning apparatus 10 in the horizontal direction. That is, when the cleaning apparatus 10 moves on the liquid level 30, the drive pattern 11211 is at least partially exposed above the liquid level 30 and the drive pattern 11211 is at least partially located below the liquid level 30. The rotation of the first wheel 1121 drives the drive pattern 11211 to rotate. The part of the drive pattern 11211 located below the liquid level 30 generates a certain force with the liquid, which is used to adjust the second driving force exerted on the cleaning apparatus 10 in the horizontal direction so as to realize the forward movement of the cleaning apparatus 10 along the second direction. When the cleaning apparatus 10 moves on the target bottom wall 401, the drive pattern 11211 is completely immersed in the liquid, and the forward force of the cleaning apparatus 10 in the second direction and the backward force of the cleaning apparatus 10 in the second direction cancel each other out, so that there is no effect on the moving of the cleaning apparatus 10 on the target bottom wall 401.

By providing the drive pattern 11211 on the first wheels 1121, a second driving force in the second direction can be provided to the cleaning apparatus 10, thereby pushing the cleaning apparatus 10 to move forward and backward along the second direction. Because the effect of the drive pattern 11211 is the same as the effect of the second thruster 132, to some extent, the drive pattern 11211 can replace the second thruster 132, thereby reducing the number of parts and costs while also reducing weight etc.

In some embodiments, there may be a plurality of drive patterns 11211, and the plurality of drive patterns 11211 are radially disposed along the first wheels 1121. The number of drive patterns 11211 may be, but is not limited to, three, four, five, six, or more, etc.

In some embodiments, the two first wheels 1121 are disposed at the front end of the bottom of the cleaning apparatus main body 101, and the two second wheels 1122 are arranged at the rear end of the bottom of the cleaning apparatus main body 101. The first and second wheels 1121 and 1122 may drive the cleaning apparatus 10 to move in a horizontal direction. When the cleaning apparatus 10 is located on the target bottom wall 401 of the target area 40, the operation of the first and second wheels 1121 and 1122 may drive the cleaning apparatus 10 to move on the target bottom wall 401 and on the target side wall 402 and to transition from the target bottom wall 401 to the target side wall 402. In some embodiments, the traveling propulsion mechanism 100 includes a track 111. The first wheels 1121 and second wheels 1122 are connected by the track 111. That is, the first wheels 1121 and the second wheels 1122 rotate with the rotation of the track 111. The operation of the track 111 may drive the cleaning apparatus 10 to move. The track 111 may drive the cleaning apparatus 10 to move in a horizontal direction. As shown in FIG. 10, when the cleaning apparatus 10 is located on the target bottom wall 401 of the target area 40, the operation of the track 111 may drive the cleaning apparatus 10 to move on the target bottom wall 401. The track 111 can also drive the cleaning apparatus 10 to move in the vertical direction. As shown in FIG. 7 and FIG. 13, when the cleaning apparatus 10 is in close contact with the target side wall 402 of the target area 40, the operation of the track 111 may further drive the cleaning apparatus 10 to move on the target side wall 402. Wherein, more details on how the cleaning apparatus 10 is brought into close contact with the target side wall 402 of the target area 40 are described below.

In some embodiments, the track 111 may also enable transition of the travel area of the cleaning apparatus 10 from the target bottom wall 401 to the target side wall 402. As shown in FIG. 11, when the track 111 moves to the junction between the target bottom wall 401 and the target side wall 402, a portion of the track 111 moves on the target side wall 402, while another portion moves on the target bottom wall 401. The portion of the track 111 at the target side wall 402 may drive the cleaning apparatus 10 upward until the travel area of the cleaning apparatus 10 switches from the target bottom wall 401 to the target side wall 402. When the travel area of the cleaning apparatus 10 is switched from the target bottom wall 401 to the target side wall 402, the cleaning apparatus 10 can move on the target side wall 402 driven by the track 111. The cleaning apparatus 10 can further move on the target side wall 402 under the action of the second driving force provided by the second thruster 132 after turning, and the cleaning apparatus 10 can further move on the target side wall 402 based on the action of the third driving force provided by the main water pump 210. For more details regarding the main water pump 210 and the third driving force it provides, please refer to the subsequent sections. By providing the track 111, the cleaning apparatus 10 can be easily moved to various positions in the liquid, and the travel area of the cleaning apparatus 10 can be switched from the target bottom wall 401 to the target side wall 402. In some embodiments, the cleaning apparatus 10 may further include a main water pump 210. The main water pump 210 may be used to drive the cleaning apparatus 10 to draw liquid from the liquid inlet section 103 and discharge it from the liquid outlet section 104. The liquid inlet section 103 may include one or more entries into which liquid enters the cleaning apparatus 10, such as a first water inlet 1031, a second water inlet 1032, etc. The liquid inlet section 103 includes a main water pump inlet 213. As shown in FIG. 9, FIG. 13, FIG. 14, and FIG. 15, the main water pump inlet 213 in the cleaning apparatus 10 may serve as an inlet for liquid into the cleaning apparatus 10, wherein the main water pump inlet 213 may be the first water inlet 1031 or the second water inlet 1032. The liquid outlet section 104 may include one or more outlets where liquid within the cleaning apparatus 10 exits the cleaning apparatus 10 into the target area 40. The liquid outlet section 104 includes a main water pump outlet 214. The main water pump outlet 214 may be a first water outlet. As shown in FIG. 9, FIG. 13, FIG. 14, and FIG. 15, the main water pump outlet 214 in the cleaning apparatus 10 may serve as an outlet for the liquid in the cleaning apparatus 10 to leave the cleaning apparatus 10 and enter the target area 40.

Like the first thruster 131, the main water pump 210 may also include a first propulsion impeller 1311 with a structure similar to the first propulsion motor 1312. The main water pump impeller 212 may rotate under the drive of the main water pump motor 211, thereby sucking the liquid in the target area 40 from the liquid inlet section 103 and discharging the liquid in the cleaning apparatus 10 to the target area 40 through the liquid outlet section 104.

In some embodiments, the cleaning apparatus 10 may switch the functions of the main water pump inlet 213 and the main water pump outlet 214 by adjusting the rotational direction of the main water pump impeller 212 in the main water pump 210. For example, when the impeller in the main water pump 210 rotates in reverse, the main water pump inlet 213 may be used for liquid discharge, and the main water pump outlet 214 may be used for liquid intake.

In some embodiments, when the cleaning apparatus 10 is located on the target side wall 402, the liquid outlet section 104 (e.g., the main water pump outlet 214) may at least face toward the interior of the target area 40 and be parallel to the horizontal direction or be inclined downward in the vertical direction. This ensures that when the main water pump 210 is operating and liquid is discharged from the main water pump outlet 214, the cleaning apparatus 10 can obtain a third driving force, enabling the cleaning apparatus 10 to remain closely attached to the target side wall 402. The third driving force may be the reaction force obtained by the cleaning apparatus 10 when the main water pump 210 discharges liquid from the main water pump outlet 214. When the main

water pump outlet 214 faces the target area 40 and is parallel to the horizontal direction, the third driving force obtained by the cleaning apparatus 10 is perpendicular to the target side wall 402 so that the cleaning apparatus 10 can closely adhere to the target side wall 402.

In some embodiments, when the cleaning apparatus 10 needs to move along the target side wall 402, if the main water pump outlet 214 faces the interior of the target area 40 and is inclined downward in the vertical direction, the third driving force obtained by the cleaning apparatus 10 will have a horizontal component directed toward the target side wall 402, allowing the cleaning apparatus 10 to remain closely attached to the target side wall 402. In addition, the third driving force may also have an upward vertical component, thereby enabling the cleaning apparatus 10 to move upward along the target side wall 402. When the cleaning apparatus 10 is located on the target bottom wall 401, the third driving force obtained by the main water pump 210 discharging water through the main water pump outlet 214 may also have a horizontal component, thereby enabling the cleaning apparatus 10 to move along the target bottom wall 401.

In some embodiments, the main water pump inlet 213 may be provided at the bottom of the cleaning apparatus 10. When the cleaning apparatus 10 needs to move on the target side wall 402, the main water pump 210 can suck liquid from the main water pump inlet 213, thereby obtaining a fourth driving force to drive the cleaning apparatus 10 to closely adhere to the target side wall 402. The fourth driving force may be the suction force generated by the main water pump 210 drawing water through the main water pump inlet 213, which can keep the cleaning apparatus 10 closely attached to the target side wall 402.

In some embodiments, when the cleaning apparatus 10 needs to move on the target side wall 402, the main water pump 210 in the cleaning apparatus 10 can drive the cleaning apparatus 10 to closely adhere to the target side wall 402, and at least one of the track 111, the second thruster 132, and the main water pump 210 in the cleaning apparatus 10 can provide a vertical upward driving force to drive the cleaning apparatus 10 to move upward on the target side wall 402. At least one of the track 111 and the second thruster 132 in the cleaning apparatus 10 can also provide a vertical downward driving force to drive the cleaning apparatus 10 to move downward on the target side wall 402.

By providing the main water pump 210, the cleaning apparatus 10 can closely adhere to the target side wall 402, thereby limiting the position of the cleaning apparatus 10, facilitating the movement of the cleaning apparatus 10 on the target side wall 402, and completing the position switching of the cleaning apparatus 10 from below the liquid level 30 to above the liquid level 30.

In some embodiments, the cleaning apparatus 10 includes a main water pump inlet 213 and a main water pump outlet 214. Wherein, the main water pump inlet 213 and the main water pump outlet 214 may be rotatably disposed in the cleaning apparatus main body 101 to rotate the liquid flow direction at the main water pump inlet 213 and the main water pump outlet 214, thereby changing the liquid flow direction in real time so that the cleaning apparatus 10 obtains propulsion in different directions.

In some embodiments, the cleaning apparatus 10 includes one or two sets of first power water inlet sections (not shown) and first power water outlet sections (not shown). The number of the first power water inlet sections and the first power water outlet sections can be one set or two sets, and the number can be determined according to the settings of the first thruster 131 and the second thruster 132. When the cleaning apparatus 10 includes a first thruster 131 or a second thruster 132, the cleaning apparatus 10 includes one set of a first power inlet section and a first power outlet section. When the cleaning apparatus 10 simultaneously includes a first thruster 131 and a second thruster 132, it includes two sets of first power inlet sections and first power outlet sections.

One set of a first power water inlet section and a first power water outlet section is provided on the cleaning apparatus 10. The first thruster 131 is connected to the first power water inlet section and the first power water outlet section. When the first thruster 131 operates, liquid is sucked in from one of the first power water inlet section and the first power water outlet section and discharged from the other of the first power water inlet section and the first power water outlet section, thereby enabling the cleaning apparatus 10 to obtain a first driving force in the vertical direction. Wherein, a set of a first power water inlet section and a first power water outlet section extends in the vertical direction. Specifically, when the first thruster 131 is the first thruster 131, the first power water inlet section is the above first propulsion opening 1313. The second power water outlet section is the above other first propulsion opening 1313.

And/or, one set of a first power water inlet section and a first power water outlet section is provided on the cleaning apparatus 10. The second thruster 132 is connected to the first power water inlet section and the first power water outlet section. When the second thruster 132 operates, liquid is sucked in from one of the other first power water inlet section and the other first power water outlet section and discharged from the other of the other first power water inlet section and the other first power water outlet section, thereby enabling the cleaning apparatus 10 to obtain a second driving force in the horizontal direction. Wherein, the other set of a first power water inlet section and a first power water outlet section extends in the horizontal direction.

The above cleaning apparatus 10 may include, but is not limited to, a first thruster 131, a first drum fan, and a first water pump. The cleaning apparatus 10 may include, but is not limited to, a second thruster 132, a second drum fan, and a second water pump. The thruster, the drum fan, and the water pump are connected to the first power water inlet section and the first power water outlet section. By changing the forward and reverse direction of the thruster, the drum fan, and the water pump, the cleaning apparatus 10 can be moved up and down in the vertical direction and forward and backward in the horizontal direction, thereby realizing position switching of the cleaning apparatus 10 above and below the liquid level 30 and forward and backward position switching in the liquid.

In some embodiments, the cleaning apparatus 10 includes one or two sets of second power water inlet sections (not shown) and second power water outlet sections (not shown). The second power water inlet section and the second power water outlet section are rotationally arranged in the cleaning apparatus 10. That is, the arrangement of the second power water inlet section and the second power water outlet section is different from the arrangement of the above first power water outlet section. That is, the angles of the second power water inlet section and the second power water outlet section can be adjusted, thereby changing the direction of liquid flow.

A set of first thrusters 131 is connected to the second power water inlet section and the second power water outlet section. When the second thruster 132 operates, liquid is sucked in from one of the second power water inlet section and the second power water outlet section and discharged from the other of the second power water inlet section and the second power water outlet section. Due to the rotation of the second power water inlet section and the second power water outlet section, the cleaning apparatus 10 obtains propulsion force in different directions. Wherein, the propulsion force includes a first driving force in the vertical direction.

And/or, a set of second thrusters 132 is connected to the second power water inlet section and the second power water outlet section. When the second thruster 132 operates, liquid is sucked in from one of the other second power water inlet section and the other second power water outlet section and discharged from the other of the other second power water inlet section and the other second power water outlet section. Due to the rotation of the second power water inlet section and the second power water outlet section, the cleaning apparatus 10 obtains propulsion force in different directions. Wherein, the propulsion force includes a second driving force in the horizontal direction.

The above second power water inlet section can cooperate with a power motor and a power transmission mechanism to achieve the rotation of the second power water inlet section relative to the cleaning apparatus 10. The second power water outlet

section can cooperate with another power motor and another power transmission mechanism to achieve the rotation of the second power water outlet section relative to the cleaning apparatus 10.

In some other embodiments, the first power water inlet section and the first power outlet section are provided in the cleaning apparatus 10 to provide propulsion force in different directions by adjusting the direction of the water spray pipe (not shown). When the first thruster 131 includes a water pump, a water spray pipe is connected between the water pump and the first power water outlet section. The water spray pipe can have different angles. It can provide propulsion in different directions as liquid enters or is discharged from the water spray pipe. When the first power water inlet section, the first power water outlet section, and the first thruster 131 are connected, the propulsion force may include a first driving force in the vertical direction. When the first power water inlet section, the first power water outlet section, and the second thruster 132 are connected, the propulsion force may include a second driving force in the horizontal direction.

Of course, in other embodiments, a first guide structure (not shown) is provided on the path of the first power water inlet section, the first thruster 131, and the first power water outlet section, and the first guide structure changes the direction of liquid flow, thereby providing propulsion in different directions. Similarly, a second guide structure (not shown) is provided on the path of the first power water inlet section, the second thruster 132, and the first power water outlet section, and the second guide structure changes the direction of liquid flow, thereby providing propulsion in different directions. The specific structures of the first guide structure and the second guide structure are not limited, as long as they can change the flow direction of the liquid, and are not limited here.

It should be noted that the above descriptions of the cleaning apparatus 10 and its various components are provided for convenience of description only and do not limit the present disclosure to the scope of the cited embodiments. It is understood that, for those skilled in the art, after understanding the principle of the device, various components may be arbitrarily combined or subcomponents may be connected with other components without departing from this principle.

FIG. 15 is a structural schematic diagram of a fourth embodiment of the cleaning apparatus of the present disclosure. The cleaning apparatus 10 may include a control component (not shown). The control component in the cleaning apparatus 10 controls the position switching of the cleaning apparatus 10 between the water surface and underwater in the swimming pool, so as to achieve water surface or underwater cleaning.

In some embodiments, the filtration mechanism includes a debris bin 711. The debris bin 711 may be used for cleaning both the water surface and underwater areas of the swimming pool. As shown in FIG. 15 and FIG. 16, the debris bin 711 may include a debris bin water inlet section 716. The debris bin water inlet section 716 is in communication with the liquid inlet section 103. The debris bin water inlet section 716 serves as an inlet for debris or other impurities in the swimming pool to enter the cleaning apparatus 10.

In some embodiments, the debris bin water inlet section 716 may include a water surface debris bin opening 7161. The water surface debris bin opening 7161 may serve as an inlet for debris or impurities on the water surface of the swimming pool to enter the debris bin 711. The water surface debris bin opening 716 may be provided on the side (e.g., front side) or top or bottom of the cleaning apparatus 10 and positioned at the floating location of the cleaning apparatus 10 when floating on the water surface, so that debris or other impurities on the water surface can enter the debris bin 711 through the water surface debris bin opening 7161 along with the liquid. For example, when the water surface debris bin opening 7161 is located on the side or bottom of the cleaning apparatus 10, the floating position of the cleaning apparatus 10 when floating on the water surface can be located at the center line position or 1/3 position of the water surface debris bin opening 7161. At this time, the cleaning apparatus 10 is in a normal posture. When the surface debris bin opening 7161 is located at the top or bottom or side of the cleaning apparatus 10, the floating position of the cleaning apparatus 10 when floating on the water may be a position of the surface debris bin opening 7161 near the water surface at the top or bottom or side. At this time, the cleaning apparatus 10 is in an inverted posture.

In some embodiments, the debris bin water inlet section 716 may further include an underwater debris bin opening 7162. The underwater debris bin opening 7162 may serve as an inlet for debris or impurities in the swimming pool water to enter the debris bin 711. The underwater debris bin opening 7162 may be provided below the floating position of the cleaning apparatus 10 on the water surface. For example, the underwater debris bin opening 7162 may be provided at the bottom of the cleaning apparatus 10. Alternatively, the underwater debris bin opening 7162 may also be provided on the side of the cleaning apparatus 10 below its floating position on the water surface. By providing the water surface debris bin opening 7161 and the underwater debris bin opening 7162, the cleaning apparatus 10 can perform water surface cleaning and water cleaning. The usage scenarios of the cleaning apparatus 10 are expanded and the user experience is improved.

In some embodiments, the debris bin 711 may further include a debris bin roller brush assembly 717. The debris bin 711 may include one or more debris bin roller brush assemblies 717. The debris bin roller brush assembly 717 may be used to roll debris or impurities from the water surface into the debris bin 711 during water surface cleaning, thereby improving cleaning efficiency. The debris bin roller brush assembly 717 may be provided within the water surface debris bin opening 7161. As shown in FIG. 14, the debris bin roller brush assembly 717 may be provided on the inner side of the water surface debris bin opening 7161.

In some embodiments, the debris bin roller brush assembly 717 may also be provided on the outer side of the water surface debris bin opening 7161 or on the water surface debris bin opening 7161 itself.

In some embodiments, the debris bin 711 also includes a water surface adjustment member (not shown) and an underwater adjustment member (not shown). The water surface adjustment member is used to adjust the opening and closing state of the water surface debris bin opening 7161. The underwater adjustment member is used to adjust the opening and closing state of the underwater debris bin opening 7162. The control component can open or close the corresponding water surface debris bin opening 7161 and/or underwater debris bin opening 7162 by adjusting the water surface adjustment member and/or the underwater adjustment member.

When the cleaning apparatus 10 performs underwater cleaning, both the water surface adjustment member and the underwater adjustment member are in an open state, that is, the water surface adjustment member opens the water surface debris bin opening 7161 and the underwater adjustment member opens the water debris bin opening 7162. By opening both the water surface debris bin opening 7161 and the underwater debris bin opening 7162, more liquid is available, thereby increasing cleaning efficiency. Alternatively, the water surface adjustment member is in a closed state and the underwater adjustment member is in an open state, that is, the water surface adjustment member closes the water debris bin opening 7161 and the underwater adjustment member opens the underwater debris bin opening 7162. By closing the water surface debris bin opening 7161 and opening the underwater debris bin opening 7162, the suction force of the cleaning apparatus 10 in the underwater debris bin opening 7162 can be improved, avoiding diversion of the water surface debris bin opening 7161 and thereby improving the underwater cleaning efficiency of the cleaning apparatus 10.

When the cleaning apparatus 10 performs water surface cleaning, both the water surface adjustment member and the underwater adjustment member may be in an open state, that is, the water surface adjustment member opens the water surface debris bin opening 7161 and the underwater adjustment member opens the water debris bin opening 7162. By opening both the water surface debris bin opening 7161 and the underwater debris bin opening 7162, this is beneficial to the stability of the cleaning

apparatus 10 on the water surface. Alternatively, the water surface adjustment member is in an open state and the underwater adjustment member is in a closed state, that is, the water surface adjustment member opens the surface water debris bin opening 7161 and the underwater adjustment member closes the underwater debris bin opening 7162. By opening the water surface debris bin opening 7161 and closing the underwater debris bin opening 7162, the suction force of the cleaning apparatus 10 in the water surface debris bin opening 7161 can be improved, avoiding diversion of the underwater debris bin opening 7162 and thereby improving the underwater cleaning efficiency of the cleaning apparatus 10. Wherein, when the cleaning apparatus 10 is in a normal posture or an inverted posture, the opening and closing state of the water surface debris bin opening 7161 can be adjusted by the water surface adjustment member; and/or, the opening and closing state of the underwater debris bin opening 7162 can be adjusted by the underwater adjustment member.

In some specific embodiments, the debris bin 711 may further include a water surface debris bin opening cover plate 718 and an underwater debris bin opening cover plate 719. Wherein, the water surface adjustment element may include the above water surface debris bin opening cover plate 718. The underwater adjustment element may include the underwater debris bin opening cover plate 719. The water surface debris bin opening cover plate 718 is used to adjust the open/closed state of the water surface debris bin opening 7161. When the water surface debris bin opening 7161 is in an open state, liquid on the surface of the swimming pool can enter the debris bin 711 through the water surface debris bin opening 7161. When the water surface debris bin opening 7161 is in a closed state, liquid on the surface of the swimming pool cannot enter the debris bin 711 through the water surface debris bin opening 7161. The water surface debris bin opening cover plate 718 is provided on the water surface debris bin opening 7161. As shown in FIG. 16, the water surface debris bin opening cover plate 718 may be provided within the water surface debris bin opening 7161. The water surface debris bin opening cover plate 718 may also be provided on the inner or outer side of the water surface debris bin opening 7161.

Similarly, the underwater debris bin opening cover plate 718 is used to adjust the open/closed state of the underwater debris bin opening 7162. The underwater debris bin opening cover plate 719 is provided on the underwater debris bin opening 7162. The underwater debris bin opening cover plate 719 may be provided within, on the inner side, or on the outer side of the underwater debris bin opening 7162.

The water surface debris bin opening cover plate 718 and the underwater debris bin opening cover plate 719 may be movable components. The control component may open or close the corresponding debris bin water inlet section 716 by adjusting the water surface debris bin opening cover plate 718 and/or the underwater debris bin opening cover plate 719. For example, the water surface debris bin opening cover plate 718 may be a rotatable component, and the control component may rotate the water surface debris bin opening cover plate 718 to switch the water surface debris bin opening 7161 from a closed to an open state.

In some embodiments, when the cleaning apparatus 10 needs to perform underwater cleaning, the control component may keep the water surface debris bin opening 7161 closed via the water surface debris bin opening cover plate 718, and keep the underwater debris bin opening 7162 open via the underwater debris bin opening cover plate 719, thereby preventing the water surface debris bin opening 7161 from diverting liquid and ensuring the suction force of the underwater debris bin opening 7162, thus improving the cleaning efficiency of the cleaning apparatus 10 underwater. In other embodiments, the water surface debris bin opening 7161 may also be in an open state.

Similarly, when the cleaning apparatus 10 needs to perform water surface cleaning, the control component may keep the underwater debris bin opening 7162 closed via the underwater debris bin opening cover plate 719, and keep the water surface debris bin opening 7161 open via the water surface debris bin opening cover plate 718, thereby preventing the underwater debris bin opening 7162 from diverting liquid and ensuring the suction force of the water surface debris bin opening 7161, thus improving the cleaning efficiency of the cleaning apparatus 10 on the water surface. In other embodiments, the underwater debris bin opening 7162 may also be in an open state.

In some embodiments, the water surface adjustment member may also be a water surface adjustment valve. The underwater adjustment member may also be an underwater adjustment valve. The opening of the water surface adjustment valve and the underwater adjustment valve can be determined by the working parameters of the main water pump 210, such as the working power of the main water pump 210. The water surface adjustment valve and the underwater adjustment valve can only be opened after meeting a certain pressure threshold. When the working power of the main water pump 210 is greater than the pressure threshold of the water surface adjustment valve, the water surface adjustment valve opens the water surface debris bin opening 7161. When the working power of the main water pump 210 is less than the pressure threshold of the water surface adjustment valve, the water surface adjustment valve closes the water surface debris bin opening 7161. When the working power of the main water pump 210 is greater than the pressure threshold of the underwater adjustment valve, the underwater adjustment valve opens the underwater debris bin opening 7162. When the working power of the main water pump 210 is less than the pressure threshold of the underwater adjustment valve, the underwater adjustment valve closes the underwater debris bin opening 7162. The above water surface adjustment valve and underwater adjustment valve can be but are not limited to duckbill valves etc., and are not limited here.

In some embodiments, the debris bin 711 may further include other structures. For example, the debris bin 711 may also include a filter layer. The aforementioned filter layer may be used to filter the liquid entering the debris bin 711.

