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CONTROLLABLE SINKING AND FLOATING SWIMMING POOL ROBOT AND SINKING AND FLOATING CONTROL METHOD FOR SWIMMING POOL ROBOT

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I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

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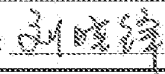
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CONTROLLABLE SINKING AND FLOATING SWIMMING POOL ROBOT AND SINKING AND FLOATING CONTROL METHOD FOR SWIMMING POOL ROBOT

FIELD OF THE INVENTION

[0001] The present disclosure relates to the field of underwater robots, and in particular to a controllable sinking and floating swimming pool robot and a sinking and floating control method for a swimming pool robot.

BACKGROUND OF THE INVENTION

[0002] With the development of artificial intelligence technologies, swimming pool robots have gradually become one of main solutions in the field of household and commercial swimming pool cleaning. Compared with traditional manual cleaning methods, the swimming pool robots can independently clean a bottom and wall surfaces of a swimming pool, which is faster, more effective and more economical.

[0003] The swimming pool robots needs to float or sink underwater and surface according to instructions or operational states to clean the bottom, walls and a waterline of the swimming pool and can be conveniently taken out of the swimming pool by users. The existing sinking and floating control method for the swimming pool robots realizes floating or sinking by changing a quality of the swimming pool robots themselves through water absorption and drainage, and the whole sinking and floating process takes a long time, resulting in a decrease in the working efficiency of the swimming pool robots.

SUMMARY OF THE INVENTION

[0004] The present disclosure is provided in view of the above problem. The present disclosure provides a controllable sinking and floating swimming pool robot and a sinking and floating control method for a swimming pool robot.

[0005] According to one aspect of the present disclosure, there is provided a controllable sinking and floating swimming pool robot, including: a sinking and floating control unit configured to control a swimming pool robot to float and sink; a waterline detection unit configured to detect a positional relationship between the swimming pool robot and a waterline of a liquid surface of a swimming pool where the swimming pool robot is located; and a main control unit configured to control a working state of the sinking and floating control unit, wherein the main control unit is capable of controlling the swimming pool robot to find a side wall or a slope based on operational requirement information of the swimming pool robot and enabling the swimming pool robot to crawl along the side wall or the slope; controlling the waterline detection unit to detect the positional relationship between the swimming pool robot and the waterline of the liquid surface of the swimming pool where the swimming pool robot is located; and controlling the sinking and floating control unit to enter a floating working state based on detection results to realize a floating of the swimming pool robot.

[0006] In addition, the controllable sinking and floating swimming pool robot according to one aspect of the present disclosure, further including a posture detection unit configured to detect a posture of the swimming pool robot, wherein the main control unit controls the waterline detection unit to start detecting the positional relationship in response to the posture meeting a first predetermined condition.

[0007] In addition, the controllable sinking and floating swimming pool robot according to one aspect of the present disclosure, the operational requirement information includes remote control command information sent by a user, clock information, operational task progress information, fault information, power information or swimming pool bottom environment information.

[0008] In addition, the controllable sinking and floating swimming pool robot according to one aspect of the present disclosure, further including a distance measurement unit or a map storage unit, wherein the main control unit controls the swimming pool robot to find the nearest side wall or the nearest slope based on distance measurement results of the distance measurement unit or map data in the map storage unit.

[0009] In addition, the controllable sinking and floating swimming pool robot according to one aspect of the present disclosure, the waterline detection unit includes an outlet water detection subunit configured to detect whether at least a part of the swimming pool robot has come out of water.

[0010] In addition, the controllable sinking and floating swimming pool robot according to one aspect of the present disclosure, the waterline detection unit further includes a proximity waterline detection subunit configured to detect whether the swimming pool robot has crawled to a distance less than or equal to a predetermined distance from the waterline.

[0011] In addition, the controllable sinking and floating swimming pool robot according to one aspect of the present disclosure, the sinking and floating control unit includes an inflation and deflation subunit and a switch subunit, wherein in response to the outlet water detection subunit detecting that at least a part of the swimming pool robot has come out of the water, the inflation and deflation subunit is controlled to start sucking air and the switch subunit is controlled to open, so that the sinking and floating control unit enters the floating working state.

[0012] In addition, the controllable sinking and floating swimming pool robot according to one aspect of the present disclosure, the sinking and floating control unit includes an inflation and deflation subunit and a switch subunit, wherein in response to the proximity waterline detection subunit detecting that the swimming pool robot has crawled to the distance less than or equal to the predetermined distance from the waterline, the inflation and deflation subunit is controlled to start sucking air, and in response to the outlet water detection subunit detecting that at least a part of the swimming pool robot has come out of the water, the switch subunit is controlled to open, so that the sinking and floating control unit enters the floating working state.

[0013] In addition, the controllable sinking and floating swimming pool robot according to one aspect of the present disclosure, the sinking and floating control unit further includes an airbag subunit connected to the inflation and deflation subunit, wherein the

airbag subunit is connected to or disconnected from outside atmosphere through the inflation and deflation subunit and the switch subunit.

[0014] In addition, the controllable sinking and floating swimming pool robot according to one aspect of the present disclosure, the sinking and floating control unit further includes an air inlet and outlet subunit, wherein the switch subunit is connected to the outside atmosphere through the air inlet and outlet subunit.

[0015] In addition, the controllable sinking and floating swimming pool robot according to one aspect of the present disclosure, the main control unit is further capable of controlling the sinking and floating control unit to enter a sinking working state based on the operational requirement information of the swimming pool robot to realize a sinking of the swimming pool robot.

[0016] In addition, the controllable sinking and floating swimming pool robot according to one aspect of the present disclosure, controlling the sinking and floating control unit to enter the sinking working state includes controlling the switch subunit to open and controlling the inflation and deflation subunit to discharge air in the airbag subunit.

[0017] In addition, the controllable sinking and floating swimming pool robot according to one aspect of the present disclosure, the inflation and deflation subunit includes an air pump assembly, and the switch subunit includes an electromagnetic valve assembly or a two-position three-way valve assembly.

[0018] In addition, the controllable sinking and floating swimming pool robot according to one aspect of the present disclosure, in response to the outlet water detection subunit detecting that at least a part of the swimming pool robot enters underwater again and/or the posture detection unit detecting that the posture of the swimming pool robot meets a second predetermined condition, the inflation and deflation subunit and the switch subunit are controlled to be closed.

[0019] In addition, the controllable sinking and floating swimming pool robot according to one aspect of the present disclosure, the inflation and deflation subunit and the switch subunit are controlled to be closed after the sinking and floating control unit enters the floating working state for a predetermined time.

[0020] In addition, the controllable sinking and floating swimming pool robot according to one aspect of the present disclosure, further including a water pump unit configured to pump liquid in the swimming pool where the swimming pool robot is located and discharge the liquid to drive the swimming pool robot, wherein a power of the water pump unit is changed after the sinking and floating control unit enters the floating working state or after the swimming pool robot climbs the side wall or the slope.

[0021] According to another aspect of the present disclosure, there is provided a sinking and floating control method for a swimming pool robot, including: controlling a swimming pool robot to find a side wall or a slope based on operational requirement information of the swimming pool robot, and enabling the swimming pool robot to crawl along the side wall or the slope; detecting a positional relationship between the swimming pool robot and a waterline of a liquid surface of a swimming pool where the swimming pool robot is located; and controlling a sinking and floating control unit to enter a floating working state based on detection results to realize a floating of the swimming pool robot.

[0022] In addition, the sinking and floating control method for a swimming pool robot according to another aspect of the present disclosure, detecting the positional relationship between the swimming pool robot and the waterline of the liquid surface of the swimming pool where the swimming pool robot is located includes: starting detecting the positional relationship in response to a posture of the swimming pool robot meeting a first predetermined condition.

[0023] In addition, the sinking and floating control method for a swimming pool robot according to another aspect of the present disclosure, the operational requirement information includes remote control command information sent by a user, clock information, operational task progress information, fault information, power information or swimming pool bottom environment information.

[0024] In addition, the sinking and floating control method for a swimming pool robot according to another aspect of the present disclosure, controlling the sinking and floating control unit to enter the floating working state based on detection results to realize the floating of the swimming pool robot includes: controlling the sinking and floating control

unit to enter the floating working state in response to detecting that at least a part of the swimming pool robot has come out of water.

[0025] In addition, the sinking and floating control method for a swimming pool robot according to another aspect of the present disclosure, further including: controlling the sinking and floating control unit to stop working in response to detecting that at least a part of the swimming pool robot enters underwater again and/or detecting that the posture of the swimming pool robot meets a second predetermined condition.

[0026] As described in detail below, the controllable sinking and floating swimming pool robot and the sinking and floating control method for the swimming pool robot according to embodiments of the present disclosure, the sinking and floating control of the swimming pool robot can be realized by inflating and deflating the airbag with the air above the water level line, thereby having a faster sinking and floating speed compared to the solution of changing a quality of the swimming pool robot itself to realize floating or sinking through water absorption and drainage, and simplifying the configuration of internal components. In the sinking and floating control method, by monitoring the working state and the posture of the swimming pool robot based on operational requirements of the swimming pool robot, starting detecting the positional relationship between the swimming pool robot and the waterline of the liquid surface of the swimming pool where the swimming pool robot is located, and starting each component of the sinking and floating control unit in stages according to detection results of the positional relationship, more accurate floating and sinking control can be realized, and the correct posture of the swimming pool robot in the whole operational process can be ensured.

BRIEF DESCRIPTION OF DRAWINGS

[0027] Through a more detailed description of embodiments of the present disclosure in combination with the drawings, the foregoing and other features and advantages of the present disclosure are more obvious. The drawings are used to provide a further understanding of embodiments of the present disclosure present disclosure, constitute a

part of this specification, and are used, together with the embodiments of the present disclosure, to explain the present disclosure, but do not constitute limitations to the present disclosure. In the drawings, the same reference numerals generally represent the same components or steps.

[0028] FIG. 1 is a component block diagram illustrating a swimming pool robot according to an embodiment of the present disclosure.

[0029] FIG. 2A and FIG. 2B are schematic diagrams illustrating a swimming pool robot according to an embodiment of the present disclosure.

[0030] FIG. 3 is a schematic diagram illustrating a sinking and floating control unit of a swimming pool robot according to an embodiment of the present disclosure.

[0031] FIG. 4 is a schematic diagram further illustrating an example of a sinking and floating control unit of a swimming pool robot according to an embodiment of the present disclosure.

[0032] FIG. 5 is a schematic diagram further illustrating another example of a sinking and floating control unit of a swimming pool robot according to an embodiment of the present disclosure.

[0033] FIG. 6 is a flowchart illustrating a sinking and floating control method for a swimming pool robot according to an embodiment of the present disclosure.

[0034] FIG. 7 is a schematic diagram illustrating a sinking and floating control method for a swimming pool robot according to an embodiment of the present disclosure.

[0035] FIG. 8A to FIG. 8E are schematic diagrams further illustrating a sinking and floating control method for a swimming pool robot according to an embodiment of the present disclosure.

DETAILED DESCRIPTION OF THE INVENTION

[0036] In order to make technical solutions and advantages of the present disclosure more obvious, exemplary embodiments according to the present disclosure are described in detail below with reference to the drawings. Apparently, the described embodiments are merely some but not all of the embodiments of the present disclosure. It is to be

understood that, the present disclosure is not limited by the exemplary embodiments described herein.

[0037] First, a swimming pool robot according to embodiments of the present disclosure will be described with reference to FIG. 1, FIG. 2A and FIG. 2B. FIG. 1 is a component block diagram illustrating a swimming pool robot according to an embodiment of the present disclosure. FIG. 2A is an overall schematic diagram illustrating a swimming pool robot according to an embodiment of the present disclosure. FIG. 2B is a schematic diagram illustrating cross-sectional components of a swimming pool robot according to an embodiment of the present disclosure.

[0038] As shown in FIG. 1, FIG. 2A and FIG. 2B, the swimming pool robot 1 according to the embodiments of the present disclosure at least includes a main control unit 10, a sinking and floating control unit 20, a waterline detection unit 30, a posture detection unit 40, a distance measurement unit 50, a map storage unit 60 and a water pump unit 70. It should be understood that only components related to the sinking and floating control method according to the embodiments of the present disclosure are shown in FIG. 1, FIG. 2A and FIG. 2B, and the swimming pool robot 1 according to the embodiments of the present disclosure is not limited to this, but can further include a driving unit, a cleaning unit, a communication unit and the like. In addition, it should be understood that the position and the number of each component in FIG. 2B are only exemplary, and the swimming pool robot 1 according to the embodiments of the present disclosure is not limited to this.