The control component may be configured to control the cleaning apparatus 10 to perform water surface or underwater cleaning. In some embodiments, the control component may acquire a target cleaning task for the target swimming pool, wherein the target task comprises water surface cleaning and underwater cleaning; based on the target task and the current position of the cleaning apparatus 10, determine adjustment parameters for the cleaning apparatus 10; and based on the adjustment parameters, control the cleaning apparatus 10 to move to the target position to complete the target task. For more details on the above embodiments, please refer to FIG. 28 and its related description.

By providing the cleaning apparatus 10 with such a configuration, comprehensive cleaning of multiple locations such as the pool bottom, pool walls, underwater, and water surface can be achieved, ensuring thorough pool cleaning.

In some embodiments, the cleaning apparatus 10 may further comprise a debris guiding component 106. The debris guiding component 106 can direct debris floating on the pool liquid level 30 into the water surface debris bin opening 7161. As shown in FIG. 15 and FIG. 16, the debris guiding component 106 may be positioned outside the water surface debris bin opening 7161 and is hollow inside. The port size of a first end 1061, which is distal from the water surface debris bin opening 7161, is greater than the size of the water surface debris bin opening 7161. The port size of a second end 1062, which connects to the water surface debris bin opening 7161, is not smaller than the size of the water surface debris bin opening 7161. The debris guiding component 106 may include, but is not limited to, a hollow frustum, a trapezoidal body, or other similar structures.

In some embodiments, the port size of the first end 1061 and the water surface debris bin opening 7161 may be set in proportion. For example, the size ratio between the first end 1061 and the water surface debris bin opening 7161 may be set to not exceed 10:1 to prevent excessive debris or impurities from simultaneously entering the water surface debris bin opening 7161, which could otherwise cause clogging. By providing the debris guiding component 106, debris spread over a wide area of the water surface can be gathered together and directed into the water surface debris bin opening 7161, thereby preventing reduced cleaning efficiency due to the small size of the water surface debris bin opening 7161.

As shown in FIGS. 15 and 16, the cleaning apparatus 10 may further include an underwater roller brush. The underwater roller brush 411 can be configured to clean the target bottom wall 401 and target side wall 402 of the swimming pool. The cleaning apparatus 10 may include one or more underwater roller brushes 411. The underwater roller brush 411 may be disposed at the bottom and/or sides of the cleaning apparatus 10. As shown in FIG. 15, the front and rear ends of the bottom of the cleaning apparatus 10 may each be provided with an underwater roller brush 411. When the cleaning apparatus 10 moves along the bottom of the swimming pool, the underwater roller brush 411 can clean the pool bottom (e.g., by sweeping away debris or algae); when the cleaning apparatus 10 moves along the pool wall, the underwater roller brush 411 can also clean the pool wall.

It should be noted that the above descriptions of the cleaning apparatus 10 and its various components are provided for convenience of description only and do not limit the present disclosure to the scope of the cited embodiments. It is understood that, for those skilled in the art, after understanding the principle of the device, various components may be arbitrarily combined or subcomponents may be connected with other components without departing from this principle.

FIG. 28 is an exemplary flow chart of a liquid cleaning control method of the present disclosure. The process 1000 may be applied to the cleaning apparatus 10 and executed by a control component. As shown in FIG. 28, process 1000 may include the following steps:

Step 1010: Obtain a target task for cleaning a target swimming pool.

The target swimming pool refers to the pool requiring cleaning. The target task refers to the cleaning task to be performed on the target swimming pool. The target task may include surface cleaning and/or underwater cleaning, where surface cleaning refers to cleaning the water surface of the target pool, and underwater cleaning refers to cleaning underwater areas (e.g., water body, pool wall, etc.) of the target pool. In some embodiments, the target task may further specify particular cleaning locations 4311. For example, underwater cleaning may include, but is not limited to, cleaning the water body, pool bottom, and various pool walls.

The control component may acquire the target task in various ways. For example, the control component may receive user input specifying the target task. Alternatively, the control component may be configured to execute the target task periodically, such as performing surface cleaning every three days and underwater cleaning every two days. Furthermore, the cleaning apparatus 10 may include a detection component for water quality detection of the target pool, obtaining water quality data. The control component may acquire this water quality data and determine the target task based on it. The water quality data reflects the condition of the pool water and may include, but is not limited to, images of the pool surface, underwater images, and images of each pool wall. The control component may input the water quality data into a task determination model, which outputs the target task. The task determination model can analyze the water quality data to determine the cleanliness (e.g., clarity, algae distribution, debris status) of various regions (such as the water surface, underwater, and each pool wall), thereby determining the corresponding target task. The task determination model may be a convolutional neural network, a graph neural network, or any other machine learning model capable of performing this function. The model may be trained on multiple sets of labeled training samples, where each sample includes water quality data of a sample pool and a label indicating the sample task. The sample task may be annotated manually based on the sample water quality data.

At step 1020, based on the target task and the current position of the cleaning apparatus 10, an adjustment parameter of the cleaning apparatus 10 is determined.

The control component can obtain the current position of the cleaning apparatus 10. For more information on obtaining the current position of the cleaning apparatus 10, please refer to the relevant content for the first sensor above.

The adjustment parameters may include route information for moving from the current position to the location in the target pool where the target task is to be performed, as well as the route information required to complete the target task.

The control component may, based on the target task, determine the starting position in the target pool for performing the target task, then determine the route information for moving from the current position to the starting position, and further determine the route information required to complete the target task, thereby determining the adjustment parameters for the cleaning apparatus 10.

At step 1030, based on the adjustment parameters, the cleaning apparatus 10 is controlled to drive the cleaning apparatus 10 to move and perform cleaning to complete the target task.

The control component may, based on the route information in the adjustment parameters, control the cleaning apparatus 10 to move the cleaning apparatus 10 from the current position to the starting position for the target task, and then, based on the route information for completing the target task, activate the debris bin 711 and main roller brush 411 to perform cleaning and complete the target task. After completing the target task, the cleaning apparatus 10 may remain at the end position, return to the initial position before movement, or move to a preset default position.

Through the above-described liquid cleaning control method, the cleaning apparatus 10 can be controlled to clean various parts of the pool, thereby improving cleaning efficiency and ensuring comprehensive cleanliness.

It should be noted that the above description regarding process 1000 is provided solely for purposes of example and illustration and does not limit the scope of applicability of the present disclosure. Those skilled in the art may make various modifications and changes to process 1000 in light of the teachings of this disclosure. However, such modifications and changes shall still fall within the scope of the present disclosure.

Some embodiments of the present disclosure further provide a computer-readable storage medium 60, which may store computer instructions. When executed by a processor 52, these computer instructions implement the liquid cleaning control method as described previously.

In some embodiments, the cleaning apparatus 10 comprises a traveling propulsion mechanism 100 and a cleaning system. The traveling propulsion mechanism 100 comprises a transmission assembly 120. The transmission assembly 120 includes a traveling drive member 121, a first driven member 123, and a second driven member 124. The cleaning system comprises a first cleaning member 410 and a second cleaning member 420. The first cleaning member 410 is used to draw debris or the like below the liquid level 30 into the filtration system. The second cleaning member 420 is used to draw debris or the like above the liquid level 30 into the filtration system. Wherein, the traveling drive member 121 is disposed inside the cleaning apparatus main body 101. The output end of the traveling drive member 121 is adapted to be drivingly connected with the wheel 112 to enable the traveling drive member 121 to drive the wheel 112 to rotate. The first driven member 123 is provided on the cleaning apparatus main body 101. The first driven member 123 is drivingly connected to the wheel 112. The output end of the first driven member 123 is adapted to connect with the first cleaning member 410. The wheel 112 drives the first driven member 123 to rotate so that the first driven member 123 drives the first cleaning member 410 to rotate. The second driven member 124 is provided on the cleaning apparatus main body 101. The second driven member 124 is drivingly connected to the wheel 112. The output end of the second driven member 124 is adapted to connect with the second cleaning member 420. The wheel 112 drives the second driven member 124 to rotate so that the second driven member 124 drives the second cleaning member 420 to rotate. For example, in this embodiment, the first cleaning member 410 is an underwater roller brush 411 and the second cleaning member 420 is a water surface roller brush 421.

By providing the traveling drive member 121, the first driven member 123, and the second driven member 124, only one traveling drive member 121 is needed to realize the driving of the wheel 112, the first cleaning member 410, and the second cleaning member 420. The driving structure is simple and the manufacturing cost is low. The traveling drive member 121 drives the wheels 112 to rotate, enabling the wheels 112 to move forward or backward. When the wheels 112 rotate, they can drive the first driven member 123 and the second driven member 124 to rotate, thereby respectively driving the first cleaning member 410 and the second cleaning member 420 to rotate. This enables the operation of different cleaning members, thereby diversifying the cleaning functions of the cleaning apparatus 10. Exemplarily, the first cleaning member 410 is an underwater roller brush 411. When the second cleaning member 420 is a water surface roller brush 421, the transmission assembly 120 can drive the rotation of the underwater roller brush 411 and the water surface roller brush 421 by driving the wheel 112 to rotate, thereby diversifying the cleaning functions of the cleaning apparatus 10. Optionally, the underwater roller brush 411 and the water surface roller brush 421 rotate in the same direction. In some embodiments, the wheel 112 includes a first wheel 1121, a second wheel 1122, and a track 111. The first wheels 1121 and second wheels 1122 are drivingly connected by the track 111. The output end of the traveling drive member 121 is drivingly connected to the first wheel 1121. Specifically, in this embodiment, two first wheels 1121 and two second wheels 1122 are provided. The two first wheels 1121 are arranged at the front end of the cleaning apparatus main body 101, and the two second wheels 1122 are arranged at the rear end of the cleaning apparatus main body 101.

By way of example, the traveling drive member 121 in this embodiment includes a traveling drive motor. The transmission assembly 120 further includes a first gear 122, and the output end of the traveling drive motor is connected to the first gear 122. The first gear 122 meshes with the first wheel 1121 so that the first gear 122 can drive the first wheel 1121 to rotate. Furthermore, the traveling drive member 121 may also be any other component capable of providing kinetic energy, and this embodiment is not limited in this regard.

Please refer to FIG. 29 and FIG. 30. FIG. 29 is a structural schematic diagram of a fifth embodiment of the cleaning apparatus of the present disclosure; and FIG. 30 is an exploded schematic diagram of a fifth embodiment of the cleaning apparatus of the present disclosure. In some embodiments, the second driven member 124 includes a second gear 1241, a third gear 1242, a fourth gear 1244, a fifth gear 1245, and a first rotating disk and a second rotating disk. The second gear 1241 is connected with the first rotating disk. The third gear 1242 is connected with the second rotating disk. The first rotating disk and the second rotating disk are drivingly connected by track 111. Additionally, the second gear 1241 meshes with the second wheel 1122. The fourth gear 1244 meshes with the third gear 1242. Additionally, the fourth gear 1244 is connected with the second cleaning member 420. The fifth gear 1245 is disposed between the third gear 1242 and the fourth gear 1244. Additionally, the fifth gear 1245 meshes with both the third gear 1242 and the fourth gear 1244.

Specifically, during operation, after the traveling drive member 121 is activated, the traveling drive member 121 drives the first gear 122 to rotate. Since the first gear 122 meshes with the first wheel 1121, the first gear 122 can drive the first wheel 1121 to rotate. Under the connection of the track 111, the first wheel 1121 can drive the second wheel 1122 to rotate through the track 111; the second wheel 1122 drives the second gear 1241 to rotate; the second gear 1241 drives the first rotating disk to rotate, thereby enabling the first rotating disk to drive the second rotating disk through the track 111; the second rotating disk drives the third gear 1242 to rotate; the third gear 1242 drives the fifth gear 1245 to rotate; the fifth gear 1245 drives the fourth gear 1244 to rotate; and finally, the fourth gear 1244 can drive the second cleaning member 420 to rotate. If the second cleaning member 420 is a water surface roller brush 421, the debris on the water surface be removed and collected.

In some optional embodiments, the second cleaning member 420 is connected to the fourth gear 1244 through a connecting shaft, and the second driven member 124 in this embodiment is only provided on one side of the cleaning apparatus main body 101, thereby facilitating the simplification of the structure of the cleaning apparatus 10 to save costs and reduce weight.

In some optional embodiments, the fourth gear 1244 and the second cleaning member 420 as a whole are removed from the second driven member 124 to facilitate disassembly and cleaning of the second cleaning member 420. The fourth gear 1244 may be disposed in the debris bin 711. Alternatively, the fourth gear 1244 may be provided on the debris bin cover plate. When disassembling the debris bin 711, the second cleaning member 420 and the fourth gear 1244 are also dismantled with the debris bin 711, and the debris bin 711 and the second cleaning member 420 can be cleaned at the same time, thereby facilitating disassembly and cleaning of the second cleaning member 420. Furthermore, in this embodiment, the second gear 1241 is coaxially arranged with the first rotating disk, the third gear 1242 is coaxially arranged with the second rotating disk, and the second rotating disk is arranged directly above the first rotating disk. This can shorten the size of the track 111 as much as possible, save costs, and at the same time help to improve the reliability and stability of the second driven member 124.

Continuing to reference FIG. 29 and FIG. 30, in some embodiments, the first driven member 123 includes a sixth gear 1231, a seventh gear 1232, and an eighth gear 1233. Wherein, the sixth gear 1231 meshes with the seventh gear 1232. The sixth gear 1231 meshes with the second wheel 1122. Additionally, the seventh gear 1232 is connected with the first cleaning member 410. The eighth gear 1233 is disposed between the sixth gear 1231 and the seventh gear 1232. Additionally, the eighth gear 1233 meshes with both the sixth gear 1231 and the seventh gear 1232.

Specifically, during operation, after the traveling drive member 121 is activated, the traveling drive member 121 drives the first gear 122 to rotate. Since the first gear 122 meshes with the first wheel 1121, the first gear 122 can drive the first wheel 1121 to rotate. Under the connection of the track 111, the first wheel 1121 can drive the second wheel 1122 through the track 111 to rotate; the second wheel 1122 drives the sixth gear 1231 to rotate; the sixth gear 1231 drives the eighth gear 1233 to rotate; the eighth gear 1233 drives the seventh gear 1232 to rotate, thereby enabling the seventh gear 1232 to drive the first cleaning member 410 to rotate. When the first cleaning member 410 is an underwater roller brush 411, the cleaning of the surface of the pool can be realized. Wherein, the pool surface may be the bottom surface of the pool or the wall surface of the pool.

Furthermore, please continue to refer to FIG. 30. The first cleaning member 410 is connected to the seventh gear 1232 through a connecting shaft and the seventh gear 1232 can be detachably connected to the cleaning apparatus main body 101 by bolts, which is conducive to the later replacement of the first cleaning member 410. By providing the sixth gear 1231, the seventh gear 1232, and the eighth gear 1233, the first cleaning member 410 can be removed while ensuring the normal operation of the first cleaning member 410, thereby avoiding the problem of the first cleaning member 410 being directly fixedly connected to the second wheel 1122 and being non-removable in the traditional technology, thereby improving the flexibility and applicability of the cleaning apparatus 10 in this embodiment and saving costs.

The cleaning apparatus 10 of this embodiment can drive different cleaning parts through a traveling drive member 121, has diversified cleaning functions, simple structure, low manufacturing cost, light weight, is easy for users to carry and transport, and improves work efficiency. Specifically, the first cleaning member 410 may be an underwater roller brush 411 and the second cleaning member 420 may be a water surface roller brush 421. The transmission assembly 120 of the cleaning apparatus 10 can drive the rotation of the underwater roller brush 411 and the water surface roller brush 421 by driving the wheel 112 to rotate, thereby diversifying the cleaning functions of the cleaning apparatus 10.

Further, in this embodiment, the cleaning apparatus 10 includes two transmission assemblies 120, two first wheels 1121, and two second wheels 1122. Each transmission assembly 120 includes at least one first driven member 123, at least one traveling drive member 121, and at least one second driven member 124.

In a specific embodiment, each transmission assembly 120 includes a second driven member 124, so that the cleaning apparatus 10 includes two first driven members 123. The two first driven members 123 are respectively provided on both sides of the cleaning apparatus body 101, and the two driven members 123 are respectively located at positions corresponding to the two second wheels 1122. In the present example, the cleaning apparatus 10 includes two first cleaning members 410, that is, two seventh gears 1232 independently drive one first cleaning member 410 each, thereby improving the cleaning efficiency. The first cleaning member 410 may be a floor cleaning roller brush, so that the cleaning apparatus 10 may realize cleaning of the surface of the pool. Wherein, the pool surface may be the bottom surface of the pool or the wall surface of the pool.

In a specific embodiment, each transmission assembly 120 includes a traveling drive member 121, so that the cleaning apparatus 10 includes two traveling drive members 121. The two traveling drive members 121 are respectively drivingly connected to a first wheel 1121, which facilitates the turning action of the cleaning apparatus 10. Wherein, the first wheel 1121 may be a front wheel of the cleaning apparatus 10 and the second wheel 1122 may be a rear wheel of the cleaning apparatus 10. Exemplarily, when the cleaning apparatus 10 needs to turn, one of the traveling drive members 121 causes one of the first wheels 1121 to stop working, slow down, or work in reverse, and the other traveling drive member 121 accelerates and drives the other first wheel 1121 to rotate, thereby realizing the turning action of the cleaning apparatus 10. In this example, two traveling drive members 121 are used to drive the two first wheels 1121 to rotate, which can provide more power to the cleaning apparatus 10 and improve work efficiency.

In another embodiment, the cleaning apparatus 10 includes two transmission assemblies 120, two first wheels 1121, and two second wheels 1122, and each transmission assembly 120 includes two first driven members 123, so that the cleaning apparatus 10 has four first driven members 123, which are respectively connected to two first wheels 1121 and two second wheels 1122, enabling the four first driven members 123 to drive the four first cleaning members 410 and thereby improving the cleaning efficiency of the cleaning apparatus 10.

In another embodiment, the cleaning apparatus 10 includes four transmission assemblies 120, two first wheels 1121 and two second wheels 1122, and each transmission assembly 120 includes a first driven member 123 and a traveling drive member 121. The four traveling drive members 121 drive two first wheels 1121 and two second wheels 1122. The four first driven members 123 are drivingly connected to two first wheels 1121 and two second wheels 1122 so that the four first driven members 123 drive the four first cleaning members 410, thereby improving the cleaning efficiency of the cleaning apparatus 10.

Please refer to FIG. 31. FIG. 31 is a cross-sectional schematic diagram of a sixth embodiment of the cleaning apparatus of the present disclosure. The cleaning apparatus 10 comprises a cleaning apparatus main body 101, a cleaning component 430, and a motion drive assembly. The cleaning component 430 is disposed on the cleaning apparatus main body 101. A motion drive assembly (not shown) is provided on the cleaning apparatus main body 101. The motion drive assembly is connected with the cleaning component 430 for driving the cleaning component 430 into telescopic movement relative to the cleaning apparatus main body 101. Telescopic movement includes at least one of the following: an extension movement in the direction away from the cleaning apparatus main body 101 and a retraction movement in the direction close to the cleaning apparatus main body 101. In the first position, the cleaning component 430 is in a retracted end position; in the second position, the cleaning component 430 is in an extended end position; it can be understood that the cleaning component 430 can be stopped in the first position, the second position, and any position between the first and second positions to accommodate different application needs. During the cleaning process, the cleaning apparatus main body 101 may move along a bottom wall of the pool, a side wall of the pool, or the water surface of the pool or be suspended in the liquid in the pool.

The present disclosure is mainly used in the field of robotics. The cleaning apparatus 10 in the present disclosure can drive the cleaning component 430 to move telescopically using a motion drive assembly, so that the cleaning component 430 is more flexible to comprehensively clean water on the surface of the pool or the water in the pool in different directions and at different distances, thereby reducing the movement of the cleaning apparatus 10 to improve cleaning efficiency. In addition, the motion drive assembly may also drive the cleaning component 430 into a rotational movement, which may allow the cleaning component 430 to rotate at any angle about the fulcrum of the position connected with the cleaning apparatus main body 101. The rotational movement also enables the change of the cleaning component 430 between the extended state and the retracted state.

Please refer to FIG. 32. FIG. 32 is a structural schematic diagram of B in FIG. 31. The cleaning component 430 may include a rotary brush 431 and a rotary shaft 432, the rotary brush 431 being disposed around the rotary shaft 432, the rotary shaft 432 being pivotally connected to the cleaning apparatus main body 101 by a motion drive assembly, and the rotary brush 431 having at least one cleaning surface 4311, the cleaning surface 4311 being tiltable and the cleaning surface 4311 being used to contact and agitate the water flow. Specifically, the rotary brush 431 includes several cleaning sections 4311. The cleaning sections 4311 are disposed around the periphery of the rotary shaft 432. The cleaning sections 4311 are disposed axially along the rotary shaft 432. The cleaning sections 4311 form a cleaning surface 4311 on one side. The cleaning sections 4311 are at least partially made of a flexible material, such as rubber, elastic fabric, bristles, etc. And/or, the cleaning sections 4311 are at least partially configured

to be made of a rigid material, such as steel wire, etc. The rigid material can improve the cleaning ability of the cleaning component 430. In addition, several cleaning sections 4311 can be made of a variety of materials alternately arranged, for example, rubber and steel wire alternately arranged. The rotary brush 431 may be the same material as the rotary shaft 432 or a different material.

In some embodiments, when the cleaning component 430 is in a retracted state, the entire cleaning component 430 is located within the range of the cleaning apparatus main body 101, or at least a portion of the cleaning component 430 is located within the range of the cleaning apparatus main body 101. The retracted state is a state formed by the motion drive assembly driving the cleaning component 430 to perform a retracting movement, or is a state in which the motion drive assembly does not drive the cleaning component 430 to perform an extending movement. For example, the retracted state is the state when the motion drive assembly drives the cleaning component 430 to retract in the direction close to the cleaning apparatus main body 101. At this time, the cleaning component 430 is gradually retracted into the cleaning apparatus main body 101. When the part of the cleaning component 430 located within the range of the cleaning apparatus main body 101 reaches a first preset value, the cleaning component 430 stops the retracting movement, wherein the first preset value can be 50%, 60%, 85%, 100%, etc. For another example, the state in which the motion driving component does not drive the cleaning component 430 to perform the extending movement, that is, the cleaning component 430 is in the retracted state. In this case, when the motion drive assembly drives the cleaning component 430 to move, only the extending movement is performed.

In other embodiments, when the cleaning component 430 is in an extended state, or at least a portion of the cleaning component 430 is located outside the range of the cleaning apparatus main body 101. The extended state is a state formed by the motion drive assembly driving the cleaning component 430 to perform an extending movement, or is a state in which the motion drive assembly does not drive the cleaning component 430 to perform a retracting movement. For example, the extended state is the state when the motion drive assembly drives the cleaning component 430 to extend in the direction away from the cleaning apparatus main body 101. At this time, the cleaning component 430 is gradually extended outside the cleaning apparatus main body 101. When the part of the cleaning component 430 located within the range of the cleaning apparatus main body 101 reaches a second preset value, the cleaning component 430 stops the extending movement, wherein the second preset value can be 50%, 60%, 85%, etc. For another example, the state in which the motion driving component does not drive the cleaning component 430 to perform the retracting movement, that is, the cleaning component 430 is in the extended state. In this case, when the motion drive assembly drives the cleaning component 430 to move, only the retracting movement is performed.

In other embodiments, the cleaning component 430 may be in an extended state or a contracted state. When the cleaning component 430 contracts toward the cleaning apparatus main body 101, the cleaning component 430 may be in a contracted state; when the cleaning component 430 extends toward the direction away from the cleaning apparatus main body 101, the cleaning component 430 may be in an extended state.

Please refer to FIG. 33. FIG. 33 is a structural schematic diagram of a connecting section in a sixth embodiment of the cleaning apparatus of the present disclosure. In some embodiments, the cleaning member 430 is driven to perform rotational and telescopic movements, and the motion drive assembly may include: a connecting section 440 and a first drive assembly (not shown). The cleaning component 430 is connected to the cleaning apparatus main body 101 through a connecting section 440. The first drive assembly is connected with the connecting section 440 for driving the cleaning component 430 into telescopic movement relative to the cleaning apparatus main body 101.

Please refer to FIG. 34. FIG. 34 is a structural schematic diagram of a connecting section in a seventh embodiment of the cleaning apparatus of the present disclosure. In some embodiments, the connecting section 440 may be a telescopic structure. See FIG. 34. The connecting section 440 includes a fixed section 441 and a telescopic section 442. The fixed section 441 is fixedly connected to the cleaning apparatus main body 101. One end of the telescopic section 442 is connected to the fixed section 441, and the other end is connected to the cleaning component 430. The telescopic section 442 can perform telescopic movement relative to the fixed section 441. The first drive assembly includes a first power source (not shown), which is provided at the connection between the fixed section 441 and the telescopic section 442, and the first power source is used to drive the connecting section 440 to telescope, thereby driving the cleaning component 430 to telescope. It can be understood that the first power source may be a power source such as a motor or cylinder, and is not specifically limited herein.

In other embodiments, the cleaning component 430 is movably connected to the motion drive assembly and the first drive assembly includes a first transmission mechanism 450 and a first power source. The input end of the first transmission mechanism 450 is connected to the first power source and the output end of the first transmission mechanism 450 is connected to the cleaning component 430. The first power source is used to provide power to the first transmission mechanism 450 so that the first transmission mechanism 450 drives the cleaning component 430 to perform telescopic movement relative to the cleaning apparatus main body 101 and the connecting section 440.