[0039] The main control unit 10 is configured to control each component of the swimming pool robot 1 according to the embodiments of the present disclosure. For example, in the sinking and floating control method for a swimming pool robot according to the embodiments of the present disclosure described in detail below, the main control unit 10 controls the sinking and floating control unit 20 based on operational requirements of the swimming pool robot 1 and according to detection results of the waterline detection unit 30, the posture detection unit 40, the distance measurement unit 50, and the like, so as to control a floating and a sinking of the swimming pool robot

1. Specifically, the main control unit 10 can control the swimming pool robot 1 to find a side wall or a slope based on operational requirement information of the swimming pool robot 1, and enable the swimming pool robot 1 crawl along the side wall or the slope; further, control the waterline detection unit 30 to detect a positional relationship between the swimming pool robot 1 and a waterline of a liquid surface of a swimming pool where the swimming pool robot 1 is located; and control the sinking and floating control unit 20 to enter a floating working state based on detection results to realize a floating of the swimming pool robot 1. Accordingly, the main control unit 10 can further control the sinking and floating control unit 20 to enter a sinking working state based on the operational requirement information to realize a sinking of the swimming pool robot 1.

[0040] More specifically, the operational requirement information includes remote control command information sent by a user, clock information, operational task progress information, fault information, power information or swimming pool bottom environment information. That is, the remote control command information, the clock information, the operational task progress information, the fault information, the power information or the swimming pool bottom environment information instruct the swimming pool robot 1 to switch to a floating state to clean a waterline area, come out of water and charge or maintain; or instruct the swimming pool robot 1 to switch to a sinking state to clean a pool bottom and/or a sidewall area.

[0041] The sinking and floating control unit 20 is configured to control the swimming pool robot 1 to float and sink. As shown in FIG. 2B, the sinking and floating control unit 20 includes an airbag subunit 201, an inflation and deflation subunit 202, a switch subunit 203 and an air inlet and outlet subunit 204. The airbag subunit 201 is connected to the inflation and deflation subunit 202, so that the airbag subunit 201 is connected to the outside atmosphere through the inflation and deflation subunit 202, the switch subunit 203 and the air inlet and outlet subunit 204. In the floating working state, the inflation and deflation subunit 202 is turned on to suck air from the outside and the switch subunit 203 is turned on. The air above a water level line enters the airbag subunit 201 through

the air inlet and outlet subunit 204, the switch subunit 203 and the inflation and deflation subunit 202, so that a volume of the airbag subunit 201 becomes larger and a buoyancy of the swimming pool robot 1 is increased to float. In the floating state, the inflation and deflation subunit 202 and the switch subunit 203 are turned off, the airbag subunit 201 is disconnected from the outside atmosphere, and the swimming pool robot 1 remains floating. In the sinking working state, the inflation and deflation subunit 202 is turned on to extract air from the airbag subunit 201, and the switch subunit 203 is turned on, the air in the airbag subunit 201 is discharged through the inflation and deflation subunit 202, the switch subunit 203 and the air inlet and outlet subunit 204, so that the volume of the airbag subunit 201 becomes smaller and the buoyancy of the swimming pool robot 1 is reduced to sink.

[0042] Further, a sinking and floating control unit of a swimming pool robot according to the embodiments of the present disclosure will be described with reference to FIG. 3. FIG. 3 is a schematic diagram illustrating a sinking and floating control unit of a swimming pool robot according to an embodiment of the present disclosure.

[0043] As shown in FIG. 3, the sinking and floating control unit 20 of the swimming pool robot according to the embodiment of the present disclosure includes two airbag subunits 201 connected in series. The two airbag subunits 201 are respectively arranged at a front and a rear of the swimming pool robot 1, thereby facilitating the balance of the swimming pool robot 1 and the inflation of the airbag subunits 201. The airbag subunits 201, the inflation and deflation subunit 202, the switch subunit 203 and the air inlet and outlet subunit 204 are connected to each other through an air pipe.

[0044] Further, the sinking and floating control unit of the swimming pool robot according to the embodiments of the present disclosure will be described with reference to FIG. 4 and FIG. 5. FIG. 4 is a schematic diagram further illustrating an example of a sinking and floating control unit of a swimming pool robot according to an embodiment of the present disclosure. FIG. 5 is a schematic diagram further illustrating another example of a sinking and floating control unit of a swimming pool robot according to an embodiment of the present disclosure.

[0045] As shown in FIG. 4, the inflation and deflation subunit 202 includes a first air pump assembly 2021 and a second air pump assembly 2022, and the switch subunit 203 includes a first electromagnetic valve assembly 2023 and a second electromagnetic valve assembly 2024. An inlet 2033 of the first electromagnetic valve assembly 2023 is connected to the air inlet and outlet subunit 204, an outlet 2043 of the first electromagnetic valve assembly 2023 is connected to an air inlet port 2031 of the first air pump assembly 2021, an air outlet port 2041 of the first air pump assembly 2021 is connected to the airbag subunit 201, and an inlet 2034 of the second electromagnetic valve assembly 2024 is connected to an air outlet port 2042 of the second air pump assembly 2022. An outlet 2044 of the second electromagnetic valve assembly 2024 is connected to the air inlet and outlet subunit 204, and an air inlet port 2032 of the second air pump assembly 2022 is connected to the airbag subunit 201.

[0046] In the floating working state, the first air pump assembly 2021 and the second air pump assembly 2022 are in a power-on working state, and the first electromagnetic valve assembly 2023 and the second electromagnetic valve assembly 2024 are in a power-off state. The air above the water level where the swimming pool robot 1 is located enters the first air pump assembly 2021 through the air inlet and outlet subunit 204 and the first electromagnetic valve assembly 2023, and is filled into the airbag subunit 201 through the first air pump assembly 2021.

[0047] In the sinking working state, the first air pump assembly 2021 and the second air pump assembly 2022 are in the power-off state, the first electromagnetic valve assembly 2023 and the second electromagnetic valve assembly 2024 are in the power-on working state. The air in the airbag subunit 201 enters the second air pump assembly 2023 and is discharged through the second air pump assembly 2023, the second electromagnetic valve assembly 2024 and the air inlet and outlet subunit 204.

[0048] As shown in FIG. 5, the inflation and deflation subunit 202 includes a third air pump assembly 2025, and the switch subunit 203 includes a first two-position three-way valve assembly 2026 and a second two-position three-way valve assembly 2027. A first port 2036 of the first two-position three-way valve assembly 2026 is connected to the air

inlet and outlet subunit 204, a second port 2046 of the first two-position three-way valve assembly 2026 is connected to the airbag subunit 201, and a third port 2056 of the first two-position three-way valve assembly 2026 is connected to an air inlet port 2035 of the third air pump assembly 2025. A first port 2037 of the second two-position three-way valve assembly 2027 is connected to the air inlet and outlet subunit 204, a second port 2047 of the second two-position three-way valve assembly 2027 is connected to the airbag subunit 201, and a third port 2057 of the second two-position three-way valve assembly 2027 is connected to an air outlet port 2045 of the third air pump assembly 2025.

[0049] In the floating working state, the first two-position three-way valve assembly 2026 and the third air pump assembly 2025 are in the power-on working state, and the second two-position three-way valve assembly 2027 is in the power-off state. The air above the water level line where the swimming pool robot 1 is located enters the third air pump assembly 2025 through the air inlet and outlet subunit 204 and the first two-position three-way valve assembly 2026, and is filled into the airbag subunit 201 through the third air pump assembly 2025.

[0050] In the sinking working state, the first two-position three-way valve assembly 2026 is in the power-off state, the second two-position three-way valve assembly 2027 and the third air pump assembly 2025 are in the power-on working state, and the air in the airbag subunit 201 enters the third air pump assembly 2025 and is discharged through the third air pump assembly 2025, the first two-position three-way valve assembly 2026 and the air inlet and outlet subunit 204.

[0051] Referring back to FIG. 1, the main control unit 10 controls the sinking and floating control unit 20 based on the detection results of the waterline detection unit 30, the posture detection unit 40 and the distance measurement unit 50 will be further described.

[0052] The waterline detection unit 30 is configured to detect the positional relationship between the swimming pool robot 1 and the waterline of the liquid surface of the swimming pool where the swimming pool robot 1 is located. Specifically, the waterline

detection unit 30 includes an outlet water detection subunit 301 and a proximity waterline detection subunit 302. The outlet water detection subunit 301 is configured to detect whether at least a part of the swimming pool robot 1 has come out of water. In one embodiment of the present disclosure, the outlet water detection subunit 301 is configured by, for example, a capacitive sensor or an ultrasonic ranging device. The proximity waterline detection subunit 302 is configured to detect whether the swimming pool robot 1 has crawled to a distance less than or equal to a predetermined distance from the waterline (for example, the predetermined distance is 10cm to 20cm). In one embodiment of the present disclosure, the proximity waterline detection subunit 302 is configured by, for example, an ultrasonic ranging device.

[0053] In one embodiment of the present disclosure, when the outlet water detection subunit 301 detects that at least a part of the swimming pool robot 1 has come out of the water, the inflation and deflation subunit 202 is controlled to start sucking air and the switch subunit 203 is controlled to open, so that the sinking and floating control unit 20 enters the floating working state.

[0054] Alternatively, in one embodiment of the present disclosure, when the proximity waterline detection subunit 302 detects that the swimming pool robot 1 has crawled to the distance less than or equal to the predetermined distance from the waterline, the inflation and deflation subunit 202 is controlled to start sucking air, and when the outlet water detection subunit 301 detects that at least a part of the swimming pool robot 1 has come out of the water, the switch subunit 203 is controlled to open, so that the sinking and floating control unit 20 enters the floating working state. In this case, the inflation and deflation subunit 202 and the switch subunit 203 are controlled to open in stages based on the detection of the outlet water detection subunit 301 and the proximity waterline detection subunit 302, and the air in the air pipe is filled into the airbag subunit 201 in advance, thereby further improving the working efficiency of the sinking and floating control unit 20.

[0055] Further, in response to the outlet water detection subunit 301 detecting that at least a part of the swimming pool robot 1 enters underwater again, the inflation and

deflation subunit 202 and the switch subunit 203 are controlled to be closed. In this state, the swimming pool robot 1 remains floating. Alternatively, in one embodiment of the present disclosure, in response to that the outlet water detection subunit 301 does not detect that at least a part of the swimming pool robot 1 enters underwater again after the sinking and floating control unit 20 enters the floating working state for a predetermined time (for example, 40 seconds), the inflation and deflation subunit 202 and the switch subunit 203 are controlled to be closed. In another embodiment of the present disclosure, after the sinking and floating control unit 20 enters the floating working state, the outlet water detection subunit 301 stops working, and after a predetermined time (for example, 40 seconds), the inflation and deflation subunit 202 and the switch subunit 203 are controlled to be closed.

[0056] In this case, inflation and deflation subunit 202 and switch subunit 203 are prevented from inflating the airbag subunit 201 for a long time, and airbag subunit 201 is protected from being damaged.

[0057] The posture detection unit 40 is configured to detect a posture of the swimming pool robot 1. In one embodiment of the present disclosure, the posture detection unit 40 is configured by, for example, an inertial sensor (IMU). The main control unit 10 controls the waterline detection unit to start to perform the detection of the positional relationship when posture detection results of the posture detection unit 40 meet a first predetermined condition (for example, changing from a state parallel to the bottom surface of the swimming pool to a state parallel to the side wall of the swimming pool). In one embodiment of the present disclosure, in the floating working state, in response to the posture detection unit 40 detecting that the posture of the swimming pool robot 1 meets a second predetermined condition (for example, changing from a state parallel to the side wall of the swimming pool to a state parallel to the bottom surface of the swimming pool), the inflation and deflation subunit 202 and the switch subunit 203 are controlled to be closed. Further, after the sinking and floating control unit 20 enters the floating working state for a predetermined time, the inflation and deflation subunit 202 and the switch subunit 203 are controlled to be closed. Alternatively, in response to a

predetermined time after the sinking and floating control unit 20 enters the floating working state, if the posture detection unit 40 does not detect that the posture of the swimming pool robot 1 meets the second predetermined condition, the inflation and deflation subunit 202 and the switch subunit 203 are controlled to be closed.

[0058] The distance measurement unit 50 performs distance measurement to control the swimming pool robot 1 to find the nearest side wall or slope in response to the operational requirement information of the swimming pool robot 1. For example, the swimming pool robot 1 rotates once in situ to detect a distance between the swimming pool robot 1 and each side wall of the swimming pool where the swimming pool robot 1 is located, so as to determine the nearest side wall or slope. After that, the main control unit 10 controls the swimming pool robot 1 to move to the nearest side wall or slope, and further makes the swimming pool robot 1 crawl along the side wall or slope to move to a liquid surface of the swimming pool.

[0059] The map storage unit 60 is configured to store map data of the swimming pool. The main control unit 10 controls the swimming pool robot to find the nearest side wall or slope based on the map data in the map storage unit. The main control unit 10 controls the swimming pool robot 1 to move to the nearest side wall or slope, and further makes the swimming pool robot crawl along the side wall or slope to move to the liquid surface of the swimming pool.

[0060] The water pump unit 70 is configured to extract liquid in the swimming pool where the swimming pool robot 1 is located, and discharge the liquid to propel the swimming pool robot 1. When the swimming pool robot 1 performs cleaning work, the extracted liquid is discharged after being filtered inside the swimming pool robot 1. In the embodiment of the present disclosure described above, a power of the water pump unit 70 is changed in response to the sinking and floating control unit 20 entering the floating working state or the swimming pool robot climbing the side wall or slope. That is, when at least a part of the swimming pool robot 1 is out of the water, a running power of the water pump unit 70 is reduced, thereby reducing an adsorption force between the swimming pool robot 1 and the side wall or slope, and facilitating the swimming pool

robot 1 to gradually enter a floating state with the inflation and deflation subunit 202 and the switch subunit 203 inflating the airbag subunit 201. In addition, in the process that the swimming pool robot 1 crawls along the side wall or slope until at least a part of the swimming pool robot 1 comes out of the water, the water pump unit 70 and a driving wheel of the swimming pool robot 1 jointly push the swimming pool robot 1 to move to the liquid surface of the swimming pool where the swimming pool robot 1 is located. Further, after the swimming pool robot 1 is in the floating state, the water pump unit 70 can be controlled to operate at an appropriate power based on the operational requirement information of the swimming pool robot 1 to perform cleaning work such as the waterline area.

[0061] Above, the swimming pool robot according to the embodiments of the present disclosure has been described with reference to FIG. 1 to FIG. 5. The swimming pool robot according to the embodiments of the present disclosure, the sinking and floating control of the swimming pool robot can be realized by inflating and deflating the airbag with the air above the water level line, thereby having a faster sinking and floating speed compared to the solution of changing a quality of the swimming pool robot itself to realize floating or sinking through water absorption and drainage, and simplifying the configuration of internal components. By monitoring the working state and the posture of the swimming pool robot based on operational requirements of the swimming pool robot, starting detecting the positional relationship between the swimming pool robot and the waterline of the liquid surface of the swimming pool where the swimming pool robot is located, and starting each component of the sinking and floating control unit in stages according to detection results of the positional relationship, more accurate floating and sinking control can be realized, and the correct posture of the swimming pool robot in the whole operational process can be ensured.

[0062] Hereinafter, a sinking and floating control method for a swimming pool robot according to embodiments of the present disclosure will be described with further reference to FIG. 6 to FIG. 8E. FIG. 6 is a flowchart illustrating a sinking and floating control method for a swimming pool robot according to an embodiment of the present

disclosure. FIG. 7 is a schematic diagram illustrating a sinking and floating control method for a swimming pool robot according to an embodiment of the present disclosure. FIG. 8A to FIG. 8E are schematic diagrams further illustrating a sinking and floating control method for a swimming pool robot according to an embodiment of the present disclosure.

[0063] As shown in FIG. 6, the sinking and floating control method for a swimming pool robot according to the embodiment of the present disclosure includes the following steps.

[0064] In step S601, a swimming pool robot is controlled to find a side wall or a slope based on operational requirement information of the swimming pool robot, and the swimming pool robot is enabled to crawl along the side wall or the slope.

[0065] In one embodiment of the present disclosure, the operational requirement information includes remote control command information sent by a user, clock information, operational task progress information, fault information, power information or swimming pool bottom environment information. That is, the remote control command information, the clock information, the operational task progress information, the fault information, the power information or the swimming pool bottom environment information instruct the swimming pool robot 1 to switch to a floating state to clean the waterline area, come out of water and charge or maintain; or instruct the swimming pool robot 1 to switch to a sinking state to clean the pool bottom and/or the sidewall area.

[0066] In one embodiment of the present disclosure, the distance measurement unit 50 performs distance measurement to control the swimming pool robot 1 to find the nearest side wall or slope in response to the operational requirement information of the swimming pool robot 1. Specifically, referring to FIG. 7, the swimming pool robot 1 rotates once in situ to detect distances L1, L2, L3 and L4 among the swimming pool robot 1 and side walls of the swimming pool where the swimming pool robot 1 is located, so as to determine the nearest side wall Wr. The distance between the swimming pool robot 1 and the side wall Wr is L4, and L4 is smaller than any of L1, L2 and L3. After that, the main control unit 10 controls the swimming pool robot 1 to move to the nearest side wall Wr,

and further makes the swimming pool robot 1 crawl along the side wall Wr to move to the liquid surface of the swimming pool.

[0067] Alternatively, the map storage unit 60 is configured to store map data of the swimming pool. The main control unit 10 controls the swimming pool robot 1 to find the nearest side wall Wr based on the map data in the map storage unit 60. The main control unit 10 controls the swimming pool robot 1 to move to the nearest side wall Wr, and further makes the swimming pool robot 1 crawl along the side wall Wr to move to the liquid surface of the swimming pool.

[0068] In one embodiment of the present disclosure, when the swimming pool robot 1 performs cleaning work at the bottom of the swimming pool, the water pump unit 70 extracts the liquid in the swimming pool where the swimming pool robot 1 is located, the extracted liquid is discharged after being filtered inside the swimming pool robot 1, and the discharged liquid pushes the swimming pool robot 1. When the swimming pool robot 1 crawls along the side wall Wr, the water pump unit 70 and the driving wheel of the swimming pool robot 1 jointly push the swimming pool robot 1 to move to the liquid surface Wt of the swimming pool where the swimming pool robot 1 is located.

[0069] In step S602, a positional relationship between the swimming pool robot and a waterline of a liquid surface of a swimming pool where the swimming pool robot is located is detected.

[0070] In one embodiment of the present disclosure, a posture of the swimming pool robot 1 is detected by a posture detection unit 40 configured by an inertial sensor (IMU). The main control unit 10 controls the waterline detection unit 30 to start to perform the detection of the positional relationship when posture detection results of the posture detection unit 40 meet a first predetermined condition (for example, changing from a state parallel to the bottom surface of the swimming pool to a state parallel to the side wall of the swimming pool). That is, as shown in FIG. 8A, when the swimming pool robot 1 crawls along the side wall Wr to move to the liquid surface of the swimming pool where the swimming pool robot 1 is located, the detection of the positional relationship

between the swimming pool robot 1 and the waterline Wt of the liquid surface of the swimming pool where the swimming pool robot 1 is located is performed.

[0071] As described above, the waterline detection unit 30 is configured to detect the positional relationship between the swimming pool robot 1 and the waterline Wt of the liquid surface of the swimming pool where the swimming pool robot 1 is located. Specifically, the waterline detection unit 30 includes an outlet water detection subunit 301 and a proximity waterline detection subunit 302. The outlet water detection subunit 301 is configured to detect whether at least a part of the swimming pool robot 1 has come out of water. In one embodiment of the present disclosure, the outlet water detection subunit 301 is configured by, for example, a capacitive sensor or an ultrasonic ranging device. The proximity waterline detection subunit 302 is configured to detect whether the swimming pool robot 1 has crawled to a distance less than or equal to a predetermined distance from the waterline (for example, the predetermined distance is 10cm to 20cm). In one embodiment of the present disclosure, the proximity waterline detection subunit 302 is configured by, for example, an ultrasonic ranging device.

[0072] In step S603, a sinking and floating control unit is controlled to enter a floating working state based on detection results to realize a floating of the swimming pool robot.

[0073] In one embodiment of the present disclosure, when the outlet water detection subunit 301 detects that at least a part of the swimming pool robot 1 has come out of the water (for example, a state shown in FIG. 8C), the inflation and deflation subunit 202 is controlled to start sucking air and the switch subunit 203 is controlled to open, so that the sinking and floating control unit 20 enters the floating working state.

[0074] Alternatively, in one embodiment of the present disclosure, when the proximity waterline detection subunit 302 detects that the swimming pool robot 1 has crawled to the distance less than or equal to the predetermined distance from the waterline (for example, a state shown in FIG. 8B, the swimming pool robot 1 has crawled to a distance less than or equal to a predetermined distance H), the inflation and deflation subunit 202 is controlled to start sucking air, and when the outlet water detection subunit 301 detects that at least a part of the swimming pool robot 1 has come out of the water (for example,

the state shown in FIG. 8C), the switch subunit 203 is controlled to open, so that the sinking and floating control unit 20 enters the floating working state. In this case, the inflation and deflation subunit 202 and the switch subunit 203 are controlled to open in stages based on the detection of the outlet water detection subunit 301 and the proximity waterline detection subunit 302, and the air in the air pipe is filled into the airbag subunit 201 in advance, thereby further improving the working efficiency of the sinking and floating control unit 20.

[0075] In one embodiment of the present disclosure, a power of the water pump unit 70 is changed in response to the sinking and floating control unit 20 entering the floating working state. That is, when at least a part of the swimming pool robot 1 is out of the water, a running power of the water pump unit 70 is reduced, thereby reducing an adsorption force between the swimming pool robot 1 and the side wall or slope, and facilitating the swimming pool robot 1 to gradually enter a floating state with the inflation and deflation subunit 202 and the switch subunit 203 inflating the airbag subunit 201. For example, as shown in FIG. 8D, as the sinking and floating control unit 20 enters the floating working state, an end of the swimming pool robot 1 that does not come out of the water gradually floats.

[0076] In step S604, the sinking and floating control unit is controlled to stop working in response to detecting that at least a part of the swimming pool robot enters underwater again and/or detecting that the posture of the swimming pool robot meets a second predetermined condition.

[0077] In one embodiment of the present disclosure, in the floating working state, in response to the outlet water detection subunit 301 detecting that at least a part of the swimming pool robot 1 enters underwater again, the inflation and deflation subunit 202 and the switch subunit 203 are controlled to be closed. Alternatively, in response to the posture detection unit 40 detecting that the posture of the swimming pool robot 1 meets a second predetermined condition (for example, changing from a state parallel to the side wall of the swimming pool to a state parallel to the bottom surface of the swimming pool), the inflation and deflation subunit 202 and the switch subunit 203 are controlled to be

closed. For example, as shown in FIG. 8E, when the swimming pool robot 1 gradually floats to the state parallel to the bottom surface of the swimming pool, that is, when the swimming pool robot 1 enters the floating state, the sinking and floating control unit is controlled to stop working.

[0078] In addition, in response to the sinking and floating control unit 20 entering the floating working state, the outlet water detection subunit 301 and the posture detection unit 40 are closed, and after a predetermined time (for example, 40 seconds), the inflation and deflation subunit 202 and the switch subunit 203 are controlled to be closed. Alternatively, in one embodiment of the present disclosure, in response to that the outlet water detection subunit 301 does not detect that at least a part of the swimming pool robot 1 enters underwater again after the sinking and floating control unit 20 enters the floating working state for a predetermined time (for example, 40 seconds), the inflation and deflation subunit 202 and the switch subunit 203 are controlled to be closed. Alternatively, in response to the predetermined time after the sinking and floating control unit 20 enters the floating working state, if the posture detection unit 40 does not detect that the posture of the swimming pool robot 1 meets the second predetermined condition, the inflation and deflation subunit 202 and the switch subunit 203 are controlled to be closed. In this case, inflation and deflation subunit 202 and switch subunit 203 are prevented from inflating the airbag subunit 201 for a long time, and airbag subunit 201 is protected from being damaged.

[0079] Further, after the swimming pool robot 1 is in the floating state, the water pump unit 70 can be controlled to operate at an appropriate power based on the operational requirement information of the swimming pool robot 1 to perform cleaning work such as the waterline area.

[0080] Above, the controllable sinking and floating swimming pool robot and the sinking and floating control method for the swimming pool robot according to embodiments of the present disclosure are described with reference to the drawings, the sinking and floating control of the swimming pool robot can be realized by inflating and deflating the airbag with the air above the water level line, thereby having a faster sinking and floating

speed compared to the solution of changing a quality of the swimming pool robot itself to realize floating or sinking through water absorption and drainage, and simplifying the configuration of internal components. In the sinking and floating control method, by monitoring the working state and the posture of the swimming pool robot based on operational requirements of the swimming pool robot, starting detecting the positional relationship between the swimming pool robot and the waterline of the liquid surface of the swimming pool where the swimming pool robot is located, and starting each component of the sinking and floating control unit in stages according to detection results of the positional relationship, more accurate floating and sinking control can be realized, and the correct posture of the swimming pool robot in the whole operational process can be ensured.

[0081] The above describes basic principles of the present disclosure with reference to specific embodiments. However, the advantages, effects, and the like mentioned in the present disclosure are merely examples but not limitations. These advantages, effects, and the like cannot be considered to be necessary for the embodiments of the present disclosure. In addition, the specific details disclosed above are only for illustrative purposes and easy-to-understand functions rather than limitation, and the foregoing details do not limit the present disclosure for implementation of the foregoing specific details.

[0082] The block diagrams of the device, apparatus, equipment, and system involved in the present disclosure are merely illustrative examples and are not intended to require or imply that the device, apparatus, equipment, and system need to be connected, arranged, and configured in the manner shown in the block diagrams. Those skilled in the art realize that the device, apparatus, equipment, and system can be connected, arranged, and configured in any manner. Terms such as “include”, “comprise”, “have”, and the like are open terms that mean “including but not limited to” and may be used interchangeably. The terms “or” and “and” used herein refer to the terms “and/or” and may be used interchangeably, unless the context clearly dictates otherwise. The

expression “such as” used herein refers to the phrase “such as but not limited to” and may be used interchangeably with “such as”.