Please refer to FIG. 35. FIG. 35 is a structural schematic diagram of a first transmission section in a sixth embodiment of the cleaning apparatus of the present disclosure. Specifically, the first transmission mechanism 450 and the first power source may be provided at one end of the connecting section 440 connected to the cleaning component 430 to control the telescopic movement of the cleaning component 430. Wherein, the first transmission mechanism 450 may include a turbine transmission mechanism and a gear transmission mechanism. For example, please refer to FIG. 35. The first transmission mechanism 450 includes a swing gear 451, a worm gear 452, a worm 453, and a transmission gear 454. The worm 453 is fixedly connected to the output end of the first power source, and the worm 453 meshes with the worm gear 452. The worm gear 452 and the transmission gear 454 are fixedly connected through a coaxial shaft. The transmission gear 454 meshes with the swing gear 451. The swing gear 451 serves as the output end of the first transmission mechanism 450 and is used to drive the components connected to the output end of the first transmission mechanism 450 to perform telescopic movement. It can be understood that the first transmission mechanism 450 may include a turbine transmission mechanism and a gear transmission mechanism, or other transmission mechanisms, which are not specifically limited here. For example, the component connected to the output end of the first transmission mechanism 450 is the cleaning component 430, which is eccentrically connected to the swinging gear 451 through a rotary shaft. Through the eccentric swing of the swing gear 451 and the rotary shaft, the cleaning component 430 is extended in a direction away from the cleaning apparatus main body 101, so that the cleaning component 430 at least partially extends out of the range of the cleaning apparatus main body 101; or, the cleaning component 430 is retracted in a direction close to the cleaning apparatus main body 101, so that at least part of the cleaning component 430 is retracted into the range of the cleaning apparatus main body 101. It can be understood that the first transmission mechanism 450 may be other transmission structures in addition to the above transmission structure, and is not specifically limited here.

In other embodiments, the first end of the connecting section 440 is connected to the cleaning component 430, the first driving assembly includes a first transmission mechanism 450 and a first power source, the input end of the first transmission mechanism 450 is connected to the first power source, and the output end of the first transmission mechanism 450 is connected to the second end of the connecting section 440 or a component located between the second end and the cleaning apparatus main body 101. The first power source is used to provide power to the first transmission mechanism 450 so that the first transmission mechanism 450 drives the connecting section 440 and the cleaning component 430 to perform telescopic movement relative to the cleaning apparatus main body 101. Wherein, the first transmission mechanism 450 can control the component connected to it to rotate or translate so that the cleaning component 430 telescopically moves relative to the cleaning apparatus main body 101.

In some embodiments, the motion drive assembly includes at least one set of second drive assemblies and the at least one set of second drive assemblies is used to drive the cleaning component 430 to perform rotational motion relative to the cleaning apparatus main body 101.

The first drive assembly and the second drive assembly may be used to control the connecting section 440 for rotational movement and telescopic movement at the same time, at which point, the component located between the second end and the cleaning apparatus main body 101 may be the second drive assembly. In a specific embodiment, each set of second drive assemblies may comprise: a second drive mechanism and a second power source. The second power source is connected to the input end of the second transmission mechanism and is used to provide power to the second transmission mechanism so that the second transmission mechanism directly or indirectly drives the cleaning component 430 to rotate. It can be understood that the second power source may be a power source such as a motor or cylinder, and is not specifically limited herein.

In another specific embodiment, the first end of the connecting section 440 is connected to the cleaning component 430, and at least one set of second drive components includes a first set of second drive components. The first end of the connecting section 440 is connected to the cleaning component 430, and the first set of second drive components is connected to the cleaning apparatus main body 101 and the second end of the connecting section 440 and is used to drive the connecting section 440 to rotate around the first direction axis 461, thereby indirectly driving the cleaning component 430 to rotate around the first direction axis 461. Wherein, the first direction axis 461 can be a linear rotation axis 432, which can be vertically arranged so that the connecting part 440 can rotate in the horizontal direction, as shown in FIG. 31, or the linear rotation axis 432 can be horizontally arranged so that the connecting part 440 can rotate in the vertical direction; the first direction axis 461 can also be a spherical rotation axis 432 so that the connecting part 440 can rotate in any angle direction, etc., and no specific limitation is made here concerning the first direction axis 461.

In another specific embodiment, at least one set of second drive assemblies includes a second set of second drive assemblies. Please refer to FIG. 33. The first end of the connecting section 440 is connected to the cleaning component 430 through a second set of second drive assemblies and the second set of second drive assemblies is used to drive the connecting section 440 to rotate around the second direction axis 462, thereby directly driving the cleaning component 430 to rotate around the second direction axis 462. It can be understood that the second direction axis 462 may be a linear rotation axis 432, a spherical rotation axis 432, etc., and is not specifically limited here.

In another specific embodiment, the cleaning component 430 is movably connected to the cleaning apparatus body 101, and at least one set of second drive assemblies includes a first set of second drive assemblies and a second set of second drive assemblies. Please refer to FIG. 31 and FIG. 33 in combination. The first end of the connecting section 440 is connected to the cleaning component 430, and the first set of second drive assemblies is connected to the cleaning apparatus body 101 and the second end of the connecting section 440 and is used to drive the connecting section 440 to rotate around the first direction axis 461; one end of the second set of second drive components is connected to the cleaning component 430 and the other end is connected to the connecting section 440 and is used to drive the connecting section 440 to rotate around the second direction axis 462 so as to perform multi-stage rotation control on the cleaning component 430, thereby improving the cleaning range that the cleaning component 430 can clean.

For example, the first direction axis 461 is a linear rotation axis 432 and is vertically disposed, and the second direction axis 462 is a linear rotation axis 432 and is horizontally disposed. Therefore, when using the cleaning component 430 for cleaning, the first set of second drive assemblies can be used to drive the connecting section 440 to rotate in the horizontal direction around the first direction axis 461. After reaching the preset position, the second set of second drive assemblies can be used to drive the cleaning component 430 to rotate in the vertical direction around the second direction axis 462 to clean the object to be cleaned up and down. In addition, if the cleaning apparatus 10 is trapped during cleaning, the cleaning component 430 and the connecting section 440 can be flexibly rotated and swung, making it easier for the cleaning apparatus 10 to escape from the predicament. Furthermore, the second drive assembly and the first drive assembly may be the same assembly.

It can be understood that, by simultaneously utilizing a set of second drive assemblies and a second set of second drive assemblies to control the rotational movement of the cleaning component 430, the connecting section 440 can be controlled to rotate in the vertical direction first, and then the cleaning component 430 can be controlled to rotate in the horizontal direction; or the connecting section 440 can be controlled to rotate in the horizontal direction first, and then the cleaning component 430 can be controlled to rotate in the vertical direction, etc. No specific limitation is made herein regarding the multi-stage rotation control scheme of the cleaning component 430.

Furthermore, with regard to at least one set of second drive assemblies, one, two, or more sets of second drive assemblies may be provided, which may be provided according to actual cleaning needs, without being specifically limited here.

In addition, in order to facilitate the cleaning component 430 cleaning the surface of the pool or the object to be cleaned or the water in the pool, a third drive assembly (not shown) can be provided in the motion drive assembly. The third drive assembly is connected to the cleaning component 430 and is used to drive the cleaning component 430 to rotate when the cleaning component 430 needs to work so as to scrub and clean the surface of the pool or the object to be cleaned or the water in the pool.

In some embodiments, there are several cleaning components 430, wherein at least one cleaning component 430 is used to perform cleaning work. For example, one cleaning component 430, two cleaning components 430, or a plurality of cleaning components 430 may be provided on the cleaning apparatus 10, which may be provided according to the specific cleaning situation, and with regard to the positioning of the cleaning component 430, may be provided only on the front wall 101a, the rear wall, or a side wall of the cleaning apparatus main body 101, or may also be provided on two opposite side walls of the cleaning apparatus main body 101, etc., as shown in FIG. 31, which is not specifically limited here. As another example, the at least one cleaning component 430 can be used for rescue work. For example, when the cleaning apparatus 10 is trapped by aquatic plants at the bottom of the water, it can be freed from the aquatic plants through the rotation and telescopic movement of the cleaning component 430, or the cleaning component 430 can be retracted into the range of the cleaning apparatus 10 to reduce the width of the cleaning apparatus 10, making it easier for the cleaning apparatus 10 to pass.

Wherein, there are several cleaning components 430, and the several cleaning components 430 are disposed on at least one of the left side wall 101b, the right side wall 101c, and the bottom of the cleaning apparatus main body 101.

Please continue to refer to FIG. 31. The cleaning apparatus main body 101 is further provided with a liquid inlet section 103, and at least one cleaning component 430 is configured to expand the cleaning range of the liquid inlet section 103. The cleaning component 430 may be a side brush. The liquid inlet section 103 is configured to suck water flow and dirt into the cleaning apparatus main body 101. The side brush is arranged on the side wall or the bottom of the cleaning apparatus main body 101. When the cleaning apparatus 10 moves along the edge of the pool, it can brush the pool surface. The side brush is provided with a cleaning material and can perform brushing by self-rotation or reciprocating motion to clean the object to be cleaned. The dirt may be floating debris in the pool, accumulated scale, or black stains in the pool. The cleaning range of the liquid inlet section 103 refers to the range in which the liquid inlet section 103 can affect the water flow and dirt when it is in the state of sucking in water flow and dirt. As shown in FIG. 31, the liquid inlet section 103 may be provided on the front wall 101a of the cleaning apparatus main body 101, and in the opening direction of the liquid inlet section 103, at least one cleaning component 430 is located in front of the liquid inlet section 103, such as provided on the left side wall 101b and/or the right side wall 101c of the cleaning apparatus main body 101, and the cleaning component 430 extends to the front wall 101a. In addition, the cleaning component 430 is inclined toward the liquid inlet section 103, and the inclination angle can be 1 degree, 5 degrees, 8 degrees, 15 degrees, 25 degrees, 30 degrees, 33 degrees, 60 degrees, 75 degrees, 80 degrees, etc. The self-rotation direction of the cleaning component 430 is toward the liquid inlet section 103, so that the cleaning component 430 can stir the water flow and dirt outside the cleaning range of the liquid inlet section 103 and guide the water flow and dirt toward the liquid inlet section 103.

Furthermore, the cleaning apparatus main body 101 may also be provided with a filter structure, an accommodating chamber 742, etc. The filter structure can separate the water flow and the dirt, that is, it plays the role of filtering the dirt. The accommodating chamber 742 can accommodate the dirt filtered out by the filter structure. The cleaning apparatus main body 101 can cooperate with the accommodating chamber 742, the filter structure, and the liquid inlet section 103. The filter structure filters the water flow sucked in by the liquid inlet section 103 to separate the dirt from the water flow. The dirt is retained in the accommodating chamber 742 and the clean water flow is discharged from the cleaning apparatus main body 101.

Please refer to FIG. 36. FIG. 36 is a structural schematic diagram of a seventh embodiment of the cleaning apparatus of the present disclosure. In some embodiments, when the liquid inlet section 103 is provided on the front wall 101a of the cleaning apparatus main body 101, the cleaning component 430 may be provided at the bottom of the cleaning apparatus main body 101. As shown in FIG. 36, the cleaning component 430 is provided at the bottom of the cleaning apparatus main body 101 and can extend beyond the bottom range of the cleaning apparatus main body 101, and the cleaning component 430 may be arranged to be inclined towards the center of the liquid inlet section 103 or parallel to the liquid inlet section 103 to direct water flow and dirt below the liquid inlet section 103 to the liquid inlet section 103. In addition, when the cleaning component 430 extends beyond the cleaning apparatus main body 101, it is also capable of brushing the contacted target object.

Furthermore, when the liquid inlet section 103 is provided on the front wall 101a of the cleaning apparatus main body 101, at least one cleaning component 430 may be provided on a side of the cleaning apparatus main body 101, for example, on the left side wall 101b or the right side wall 101c. The at least one cleaning component 430 may also be provided on both the left and right side walls 101b and 101c of the cleaning apparatus main body 101. In this case, an end of the connecting section 440 away from the cleaning apparatus main body 101 extends toward the bottom of the cleaning apparatus main body 101, so that the cleaning component 430 located on an end of the connecting section 440 away from the cleaning apparatus main body 101 is close to the bottom of the cleaning apparatus main body 101, and the cleaning component 430 is inclined toward the liquid inlet section 103 located at the bottom of the cleaning apparatus main body 101 to guide water flow and dirt outside the bottom range of the apparatus device main body 101 to the liquid inlet section 103.

In other embodiments, the liquid inlet section 103 is provided at the bottom of the cleaning apparatus main body 101. In order to expand the cleaning range of the liquid inlet section 103, at least one cleaning component 430 may also be provided at the bottom of the cleaning apparatus main body 101 and located in front of the liquid inlet section 103.

In addition, when the liquid inlet section 103 is disposed at the bottom of the cleaning apparatus main body 101, at least one cleaning component 430 is disposed on the left side wall 101b and/or the right side wall 101c of the cleaning apparatus main body 101. An end of the connecting section 440 away from the cleaning apparatus main body 101 extends toward the bottom of the cleaning apparatus main body 101, so that the cleaning component 430 located on an end of the connecting section 440 away from the cleaning apparatus main body 101 is close to the bottom of the cleaning apparatus main body 101, and the cleaning component 430 is inclined toward the liquid inlet section 103 located at the bottom of the cleaning apparatus main body 101 to guide water flow and dirt outside the bottom range of the apparatus device main body 101 to the liquid inlet section 103.

In some embodiments, the cleaning apparatus 10 further comprises at least one of a trigger data acquisition unit and an in-place sensor. The trigger data acquisition unit is used to collect trigger data about the preset movement of the cleaning component 430 and the in-place sensor is used to collect reference data on whether the preset movement of the cleaning component 430 is in place. For example, the in-place sensor may be an acceleration detection sensor, a distance sensor, a position detection sensor, etc.

In some embodiments, the cleaning apparatus main body 101 may float on the water surface. When the cleaning apparatus main body 101 floats on the water surface, the cleaning component 430 is at least partially below the water surface. For example, the cleaning component 430 may be partially below the water surface, or the cleaning component 430 may be entirely below the water surface.

In a specific embodiment, when the cleaning apparatus main body 101 is floating on the water surface, half of the cleaning component 430 is located above the water surface and the other half is located below the water surface. Through the above arrangement, the cleaning component 430 can conveniently clean the dirt on the water surface. In addition, when the cleaning component 430 is tilted, the portion of the cleaning component 430 located above the water surface will not agitate the water flow when rotating. The dirt will not be continuously pushed forward by the water flow and thus cannot reach the vicinity of the liquid inlet section 103, and the cleaning apparatus 10 has a better cleaning effect.

In another specific embodiment, when the cleaning apparatus body main 101 floats on the water surface, the cleaning component 430 is completely located below the water surface. Through the above arrangement, since the cleaning component 430 is completely located underwater, the cleaning component 430 is unlikely to splash water when rotating and is unlikely to wet the bank of the pool.

In addition, when the cleaning apparatus main body 101 is floating on the water surface and the liquid inlet section 103 is located on the front wall 101a of the cleaning apparatus main body 101, the liquid inlet section 103 may also be at least partially below the water surface. For example, in one specific embodiment, half of the liquid inlet section 103 is located above the water surface and the other half is located below the water surface. Thus, the dirt located near the water surface can directly enter the liquid inlet section 103, and the dirt does not need to overcome buoyancy to move to the liquid inlet section 103, thereby improving the cleaning efficiency.

In another specific embodiment, when the cleaning apparatus main body 101 floats on the water surface and the liquid inlet section 103 is located on the front wall 101a of the cleaning apparatus main body 101, the liquid inlet section 103 is entirely located below the water surface; or when the liquid inlet section 103 is located at the bottom of the cleaning apparatus main body 101, the liquid inlet section 103 is entirely located below the water surface. As a result, the liquid inlet section 103 is entirely located underwater and can be exposed to a larger flow of water, resulting in a high dirt suction efficiency.

In some embodiments, the cleaning component 430 has a starting position and a telescopic position. The cleaning apparatus 10 also includes a reset component (not shown). The reset component is arranged on the cleaning apparatus main body 101. The reset component is connected to the cleaning component 430. The reset component is used to provide a reset force for the cleaning component 430 to maintain the starting position. The cleaning component 430 can reach the telescopic position when the power drive assembly drives the cleaning component 430 to perform telescopic movement.

In a specific embodiment, with the cleaning component 430 in the starting position, the cleaning component 430 is in a retracted state. When the cleaning component 430 is driven to the telescopic position, the cleaning component 430 is in an extended state. For example, the starting position of the cleaning component 430 is the retracted position, that is, the cleaning component 430 is in a normally retracted state. When the motion drive assembly drives the cleaning component 430 to move to the extended position, the cleaning component 430 changes from the normally retracted state to the extended state. If the subsequent motion drive assembly no longer provides power to the cleaning component 430 in the extended state, the reset component will provide a reset force to the cleaning component 430 so that the cleaning component 430 returns to the starting position.

In another specific embodiment, with the cleaning component 430 in the starting position, the cleaning component 430 is in an extended state. When the cleaning component 430 is driven to the telescopic position, the cleaning component 430 is in a retracted state. For example, the starting position of the cleaning component 430 is the extended position, that is, the cleaning component 430 is in a normally extended state. When the motion drive assembly drives the cleaning component 430 to move to the extended position, the cleaning component 430 changes from the normally extended state to the retracted state. If the subsequent motion drive assembly no longer provides power to the cleaning component 430 in the retracted state, the reset component will provide a reset force to the cleaning component 430 so that the cleaning component 430 returns to the starting position.

Please refer to FIG. 37. FIG. 37 is a flow chart illustrating an embodiment of the cleaning apparatus control method of the present disclosure, wherein the control method is used to control the cleaning apparatus 10 mentioned above. Specifically, the following steps may be referenced:

Step S710: Detecting that the cleaning apparatus 10 currently meets the telescopic trigger condition.

In some embodiments, the telescopic trigger condition includes at least one of the following:

1) The distance between the cleaning apparatus 10 and the target object is within a preset distance range, wherein the target object includes at least one of a wall and an obstacle.

Specifically, the trigger data acquisition unit includes a first trigger sensor, and thus can determine whether the distance between the cleaning apparatus 10 and the target object is within a preset distance range based on the first sensor data acquired by the first trigger sensor of the cleaning apparatus 10. For example, a distance sensor on the cleaning apparatus 10 is used to detect the direction of travel of the cleaning apparatus 10 or surrounding objects. If a target object is detected and the distance between the cleaning apparatus 10 and the target object is within a preset distance range, the motion drive assembly in the cleaning apparatus 10 can be used to control the cleaning component 430 to perform telescopic and rotational motion to clean the target object.

2) The cleaning apparatus 10 is in a trapped state. When the cleaning apparatus 10 is detected to be in a trapped state, the range of the cleaning apparatus 10 can be reduced by controlling the cleaning component 430 to perform telescopic motion so that the cleaning apparatus 10 is easily accessible. Wherein, detecting that the cleaning apparatus 10 is in a trapped state may include, but is not limited to, the following:

2-1. Based on the second sensor data collected by the second trigger sensor of the cleaning apparatus 10, it is determined that the actual rotation angle of the cleaning apparatus 10 has a preset deviation from the preset rotation angle. Wherein, the second trigger sensor belongs to the trigger data acquisition unit.

In some embodiments, the preset rotation angle may be obtained after the cleaning apparatus 10 analyzes the received operating instructions, and the second trigger sensor may be a gyroscope sensor. Through the gyroscope sensor, the actual rotation angle of the cleaning apparatus 10 after receiving the operating instructions may be detected, and the actual rotation angle may be sent to the central processor 52 unit of the cleaning apparatus 10 for comparison with the preset rotation angle. If there is a deviation and the deviation exceeds the preset deviation, the central processor 52 unit determines that the cleaning apparatus 10 is currently trapped.

2-2. It is detected that the target distance is not run after the first time of movement of the cleaning apparatus 10.

In some embodiments, the cleaning apparatus 10 is provided with an acceleration sensor. After the cleaning apparatus 10 receives an operating instruction to advance the target distance within a first time, the acceleration sensor is used to detect the acceleration of the cleaning apparatus 10 during movement, and the detected acceleration is sent to the central processor 52 unit of the cleaning apparatus 10. The central processor 52 unit can calculate the actual movement distance of the cleaning apparatus 10 based on the acceleration and the first time. If the calculated actual movement distance is inconsistent with the target distance, it is determined that the cleaning apparatus 10 is currently trapped. Wherein, the first time may be set to 3 seconds, 5 seconds, 10 seconds, 20 seconds, etc.

2-3. It is detected that the relative position differences between the cleaning apparatus 10 and the reference point before and after the second time are within a preset difference range, wherein the reference point is determined by using the third trigger sensor.

In some embodiments, the third trigger sensor may be a Time of Flight (TOF) sensor. The TOF sensor may be provided on the front wall 101a of the cleaning apparatus 10. The TOF sensor determines a point in front of the cleaning apparatus 10 as a reference point, calculates the first relative position of the current cleaning apparatus 10 relative to the reference point, and calculates the second relative position of the cleaning apparatus 10 relative to the reference point again after a second time. The difference between the first relative position and the second relative position is compared. If the difference is within a preset difference range, it means that the cleaning apparatus 10 has not moved or the moving distance is very small, and it will be judged that the cleaning apparatus 10 is trapped. Wherein, the second time may be set to 5 seconds, 10 seconds, 20 seconds, etc.

2-4. The current of the drive motor of the cleaning apparatus 10 increases and the current increase is consistent with the current change of being trapped.

In some embodiments, when it is detected that the relative position difference between the cleaning apparatus 10 and the reference point before and after the second time is within a preset difference range, the current of the drive motor of the cleaning apparatus 10 increases, which can be used to further determine that the cleaning apparatus 10 is trapped. It can be understood that in addition to the above, 2-1 and 2-4, 2-2 and 2-4, or other circumstances may also be combined to determine whether the cleaning apparatus 10 is trapped.

3) The cleaning apparatus 10 receives a preset instruction. In some embodiments, it is detected that the cleaning apparatus 10 receives a preset instruction and the cleaning component 430 is controlled according to the preset instruction. Wherein, the preset instruction may be a remote instruction, and the remote instruction may be an instruction sent from a remote control, or an instruction sent through an application such as a cell phone, tablet, etc., to control the cleaning component 430 of the cleaning apparatus 10 for telescopic and/or rotational movement. It can be understood that in addition to being a remote instruction, the preset instruction may also be an instruction automatically generated according to the current state of the cleaning apparatus 10 etc., and no specific limitation is made here.

4) The cleaning apparatus 10 is in a preset working mode, wherein the preset working mode includes at least one of an energy-saving mode, a return mode, and a charging mode, wherein the return mode is when the cleaning work has been completed and the apparatus is in the process of returning. It can be understood that in addition to the above modes, the preset working mode may also include an escape mode etc., which is not specifically limited here.

In some embodiments, the cleaning component 430 is controlled when the cleaning apparatus 10 is detected to be in a preset working mode. For example, when the cleaning apparatus 10 is in the energy-saving mode or the return mode and the cleaning component 430 is in the extended state, the cleaning component 430 needs to be controlled to retract in the direction near the cleaning apparatus main body 101; when the cleaning apparatus 10 is in the rest mode and the cleaning component 430 is in the retracted state, there is no need to control the cleaning component 430 to repeatedly retract in the direction near the cleaning apparatus main body 101.

Step S720: Controlling the cleaning component 430 of the cleaning apparatus 10 to perform telescopic movement.

Telescopic movement includes at least one of the following: an extension movement in the direction away from the cleaning apparatus main body 101 of the cleaning apparatus 10 and a retraction movement in the direction close to the cleaning apparatus main body 101.

In some embodiments, when the default state of the cleaning component 430 of the cleaning apparatus 10 is in the retracted state and the distance between the cleaning apparatus 10 and the target is detected to be within a preset distance range, the cleaning component 430 of the cleaning apparatus 10 may be controlled to extend in the direction away from the cleaning apparatus main body 101 of the cleaning apparatus 10 to clean the target object.

In other embodiments, the default state of the cleaning component 430 of the cleaning apparatus 10 is the extended state, and when at least one of the cleaning apparatus 10 being in a trapped state, a preset instruction being received, or the cleaning apparatus 10 being in a preset working mode, the cleaning component 430 of the cleaning apparatus 10 can be controlled to perform a retracted movement in the direction of the cleaning apparatus main body 101 near the cleaning apparatus 10.

Further, in the process of controlling the telescopic movement of the cleaning component 430, detecting whether the telescopic movement is in place using the in-place sensor; in response to detecting that the telescopic movement is in place, determining to stop the telescopic movement of the cleaning component 430.

In addition, if it is detected that the cleaning apparatus 10 currently meets the rotation trigger condition, the cleaning component 430 of the cleaning apparatus 10 can be controlled to rotate relative to the cleaning apparatus main body 101. Alternatively, it is detected that the cleaning apparatus 10 is in the target working state, and the cleaning component 430 of the cleaning apparatus 10 is controlled to rotate to cause the cleaning component 430 to work.