[0083] In addition, as used herein, “or” used in a listing of items beginning with “at least one” indicates a separate listing. Therefore, for example, a listing of “at least one of A, B, or C” means A, or B or C, or AB or AC or BC, or ABC (that is, A and B and C). In addition, the word “exemplary” does not mean that the described example is preferred or better than other examples.

[0084] In the system and method of the present disclosure, the components or steps may be decomposed and/or recombined. These decompositions and/or recombinations shall be regarded as equivalent solutions of the present disclosure.

[0085] Various changes, substitutions, and alterations may be made to the technology described herein without departing from the technology taught by the appended claims. In addition, the scope of the claims of the present disclosure is not limited to the foregoing specific aspects such as the processing, the machine, the manufacturing, the event composition, the means, the methods, and the actions. Existing or to-be-developed processing, machines, manufacturing, event composition, means, methods, or actions later performing substantially the same functions or achieving substantially the same results as the corresponding aspects described herein may be used. Therefore, the attached claims include such processing, machine, manufacturing, event composition, means, methods or actions within its scope.

[0086] The foregoing description of the disclosed aspects is provided to enable a person skilled in the art to make modifications to or use the present disclosure. Various modifications to these aspects are apparent to a person skilled in the art, and the general principles defined herein can be applied to other aspects without departing from the scope of the present disclosure. Therefore, the present disclosure is not intended to be limited to the aspects shown herein but in accordance with the widest scope consistent with the principles and novel features disclosed herein.

[0087] The foregoing description has been given for the purposes of illustration and description. In addition, this description is not intended to limit the embodiments of the

present disclosure to the form disclosed herein. Although a plurality of example aspects and embodiments have been discussed above, those skilled in the art realize some variations, modifications, changes, additions, and sub-combinations thereof.

Claims

1. A controllable sinking and floating swimming pool robot, comprising:
 - a sinking and floating control unit configured to control a swimming pool robot to float and sink;
 - a waterline detection unit configured to detect a positional relationship between the swimming pool robot and a waterline of a liquid surface of a swimming pool where the swimming pool robot is located; and
 - a main control unit configured to control a working state of the sinking and floating control unit, wherein the main control unit is capable of controlling the swimming pool robot to find a side wall or a slope based on operational requirement information of the swimming pool robot and enabling the swimming pool robot to crawl along the side wall or the slope;
 - controlling the waterline detection unit to detect the positional relationship between the swimming pool robot and the waterline of the liquid surface of the swimming pool where the swimming pool robot is located; and
 - controlling the sinking and floating control unit to enter a floating working state based on detection results to realize a floating of the swimming pool robot.
2. The controllable sinking and floating swimming pool robot according to claim 1, further comprising a posture detection unit configured to detect a posture of the swimming pool robot, wherein the main control unit controls the waterline detection unit to start detecting the positional relationship in response to the posture meeting a first predetermined condition.
3. The controllable sinking and floating swimming pool robot according to claim 1, wherein the operational requirement information comprises remote control command information sent by a user, clock information, operational task progress information, fault information, power information or swimming pool bottom environment information.
4. The controllable sinking and floating swimming pool robot according to claim 1, further comprising a distance measurement unit or a map storage unit, wherein the main control unit controls the swimming pool robot to find the nearest side wall or the nearest slope based on distance measurement results of the distance measurement unit or map data in the map storage unit.

5. The controllable sinking and floating swimming pool robot according to claim 1, wherein the waterline detection unit comprises an outlet water detection subunit configured to detect whether at least a part of the swimming pool robot has come out of water.
6. The controllable sinking and floating swimming pool robot according to claim 1, wherein the waterline detection unit further comprises a proximity waterline detection subunit configured to detect whether the swimming pool robot has crawled to a distance less than or equal to a predetermined distance from the waterline.
7. The controllable sinking and floating swimming pool robot according to claim 5, wherein the sinking and floating control unit comprises an inflation and deflation subunit and a switch subunit, wherein in response to the outlet water detection subunit detecting that at least a part of the swimming pool robot has come out of the water, the inflation and deflation subunit is controlled to start sucking air and the switch subunit is controlled to open, so that the sinking and floating control unit enters the floating working state.
8. The controllable sinking and floating swimming pool robot according to claim 5, wherein the sinking and floating control unit comprises an inflation and deflation subunit and a switch subunit, wherein in response to the proximity waterline detection subunit detecting that the swimming pool robot has crawled to the distance less than or equal to the predetermined distance from the waterline, the inflation and deflation subunit is controlled to start sucking air, and in response to the outlet water detection subunit detecting that at least a part of the swimming pool robot has come out of the water, the switch subunit is controlled to open, so that the sinking and floating control unit enters the floating working state.
9. The controllable sinking and floating swimming pool robot according to claim 7, wherein the sinking and floating control unit further comprises an airbag subunit connected to the inflation and deflation subunit, wherein the airbag subunit is connected to or disconnected from outside atmosphere through the inflation and deflation subunit and the switch subunit,

and wherein the sinking and floating control unit further comprises an air inlet and outlet subunit, wherein the switch subunit is connected to the outside atmosphere through the air inlet and outlet subunit.

10. The controllable sinking and floating swimming pool robot according to claim 1, wherein the main control unit is further capable of controlling the sinking and floating control unit to enter a sinking working state based on the operational requirement information of the swimming pool robot to realize a sinking of the swimming pool robot.
11. The controllable sinking and floating swimming pool robot according to claim 10, wherein controlling the sinking and floating control unit to enter the sinking working state comprises controlling the switch subunit to open and controlling the inflation and deflation subunit to discharge air in the airbag subunit.
12. The controllable sinking and floating swimming pool robot according to claim 7, wherein the inflation and deflation subunit comprises an air pump assembly, and the switch subunit comprises an electromagnetic valve assembly or a two-position three-way valve assembly.
13. The controllable sinking and floating swimming pool robot according to claim 7, wherein in response to the outlet water detection subunit detecting that at least a part of the swimming pool robot enters underwater again and/or the posture detection unit detecting that the posture of the swimming pool robot meets a second predetermined condition, the inflation and deflation subunit and the switch subunit are controlled to be closed.
14. The controllable sinking and floating swimming pool robot according to claim 7, wherein the inflation and deflation subunit and the switch subunit are controlled to be closed after the sinking and floating control unit enters the floating working state for a predetermined time.
15. The controllable sinking and floating swimming pool robot according to claim 7, further comprising a water pump unit configured to pump liquid in the swimming pool where the swimming pool robot is located and discharge the liquid to drive the swimming pool robot,

wherein a power of the water pump unit is changed after the sinking and floating control unit enters the floating working state or after the swimming pool robot climbs the side wall or the slope.

16. A sinking and floating control method for a swimming pool robot, comprising:
 - controlling a swimming pool robot to find a side wall or a slope based on operational requirement information of the swimming pool robot, and enabling the swimming pool robot to crawl along the side wall or the slope;
 - detecting a positional relationship between the swimming pool robot and a waterline of a liquid surface of a swimming pool where the swimming pool robot is located; and
 - controlling a sinking and floating control unit to enter a floating working state based on detection results to realize a floating of the swimming pool robot.
17. The sinking and floating control method for the swimming pool robot according to claim 16, wherein detecting the positional relationship between the swimming pool robot and the waterline of the liquid surface of the swimming pool where the swimming pool robot is located comprises:
 - starting detecting the positional relationship in response to a posture of the swimming pool robot meeting a first predetermined condition.
18. The sinking and floating control method for the swimming pool robot according to claim 17, wherein the operational requirement information comprises remote control command information sent by a user, clock information, operational task progress information, fault information, power information or swimming pool bottom environment information.
19. The sinking and floating control method for the swimming pool robot according to claim 18, wherein controlling the sinking and floating control unit to enter the floating working state based on detection results to realize the floating of the swimming pool robot comprises:
 - controlling the sinking and floating control unit to enter the floating working state in response to detecting that at least a part of the swimming pool robot has come out of water.

20. The sinking and floating control method for the swimming pool robot according to claim 18, further comprising:
- controlling the sinking and floating control unit to stop working in response to detecting that at least a part of the swimming pool robot enters underwater again and/or detecting that the posture of the swimming pool robot meets a second predetermined condition.

Abstract

The present disclosure relates to the field of underwater robots, and in particular to a controllable sinking and floating swimming pool robot and a sinking and floating control method for a swimming pool robot. The controllable sinking and floating swimming pool robot of the present disclosure includes a sinking and floating control unit configured to control a swimming pool robot to float and sink; a waterline detection unit configured to detect a positional relationship between the swimming pool robot and a waterline of a liquid surface of a swimming pool where the swimming pool robot is located; and a main control unit configured to control a working state of the sinking and floating control unit to enter a floating working state based on detection results to realize a floating of the swimming pool robot.



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APPLICATION #
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3720-24P06732US

Title of Invention

CONTROLLABLE SINKING AND FLOATING SWIMMING POOL ROBOT AND SINKING AND
FLOATING CONTROL METHOD FOR SWIMMING POOL ROBOT

Application Information

APPLICATION TYPE Utility - Nonprovisional Application
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FILING DATE -

CUSTOMER # 92940

FIRST NAMED INVENTOR Xiaofeng LIU

CORRESPONDENCE ADDRESS -

AUTHORIZED BY -

Documents

TOTAL DOCUMENTS: 8

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
aia0424-track_one.pdf	2	Track One Request	123 KB
3720-24P06732US-ADS.pdf	8	Application Data Sheet	1780 KB
24P06732US-New application-Drawings.pdf	9	Drawings-only black and white line drawings	1203 KB
24P06732US-DECLARATION_Yongfei HUA.pdf	1	Oath or Declaration filed	361 KB
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24P06732US-POA-AIPER-p.pdf	2	Power of Attorney	723 KB

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24P06732US-Newapplication-Specification0902-APP.TEXT.docx	30	Application body structured text document	29 KB
24P06732US-Newapplication-Specification0902.pdf	30	Auxiliary PDF of Application	131 KB

Digest

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Page 34 of 178

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3720-24P06732US

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CUSTOMER # 92940

FILING DATE -

CORRESPONDENCE
ADDRESS -FIRST NAMED
INVENTOR Xiaofeng LIU

Payment Information

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CARD / 5684PAYMENT TRANSACTION ID
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FEE CODE	DESCRIPTION	ITEM PRICE(\$)	QUANTITY	ITEM TOTAL(\$)
2830	PROCESSING FEE, EXCEPT IN PROVISIONAL APPLICATIONS	56.00	1	56.00
2817	REQUEST FOR PRIORITIZED EXAMINATION	1680.00	1	1680.00
2111	UTILITY PATENT APPL. SEARCH FEE	280.00	1	280.00
4011	BASIC FILING FEE- UTILITY	64.00	1	64.00
2311	EXAMINATION OF ORIGINAL PATENT APPLICATION	320.00	1	320.00
TOTAL AMOUNT:				\$2,400.00

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If a new application is being filed and the application includes the necessary components for filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

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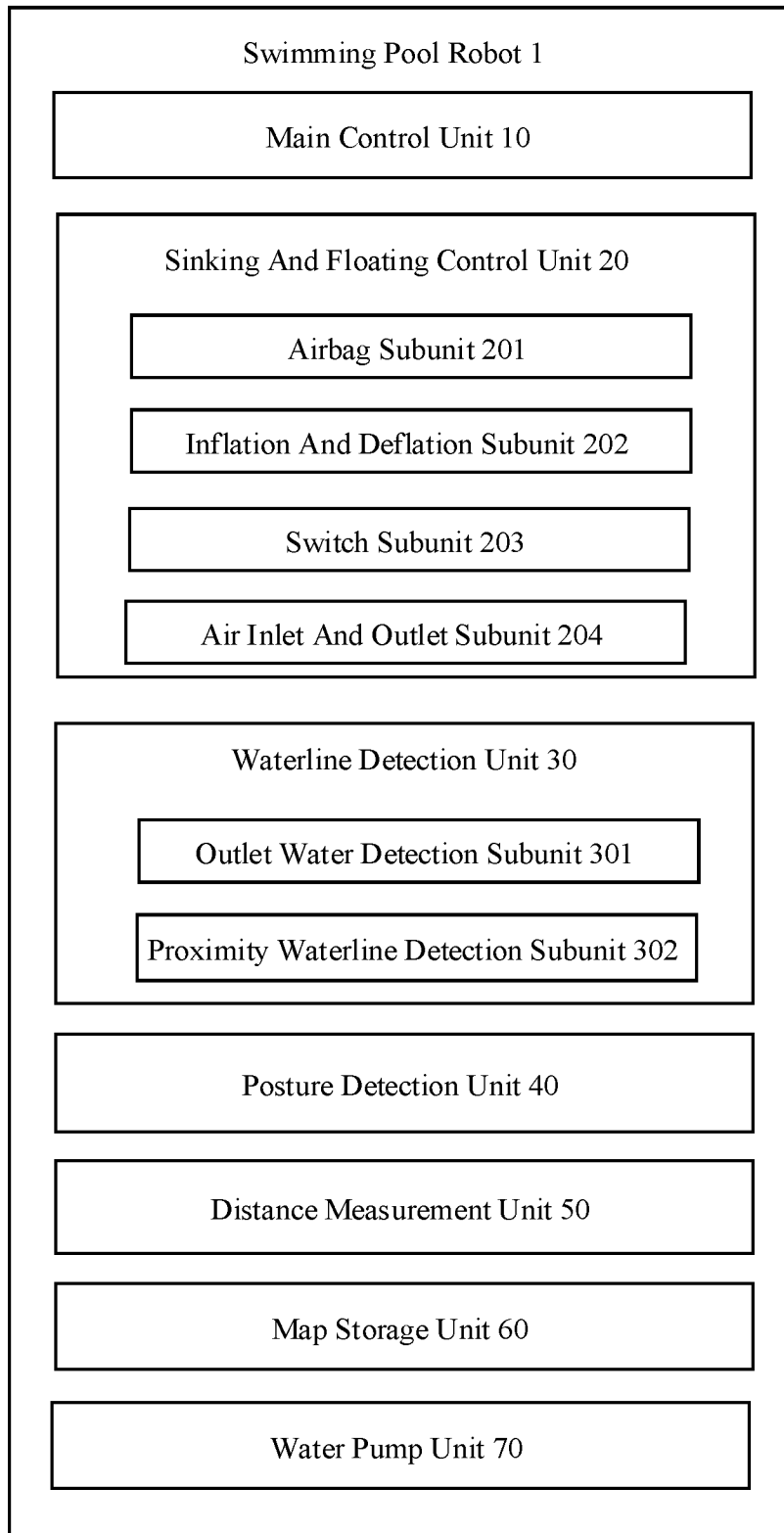