The cleaning component 430 of the cleaning apparatus 10 in the present disclosure can rotate, telescopically and rotationally move, and move flexibly. During the cleaning process, the range of a single cleaning of the cleaning apparatus 10 can be improved and the cleaning path of the cleaning apparatus 10 can be reduced, improving the cleaning efficiency. Furthermore, when the cleaning apparatus 10 is trapped while cleaning the pool, the cleaning member 430 can be flexibly moved to escape from the predicament and reduce the range of the cleaning apparatus 10 to facilitate escape.

In addition, the cleaning component 430 is disposed in a position that may be associated with the liquid inlet section 103 to expand the cleaning range of the liquid inlet section 103 while also improving the cleaning efficiency.

Those skilled in the art can understand that in the above method of the specific embodiment, the writing order of each step does not imply a strict execution order or constitute any limitation on the implementation process, and the specific execution order of each step should be determined by its function and possible internal logic.

Please refer to FIG. 38. FIG. 38 is a schematic diagram of a framework of an embodiment of an electronic device of the present disclosure. The electronic device 50 includes a memory 51 and a processor 52 coupled to each other, and the processor 52 is used to execute program instructions stored in the memory 51 to implement the steps in any of the above control method embodiments of the cleaning apparatus 10. In the present disclosure, the electronic device 50 is a cleaning apparatus 10.

In particular, the processor 52 is used to control itself and the memory 51 to implement the steps of any of the above control method embodiments of the cleaning apparatus 10. The processor 52 may also be referred to as a CPU (Central Processing Unit). The processor 52 may be an integrated circuit chip with signal processing capabilities. The processor 52 may also be a general purpose processor 52, a digital signal processor 52 (DSP), an application-specific integrated circuit (ASIC), a field-programmable gate array (FPGA), or other programmable logic devices, discrete gates, or transistor logic devices or discrete hardware components. The general purpose processor 52 may be a microprocessor 52 or the processor 52 may be any conventional processor 52. In addition, the processor 52 may be implemented by an integrated circuit chip.

Please refer to FIG. 39. FIG. 39 is a schematic diagram of a framework of an embodiment of a computer-readable storage medium of the present disclosure. The computer-readable storage medium 60 stores program instructions 901 capable of being run by the processor 52 for implementing the steps in any of the above control method embodiments of the cleaning apparatus 10.

In some embodiments, the functions or modules included in the apparatus provided by the embodiments of the present disclosure can be used to execute the method described in the above method embodiments. For the specific implementation, refer to the descriptions of the above method embodiments. For the sake of brevity, they will not be repeated here.

Please refer to FIG. 40 and FIG. 41. FIG. 40 is a cross-sectional schematic diagram of a first movement state of a filtration assembly in an eighth embodiment of the cleaning apparatus of the present disclosure; and FIG. 41 is an enlarged schematic diagram of C in FIG. 40. In some embodiments, the cleaning apparatus main body 101 comprises at least one debris chamber. The filtration mechanism comprises at least one filtration assembly 710. The filtration assembly 710 includes at least one debris bin 711, a first filter layer (not shown), at least one flow guide port 715, and a cover member 720. The debris bin 711 is formed with a first chamber 714. The debris bin 711 includes at least a first movement state and a second movement state. The first filter layer is at least provided on the side wall 711 of the debris bin and is in communication with the first chamber 714. The flow guide port 715 is provided on the debris bin 711 and/or the first filter layer. For example, the flow guide port 715 may be provided on the debris bin

711; alternatively, it may be provided on the first filter layer; or it may be provided on both the debris bin 711 and the first filter layer. In a first movement state of the debris bin 711, the cover member 720 seals the flow guide port 715. In a second movement state of the debris bin 711, the cover member 720 opens the flow guide port 715. It is understood that opening the flow guide port 715 means that at least a portion of the water flow can exit the debris bin 711 through the flow guide port 715.

The debris bin 711 is provided with a debris bin water inlet section 716 for allowing water to enter the first chamber 714. The first filter layer serves a filtering function. Water enters the first chamber 714 of the debris bin 711 through the debris bin water inlet section 716 and passes through the first filter layer to filter out impurities and the like in the water. The filtered water enters the debris chamber 1023 of the filtration assembly 710 and then flows through the debris chamber 1023 into the main water pump 210.

The aforementioned first movement state or third movement state may correspond to the state of the filtration assembly 710 when the cleaning apparatus 10 is cleaning the underwater bottom surface or the water surface. In this case, when the filtration assembly 710 is in a normal placement state, the cover member 720 covers the flow guide port 715 in a natural placement state, and the water flow passing normally through the filtration assembly 710 does not provide sufficient thrust to open the flow guide port 715. The second movement state may correspond to the state of the filtration assembly 710 when the cleaning apparatus 10 is climbing underwater slopes or walls, or when the first filter layer is clogged, etc. At this time, the filtration assembly 710, together with the cleaning apparatus 10, is in an inclined, inverted, or operating state. Under the action of gravity and/or external forces, such as water flow thrust, the cover member 720 moves to open the flow guide port 715. The first movement state or second movement state are both different from the second movement state.

Please refer to FIG. 42 and FIG. 43. FIG. 42 is a cross-sectional schematic diagram of a second movement state of a filtration assembly in an eighth embodiment of the cleaning apparatus of the present disclosure; and FIG. 43 is an enlarged schematic diagram of D in FIG. 42. In conjunction with FIG. 40 and FIG. 41, when the debris bin 711 is in the first movement state or the third movement state, the cover member 720 covers the flow guide port 714, and water in the first chamber 714 flows out through the first filter layer of the debris bin 711, thereby reducing the impact on the cleaning effect of the cleaning apparatus 10 and enabling the cleaning apparatus 10 to perform its normal cleaning function.

Please refer to FIG. 44, FIG. 45, FIG. 46, and FIG. 47. FIG. 44 is a cross-sectional schematic diagram of a first movement state of a filtration assembly in a ninth embodiment of the cleaning apparatus of the present disclosure; FIG. 45 is an enlarged schematic diagram of E in FIG. 46; FIG. 46 is a cross-sectional schematic diagram of a second movement state of a filtration assembly in a ninth embodiment of the cleaning apparatus of the present disclosure; and FIG. 47 is an enlarged schematic diagram of F in FIG. 46. In conjunction with FIGS. 40-43, when the filtration assembly 710 is in the second movement state, the cover member 720 gradually opens the flow guide port 715. At least part of the water in the first chamber 714 directly exits through the flow guide port 715, increasing the water discharge of the debris bin 711, so that when the cleaning apparatus 10 is climbing walls or slopes, or when the first filter layer is clogged to a certain extent, the main water pump 210's water intake requirements are always met, thereby maintaining stable wall-climbing, slope-climbing, or operational performance. As a result, the apparatus can be applied to more scenarios, such as underwater and surface cleaning.

For example, when the filtration assembly 710 is operating in the first or third movement state and contaminants on the first filter layer have not clogged it to a certain extent, the filtration assembly 710 is in normal operation. When the cleaning apparatus 10 is climbing a slope or wall, the cover member 720 opens the flow guide port 715 by its own gravity or external force, thereby maintaining stable wall-climbing or slope-climbing functionality.

If, during operation in the first or third movement state, the first filter layer becomes clogged to a certain extent, the filtration assembly 710 cannot operate normally. At this time, by opening the flow guide port 715 via the cover member 720, the water intake demand of the main water pump 210 can be increased, thereby maintaining stable operational performance. Subsequently, the device can operate in states such as climbing a slope or climbing a wall.

For example, when the filtration assembly 710 is climbing a slope or a hill, the first filter layer is clogged with dirt. At this time, the cover member 720 opens the flow guide port 715 by its own gravity or external power, thereby maintaining stable wall climbing or slope climbing.

Thus, through the coordinated interaction of the first chamber 714 in the debris bin 711, the flow guide port 715, and the cover member 720, when the debris bin 711 is in the first movement state or the third movement state, the cover member 720 covers the flow guide port 715, which reduces the impact on the cleaning performance of the cleaning apparatus 10. When the debris bin 711 is in the second movement state, the cover member 720 opens the flow guide port 715, increasing the water outflow from the first chamber 714, enhancing the water intake of the main water pump 210, and thus increasing the thrust of the cleaning apparatus 10, which in turn improves the wall-climbing, slope-climbing, or operational performance of the cleaning apparatus 10 and enhances user experience.

The above flow guide port 715 may include a flow guide sub-port (not shown). Alternatively, the flow guide port 715 may include two or more flow guide sub-ports, such as two, three, or multiple flow guide sub-ports. The number of flow guide sub-ports can be determined according to actual requirements. When there are multiple flow guide sub-ports, the total water outflow from the combination of multiple sub-ports should be kept as consistent as possible with that of a single sub-port in order to ensure consistent water outflow from the flow guide port 715. This ensures that the cleaning apparatus 10, whether climbing a wall, climbing a slope, or when the first filter layer is partially clogged, can always meet the water intake demand of the main water pump 210, thereby maintaining stable wall-climbing, slope-climbing, or operational performance.

The number of flow guide ports 715 may be one, two, three, four, etc., and is not limited herein. The periphery of the debris bin 711 is hollowed out, and the first filter layer is located at the hollowed-out position. The flow guide port 715 may be provided at the hollowed-out part of the debris bin 711 or at other positions of the debris bin 711 apart from the hollowed-out part. Alternatively, the flow guide port 715 may be provided on the first filter layer. When the flow guide port 715 is provided on the first filter layer, the structure of the debris bin 711 defines the periphery of the flow guide port 715, which increases the stability of the cover member 720 in covering or opening the flow guide port 715.

In some embodiments, the above-mentioned cover member 720 may be driven by a drive assembly (not shown), which is connected to the cover member 720 to realize the covering or opening of the flow guide port 715. The drive assembly may include a drive motor (not shown) connected to the cover member 720 to control its movement. Alternatively, the cover member 720 may be provided with relevant structures, so that the cover member 720 can be self-driven together with the relevant structures to realize the covering or opening of the flow guide port 715. In other embodiments, the cover member 720 may cover or open the flow guide port 715 in other ways, which are not limited herein. The cover member 720 may be a cover plate, a flap, etc.

The above cover member 720 may be mounted on the debris bin 711. The cover member 720 may be mounted on the debris bin 711 via pivoting, telescoping, hinging, etc., to cover or open the flow guide port 715.

Please refer to FIG. 48 and FIG. 49. FIG. 48 is a partial schematic diagram of a first movement state of a filtration assembly in an eighth embodiment of the cleaning apparatus of the present disclosure; and FIG. 49 is a partial schematic diagram of a second movement state of a filtration assembly in an eighth embodiment of the cleaning apparatus of the present disclosure. In conjunction with FIGS. 40-43, in some embodiments, the cover member 720 is pivotally connected to the debris bin 711. When the cover member 720 is pivotally connected to the debris bin 711, it allows the cover member 720 to cover and open the flow guide port 715 with less effort. The filtration assembly 710 also includes adjustment members 730a and 730b mounted on the cover member 720. The adjustment members 730a and 730b are located away from the pivotal connection of the cover member 720 with the debris bin 711. The mounting positions of the adjustment members 730a and 730b are located away from the pivotal connection of the cover member 720 with the debris bin 711. The adjustment members 730a and 730b assist the cover member 720 to cover or open the flow guide port 715.

In the first movement state or the third movement state, the pivot point about which the cover member 720 rotates around the debris bin 711 lies on the action line of the combined gravity and buoyancy forces acting on the cover member 720 and the adjustment members 730a and 730b. In other words, the rotational moment of the cover member 720 about the debris bin 711 is zero, so the cover member 720 does not rotate and remains in a vertical state, thereby effectively covering the flow guide port 715.

In a second movement state, the filtration assembly 710 is in an inclined or inverted state, and the pivot point about which the cover member 720 rotates around the debris bin 711 deviates from the action line of the combined gravity and buoyancy forces acting on the cover member 720 and the adjustment members 730a and 730b. That is, the rotational moment of the cover member 720 about the debris bin 711 is no longer zero, thus generating a rotational moment that causes the cover member 720 to rotate and open the flow guide port 715. The adjustment members 730a and 730b may be components of different density capable of assisting the movement of the cover member 720, and their specific structure is not limited herein. In another second state, when the first filter layer of the filtration assembly 710 becomes clogged and the filtration assembly 710 is not significantly inclined or inverted, the suction of the main water pump 210 creates a large pressure difference between the debris chamber 1023 and the first chamber 714, and a cover member 720 responsive to this pressure difference can open the flow guide port 715 to balance the pressure.

Through the above adjustment members 730a and 730b and their positions on the cover member 720, the cover member 720 can more quickly cover or open the flow guide port 715, increasing the water outflow from the first chamber 714, thereby increasing the water intake of the main water pump 210, and thus improving the wall-climbing, slope-climbing, or operational performance of the cleaning apparatus 10. Furthermore, the cover member 720 can autonomously switch between the first/third movement state and the second movement state, reducing the use of the drive assembly and saving costs.

Specifically, the cover member 720 includes oppositely arranged first and second side ends 720a and 720b. When the filtration assembly 710 is in the first and second movement states, the first side end 720a is at the uppermost end of the cover member 720 and the second side end 720b is at the lowermost end. The first side end 720a and the second side end 720b may both be disposed to be pivotally connected to the debris bin 711. However, due to the different positions of the first and second side ends 720a and 720b, their overall force on the cover member 720 will differ when pivotally connected to the debris bin 711. To achieve the above-mentioned purpose of closing the flow guide port 715 in the first or third movement state and opening it in the second movement state, the adjustment members' 730a and 730b configuration must be adjusted according to whether the first or second side end 720a or 720b is pivotally connected to the debris bin 711 to facilitate the movement of the cover member 720. Based on this, the specific results of the first side end 720a or the second side end 720b being pivotally connected to the debris bin 711 are described and analyzed below:

#### Embodiment 1:

In this Embodiment 1, the first side end 720a is pivotally connected to the debris bin 711 and the second side end 720b pivots away from or against the debris bin 711 around the first side end 720a to facilitate opening or closing the flow guide port 715. At this point, the filtration assembly 710 as a whole is located underwater, i.e., the filtration assembly 710 as a whole is located at a position below the water surface, and the gravity of the adjustment member 730a is set to be greater than the buoyancy.

Specifically, the first side end 720a is pivotally connected with the debris bin 711, and the adjustment member 730a is far away from the pivotal connection between the first side end 720a and the debris bin 711. Because the gravity of the adjustment member 730a is greater than the buoyancy, the second side end 720b can be pivoted around the first side end 720a away from the debris bin 711 so that the cover member 720 opens the flow guide port 715. Alternatively, the second side end 720b can be pivoted about the first side end 720a to abut against the debris bin 711 so that the cover member 720 is covered to the flow guide port 715. The gravity of the above adjustment member 730a is much greater than the buoyancy of the cover member 720 in water. When the debris bin 711 is in the first or third movement state, the cover member 720 depends on the adjustment member 730a to change its center of gravity, which is conducive to the cover member 720 to form a certain pre-tightening force in the direction of gravity, which can cause the cover member 720 to fit to the debris bin 711. When the debris bin 711 is in the second movement state, the cover member 720 relies on its own gravity and the gravity of the adjustment member 730a such that the second side end 720b pivots about the first side end 720a away from the debris bin 711.

As such, through the above first side end 720a being pivotally connected to the debris bin 711, the second side end 720b being pivotally connected away from or against the debris bin 711 around the first side end 720a, and the gravity of the adjustment element 730a being greater than the buoyancy, this not only increases the speed of the cover member 720 closing or opening the flow guide port 715, but also makes it easier for the cover member 720 to change autonomously between the first and second movement states, reducing the use of the drive assembly and saving costs.

Optionally, in this embodiment, the density of the above adjustment member 730a is greater than  $1 \text{ kg/m}^3$ . The adjustment member 730a may have a density of  $1.1 \text{ kg/m}^3$ ,  $2 \text{ kg/m}^3$ ,  $3 \text{ kg/m}^3$ ,  $3.4 \text{ kg/m}^3$ ,  $4.3 \text{ kg/m}^3$ , etc., which is not limited here. That is, the density of the adjustment member 730a needs to be greater than the density of water. When the debris bin 711 is in the first or third movement state, the cover member 720 relies on the gravity formed by the adjustment member 730a, so that the cover member 720 is extended in the direction of gravity, that is, the cover member 720 remains in a vertical state, and at this time, the cover member 720 can cover the flow guide port 715. In addition, when the debris bin 711 is in the second movement state, the cover member 720 may rely on its own gravity as well as the gravity of the adjustment member 730a to open the flow guide port 715.

As such, by defining the density of the adjustment member 730a, it is convenient to adjust the cover plate 720 to quickly cover or open the flow guide port 715. The adjustment member 730a described above may be a counterweight (not shown) or the like. Wherein, the counterweight may be a metal block, an alloy block, a stone, etc., which is not limited here.

More specifically, the ratio of the distance from the center of the adjustment member 730a to the first side end 720a to the distance from the center of the adjustment member 730a to the second side end 720b is less than 1. The distance from the center of the adjustment member 730a to the first side end 720a may be S1. The distance between the center of the adjustment member 730a and the second side end 720b is S2. Wherein, the ratio of S1 to S2 is less than 1. By limiting the positional relationship between the adjustment member 730a and the first side end 720a and the second side end 720b, the center of gravity position of the cover member 720 is adjusted, which is beneficial for providing a certain pre-tightening force for the cover member 720 when it is in the first movement state or the third movement state, thereby improving the tightness of the cover member 720 to the debris bin 711.

In some specific application scenarios, the adjustment member 730a is protruded from the inner side surface 725 of the cover member 720 facing the first chamber 714. When the debris bin 711 is in the first movement state or the third movement state, the line between the center of gravity of the adjustment member 730a and the pivot center of the cover member 720 forms an acute angle with the direction of gravity. The adjustment member 730a can be detachably or fixedly connected to the cover member 720. Wherein, the detachable method may be a snap-on, plug-in, or bolt-on method, etc. The line connecting the center of gravity of the adjustment member 730a and the pivot center of the cover member 720 is at an acute angle to the direction of gravity, that is, the center of gravity of the adjustment member 730a is set higher than the side of the cover member 720 facing the first chamber 714, thereby increasing the pre-tightening force of the cover member 720 in the first movement state or the third movement state and increasing the speed at which the cover member 720 covers the flow guide port 715; at the same time, it is easier for the cover member 720 to pivot away from the flow guide port 715, thereby increasing the speed at which the cover member 720 opens the flow guide port 715.

Further, the cover member 720 is provided with an adjustment mounting section 721. The adjustment mounting section 721 provides a mounting position for the adjustment member 730a. The adjustment member 730a may be snapped, plugged, or bolted into the adjustment mounting section 721.

#### Embodiment 2:

Please refer to FIG. 50 and FIG. 51. FIG. 50 is a partial schematic diagram of a second movement state of a filtration assembly in an eighth embodiment of the cleaning apparatus of the present disclosure; and FIG. 51 is a structural schematic diagram of a mounting bracket in a filtration assembly in a ninth embodiment of the cleaning apparatus of the present disclosure. In conjunction with FIGS. 44-45, the second side end 720b is pivotally connected with the debris bin 711. The first side end 720a pivots away from or against the debris bin 711 about the second side end 720b to facilitate opening or closing the flow guide port 715. At this point, the filtration assembly 710 as a whole is located underwater, i.e., the filtration assembly 710 as a whole is located at a position below the water surface, and the buoyancy of the adjustment member 730b is set to be greater than the gravity.

Specifically, the second side end 720b is pivotally connected with the debris bin 711, and the adjustment member 730b is far away from the pivotal connection between the second side end 720b and the debris bin 711. The first side end 720a can be pivoted around the second side end 720b away from the debris bin 711 so that the cover member 720 opens the flow guide port 715. Alternatively, the first side end 720a can be pivoted around the second side end 720b to abut against the debris bin 711. Because the buoyancy of the adjustment member 730b is greater than gravity, this causes the cover member 720 to close to the flow guide port 715. The buoyancy of the above adjustment member 730b is much greater than the gravity of the cover member 720 in water. When the debris bin 711 is in the first or third movement state, the cover member 720 relies on the buoyancy of the adjustment member 730b, so that the cover member 720 is extended in the direction of gravity, and at this time, the cover member 720 can cover to the flow guide port 715. When the debris bin 711 is in the second movement state, the cover member 720 relies on its own gravity such that the second side end 720b pivots about the first side end 720a away from the debris bin 711.

As such, through the above first side end 720a being pivotally connected to the debris bin 711, the second side end 720b being pivotally connected away from or against the debris bin 711 around the first side end 720a, and the gravity of the adjustment element 730b being greater than the buoyancy, this not only increases the speed of the cover member 720 closing or opening the flow guide port 715, but also makes it easier for the cover member 720 to change autonomously between the first and second movement states, reducing the use of the drive assembly and saving costs.

Optionally, in this embodiment, the density of the adjustment member 730b is less than  $1 \text{ kg/m}^3$ . The adjustment member 730b may have a density of  $0.9 \text{ kg/m}^3$ ,  $0.8 \text{ kg/m}^3$ ,  $0.64 \text{ kg/m}^3$ ,  $0.54 \text{ kg/m}^3$ ,  $0.1 \text{ kg/m}^3$ , etc., which is not limited here. That is, the density of the adjustment member 730b needs to be less than the density of water. When the debris bin 711 is in the first movement state or the third movement state, the cover member 720 is in a vertical state depending on the buoyancy of the adjustment member 730b, and the cover member 720 covers the flow guide port 715. In addition, when the debris bin 711 is in the second movement state, the cover member 720 may rely on its own gravity to open the flow guide port 715.

As such, by defining the density of the adjustment member 730b, it is convenient to adjust the cover plate 720 to quickly cover the flow guide port 715. The adjustment member 730b may be a hollow structure, foam, plastic, or filled with other air bags, etc., which is not limited here. The hollow structure may be a hollow box structure. In this embodiment, the adjustment member 730b is foam.

More specifically, in this Embodiment 2, the filtration assembly 710 also includes a moving part 731. The cover member 720 also includes an accommodating channel 722. The accommodating channel 722 is disposed between the first side end 720a and the second side end 720b. The center line of the accommodating channel 722 intersects with the plane where the first side end 720a or the second side end 720b is located. The moving part 731 is housed within the accommodating channel 722 and can move along the accommodating channel 722.

During the change of the debris bin 711 from the first movement state to the second movement state, or during the change of the debris bin 711 from the second movement state to the first movement state, the moving part 731 is housed in the accommodating channel 722 and can move along the accommodating channel 722. The change in the position of the moving part 731 can change the center of gravity of the cover member 720 so that the cover member 720 can quickly cover or close the flow guide port 715, improving the wall-climbing, slope-climbing, or operational performance of the cleaning apparatus 10. Wherein, the moving part 731 may be a rolling part (not shown). The rolling part rolls in the accommodating channel 722, which can reduce the friction between the rolling part and the accommodating channel 722, thereby being able to change the center of gravity of the cover member 720 more quickly. The rolling part may be a ball. The ball density may be greater than  $1 \text{ kg/m}^3$ . The size of the ball can be determined according to the actual situation and is not limited here.

The accommodating channel 722 is disposed between the first side end 720a and the second side end 720b. The center line of the accommodating channel 722 intersects with the plane where the first side end 720a is located, that is, the accommodating channel 722 is disposed close to the first side end 720a. Alternatively, the accommodating channel 722 is disposed between the first side end 720a and the second side end 720b. The center line of the accommodating channel 722 is on the plane where the second side end 720b is located, that is, the accommodating channel 722 is disposed close to the second side end 720b. The

accommodating channel 722 may be disposed at any angle at the first side end 720a or the second side end 720b.

In some embodiments, the center line of the accommodating channel 722 intersects perpendicularly with the plane where the first side end 720a or the second side end 720b is located. The center line of the accommodating channel 722 intersects perpendicularly with the plane where the first side end 720a is located. Alternatively, the center of the accommodating channel 722 intersects perpendicularly with the plane where the second side end 720b is located. When the moving part 731 moves along the accommodating channel 722, the center of gravity can change from the first side end 720a to the second side end 720b, so that the center of gravity of the cover member 720 has a certain regularity, which is simple and easy to implement.

In some embodiments, the cover member 720 includes an inner side surface 725 facing first chamber 714. The accommodating channel 722 extends from the second side end 720b toward the direction close to the inner side surface 725 and toward the first side end 720a. The accommodating channel 722 extends from the second side end 720b toward the direction close to the inner side surface 725 and at the same time extends toward the first side end 720a. That is, the accommodating channel 722 is arranged at an angle. When the debris bin 711 is in the second movement state, the moving part 731 moves from the second side end 720b to the first side end 720a along the accommodating channel 722 in the inclined arrangement due to gravity. At this time, the center of gravity of the cover member 720 moves forward, so that the center of gravity of the cover member 720 is greater than the buoyancy of the cover member 720, thereby causing the cover member 720 to open the flow guide port 715.

By changing the inclination direction of the accommodating channel 722, the movement of the moving part 731 is facilitated, and the gravity of the center of gravity of the cover member 720 can be quickly changed, thereby enabling the cover member 720 to quickly open or close the flow guide port 715.

Whether it is Embodiment 1 or Embodiment 2 above, or any other specific embodiment, the cover member 720 may be directly pivotally connected to the side wall of the debris bin 711. However, for the sake of stability and firmness of installation, the cover member 720 may be indirectly pivotally connected to the side wall of the debris bin 711 through other installation members, such as a mounting bracket 740.

In some embodiments, referring to FIGS. 40 to 51, the mounting bracket 740 is disposed on the side wall of the debris bin 711. The mounting bracket 740 at least partially covers the flow guide port 715. The portion of the mounting bracket 740 covering the flow guide port 715 is provided with several grille holes 741. The grille holes 741 are in communication with the flow guide port 715. The cover member 720 is mounted to the mounting bracket 740.

Specifically, the mounting bracket 740 is detachable or fixed on the side wall of the debris bin 711. When the mounting bracket 740 is mounted to the side wall of the debris bin 711, the mounting bracket 740 at least partially covers the flow guide port 715. The portion of the mounting bracket 740 covering the flow guide port 715 is provided with several grille holes 741. Several grille holes 741 are provided in communication with the flow guide port 715. At least part of the water of the first chamber 714 flows out sequentially through the flow guide port 715 and the grille holes 741. The grille holes 741 are provided on the mounting bracket 740 to prevent larger impurities (such as leaves) from entering the main water pump 210 after the cover member 720 is opened, thereby preventing the main water pump impeller 212 and the like in the main water pump 210 from being damaged. The size and shape of the above grille hole 741 are not limited, as long as they meet actual usage needs. In this embodiment, the grille holes 741 are square in shape.

Further, the mounting bracket 740 is detachably mounted to the side wall of the debris bin 711. The detachable method may be snap-on, bolt-on, or plug-in, etc. In this embodiment, several mounting sections 744 are provided on the outer periphery of the mounting bracket 740. The mounting sections 744 are provided with mounting holes (not shown). The fixing members pass through the mounting holes and are fixed to the side wall of the debris bin 711. In addition, the mounting bracket 740 is provided with several mounting clips 745 on the periphery. The mounting clips 745 are inserted through the flow guide port 715 and clamped on the side wall of the flow guide port 715. The mounting bracket 740 cooperates with the mounting section 744 and the mounting clips 745 to improve the stability of the mounting bracket 740 when mounted to the side wall of the debris bin 711, thereby improving the stability of the filtration assembly 710. The location and quantity of the mounting bracket 740 and the mounting clips 745 can be determined according to actual conditions and are not limited here.

In addition, when the debris bin 711 is provided with a mounting bracket 740, the cover member 720 can be movably mounted on the mounting bracket 740. The movement method can be rotation. The cover member 720 is pivotally connected to the mounting bracket 740.

In some more specific embodiments, the mounting bracket 740 is provided with an accommodating chamber 742 recessed on a side facing the first chamber 714. A side wall of the accommodating chamber 742 is provided with a pivot mounting groove 743. The cover member 720 is movably housed within the accommodating chamber 742. The cover member 720 is provided with a pivot section 723. A stop-limit protrusion is provided below the pivot section 723. The pivot section 723 is pivotally mounted in the pivot mounting groove 743. Additionally, the stop-limit protrusion rotates with the cover member 720 until it stops on the side wall.

The accommodating chamber 742 is recessed and disposed on a side of the mounting bracket 740 facing the first chamber 714. The accommodating chamber 742 can be used to accommodate the cover member 720. The accommodating chamber 742 is disposed in communication with the pivot mounting groove 743. The pivot section 723 is fixed or detachably mounted to the cover member 720. When the cover member 720 is movably mounted in the accommodating chamber 742, the pivot section 723 is pivotally installed in the pivot mounting groove 743 to realize the rotation of the cover member 720. The pivot section 723 is fixed or detachably mounted to the cover member 720. A stop-limit protrusion is provided below the pivot section 723. The pivot section 723 is detachably or fixedly connected to the stop-limit protrusion. The stop-limit protrusion acts as to stop and limit. When the pivot section 723 pivots, the stop-limit protrusion also rotates with the pivot section 723. When the cover member 720 rotates to a certain angle, the stop-limit protrusion stops on the side wall of the accommodating chamber 742, thereby stopping the cover member 720 from rotating and limiting the rotation angle of the cover member 720.

By cooperating with each other, the accommodating chamber 742, the pivot mounting groove 743, the pivot section 723, and the stop-limit protrusion limit the rotation angle of the cover member 720 to prevent the cover member 720 from rotating too much and causing the cover member 720 to be adsorbed to the side wall of the debris bin 711, thereby affecting the closing of the cover member 720.

When the debris bin 711 is in the second movement state, the cover member 720 can limit the angle between the cover member 720 and the debris bin 711 through the above stop-limit protrusion and other related structures. Wherein, the angle between the cover member 720 and the debris bin 711 is greater than or equal to 30° and less than or equal to 100°. The angle between the cover member 720 and the debris bin 711 may be 30°, 43°, 54°, 65°, 76°, 87°, 90°, 98°, 100°, etc., which is not limited here. By limiting the angle range between the cover member 720 and the debris bin 711, not only does it facilitate at least part of the water in the first chamber 714 to flow out through the flow guide port 715, thereby increasing the water output of the debris bin 711, but it also reduces the risk of the cover member 720 being adsorbed onto the side wall of the debris bin 711. In this embodiment, when the debris bin 711 is in the first movement state or the third movement state, the stop-limit protrusion limits the cover member 720 and the debris bin 711 to be arranged vertically, that is, the angle between the cover member 720 and the debris bin 711 is 90°.

Optionally, in other embodiments, when the cover member 720 pivots to the debris bin 711, structures such as the pivot mounting groove 743, the pivot section 723, and the stop-limit protrusion between the cover member 720 and the mounting bracket 740 can also be arranged between the cover member 720 and the debris bin 711, which will not be described in detail here.

Optionally, an overlapping section 724 is further extended from the edge of the cover member 720. When the cover member 720 is received in the accommodating chamber 742, the overlapping section 724 abuts against the inner side surface 725 of the mounting bracket 740. The overlapping section 724 is fixed or detachably connected to the cover member 720. The overlapping section 724 is located at the edge of the cover member 720. When the debris bin 711 is in the first movement state or the third movement state, the overlapping section 724 of the cover member 720 can abut against the inner side surface 725 of the mounting bracket 740 when the cover member 720 is accommodated in the accommodating chamber 742.

By the above method, the sealing performance of the cover member 720 covering the flow guide port 715 is improved, and water is reduced from entering the debris bin 711 through the gap between the cover member 720 and the mounting bracket 740 and thereby affecting the cleaning efficiency of the cleaning apparatus 10.

Please refer to FIG. 52 and FIG. 53. FIG. 52 is a partial schematic diagram of an eighth embodiment of the underwater cleaning apparatus of the present disclosure; and FIG. 53 is a partial exploded schematic diagram of an eighth embodiment of the underwater cleaning apparatus of the present disclosure. In conjunction with FIGS. 40 to 47, in some practical application scenarios, the debris bin 711 of the filtration assembly 710 provided by the embodiments of the present disclosure is arranged in an approximately square shape. The debris bin 711 has at least two types of structures. The first type of debris bin 711 has an opening. The debris bin 711 includes a first side surface 7111a, a second side surface 7111b, a third side surface 7111c, and a fourth side surface 7111d. The first side surface 7111a, the second side surface 7111b, the third side surface 7111c, and the fourth side surface 7111d are arranged around to form the above opening. The first side surface 7111a and the second side surface 7111b are arranged opposite to each other. The third side surface 7111c and the fourth side surface 7111d are arranged opposite to each other. The first side surface 7111a is positioned forward relative to the movement of the cleaning apparatus 10. The flow guide port 715 may be disposed on at least one of the first side surface 7111a, the second side surface 7111b, the third side surface 7111c, and the fourth side surface 7111d. At least one of the first side surface 7111a, the second side surface 7111b, the third side surface 7111c, and the fourth side surface 7111d may be provided with one, two, or more flow guide ports 715, which is not limited here. That is, the cover member 720 may be pivotally connected to at least one of the first side surface 7111a, the second side surface 7111b, the third side surface 7111c, and the fourth side surface 7111d. The cover member 720 covers or opens the flow guide port 715 at the corresponding position.

When the flow guide port 715 is disposed on the first side surface 7111a, the cover member 720 is disposed on the first side surface 7111a and pivots into the debris bin 711. When the flow guide port 715 is disposed at the second side surface 7111b and the third side surface 7111c, a pivot section 723 is disposed on the cover member 720 on the second side surface 7111b and the third side surface 7111c. The pivot section 723 is vertically disposed on the mounting bracket 740 or the side wall of the debris bin 711. The cover member 720 may pivot within the debris bin 711 or outside the debris bin 711. Of course, in other embodiments, the cover member 720 may also be provided in other ways, which are not limited here. When the flow guide port 715 is disposed on the fourth side surface 7111d, the cover member 720 may be disposed on the fourth side surface 7111d and pivot toward the outer periphery of the debris bin 711.

The second type of debris bin 711 has no opening. The debris bin 711 includes a first side surface 7111a, a second side surface 7111b, a third side surface 7111c, a fourth side surface 7111d, and a fifth side surface 7111e. The fifth side surface 7111e covers an opening formed by the first side surface 7111a, the second side surface 7111b, the third side surface 7111c, and the fourth side surface 7111d. The fifth side surface 7111e is fixed or detachably connected to at least one of the first side surface 7111a, the second side surface 7111b, the third side surface 7111c, and the fourth side surface 7111d. Wherein, the first side surface 7111a, the second side surface 7111b, the third side surface 7111c, the fourth side surface 7111d, and the fifth side surface 7111e are configured to keep the debris bin 711 in a closed state. The flow guide port 715 may be disposed on at least one of the first side surface 7111a, the second side surface 7111b, the third side surface 7111c, the fourth side surface 7111d, and the fifth side surface 7111e. That is, the cover member 720 may be pivotally connected to at least one of the first side surface 7111a, the second side surface 7111b, the third side surface 7111c, the fourth side surface 7111d, and the fifth side surface 7111e. The cover member 720 covers or opens the flow guide port 715 at the corresponding position.

When the flow guide port 715 is located on the fifth side surface 7111e, the cover member 720 may be disposed on the fifth side surface 7111e. Alternatively, the cover member 720 may be disposed on the cleaning apparatus 10 near the fifth side surface 7111e. That is, the cover member 720 may pivotally rotate within the debris bin 711 or outside the debris bin 711. Therefore, the positioning of the cover member 720 is not only related to the structure of the debris bin 711, but also to the setting of the flow guide port 715, and is also related to the structure of the cleaning apparatus 10 itself. Wherein, the structure of the cover member 720 can be selected and fine-tuned according to actual conditions to meet the needs of the cover member 720 to cover or open the flow guide port 715, thereby improving the thrust of the cleaning apparatus 10, improving the wall-climbing, slope-climbing, or operational performance of the cleaning apparatus 10, and improving the user experience.

When the filtration assembly 710 is provided with only one flow guide port 715, a first type of cover member 720 and an adjustment member 730a with a density greater than  $1 \text{ kg/m}^3$  may be provided at the flow guide port 715. Alternatively, a second type of cover member 720, an adjustment member 730b with a density less than  $1 \text{ kg/m}^3$ , and a moving part 731 may be provided at the flow guide port 715.

When the filtration assembly 710 is provided with two flow guide ports 715, a first type of cover member 720 and an adjustment member 730a with a density greater than  $1 \text{ kg/m}^3$  may be provided at the two flow guide ports 715. Alternatively, a second type of cover member 720, an adjustment member 730b with a density less than  $1 \text{ kg/m}^3$ , and a moving part 731 may be provided at the two flow guide ports 715. Alternatively, a first type of cover member 720 and an adjustment member 730a with a density greater than  $1 \text{ kg/m}^3$  are provided at one flow guide port 715. A second type of cover member 720, an adjustment member 730b with a density less than  $1 \text{ kg/m}^3$ , and a moving part 731 are provided at the other flow guide port 715.

When the filtration assembly 710 is provided with three or more guide ports 715, the types of cover members 720, the types of adjustment members 730b, etc. at the flow guide ports 715 can be determined according to actual conditions and will not be described in detail here.

In addition, the shape of the above flow guide port 715 can be regular or irregular. Regular shapes can be regular polygons, circles, etc. Irregular shapes can be formed by a combination of arcs and [broken lines]. The shape of the cover member 720 may be the same as or different from the shape of the flow guide port 715. When the shape of the cover member 720 is different from the shape of the flow guide port 715 and the debris bin 711 is in the first movement state or the third movement state, the cover member 720 only needs to cover the flow guide port 715, and its specific shape is not limited.

It should be understood that the cover member 720 of the filtration assembly 710 provided in the present disclosure may also be provided with a second filter layer. When the cover member 720 is not open, the second filter layer serves to filter impurities, preventing the cover member 720 from affecting the normal operation of the cleaning apparatus 10. The position of the second filter layer should avoid the position of the adjustment members 730a and 730b, and its specific position and form are not limited herein.

The above cover member 720 may be movably connected to the cleaning apparatus 10. For example, the cover member 720 may be mounted on structures of the cleaning apparatus 10 other than the debris bin 711, such as by pivoting, telescoping, hinging, or other means, to cover or open the flow guide port 715, etc. When the cover member 720 is pivotally connected to the cleaning apparatus 10, its structure is the same as that of the cover member 720 pivotally connected to the debris bin 711 as described above, and will not be described in detail here. That is, the installation position of the cover member 720 may be selected from various options, and the specific installation position may be determined according to actual requirements.

Please refer to FIG. 54. FIG. 54 is a partial cross-sectional schematic diagram of an eighth embodiment of the underwater cleaning apparatus of the present disclosure. In conjunction with FIGS. 40-47, 52, and 53, in some embodiments, the cleaning apparatus 10 includes a filtration assembly 710. The filtration assembly 710 is as described in the above embodiments and will not be described in detail here. By using the aforementioned filtration assembly 710 in the cleaning apparatus 10, it can not only reduce the impact on the cleaning effect of the cleaning apparatus 10, but also increase the water intake of the main water pump 210, thereby increasing the thrust of the cleaning apparatus 10, and thus improving the wall-climbing, slope-climbing, or operational performance of the cleaning apparatus 10, enhancing the user experience.

In one embodiment, the debris bin 711 is formed with a debris bin water inlet section 716. The debris bin water inlet section 716 is in communication with the first chamber 714. That is, water enters the first chamber 714 from the debris bin water inlet section 716. The cleaning apparatus 10 further includes a main water pump 210. The main water pump 210 is provided outside the debris bin 711. The main water pump 210 is in communication with the first chamber 714 of the debris bin 711. The main water pump 210 provides driving force for water flow and can guide the direction of water flow.

When the filtration assembly 710 is in the first movement state or the third movement state, the cover member 720 covers the flow guide port 715. The main water pump 210 is configured to guide water sequentially from the debris bin water inlet section 716, through the first chamber 714, the first filter layer, and then into the main water pump 210. That is, the main water pump 210 is configured to guide water from the pool into the first chamber 714 via the debris bin water inlet section 716. The water in the first chamber 714 passes through the first filter layer on the debris bin 711 and then flows into the main water pump 210.

When the filtration assembly 710 is in the second movement state, the cover member 720 opens the flow guide port 715. The main water pump 210 is configured to guide at least part of the water sequentially from the debris bin water inlet section 716, through the first chamber 714 and the flow guide port 715, and then into the main water pump 210. That is, the main water pump 210 is configured to guide water from the pool into the first chamber 714 via the debris bin water inlet section 716. At least part of the water in the first chamber 714 flows directly through the flow guide port 715 and then into the main water pump 210. Some water may also flow through the first filter layer and then into the main water pump 210.

Thus, the main water pump 210 not only provides driving force for water flow and defines the flow direction, but also ensures that the main water pump 210 always meets the water intake requirements, thereby maintaining stable wall-climbing, slope-climbing, or operational performance of the cleaning apparatus 10.

In one embodiment, the cleaning apparatus 10 includes a debris chamber 1023. The debris bin 1023 is formed with a second chamber 10231. The filtration assembly 710 is disposed in the second chamber 10231. The second chamber 10231 is disposed in communication with the first chamber 714 of the debris bin 711 in the filtration assembly 710. For example, the second chamber 10231 may be in communication with the first chamber 714 via the first filter layer and the flow guide port 715. The main water pump 210 is provided outside the debris chamber 1023. The debris bin water inlet section 716 is formed between the debris bin 711 and the debris chamber 1023. The debris bin water inlet section 716 is in communication with the first chamber 714. That is, water enters the first chamber 714 from the debris bin water inlet section 716. The installation position and manner of the debris bin water inlet section 716 are not limited, as long as water can directly enter the first chamber 714 via the debris bin water inlet section 716.

When the cleaning apparatus 10 is placed in the pool, the main water pump 210 is configured to guide water from the pool into the first chamber 714 via the debris bin water inlet section 716, then, after filtration by the first filter layer, into the second chamber 10231, and then through the second chamber 10231 and into the main water pump 210.

When the filtration assembly 710 is in the first movement state or the third movement state, the cover member 720 covers the flow guide port 715. The main water pump 210 is configured to guide water sequentially from the debris bin water inlet section 716, through the first chamber 714, the first filter layer, and the second chamber 10231 and then into the main water pump 210. That is, the main water pump 210 is configured to guide water from the pool into the first chamber 714 via the debris bin water inlet section 716. Water in the first chamber 714 flows through the first filter layer on the debris bin 711 into the second chamber 10231, after which the water passes through the second chamber 10231 and into the main water pump 210. Specifically, the first movement state or the third movement state refers to the state in which the debris bin 711 is moving along a direction perpendicular to the direction of gravity within the cleaning apparatus 10; or when the cleaning apparatus 10 is at a certain tilt angle such that the gravity of the cover member 720 itself or an external force is insufficient to open the flow guide port 715.

When the debris bin 711 of the filtration assembly 710 is in the second movement state, the cover member 720 opens the flow guide port 715. The main water pump 210 is configured to guide at least part of the water sequentially from the debris bin water inlet section 716, through the first chamber 714, the flow guide port 715, and the second chamber 10231, and then into the main water pump 210. That is, the main water pump 210 is configured to guide water from the pool into the first chamber 714 via the debris bin water inlet section 716. At least part of the water in the first chamber 714 directly flows into the second chamber 10231 through the flow guide port 715. Some of the water may also flow into the second chamber 10231 through the first filter layer, after which the water passes through the second chamber and into the main water pump 210.

By providing a debris chamber 1023 in the cleaning apparatus 10, water can be concentrated in the second chamber 10231, thereby enabling concentrated flow into the main water pump 210, which increases the water intake requirements of the main water pump 210 and further enhances the wall-climbing, slope-climbing, or operational performance of the cleaning apparatus 10. The above debris chamber 1023 is provided with a water outlet (not shown). The water outlet is in communication with the main water pump 210. The water outlet may be provided on the side wall of the debris chamber 1023 adjacent to the main water pump 210. Alternatively, the water outlet may also be provided at other locations of the debris chamber 1023, which is not limited herein.

In one embodiment, the cover member 720 is pivotally connected to the debris chamber 1023. The structure of the cover member 720 pivotally connected to the debris chamber 1023 is the same as that of the cover member 720 pivotally connected to the debris bin 711, and will not be described in detail here. By providing the cover member 720 on the debris chamber 1023, the resistance of the cover member 720 to water flow can be reduced, allowing water to flow out of the debris bin 711 more smoothly. For example, the cover member 720 may be provided on the side wall of the debris chamber 1023 to cover or open the flow guide

port 715.

During the process of opening the flow guide port 715 by the cover member 720, when the cleaning apparatus 10 transitions from the second state to the first state, the cover member 720 can automatically reset due to its own structure, thereby covering the flow guide port 715. Of course, a reset component may be provided between the cover member 720 and the debris bin 711, or between the cover member 720 and the debris chamber 1023. The reset component enables rapid resetting. The reset component may be a torsion spring, a spring, a tension spring, etc., without limitation.

In one embodiment, the cleaning apparatus 10 further comprises a flip cover (not shown). The debris bin 1023 is formed with an opening (not shown). The flip cover is provided over the opening to seal the debris chamber 1023. The flip cover is provided on the top of the debris chamber 1023. The flow guide port 715 is disposed on top of the debris bin 711. At this time, the debris bin 711 is partially hollowed and provided with a flow guide port 715. The cover member 720 is movably connected to the flip cover and is configured to cover or open the flow guide port 715 of the debris bin 711. That is, in addition to being provided on the debris chamber 1023, the cover member 720 may also be provided on the flip cover.

In other embodiments, when the top of the debris bin 711 comprises a fifth side 7111e, the cover member 720 may be movably mounted on the top cover housing (not shown) of the cleaning apparatus 10. The top cover housing is the outermost housing of the cleaning apparatus 10. When the top cover housing is opened, the filtration assembly 710 can be removed from the cleaning apparatus 10 for cleaning or replacement. The cover member 720 covers or opens the flow guide port 715 on the fifth side surface 7111e.

In an alternative embodiment, when the top of the debris bin 711 comprises a fifth side surface 7111e, the fifth side surface 7111e is formed with a flow guide port 715. The cover member 720 may be movably mounted on the fifth side surface 7111e to cover or open the flow guide port 715 on the fifth side surface 7111e.

In one embodiment, the cover member 720 is further provided with a second filter layer (not shown). The second filter layer is in communication with the first chamber 714 and the second chamber 10231. The second filter layer serves a filtering function. When the filtration assembly 710 is in the first movement state or the third movement state, the cover member 720 covers the flow guide port 715. Water in the pool can enter the first chamber 714 via the debris bin water inlet section 716. Water in the first chamber 714 flows through the first filter layer on the debris bin 711 and the second filter layer on the cover member 720 into the second chamber 10231, after which the water passes through the second chamber 10231 and into the main water pump 210. Thus, by providing a second filter layer on the cover member 720, the cleaning efficiency of the cleaning apparatus 10 can be improved. The structure of the second filter layer may be the same as or different from that of the first filter layer, without limitation.

In one embodiment, the main water pump 210 includes a main water pump impeller cover 215. The area of the flow guide port 715 of the filtration assembly 710 is larger than the water inlet cross-sectional area of the main water pump impeller cover 215. The area of the flow guide port 715 is larger than the water inlet cross-sectional area of the main water pump impeller cover 215, which increases the water outlet area of the filtration assembly 710 so that the water output of the filtration assembly 710 is greater than the water input of the main water pump 210, ensuring that the water input requirement of the main water pump 210 is always met when climbing a wall or a slope or the first filter layer is blocked and thereby maintaining wall-climbing, slope-climbing, or operational performance.

The above main water pump 210 also includes a main water pump impeller 212 and a main water pump motor 211. The output end of the main water pump motor 211 is connected to the main water pump impeller 212. The main water pump motor 211 drives the main water pump impeller 212 to rotate within the main water pump impeller cover 215. Wherein, the main water pump motor 211 in the main water pump 210 drives the main water pump impeller 212 to rotate, and water flows into the main water pump impeller 212, accelerating the water output of the filtration assembly 710 thereby improving the cleaning efficiency of the cleaning apparatus 10 for sewage in the pool.

Since the size of debris on the liquid level 30 is larger than that of debris below the liquid level 30, the mesh size of the first filter layer of the filtration assembly for water surface cleaning may be larger than that for underwater cleaning. In some embodiments, the debris bin 711 may be provided with two or more first filter layers. The cover member 720 covers or opens the flow guide port 715 on the filtration assembly 710. When the cleaning apparatus 10 performs underwater cleaning, the cover member 720 covers the flow guide port 715. The multiple first filter layers provide layered filtration, improving underwater cleaning and filtration efficiency. When the cleaning apparatus 10 performs water surface cleaning, the cover member 720 at least partially opens the flow guide port 715, reducing the number of first filter layers at the flow guide port 715, which facilitates the filtration of larger debris on the liquid level 30 and reduces clogging of multiple first filter layers by large debris. The structure, arrangement, and position of the cover member 720 are as described above and will not be repeated here.

Based on the above description, the cleaning apparatus 10 can perform cleaning in various scenarios in the pool, including bottom cleaning, wall cleaning, water surface cleaning, waterline cleaning, and water quality treatment at a set depth in the pool.

During bottom and wall cleaning, the first water inlet 1031 at the bottom of the cleaning apparatus 10 sucks in debris-laden water flow, which enters the filtration mechanism through the underwater debris bin opening 7162 for filtration and is then discharged outside the apparatus through the liquid outlet section 104. At the same time, at least one first cleaning member 410 at the bottom of the cleaning apparatus 10 brushes the pool bottom or wall. During waterline cleaning, at least one first cleaning member of the cleaning apparatus 10 brushes the pool wall waterline, and the dirt attached to the waterline is brushed off and falls to the pool bottom or is partially sucked into the filtration mechanism inside the cleaning apparatus 10 through the first water inlet 1031.

During water surface cleaning, at least one water surface debris bin opening 7161 (which may be the same as the underwater debris bin opening 7162) provided on the cleaning apparatus 10 sucks floating debris on the water surface into the filtration mechanism of the cleaning apparatus 10. Meanwhile, due to the influence of wind on the water surface, debris may be blown to the pool wall or corners. During the cleaning process, due to structural limitations, the cleaning apparatus 10 may miss cleaning debris at the pool wall waterline or corners. In this case, a nozzle can be provided on the cleaning apparatus 10. The nozzle blows debris at the pool wall waterline or corners away from these locations and into the cleaning range of the water surface debris bin opening 7161, thereby improving cleaning efficiency.