FIG. 1

Swimming Pool Robot 1

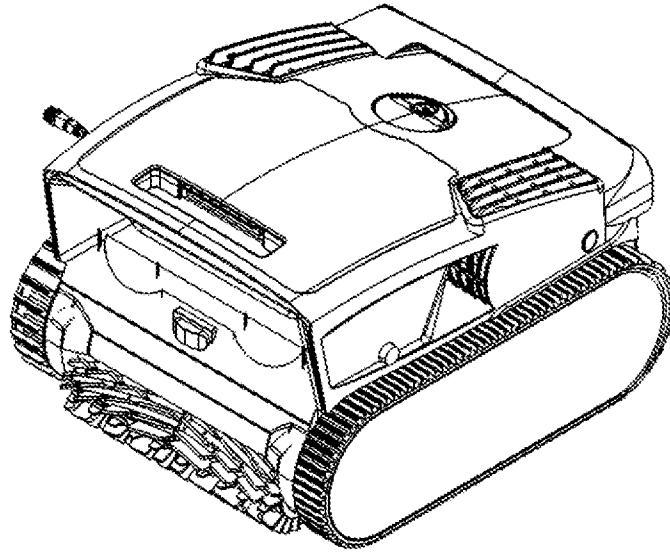


FIG. 2A

Swimming Pool Robot 1

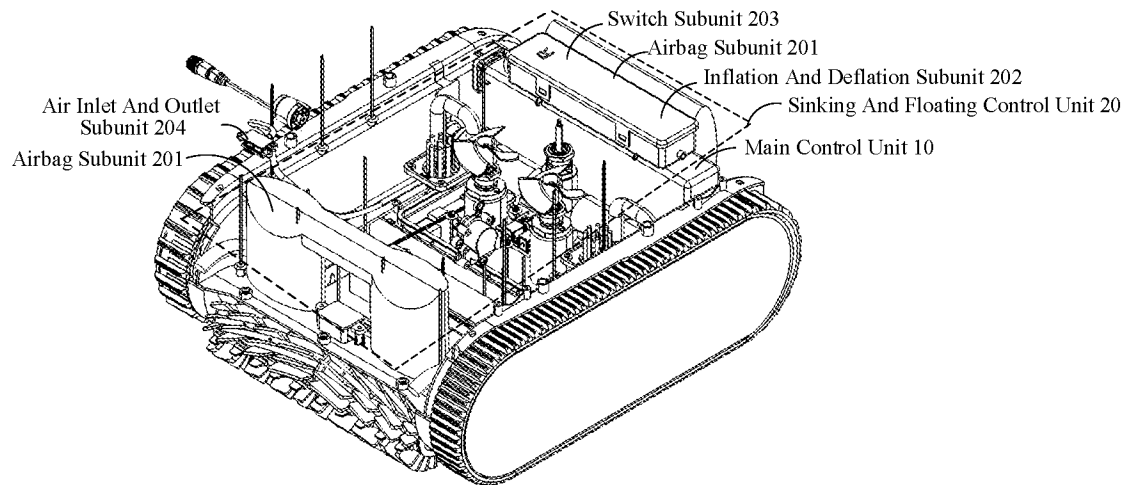


FIG. 2B

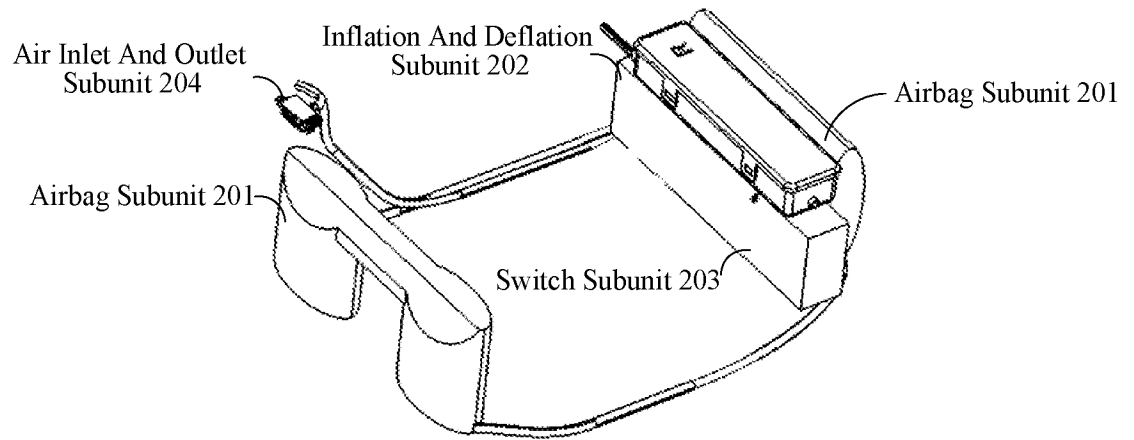
Sinking And Floating Control Unit 20

FIG. 3

Sinking And Floating Control Unit 20

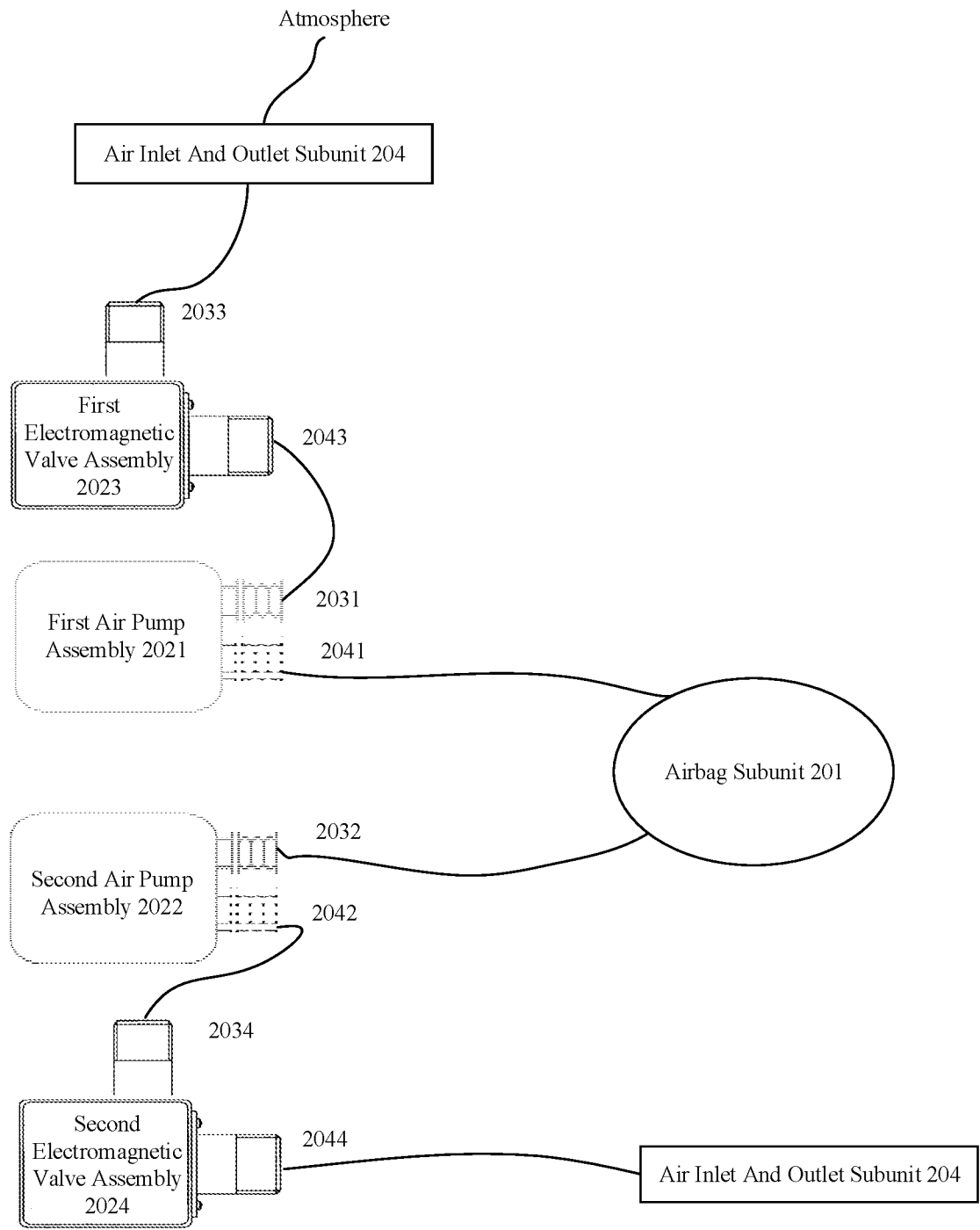


FIG. 4

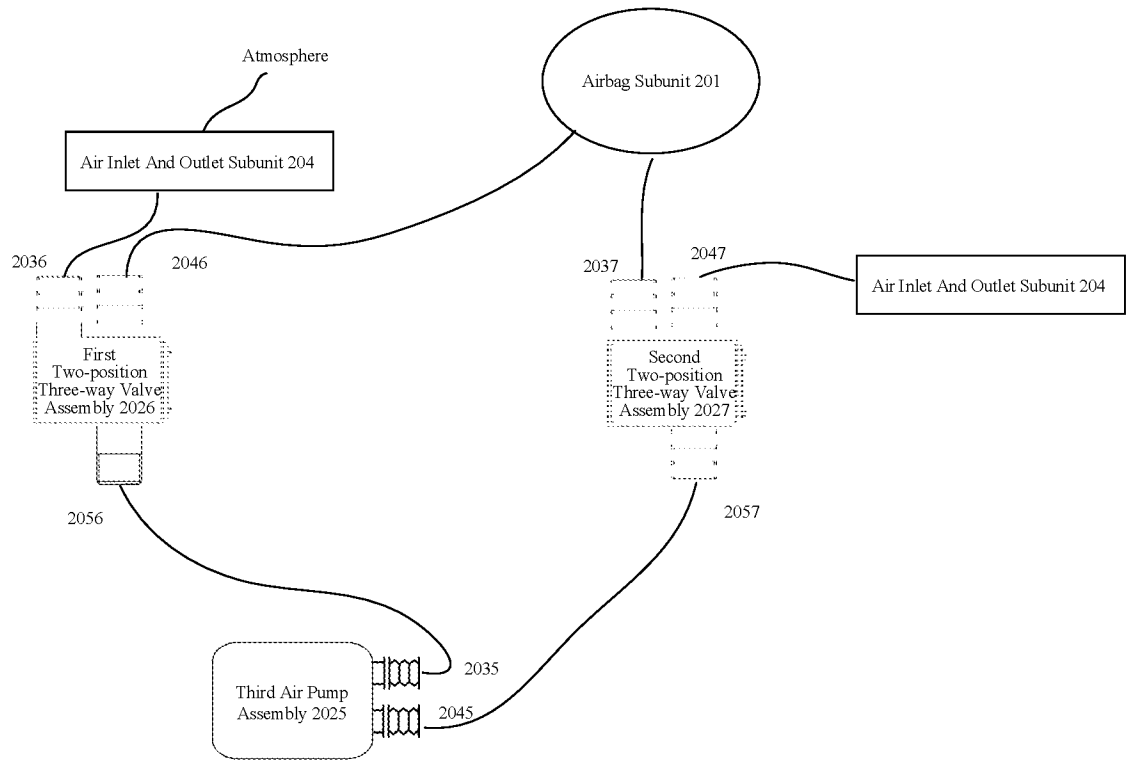
Sinking And Floating Control Unit 20

FIG. 5

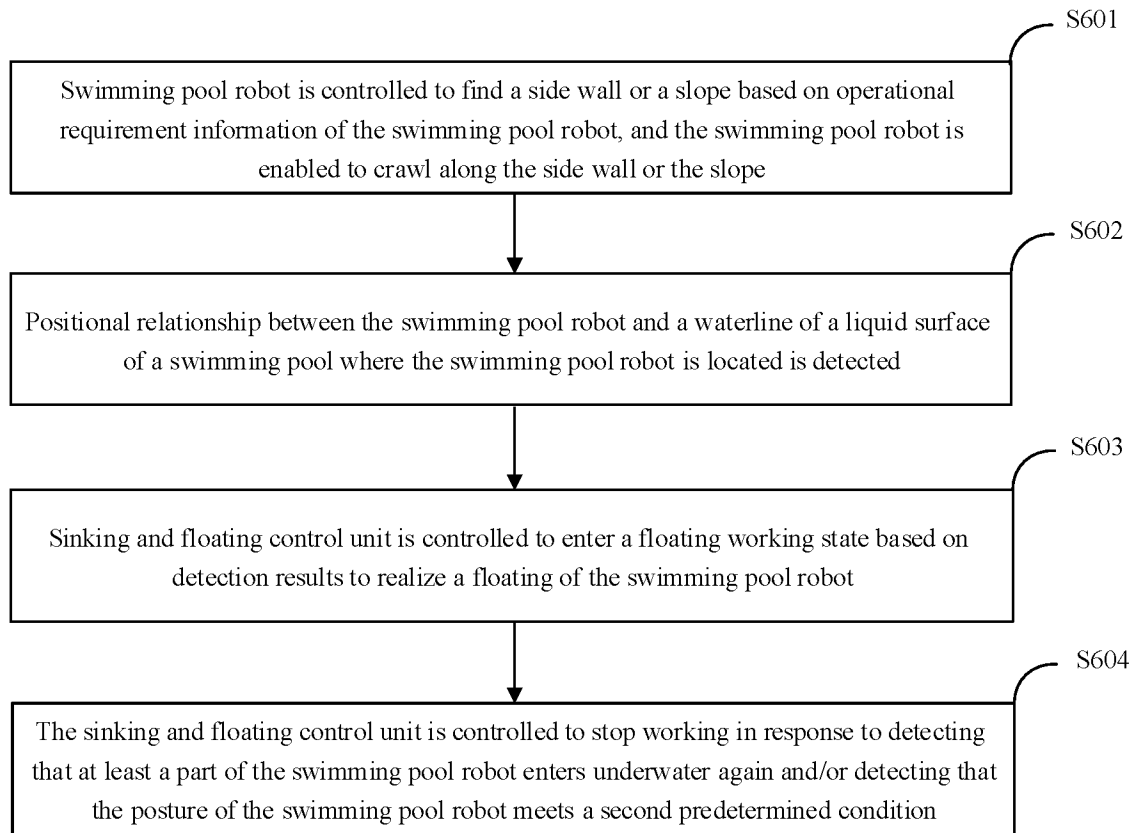


FIG. 6

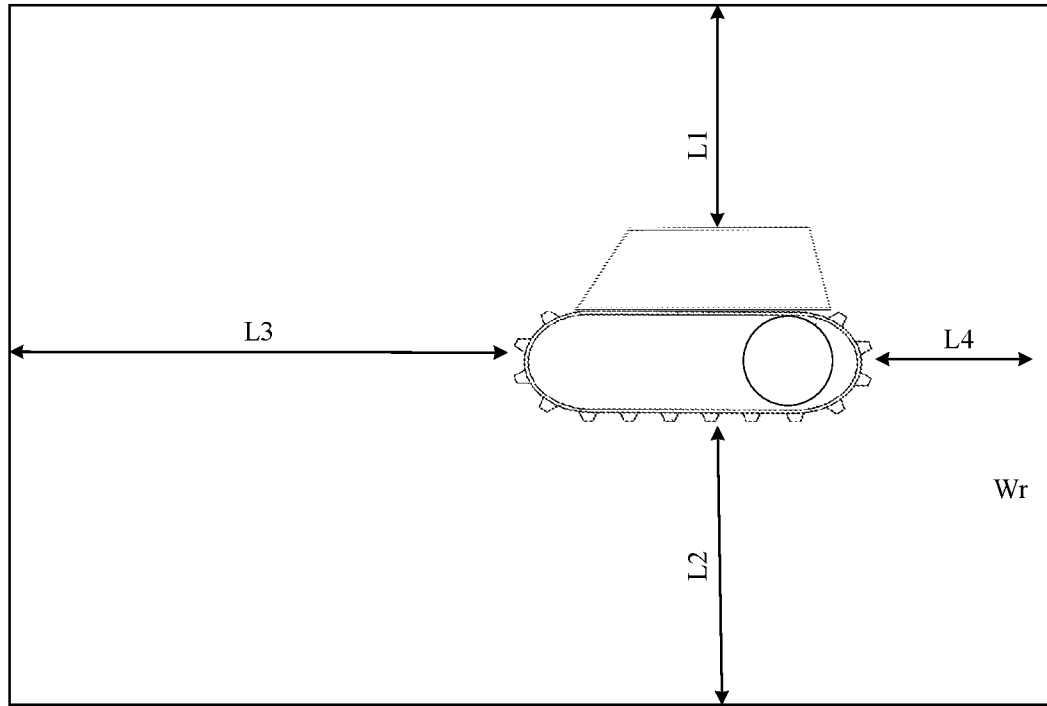


FIG. 7

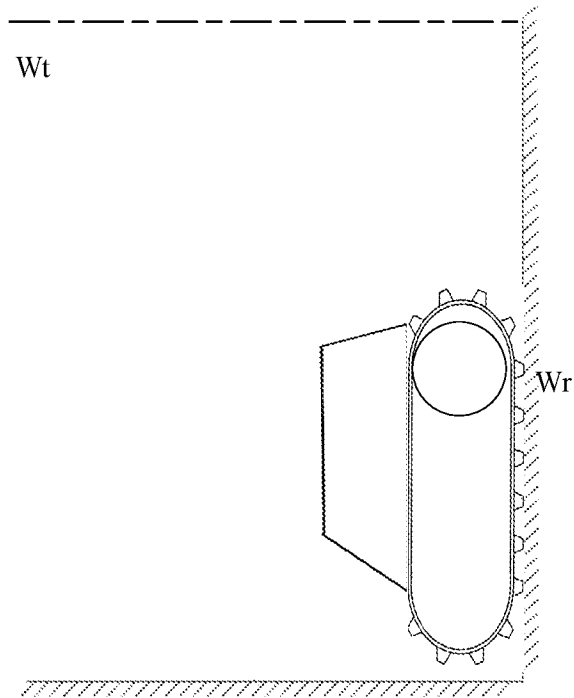


FIG. 8A

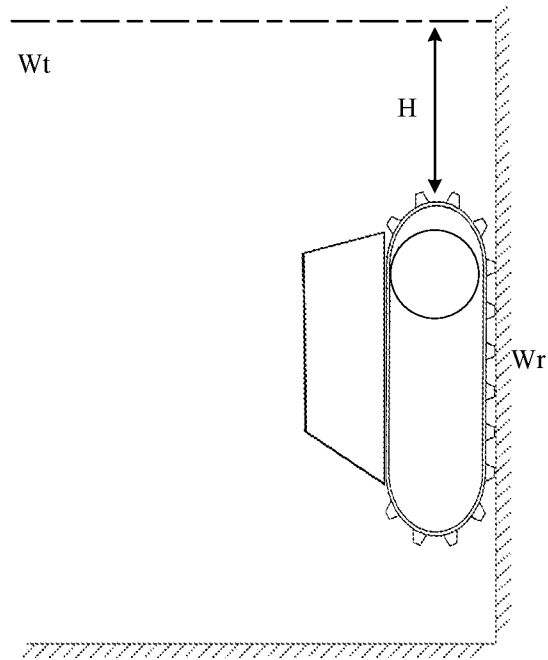


FIG. 8B

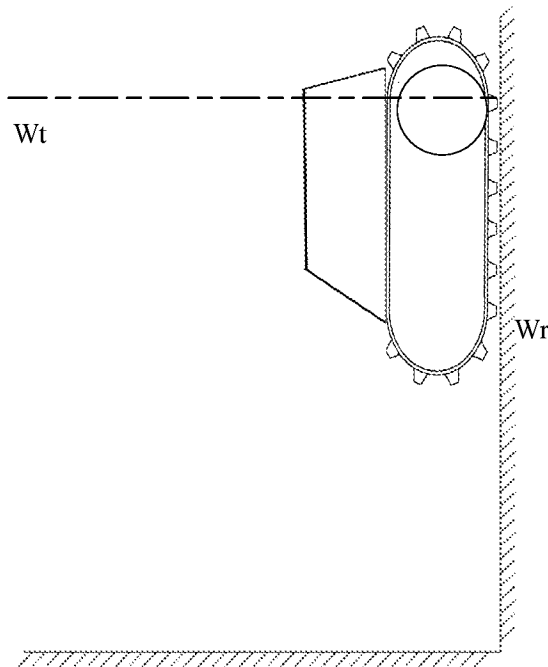


FIG. 8C

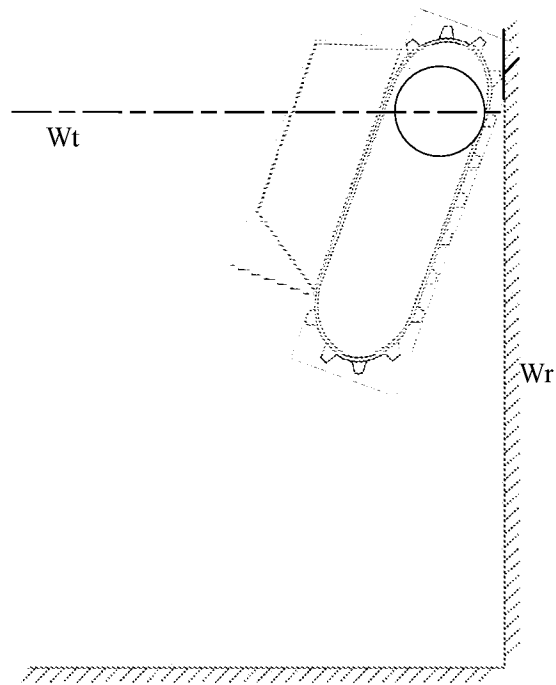


FIG. 8D

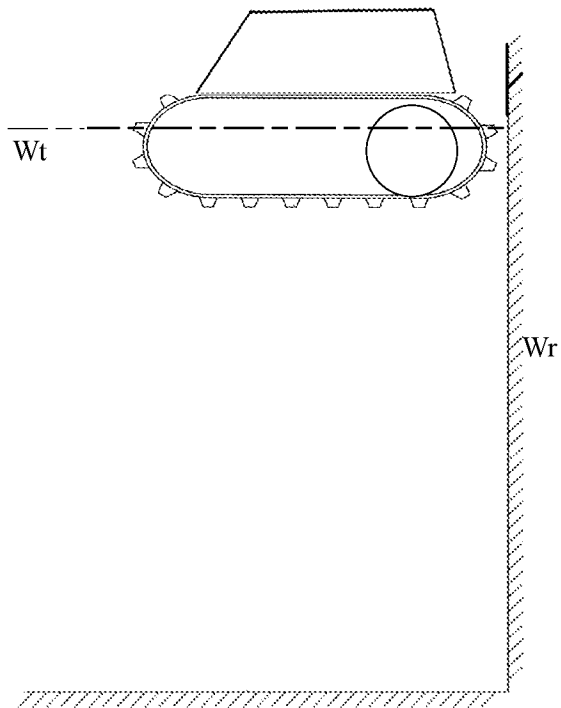


FIG. 8E

**CERTIFICATION AND REQUEST FOR PRIORITIZED EXAMINATION
UNDER 37 CFR 1.102(e) (Page 1 of 1)**

First Named Inventor:	Xiaofeng LIU	Nonprovisional Application Number (if known):	
Title of Invention:	CONTROLLABLE SINKING AND FLOATING SWIMMING POOL ROBOT AND SINKING AND FLOATING CONTROL METHOD FOR SWIMMING POOL ROBOT		

APPLICANT HEREBY CERTIFIES THE FOLLOWING AND REQUESTS PRIORITIZED EXAMINATION FOR THE ABOVE-IDENTIFIED APPLICATION.