If the filtration mechanism is a filter mesh structure, it may become clogged by debris, floating algae, etc., in the water during operation, resulting in poor water flow and affecting the amount of water discharged from the cleaning apparatus 10. When the cleaning apparatus 10 operates on the pool bottom or wall, the discharged water provides wall-adhering reverse thrust. Especially when the cleaning apparatus 10 operates on the pool wall, insufficient reverse thrust may cause the cleaning apparatus 10 to roll over easily. Therefore, a second water flow channel can be provided on the filtration mechanism to cope with filter mesh clogging, ensuring that the cleaning apparatus 10 can still stably adhere to the wall.

In certain situations, due to structural limitations of the first cleaning member 410 of the cleaning apparatus 10 as well as the effective cleaning range of the cleaning apparatus 10 itself, some specific areas are difficult to clean, such as within a certain range at the junction between the pool bottom and the pool wall, or within a certain range at the junction between pool walls. In such cases, cleaning of the above-mentioned specific areas can be achieved by providing at least one rotary brush 431 on the cleaning apparatus 10. To ensure that the rotary brush 431 does not interfere with the normal operation of the cleaning apparatus 10 during operation, the rotary brush 431 may be configured in a retractable form. For example, when needed, the rotary brush 431 is extended for cleaning, and upon completion of the cleaning process, the rotary brush 431 is retracted into the cleaning apparatus 10.

The above description is only exemplary embodiments of the present application and does not limit the scope of the patent of the present application. Any equivalent structural or process transformations made using the content of the present application and drawings, or direct or indirect application to other related technical fields, shall be included within the scope of patent protection of the present application.

## Claims

1. A cleaning apparatus comprising a cleaning apparatus main body, the cleaning apparatus main body comprising:
  - a liquid inlet section including at least a first water inlet;
  - a liquid outlet section including at least a first water outlet;
  - a filtration mechanism including at least a first entry and a first outlet, the first entry being in fluid communication with the first water inlet and the outlet being in fluid communication with the first water outlet;
  - a drive mechanism for generating suction to form a first water flow channel in the liquid inlet section, the filtration mechanism, and the liquid outlet section;
 Wherein, the cleaning apparatus main body further comprises:
  - a mode switching component for switching between a first movement state and a third movement state. The cleaning apparatus can perform underwater cleaning work in the first movement state and the cleaning apparatus can perform water surface cleaning work in the third movement state.
2. The cleaning apparatus according to Claim 1, wherein the cleaning apparatus further comprises a second movement state and the cleaning apparatus may perform a pool wall or waterline cleaning work in the second movement state; and the switching of the cleaning apparatus between the first and third movement states includes or does not include a second movement state.
3. The cleaning apparatus according to Claim 1, wherein the first water inlet is located at the front of the lower part of the cleaning apparatus body; when the cleaning apparatus performs underwater cleaning, the first water inlet is below the liquid level; when the cleaning apparatus performs water surface cleaning, at least part of the first water inlet is exposed above the liquid level.
4. The cleaning apparatus according to Claim 1, wherein the first water inlet is located at the bottom of the cleaning apparatus body; when the cleaning apparatus performs underwater cleaning, the first water inlet faces the surface to be cleaned; when the cleaning apparatus performs water surface cleaning, the first water inlet faces the water surface and is located below the water surface.
5. The cleaning apparatus according to Claim 1, wherein the first water inlet is located at the bottom of the cleaning apparatus main body, and when the cleaning apparatus performs underwater cleaning, the first water inlet faces the surface to be cleaned; the cleaning apparatus also includes a second water inlet, the second water inlet is arranged on the front side of the cleaning apparatus main body, and when the cleaning apparatus performs water surface cleaning, the second water inlet is at least partially exposed above the liquid level.
6. The cleaning apparatus according to Claim 1, wherein the first water inlet is located at the bottom of the cleaning apparatus main body, and when the cleaning apparatus performs underwater cleaning, the first water inlet faces the surface to be cleaned; the cleaning apparatus also includes a second water inlet, the second water inlet is arranged on the side or top of the cleaning apparatus main body, and when the cleaning apparatus performs water surface cleaning, the second water inlet faces the water surface and is located below the liquid level.
7. The cleaning apparatus according to Claim 5 or 6, wherein the filtration mechanism includes a second entry, which is in fluid communication with the second water inlet; the second entry and the first entry are located on different surfaces of the filtration mechanism.
8. The cleaning apparatus according to Claim 5 or 6, wherein the second water inlet is also in fluid communication with the first entry.
9. The cleaning apparatus according to Claim 5 or 6, wherein the filtration mechanism includes a first filtration assembly and a second filtration assembly; the first filtration assembly is provided with a first entry and the second filtration assembly is provided with a second entry; the first water inlet is in fluid communication with the first entry and the second water inlet is in fluid communication with the second entry.
10. The cleaning apparatus according to any of Claims 1 to 9, wherein the mode switching component comprises:
  - a buoyancy chamber, configured to accommodate liquid and/or gas;
  - a buoyancy adjustment member, configured to adjust the volume of liquid or gas in the buoyancy chamber.
11. The cleaning apparatus according to any of Claims 1 to 10, wherein the cleaning apparatus further comprises a first thruster for adjusting a first driving force applied to the cleaning apparatus in a vertical direction.
12. The cleaning apparatus according to any one of Claims 1 to 11, wherein the cleaning apparatus comprises a traveling propulsion mechanism and a first cleaning member; the traveling propulsion mechanism includes at least a first wheel, a second wheel, and a track, and the first wheel and the second wheel are connected by the track; the first wheel is driven by a traveling drive member and the second wheel drives the first cleaning member to rotate.
13. The cleaning apparatus according to Claim 12, wherein the cleaning apparatus further comprises a second cleaning member and the second cleaning member is driven to rotate by the second wheel.
14. The cleaning apparatus according to any one of Claims 1 to 13, wherein the cleaning apparatus further comprises:
  - a cleaning component provided on the side of the cleaning apparatus main body;
  - a motion drive assembly provided on the cleaning apparatus main body, and the motion drive assembly is connected to the cleaning component and is used to drive the cleaning component to move or switch between a first position and a second position.
15. The cleaning apparatus according to Claim 14, wherein: In the first position, the cleaning component is at least partially located within the range of the cleaning apparatus main body; in the second position, the cleaning apparatus is at least partially located outside the range of the cleaning apparatus main body.
16. The cleaning apparatus according to Claim 14 or 15, wherein the motion drive assembly comprises a third drive assembly connected to the cleaning component for driving the cleaning component to rotate or reciprocate.
17. The cleaning apparatus according to Claim 14 or 15 or 16, wherein the cleaning apparatus further comprises a reset component connected with the cleaning component for providing a reset force for holding the cleaning component in the first position or the second position.

18. The cleaning apparatus according to any of Claims 2 to 17, wherein the filtration mechanism comprises a filtration assembly, and the filtration assembly comprises:

- a debris bin formed with a first chamber;
- a flow guide port disposed on the debris bin, the flow guide port being connected to the first chamber;
- a cover member, wherein in the first movement state or the third movement state, the cover member covers the flow guide port; in the second movement state, the cover member opens the flow guide port, and the liquid inlet section, the filtration mechanism, the flow guide port, and the drive mechanism form a second water flow channel.

19. The cleaning apparatus according to Claim 18, wherein the debris bin comprises a first filter layer, the first filter layer is connected to the first chamber, and the flow guide port is provided on the first filter layer.

20. The cleaning apparatus according to Claim 18 or 19, wherein grille holes are provided at the flow guide port, and at least part of the water in the first chamber flows out of the debris bin after passing through the flow guide port and the grille holes in sequence.