1. The processing fee set forth in 37 CFR 1.17(i)(1) and the prioritized examination fee set forth in 37 CFR 1.17(c) have been filed with the request. The publication fee requirement is met because that fee, set forth in 37 CFR 1.18(d), is currently \$0. The basic filing fee, search fee, and examination fee are filed with the request or have been already been paid. I understand that any required excess claims fees or application size fee must be paid for the application.
2. I understand that the application may not contain, or be amended to contain, more than four independent claims, more than thirty total claims, or any multiple dependent claims, and that any request for an extension of time will cause an outstanding Track I request to be dismissed.
3. The applicable box is checked below:

I. ☒ Original Application (Track One) - Prioritized Examination under § 1.102(e)(1)

- i. (a) The application is an original nonprovisional utility application filed under 35 U.S.C. 111(a). This certification and request is being filed with the utility application via EFS-Web.
---OR---
(b) The application is an original nonprovisional plant application filed under 35 U.S.C. 111(a). This certification and request is being filed with the plant application in paper.
- ii. An executed inventor's oath or declaration under 37 CFR 1.63 or 37 CFR 1.64 for each inventor, or the application data sheet meeting the conditions specified in 37 CFR 1.53(f)(3)(i) is filed with the application.

II. ☐ Request for Continued Examination - Prioritized Examination under § 1.102(e)(2)

- i. A request for continued examination has been filed with, or prior to, this form.
- ii. If the application is a utility application, this certification and request is being filed via EFS-Web.
- iii. The application is an original nonprovisional utility application filed under 35 U.S.C. 111(a), or is a national stage entry under 35 U.S.C. 371.
- iv. This certification and request is being filed prior to the mailing of a first Office action responsive to the request for continued examination.
- v. No prior request for continued examination has been granted prioritized examination status under 37 CFR 1.102(e)(2).

Signature /NA XU/	Date 2024-08-30
Name (Print/Typed) NA XU	Practitioner Registration Number 64369

Note: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. Submit multiple forms if more than one signature is required.*

☒ *Total of 1 forms are submitted.

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS

NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5, unless the application number and filing date are identified in the Power of Attorney by Applicant form. If neither form PTO/AIA/82A nor form PTO/AIA/82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

Application Number	
Filing Date	Concurrently submitted
First Named Inventor	Xiaofeng LIU
Title	CONTROLLABLE SINKING AND FLOATING SWIMMING POOL ROBOT AND SINKING AND FLOATING CONTROL METHOD FOR SWIMMING POOL ROBOT
Art Unit	
Examiner Name	
Attorney Docket Number	3720-24P06732US

SIGNATURE of Applicant or Patent Practitioner

Signature	/NA XU/	Date (Optional)	
Name	NA XU	Registration Number	64369
Title (if Applicant is a juristic entity)			
Applicant Name (if Applicant is a juristic entity)			

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.



*Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

Application Number	Filing Date

(Note: The boxes above may be left blank if information is provided on form PTO/AIA/82A.)

☒ I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above:

92940

OR

☐ I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

Please recognize or change the correspondence address for the application identified in the attached transmittal letter or the boxes above to:

☒ The address associated with the above-mentioned Customer Number

OR

☐ The address associated with Customer Number:

OR

Firm or Individual Name				
Address				
City	State	Zip		
Country				
Telephone	Email			

I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

AIPER GLOBAL PTE. LTD.

☐ Inventor or Joint Inventor (title not required below)

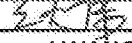
☐ Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)

☒ Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)

☐ Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

SIGNATURE of Applicant for Patent

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

Signature		Date (Optional)	
Name	Dawei WANG		
Title	Director of Intellectual Property Department		

NOTE: Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. If more than one applicant, use multiple forms.

☒ Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	3720-24P06732US
		Application Number	
Title of Invention	CONTROLLABLE SINKING AND FLOATING SWIMMING POOL ROBOT AND SINKING AND FLOATING CONTROL METHOD FOR SWIMMING POOL ROBOT		
The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76. This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.			

Secrecy Order 37 CFR 5.2:

☐	Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)
--------------------------	---

Inventor Information:

Inventor 1					Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
	Xiaofeng		LIU		
Residence Information (Select One) ☐ US Residency ☒ Non US Residency ☐ Active US Military Service					
City	Singapore	Country of Residence ⁱ	SG		
Mailing Address of Inventor:					
Address 1	60 Paya Lebar Road #12-03, Paya Lebar Square				
Address 2					
City	Singapore	State/Province			
Postal Code		Country ⁱ	SG		
Inventor 2					Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
	Yongfei		HUA		
Residence Information (Select One) ☐ US Residency ☒ Non US Residency ☐ Active US Military Service					
City	Singapore	Country of Residence ⁱ	SG		
Mailing Address of Inventor:					
Address 1	60 Paya Lebar Road #12-03, Paya Lebar Square				
Address 2					
City	Singapore	State/Province			
Postal Code		Country ⁱ	SG		
All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the Add button. Add					

Correspondence Information:

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	3720-24P06732US
		Application Number	
Title of Invention	CONTROLLABLE SINKING AND FLOATING SWIMMING POOL ROBOT AND SINKING AND FLOATING CONTROL METHOD FOR SWIMMING POOL ROBOT		

Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

☐ An Address is being provided for the correspondence information of this application.

Customer Number	92940		
Email Address	contact@us-ip.com	Add Email	Remove Email

Application Information:

Title of the Invention	CONTROLLABLE SINKING AND FLOATING SWIMMING POOL ROBOT AND SINKING AND FLOATING CONTROL METHOD FOR SWIMMING POOL ROBOT		
Attorney Docket Number	3720-24P06732US	Small Entity Status Claimed	☒
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)		Suggested Figure for Publication (if any)	

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	☒ Customer Number	☐ US Patent Practitioner	☐ Limited Recognition (37 CFR 11.9)
Customer Number	92940		

BEATBOT
Ex. 1002

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	3720-24P06732US
	Application Number	
Title of Invention	CONTROLLABLE SINKING AND FLOATING SWIMMING POOL ROBOT AND SINKING AND FLOATING CONTROL METHOD FOR SWIMMING POOL ROBOT	

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.

When referring to the current application, please leave the "Application Number" field blank.

Prior Application Status		Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the Add button.			Add

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)ⁱ the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Access Code ⁱ (if applicable)
2024110176973	CN	2024-07-26	560C
Additional Foreign Priority Data may be generated within this form by selecting the Add button.			Add

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐	This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013. NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.
--------------------------	---

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	3720-24P06732US
	Application Number	
Title of Invention	CONTROLLABLE SINKING AND FLOATING SWIMMING POOL ROBOT AND SINKING AND FLOATING CONTROL METHOD FOR SWIMMING POOL ROBOT	

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	3720-24P06732US
		Application Number	
Title of Invention	CONTROLLABLE SINKING AND FLOATING SWIMMING POOL ROBOT AND SINKING AND FLOATING CONTROL METHOD FOR SWIMMING POOL ROBOT		

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.			
Applicant 1			Remove
If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.			
Clear			
☒ Assignee	☐ Legal Representative under 35 U.S.C. 117		☐ Joint Inventor
☐ Person to whom the inventor is obligated to assign.		☐ Person who shows sufficient proprietary interest	
If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:			
Name of the Deceased or Legally Incapacitated Inventor:			
If the Applicant is an Organization check here. ☒			
Organization Name	Aiper Global Pte. Ltd.		
Mailing Address Information For Applicant:			
Address 1	60 Paya Lebar Road #12-03, Paya Lebar Square		
Address 2			
City	Singapore	State/Province	
Country	SG	Postal Code	
Phone Number		Fax Number	
Email Address			
Additional Applicant Data may be generated within this form by selecting the Add button. Add			

Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	3720-24P06732US
		Application Number	
Title of Invention	CONTROLLABLE SINKING AND FLOATING SWIMMING POOL ROBOT AND SINKING AND FLOATING CONTROL METHOD FOR SWIMMING POOL ROBOT		

Assignee 1

Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.

[Remove](#)If the Assignee or Non-Applicant Assignee is an Organization check here. ☐

Prefix	Given Name	Middle Name	Family Name	Suffix

Mailing Address Information For Assignee including Non-Applicant Assignee:

Address 1				
Address 2				
City		State/Province		
Country ⁱ		Postal Code		
Phone Number		Fax Number		
Email Address				

Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button.

[Add](#)**Signature:**[Remove](#)

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). However, if this Application Data Sheet is submitted with the **INITIAL** filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/Na Xu/			Date (YYYY-MM-DD)	2024-08-29
First Name	Na	Last Name	Xu	Registration Number	64369

Additional Signature may be generated within this form by selecting the Add button.

[Add](#)

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	3720-24P06732US
		Application Number	
Title of Invention	CONTROLLABLE SINKING AND FLOATING SWIMMING POOL ROBOT AND SINKING AND FLOATING CONTROL METHOD FOR SWIMMING POOL ROBOT		

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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The information provided by you in this form will be subject to the following routine uses:

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- 3 A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
- 4 A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
- 5 A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
- 6 A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
- 7 A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
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- 9 A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

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DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)**Title of
Invention****CONTROLLABLE SINKING AND FLOATING SWIMMING POOL ROBOT AND SINKING AND FLOATING CONTROL METHOD FOR SWIMMING POOL ROBOT**

As the below named inventor, I hereby declare that:

This declaration
is directed to:

The attached application, or



United States application or PCT international application number _____

filed on _____

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

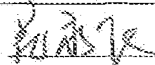
I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

LEGAL NAME OF INVENTORInventor: Yongfei HUA

Date (Optional): _____

Signature: 

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
18/822,334	09/02/2024		664	3720-24P06732US	20	2

CONFIRMATION NO. 6388

92940
IPro, PLLC
12332 Towncenter Plaza
PMB# 816
Sterling, VA 20164

FILING RECEIPT



0000000077806882

Date Mailed: 09/13/2024

Receipt is acknowledged of this non-provisional utility patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF FIRST INVENTOR, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection.

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Inventor(s)

Xiaofeng LIU, Singapore, SINGAPORE;
Yongfei HUA, Singapore, SINGAPORE;

Applicant(s)

Aiper Global Pte. Ltd., Singapore, SINGAPORE;

Power of Attorney: The patent practitioners associated with Customer Number 92940

Domestic Applications for which benefit is claimed - None.

A proper domestic benefit claim must be provided in an Application Data Sheet in order to constitute a claim for domestic benefit. See 37 CFR 1.76 and 1.78.

Foreign Applications (You may be eligible to benefit from the Patent Prosecution Highway program at the USPTO. Please see <http://www.uspto.gov> for more information.)

CHINA 2024110176973 07/26/2024 Access Code Provided

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Permission to Access Search Results: Yes

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If Required, Foreign Filing License Granted: 09/11/2024

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 18/822,334**

Projected Publication Date: 01/29/2026

Non-Publication Request: No

Early Publication Request: No

**** SMALL ENTITY ****

Title

CONTROLLABLE SINKING AND FLOATING SWIMMING POOL ROBOT AND SINKING AND
FLOATING CONTROL METHOD FOR SWIMMING POOL ROBOT

Preliminary Class

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

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Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

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For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific

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Title 37, Code of Federal Regulations, 5.11 & 5.15

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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number
18/822,334

APPLICATION AS FILED - PART I

(Column 1)		(Column 2)	SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE(\$)	FEE(\$)		RATE(\$)	FEE(\$)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	64		N/A	
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A	280		N/A	
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	320		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	20 minus 20 =	*	x	= 0	OR		
INDEPENDENT CLAIMS (37 CFR 1.16(h))	2 minus 3 =	*	x	= 0			
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			0			
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				0			
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	664		TOTAL	

APPLICATION AS AMENDED - PART II

	(Column 1)	(Column 2)	(Column 3)	SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
		CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)		ADDITIONAL FEE(\$)	RATE(\$)
AMENDMENT A	Total (37 CFR 1.16(i))	*	Minus	**	=		x	=
	Independent (37 CFR 1.16(h))	*	Minus	***	=		x	=
	Application Size Fee (37 CFR 1.16(s))							
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
				TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	
AMENDMENT B	Total (37 CFR 1.16(i))	*	Minus	**	=		x	=
	Independent (37 CFR 1.16(h))	*	Minus	***	=		x	=
	Application Size Fee (37 CFR 1.16(s))							
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
				TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

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Kathi Vidal

Under Secretary of Commerce for Intellectual Property and
Director of the United States Patent and Trademark Office

Derrick Brent

Deputy Under Secretary of Commerce for Intellectual Property and
Deputy Director of the United States Patent and Trademark Office