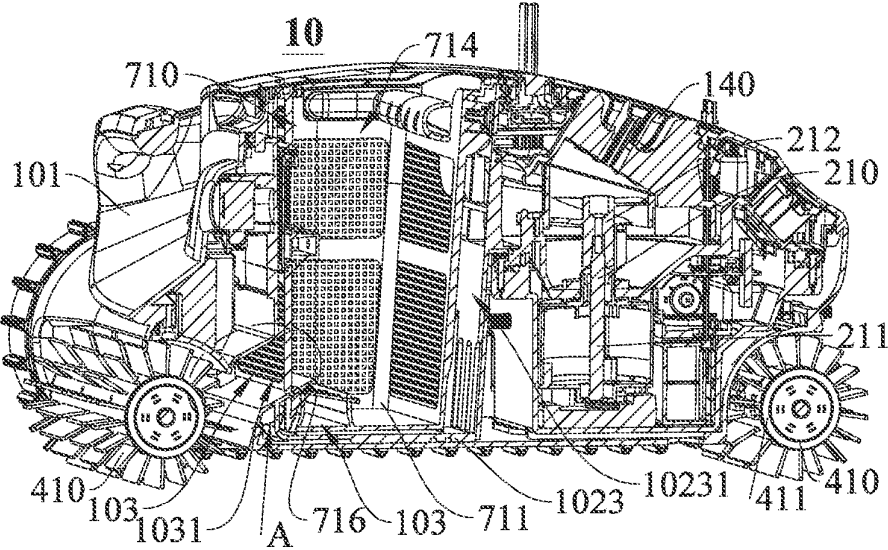


FIG. 1

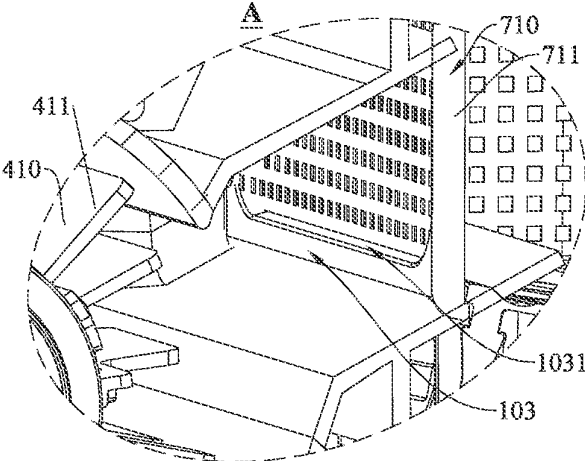


FIG. 2

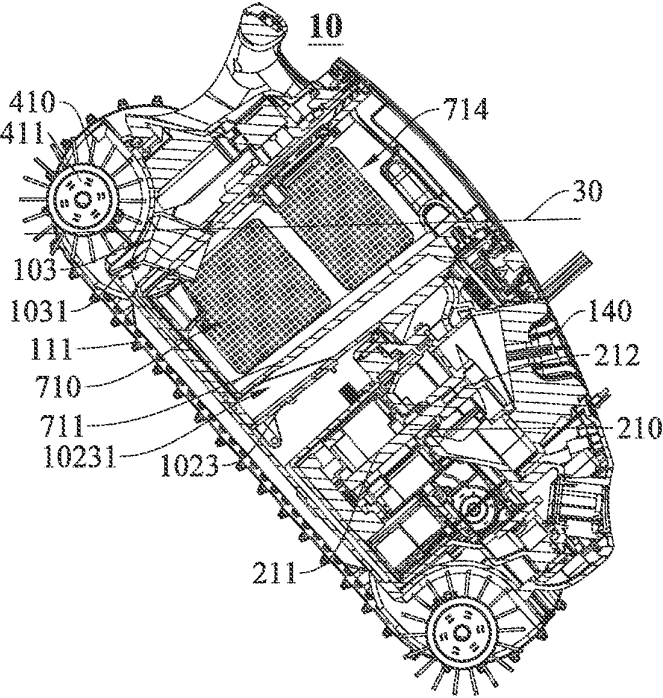


FIG. 3

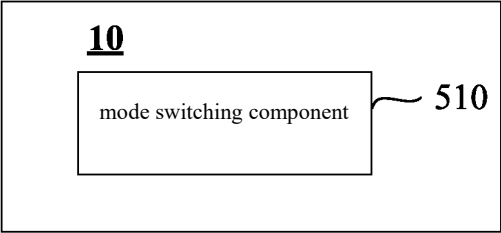


FIG. 4

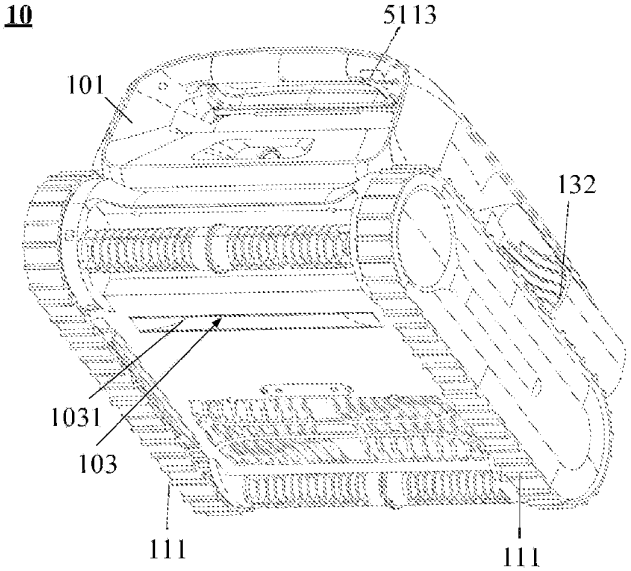


FIG. 5

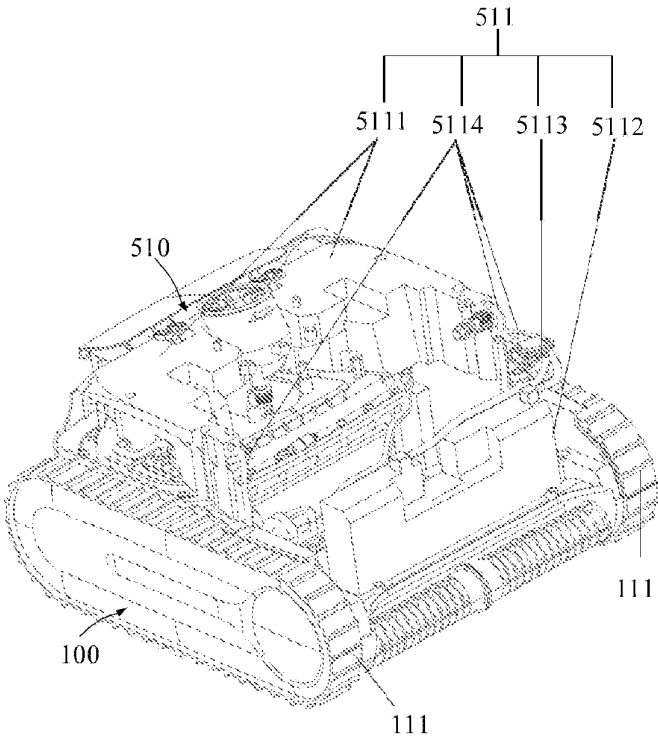


FIG. 6

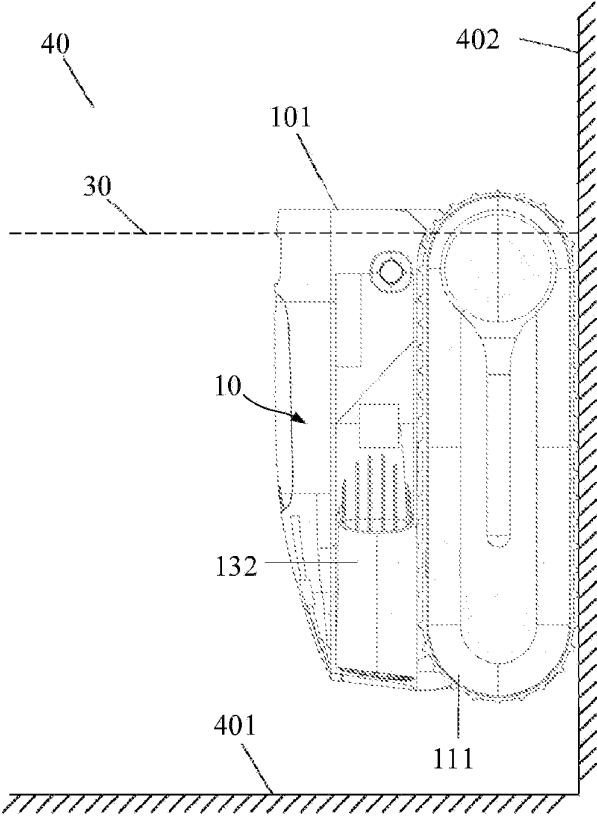


FIG. 7

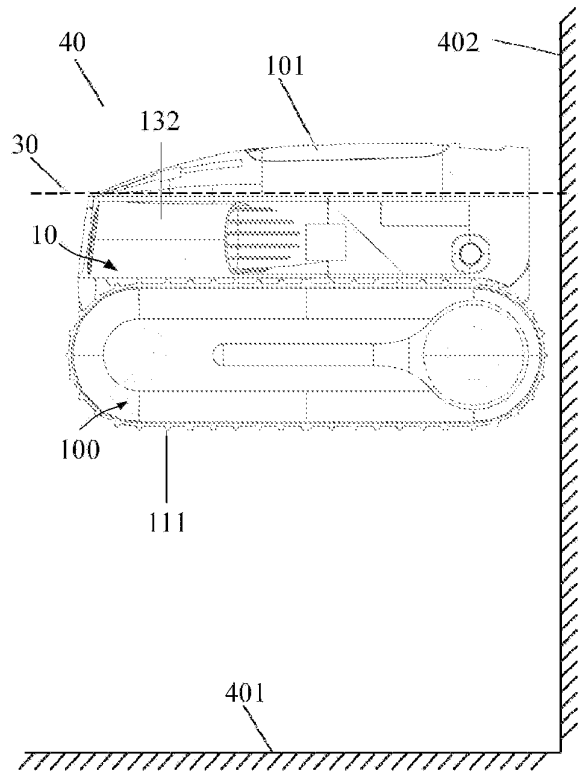


FIG. 8

10

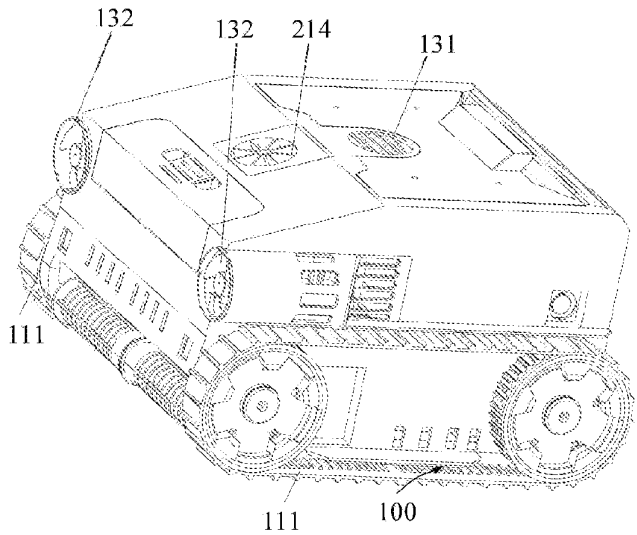


FIG. 9

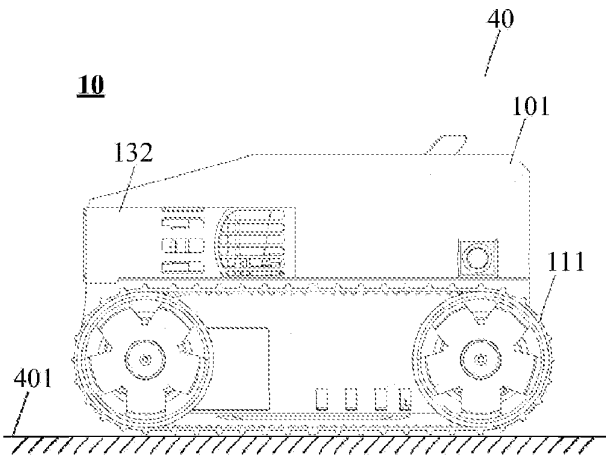


FIG. 10

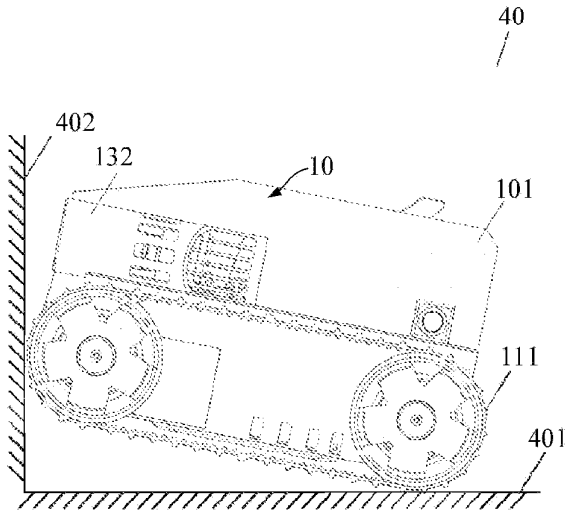


FIG. 11

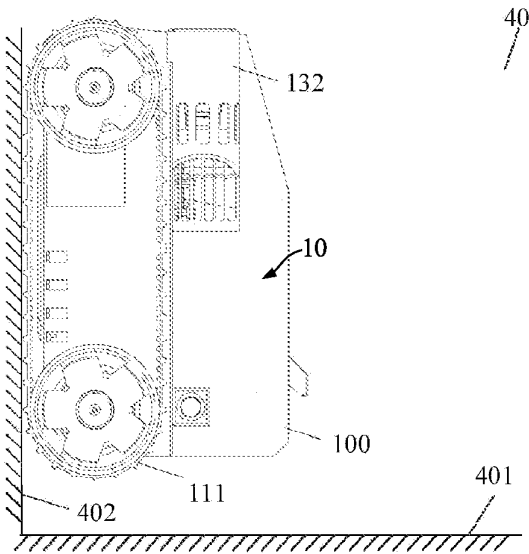


FIG. 12

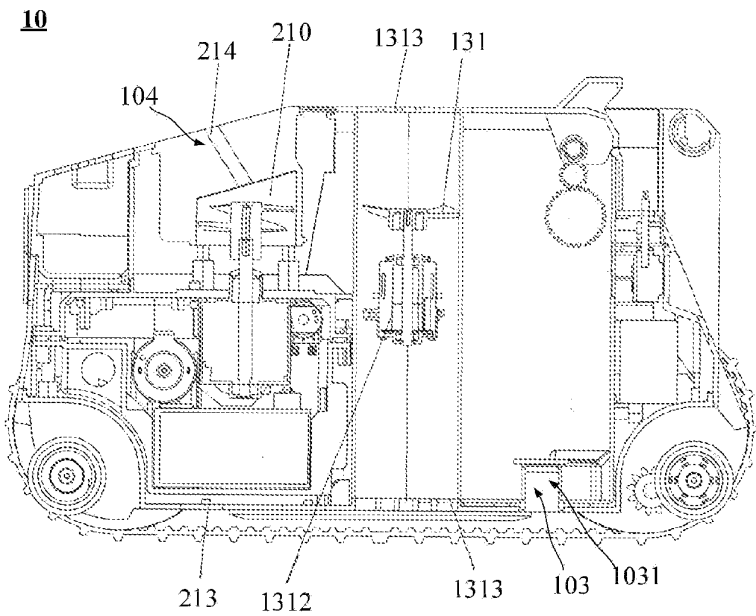


**FIG. 13**

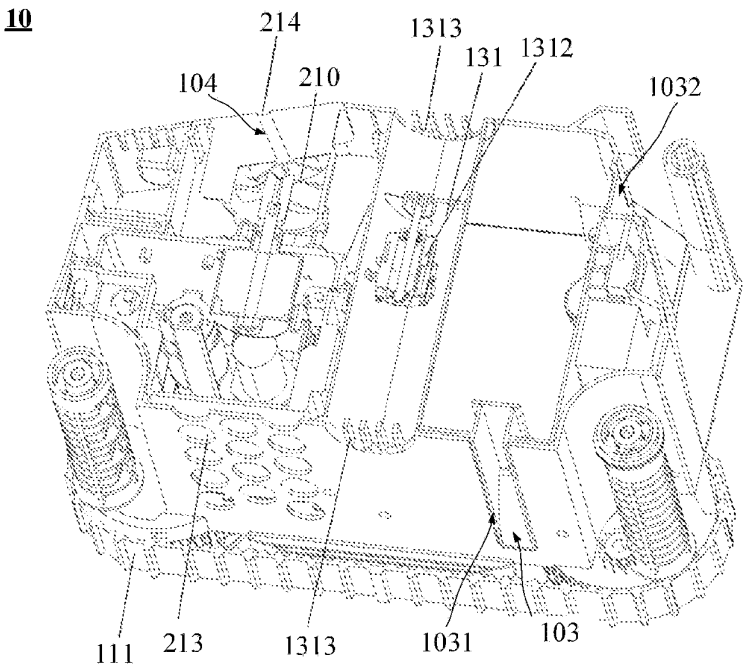


**FIG. 14**

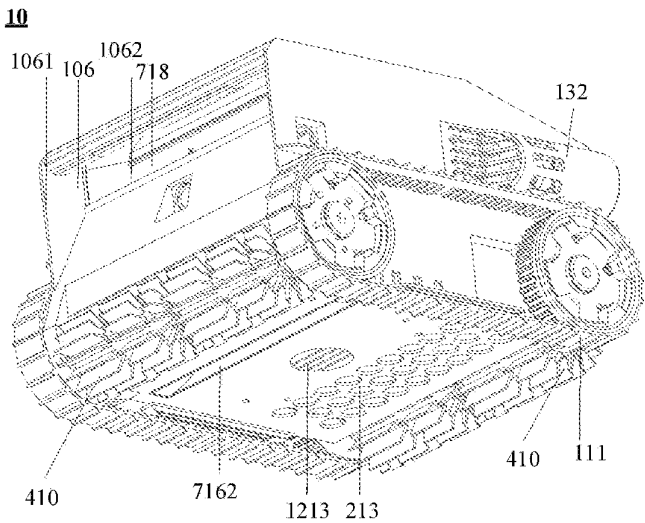


**FIG. 15**

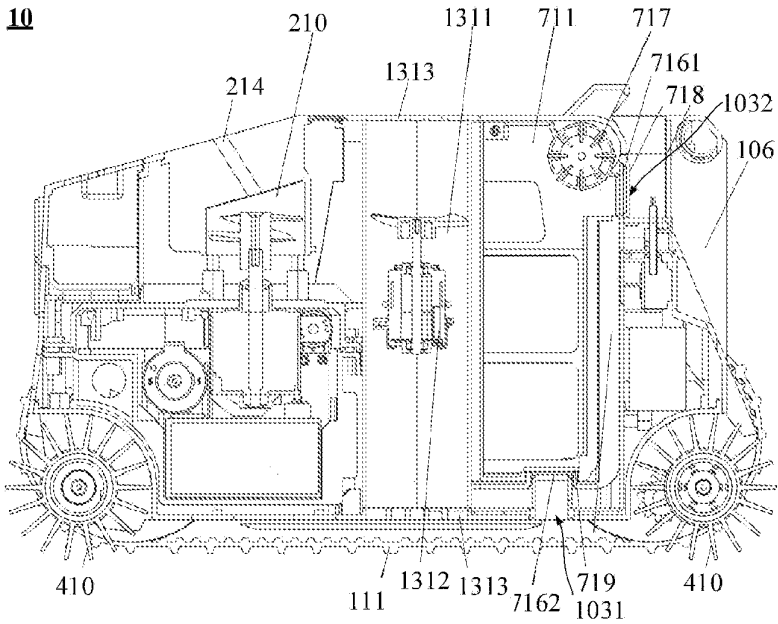


**FIG. 16**

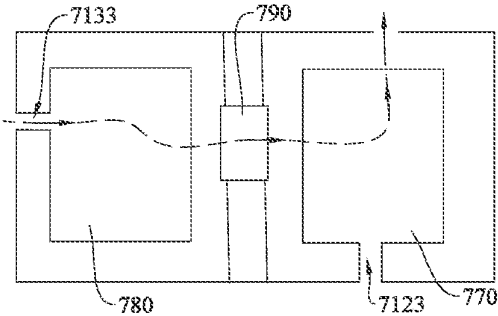


**FIG. 17**

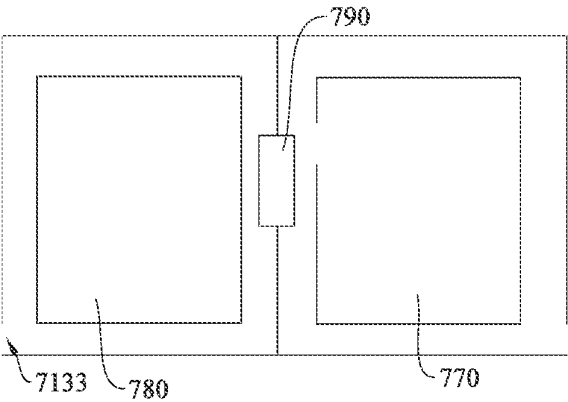


FIG. 18

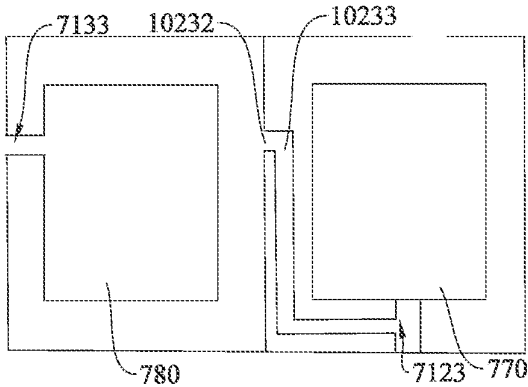


FIG. 19

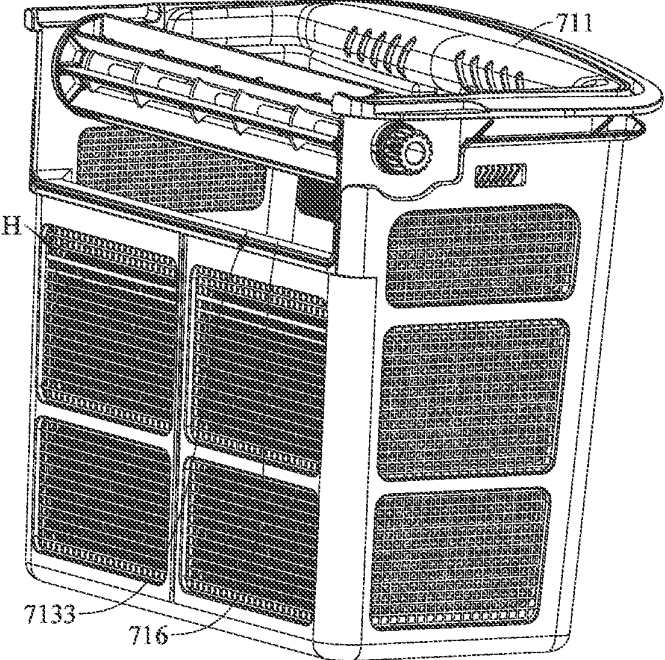


FIG. 20

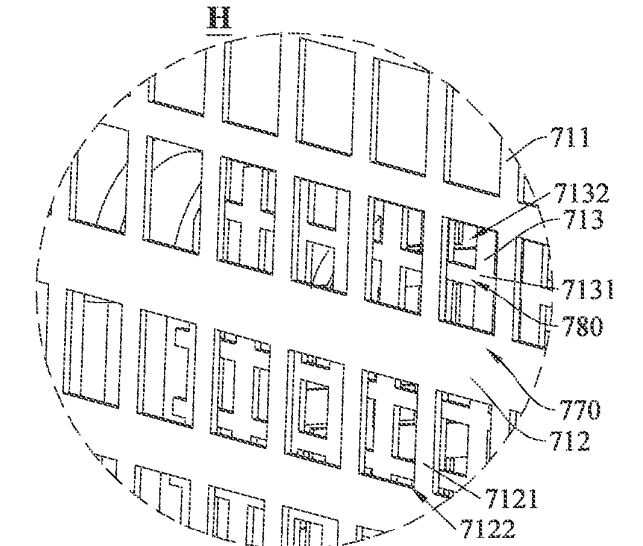


FIG. 21

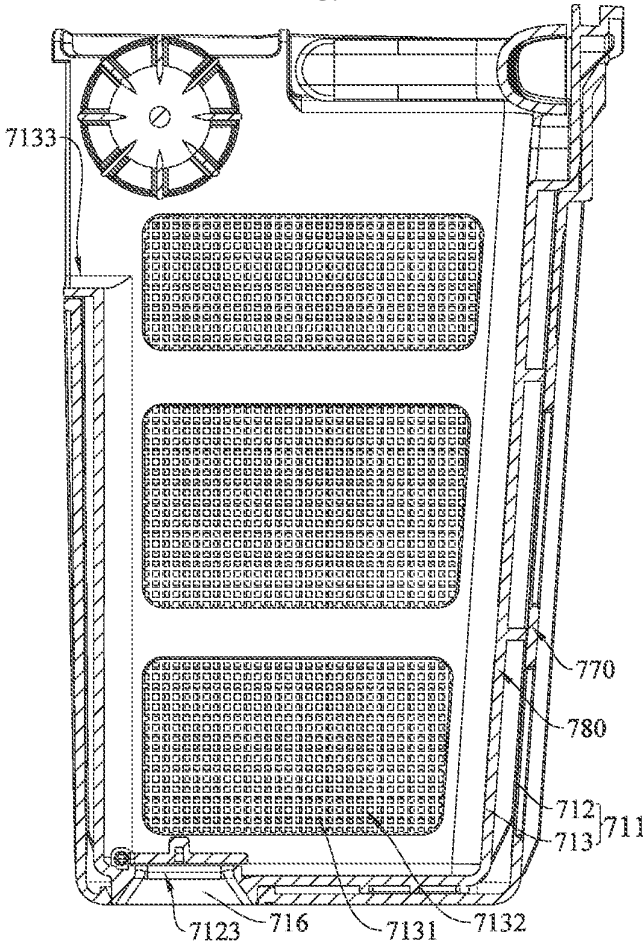


FIG. 22

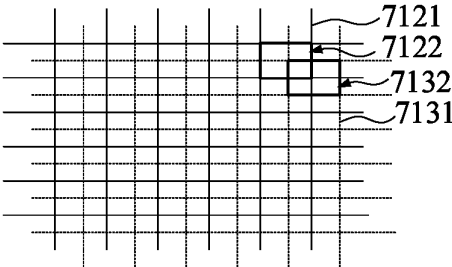


FIG. 23

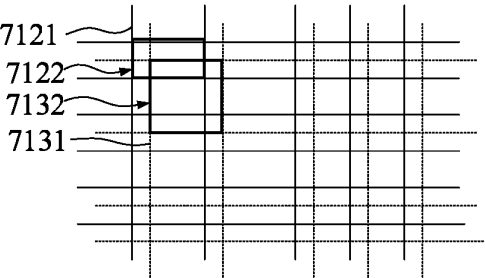


FIG. 24

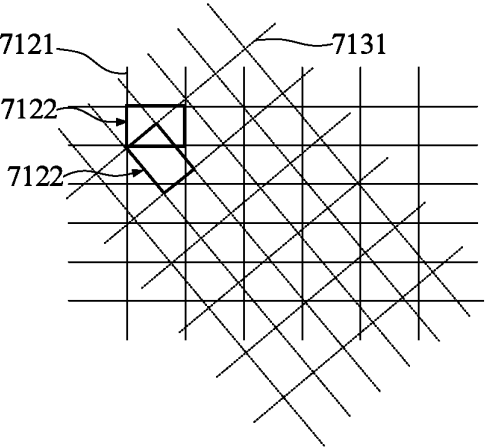


FIG. 25

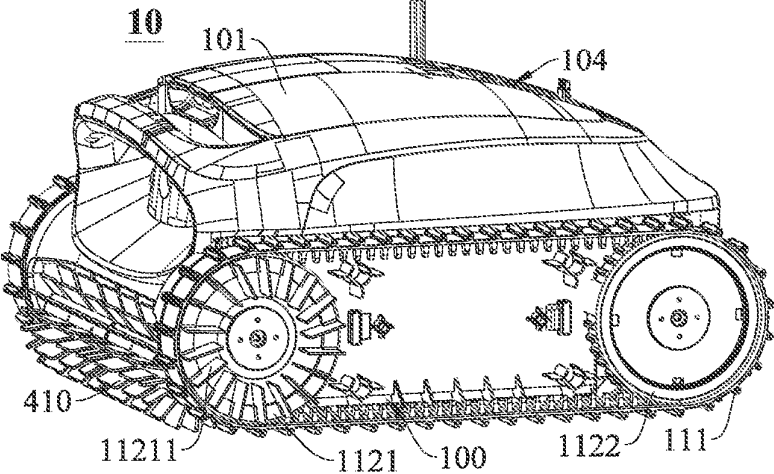


FIG. 26

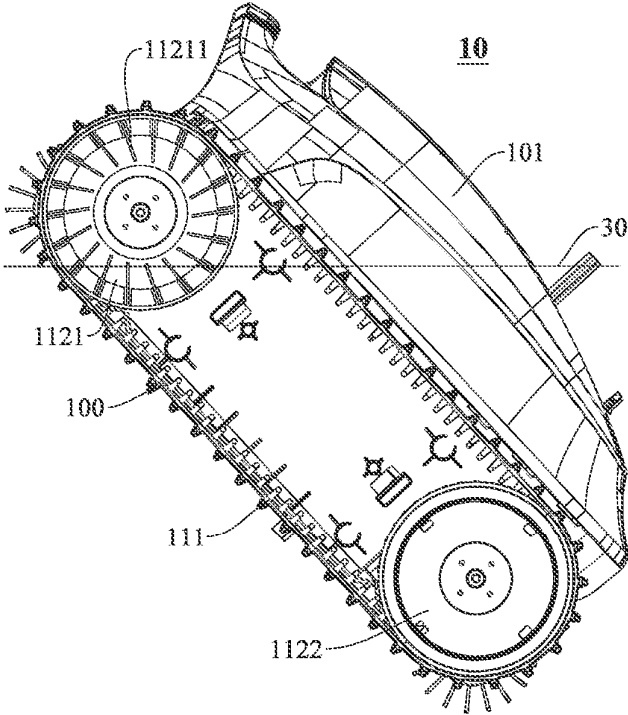


FIG. 27

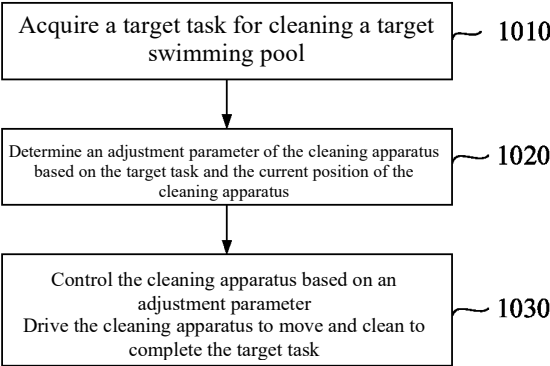


FIG. 28

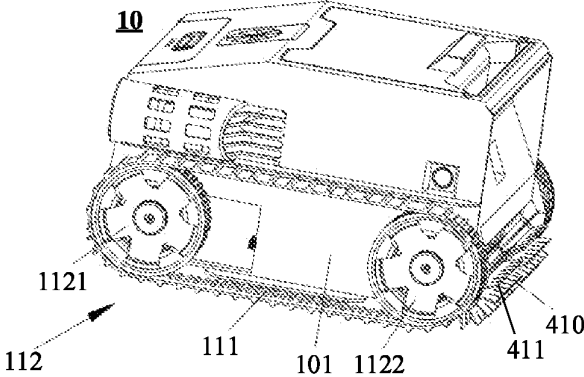
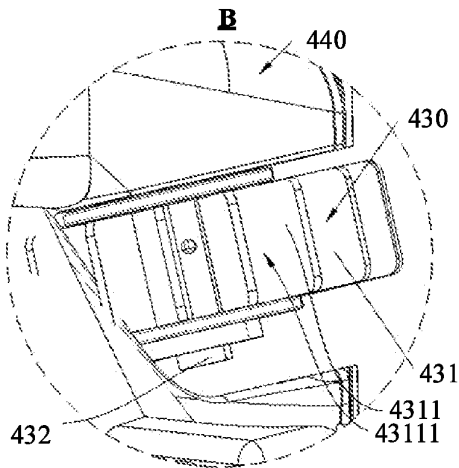
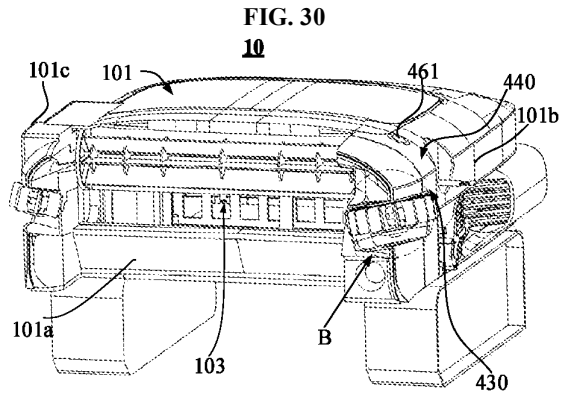
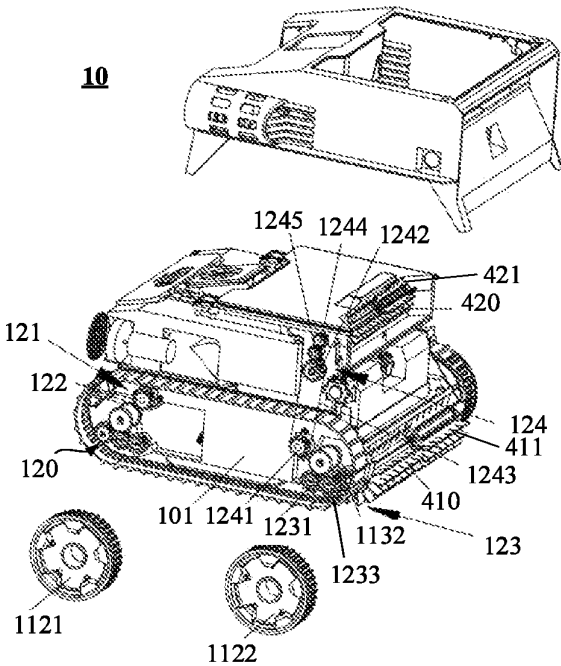


FIG. 29



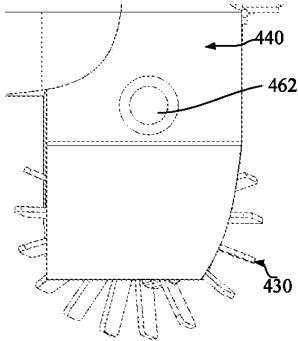


FIG. 33

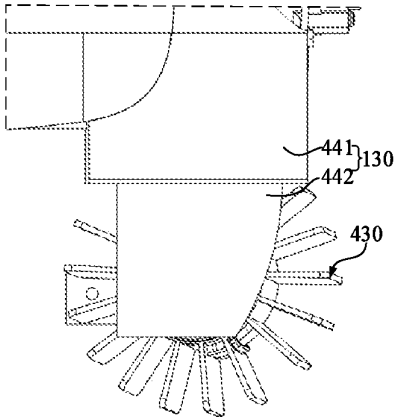


FIG. 34

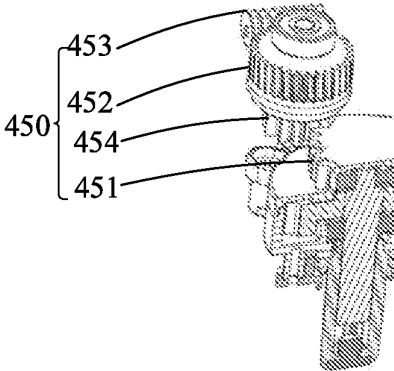


FIG. 35

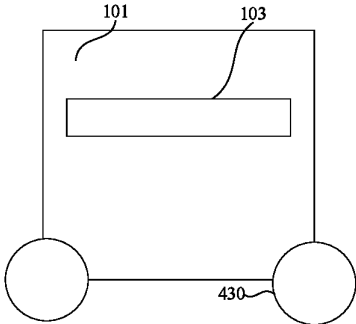


FIG. 36

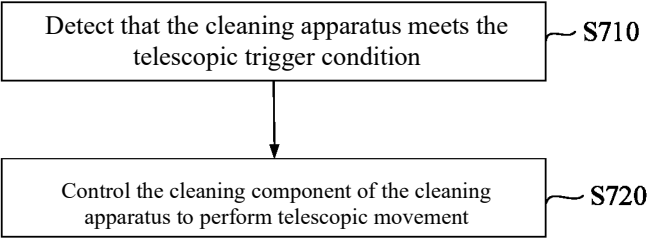


FIG. 37

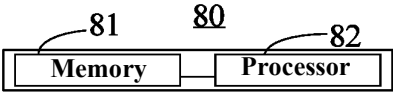


FIG. 38

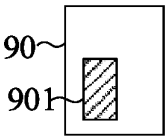


FIG. 39

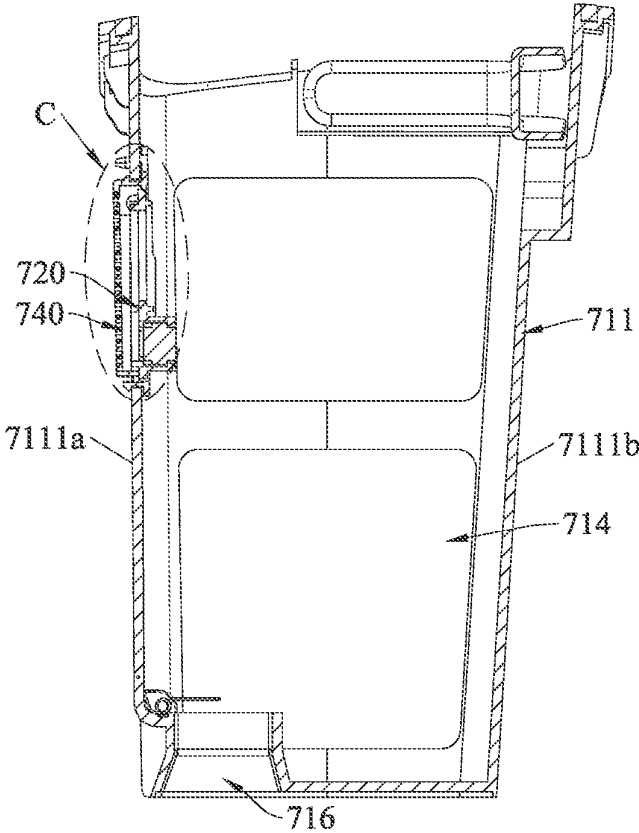
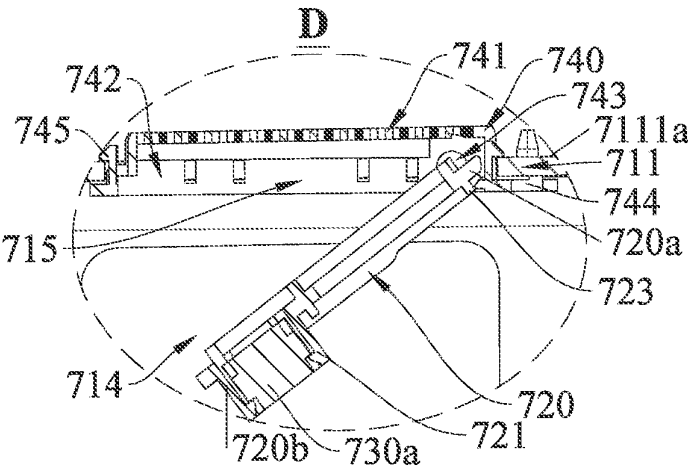
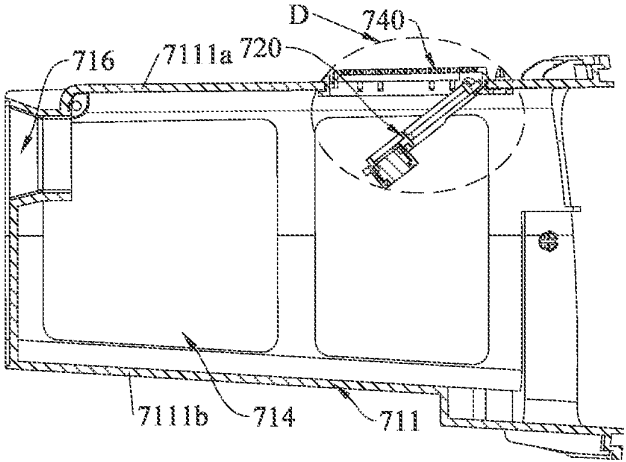
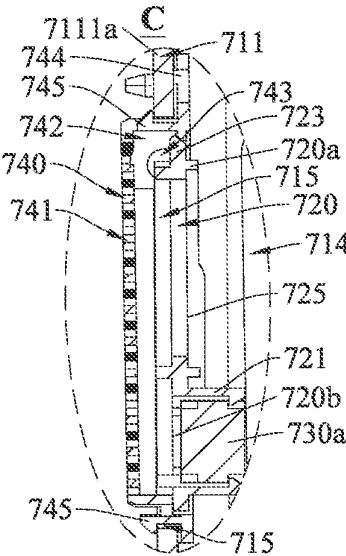


FIG. 40



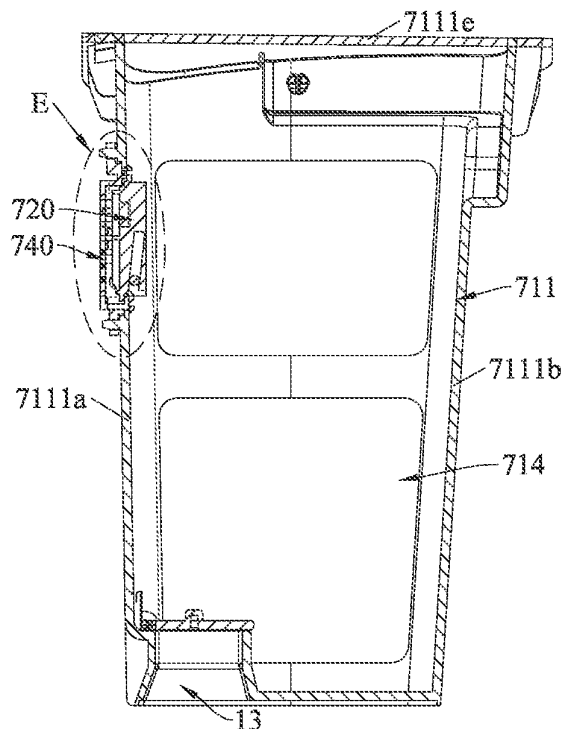


**FIG. 44**

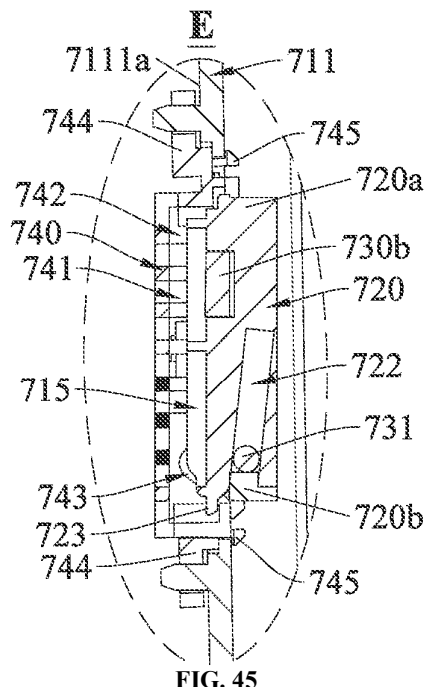


**FIG. 45**

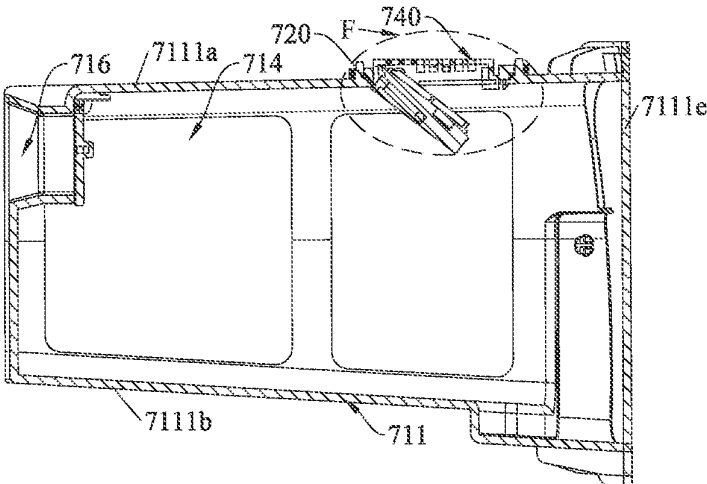


FIG. 46

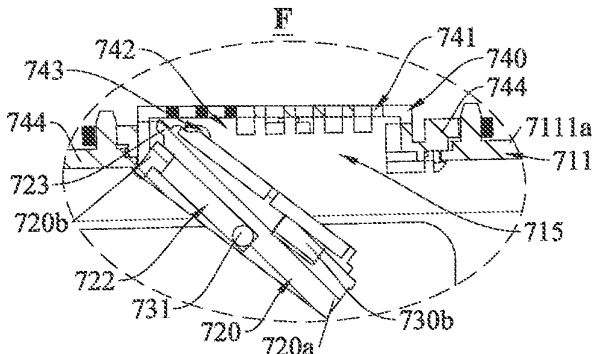


FIG. 47

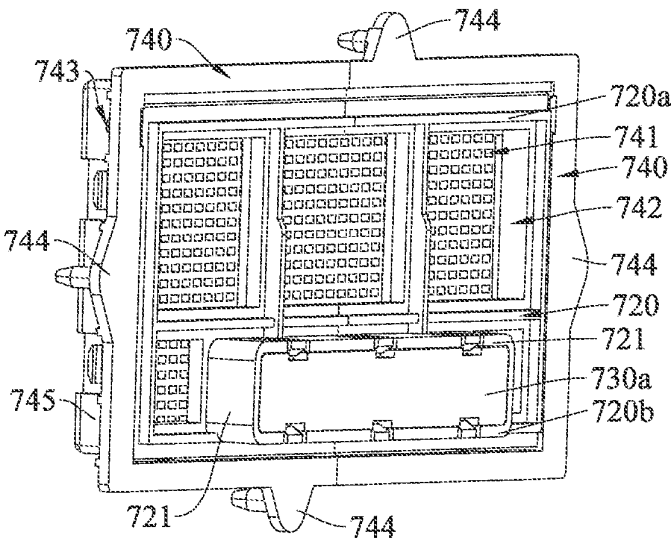


FIG. 48

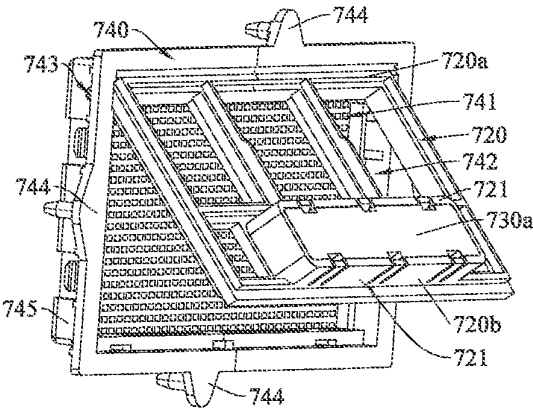


FIG. 49

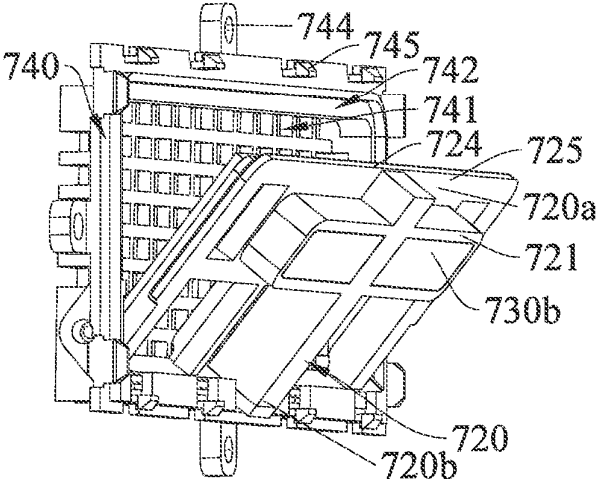


FIG. 50

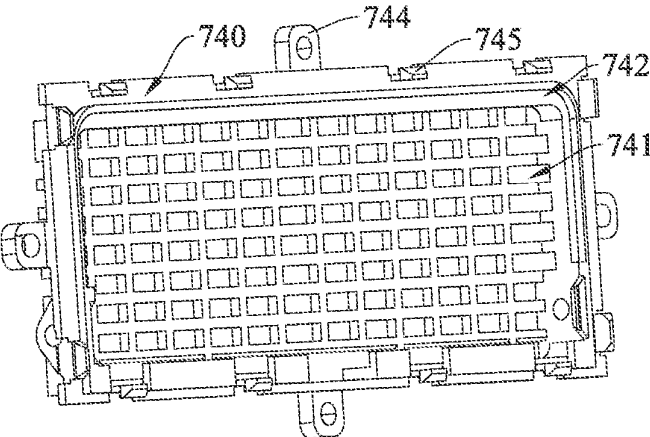


FIG. 51

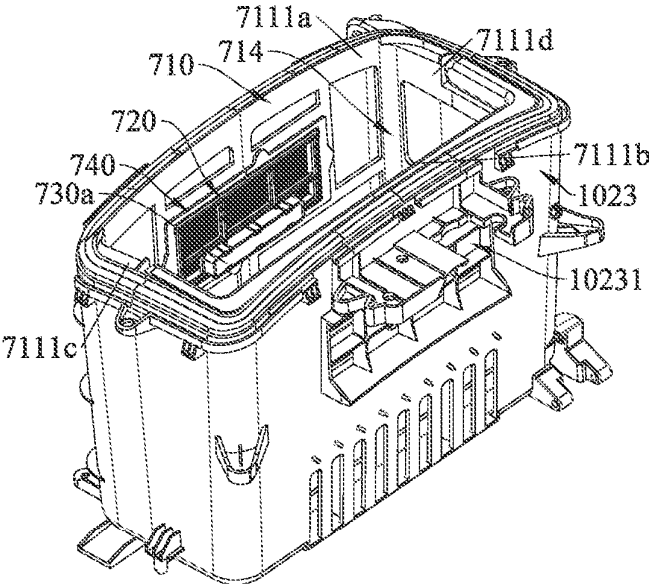


FIG. 52

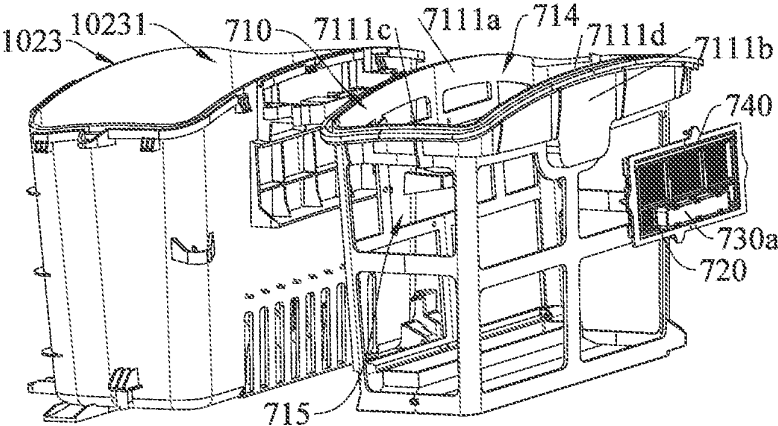


FIG. 53

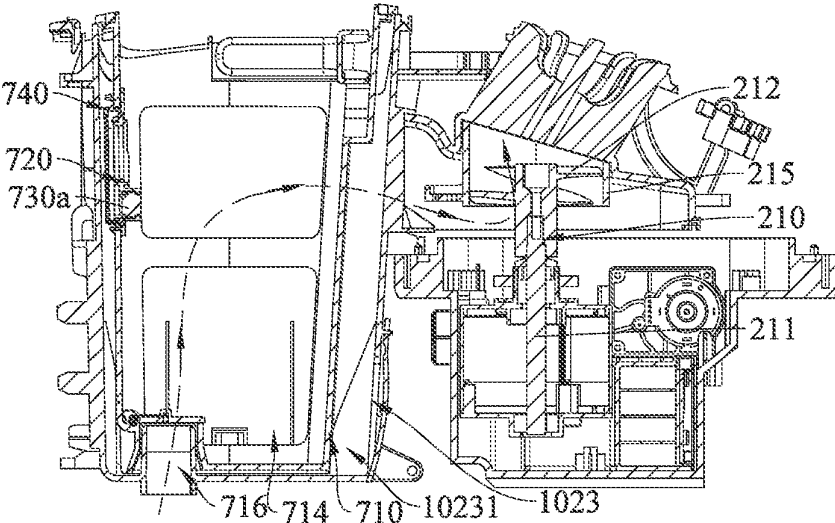


FIG. 54

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2024/076040

**A. CLASSIFICATION OF SUBJECT MATTER**

E04H4/16(2006.01)i; B01D35/02(2006.01)i; B01D35/30(2006.01)i; B01D29/96(2006.01)i; B01D29/56(2006.01)i;  
B62D55/065(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: E04H B01D B62D

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

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

CNABS; CNTXT; CNKI; WANFANG; CHAOXING DUXIU; VEN; EPTXT; USTXT; WOTXT: Xingmai Innovation Technology, pool, swimming pool, water surface, float, filter, filter screen, debris chamber, debris bin, block, block, block, obstruct, bypass, bypass, side door, brush, pool, pond, surface, float, flotation, sweep, skim, filter+, filtration, percolate, strain+, block, obstruct, bypass

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                                                         | Relevant to claim No. |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| PX        | CN 117120696 A (XINGMAI INNOVATION TECHNOLOGY (SUZHOU) CO., LTD.) 24 November 2023 (2023-11-24)<br>description, paragraphs [0028]-[0099], and figures 1-10 | 1-13                  |
| PY        | CN 116999943 A (XINGMAI INNOVATION TECHNOLOGY (SUZHOU) CO., LTD.) 07 November 2023 (2023-11-07)<br>description, paragraphs [0041]-[0103], and figures 1-15 | 18-20                 |
| PY        | CN 117323733 A (XINGMAI INNOVATION TECHNOLOGY (SUZHOU) CO., LTD.) 02 January 2024 (2024-01-02)<br>description, paragraphs [0046]-[0124], and figures 1-15  | 18-20                 |
| PA        | CN 219316535 U (XINGMAI INNOVATION TECHNOLOGY (SUZHOU) CO., LTD.) 07 July 2023 (2023-07-07)<br>description, paragraphs [0036]-[0052], and figures 1-2      | 1-20                  |
| X         | CN 104790696 A (SOUTHWEST JIAOTONG UNIVERSITY) 22 July 2015 (2015-07-22)<br>description, paragraphs [0028]-[0037], and figures 1-4                         | 1, 3-10               |

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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“&” document member of the same patent family

Date of the actual completion of the international search

**10 April 2024**

Date of mailing of the international search report

**30 April 2024**

Name and mailing address of the ISA/CN

**China National Intellectual Property Administration (ISA/  
CN)  
China No. 6, Xitucheng Road, Jimenqiao, Haidian District,  
Beijing 100088**

Authorized officer

Telephone No.

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2024/076040

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                                                 | Relevant to claim No. |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| X         | US 2016060887 A1 (MAYTRONICS LTD.) 03 March 2016 (2016-03-03)<br>description, paragraphs [0060]-[0157], and figures 1-18                           | 1, 3-17               |
| Y         | US 2016060887 A1 (MAYTRONICS LTD.) 03 March 2016 (2016-03-03)<br>description, paragraphs [0060]-[0157], and figures 1-18                           | 2, 18-20              |
| Y         | US 2022112735 A1 (ZODIAC POOL CARE EUROPE) 14 April 2022 (2022-04-14)<br>description, paragraphs [0025]-[0048], and figures 1A-4                   | 2, 18-20              |
| A         | DE 102006049990 A1 (POMMERANZ, W.) 30 April 2008 (2008-04-30)<br>description, paragraphs [0052]-[0065], and figure 1                               | 1-20                  |
| A         | US 2015067974 A1 (MAYTRONICS LTD.) 12 March 2015 (2015-03-12)<br>description, paragraphs [0065]-[0133], and figures 1-15                           | 1-20                  |
| A         | CN 114059811 A (POSITEC POWER TOOLS (SUZHOU) CO., LTD.) 18 February 2022<br>(2022-02-18)<br>description, paragraphs [0037]-[0054], and figures 1-5 | 1-20                  |

# INTERNATIONAL SEARCH REPORT

## Information on patent family members

International application No.

**PCT/CN2024/076040**

| Patent document cited in search report |              |    | Publication date (day/month/year) | Patent family member(s) |            |    | Publication date (day/month/year) |
|----------------------------------------|--------------|----|-----------------------------------|-------------------------|------------|----|-----------------------------------|
| CN                                     | 117120696    | A  | 24 November 2023                  | US                      | 11946282   | B1 | 02 April 2024                     |
| CN                                     | 116999943    | A  | 07 November 2023                  | None                    |            |    |                                   |
| CN                                     | 117323733    | A  | 02 January 2024                   | None                    |            |    |                                   |
| CN                                     | 219316535    | U  | 07 July 2023                      | None                    |            |    |                                   |
| CN                                     | 104790696    | A  | 22 July 2015                      | CN                      | 104790696  | B  | 24 May 2017                       |
| US                                     | 2016060887   | A1 | 03 March 2016                     | US                      | 10704283   | B2 | 07 July 2020                      |
|                                        |              |    |                                   | US                      | 2022333394 | A1 | 20 October 2022                   |
|                                        |              |    |                                   | ES                      | 2954250    | T3 | 21 November 2023                  |
|                                        |              |    |                                   | EP                      | 3012386    | A1 | 27 April 2016                     |
|                                        |              |    |                                   | EP                      | 3012386    | C0 | 07 June 2023                      |
|                                        |              |    |                                   | US                      | 2020277804 | A1 | 03 September 2020                 |
|                                        |              |    |                                   | US                      | 11274462   | B2 | 15 March 2022                     |
|                                        |              |    |                                   | EP                      | 4234848    | A2 | 30 August 2023                    |
|                                        |              |    |                                   | EP                      | 4234848    | A3 | 20 September 2023                 |
|                                        |              |    |                                   | EP                      | 3012386    | B1 | 07 June 2023                      |
|                                        |              |    |                                   | US                      | 11939791   | B2 | 26 March 2024                     |
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|                                        |              |    |                                   | WO                      | 2022079594 | A1 | 21 April 2022                     |
|                                        |              |    |                                   | AU                      | 2021359205 | A1 | 09 February 2023                  |
| DE                                     | 102006049990 | A1 | 30 April 2008                     | None                    |            |    |                                   |
| US                                     | 2015067974   | A1 | 12 March 2015                     | EP                      | 2845969    | A2 | 11 March 2015                     |
|                                        |              |    |                                   | EP                      | 2845969    | A3 | 25 March 2015                     |
|                                        |              |    |                                   | EP                      | 2845969    | B1 | 21 September 2016                 |
|                                        |              |    |                                   | ES                      | 2607680    | T3 | 03 April 2017                     |
|                                        |              |    |                                   | US                      | 10378229   | B2 | 13 August 2019                    |
|                                        |              |    |                                   | US                      | 2020002965 | A1 | 02 January 2020                   |
|                                        |              |    |                                   | US                      | 10890008   | B2 | 12 January 2021                   |
| CN                                     | 114059811    | A  | 18 February 2022                  | CN                      | 212507600  | U  | 09 February 2021                  |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                        |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|
| International Search Report                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | International Application No.<br><br>PCT/CN2024/076040 |
| <b>A. Classification of Subject Matter</b><br><br>E04H4/16(2006.01)i; B01D35/02(2006.01)i; B01D35/30(2006.01)i; B01D29/96(2006.01)i; B01D29/56(2006.01)i; B62D55/065(2006.01)i<br><br>According to International Patent Classification (IPC) or to both national classification and IPC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                        |
| <b>B. Fields Searched</b><br><br>Minimum documentation searched (classification system followed by classification symbols)<br>IPC: E04H B01D B62D<br><br>Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched<br><br>Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)<br>CNABS; CNTXT; CNKI; WANFANG; CHAOXING DUXIU; VEN; EPTXT; USTXT; WOTXT: Xingmai Innovation Technology, pool, swimming pool, water surface, float, filter, filter screen, debris chamber, debris bin, block, block, block, obstruct, bypass, bypass, side door, brush, pool, pond, surface, float, flotage, sweep, skim, filter+, filtration, percolate, strain+, block, obstruct, bypass |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                        |
| <b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                        |
| Category*                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Citation of document, with indication, where appropriate, of the relevant passages                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Relevant to claim No.                                  |
| PX                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | CN 117120696 A (Xingmai Innovation Technology (Suzhou) Co., Ltd.) November 24, 2023 (11/24/2023)<br>specification, paragraphs [0028]-[0099], and figures 1-10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1-13                                                   |
| PY                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | CN 116999943 A (Xingmai Innovation Technology (Suzhou) Co., Ltd.) November 7, 2023 (11/07/2023)<br>specification, paragraphs [0041]-[0103], and figures 1-15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 18-20                                                  |
| PY                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | CN 117323733 A (Xingmai Innovation Technology (Suzhou) Co., Ltd.) January 2, 2024 (01/02/2024)<br>specification, paragraphs [0046]-[0124], and figures 1-15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 18-20                                                  |
| PA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | CN 219316535 U (Xingmai Innovation Technology (Suzhou) Co., Ltd.) July 7, 2023 (07/07/2023)<br>specification, paragraphs [0036]-[0052], and figures 1-2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1-20                                                   |
| X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | CN 104790696 A (SOUTHWEST JIAOTONG UNIVERSITY) July 22, 2015 (07/22/2015)<br>specification, paragraphs [0028]-[0037], and figures 1-4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1, 3-10                                                |
| X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | US 2016060887 A1 (MAYTRONICS LTD) March 3, 2016 (03/03/2016)<br>specification, paragraphs [0060]-[0157], and figures 1-18                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 1, 3-17                                                |
| Y                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | US 2016060887 A1 (MAYTRONICS LTD) March 3, 2016 (03/03/2016)<br>specification, paragraphs [0060]-[0157], and figures 1-18                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 2, 18-20                                               |
| <input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                        |
| * Special categories of cited documents:<br>“A” document defining the general state of the art which is not considered to be of particular relevance<br>“D” document cited by the applicant in the international application<br>“E” earlier application or patent but published on or after the international filing date<br>“L” document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)<br>“O” document referring to an oral disclosure, use, exhibition or other means<br>“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<br>“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<br>“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<br>“&” document member of the same patent family |                                                        |
| Date of the actual completion of the international search<br><br>April 10, 2024                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Date of mailing of the international search report<br><br>April 30, 2014                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                        |
| Name and mailing address of the ISA/CN<br><br>China National Intellectual Property Administration (ISA/CN)<br>China No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Authorizing Officer<br><br>Zheng Ke<br><br>Phone Number (+86) 0512-88997919                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                        |

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                                                    | Relevant to claim No. |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| Y         | US 2022112735 A1 (ZODIAC POOL CARE EUROPE) April 14, 2022 (04/14/2022)<br>specification, paragraphs [0025]-[0048], and figures 1A-4                   | 2, 18-20              |
| A         | DE 102006049990 A1 (POMMERANZ WINFRID) April 30, 2008 (04/30/2008)<br>specification, paragraphs [0052]-[0065], and figure 1                           | 1-20                  |
| A         | US 2015067974 A1 (MAYTRONICS LTD) March 12, 2015 (03/12/2015)<br>specification, paragraphs [0065]-[0133], and figures 1-15                            | 1-20                  |
| A         | CN 114059811 A (POSITEC POWER TOOLS (SUZHOU) CO., LTD.) February 18, 2022<br>(02/18/2022)<br>specification, paragraphs [0037]-[0054], and figures 1-5 | 1-20                  |

International Search Report  
Information regarding related family patents

International Application No.  
PCT/CN2024/076040

| Patent document cited in search report |              |    | Publication date<br>(MM/DD/YYYY) | Patent family member(s) |            |    | Publication date<br>(MM/DD/YYYY) |
|----------------------------------------|--------------|----|----------------------------------|-------------------------|------------|----|----------------------------------|
| CN                                     | 117120696    | A  | November 24, 2023                | US                      | 11946282   | B1 | April 2, 2024                    |
| CN                                     | 116999943    | A  | November 7, 2023                 | None                    |            |    |                                  |
| CN                                     | 117323733    | A  | January 2, 2024                  | None                    |            |    |                                  |
| CN                                     | 219316535    | U  | July 7, 2023                     | None                    |            |    |                                  |
| CN                                     | 104790696    | A  | July 22, 2015                    | CN                      | 104790696  | B  | May 24, 2017                     |
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|                                        |              |    |                                  | US                      | 2022333394 | A1 | October 20, 2022                 |
|                                        |              |    |                                  | ES                      | 2954250    | T3 | November 21, 2023                |
|                                        |              |    |                                  | EP                      | 3012386    | A1 | April 27, 2016                   |
|                                        |              |    |                                  | EP                      | 3012386    | C0 | June 7, 2023                     |
|                                        |              |    |                                  | US                      | 2020277804 | A1 | September 3, 2020                |
|                                        |              |    |                                  | US                      | 11274462   | B2 | March 15, 2022                   |
|                                        |              |    |                                  | EP                      | 4234848    | A2 | August 30, 2023                  |
|                                        |              |    |                                  | EP                      | 4234848    | A3 | September 20, 2023               |
|                                        |              |    |                                  | EP                      | 3012386    | B1 | June 7, 2023                     |
|                                        |              |    |                                  | US                      | 11939791   | B2 | March 26, 2024                   |
| US                                     | 2022112735   | A1 | April 14, 2022                   | EP                      | 4200498    | A1 | June 28, 2023                    |
|                                        |              |    |                                  | WO                      | 2022079594 | A1 | April 21, 2022                   |
|                                        |              |    |                                  | AU                      | 2021359205 | A1 | February 9, 2023                 |
| DE                                     | 102006049990 | A1 | April 30, 2008                   | None                    |            |    |                                  |
| US                                     | 2015067974   | A1 | March 12, 2015                   | EP                      | 2845969    | A2 | March 11, 2015                   |
|                                        |              |    |                                  | EP                      | 2845969    | A3 | March 25, 2015                   |
|                                        |              |    |                                  | EP                      | 2845969    | B1 | September 21, 2016               |
|                                        |              |    |                                  | ES                      | 2607680    | T3 | April 3, 2017                    |
|                                        |              |    |                                  | US                      | 10378229   | B2 | August 13, 2019                  |
|                                        |              |    |                                  | US                      | 2020002965 | A1 | January 2, 2020                  |
|                                        |              |    |                                  | US                      | 10890008   | B2 | January 12, 2021                 |
| CN                                     | 114059811    | A  | February 18, 2022                | CN                      | 212507600  | U  | February 9, 2021                 |