BEATBOT
Ex. 1002



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
18/822,334	09/02/2024	Xiaofeng LIU	3720-24P06732US	6388
92940	7590	10/02/2024	EXAMINER	
IPro, PLLC			CENTRAL, DOCKET	
12332 Towncenter Plaza			ART UNIT	
PMB# 816			PAPER NUMBER	
Sterling, VA 20164			OPAP	
			NOTIFICATION DATE	DELIVERY MODE
			10/02/2024	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

contact@us-ip.com
uspto+949965@dockettrak.com

<i>Decision Granting Request for Prioritized Examination (Track I)</i>	Application No. 18/822,334	Applicant(s) LIU et al.	
	Examiner FIKIRTE A GEREMEW	Art Unit OMBL	AIA (FITF) Status Yes
1. THE REQUEST FILED <u>02 September 2024</u> IS GRANTED . The above-identified application has met the requirements for prioritized examination A. ☒ for an original nonprovisional application (Track I). B. ☐ for an application undergoing continued examination (RCE). 2. The above-identified application will undergo prioritized examination. The application will be accorded special status throughout its entire course of prosecution until one of the following occurs: A. filing a <u>petition for extension of time</u> to extend the time period for filing a reply; B. filing an <u>amendment to amend the application to contain more than four independent claims, more than thirty total claims</u>, or a multiple dependent claim; C. filing a <u>request for continued examination</u> ; D. filing a notice of appeal; E. filing a request for suspension of action; F. mailing of a notice of allowance; G. mailing of a final Office action; H. completion of examination as defined in 37 CFR 41.102; or I. abandonment of the application. Telephone inquiries with regard to this decision should be directed to FIKIRTE GEREMEW at (703) 756-1930. In his/her absence, calls may be directed to Petition Help Desk at (571) 272-3282.			
/FIKIRTE A GEREMEW/ PROGRAM SUPPORT SPECIALIST, OMBL			

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Filing date: **26 Jul 2024 (26.07.2024)**

Application number: **202411017697.3**

Date of availability of document: **31 Jul 2024 (31.07.2024)**

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Date of issue of this certificate: **10 Oct 2024 (10.10.2024)**

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证 明

本证明之附件是向本局提交的下列专利申请文件副本。

申 请 号： 202411017697.3

申 请 类 型： 发明专利

发明 创造 名称： 可控沉浮的泳池机器人和用于泳池机器人的沉浮控制方法

申 请 日： 2024年07月26日

申 请 人： 元鼎智能创新(国际)有限公司

发明人或设计人： 刘晓锋、花永飞

局长

申长雨

2024 年 07 月 31 日

说明书附图

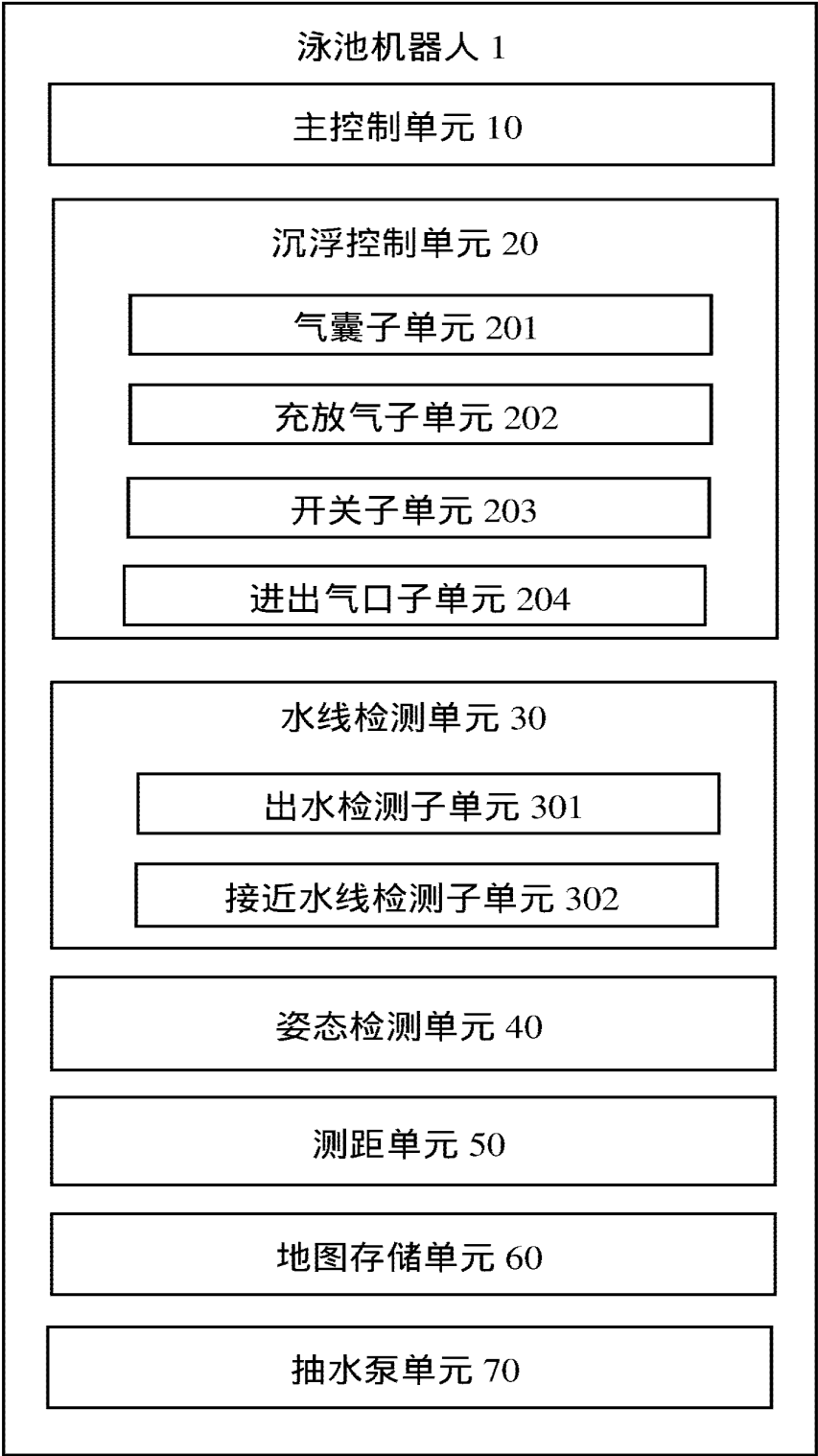


图 1

泳池机器人 1

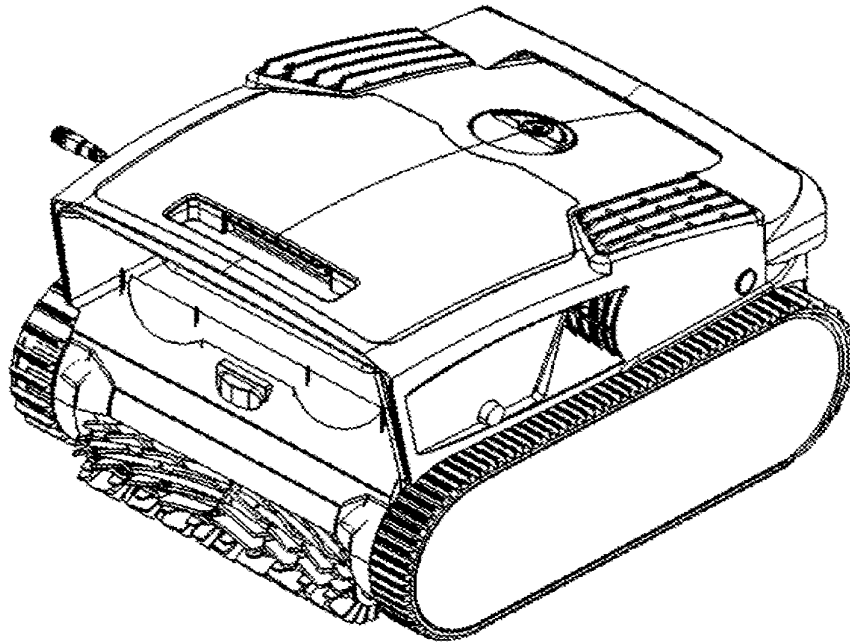


图 2A

泳池机器人 1

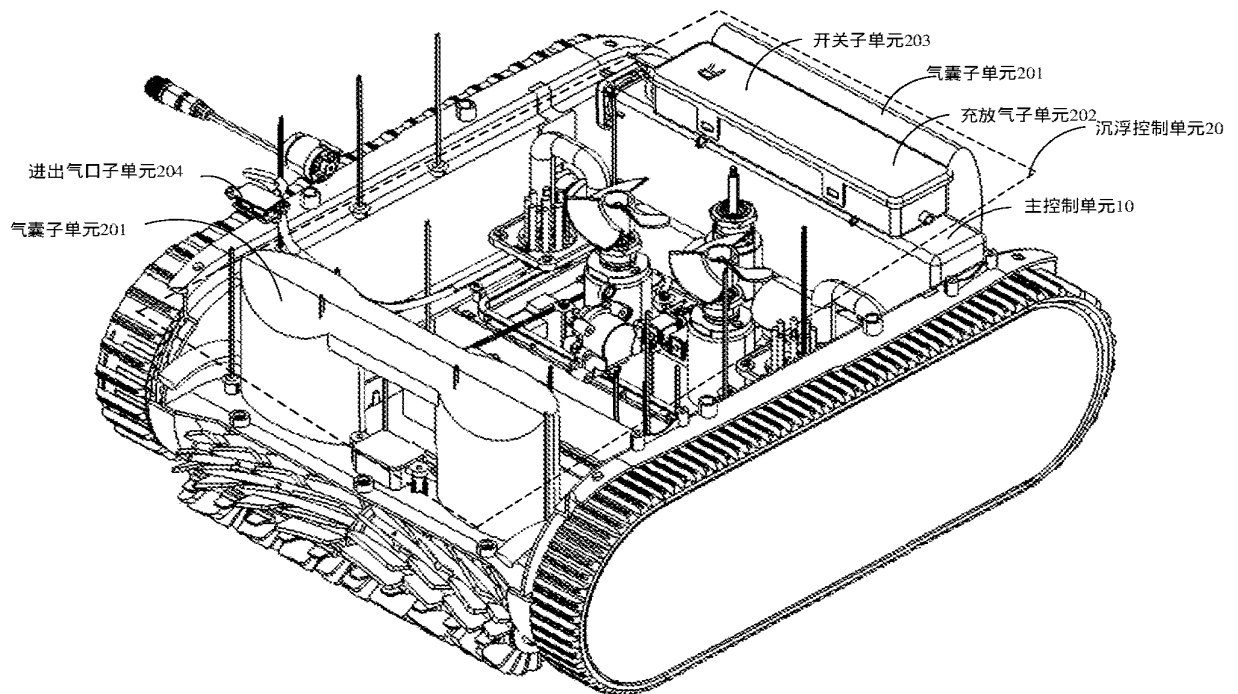


图 2B

沉浮控制单元 20

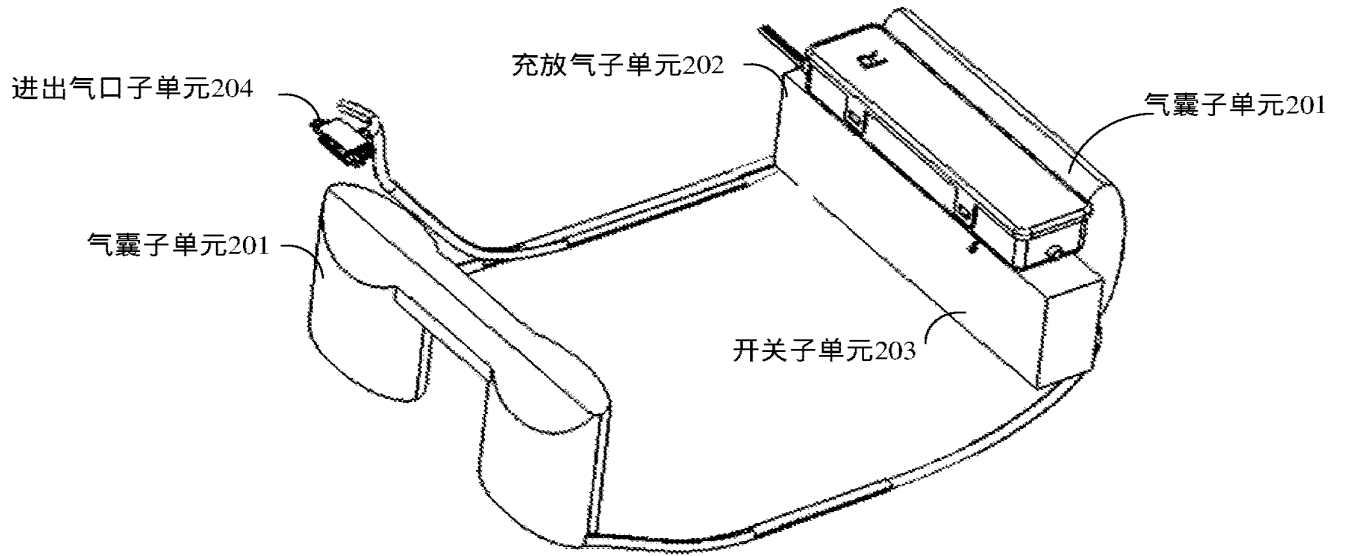


图 3

沉浮控制单元 20

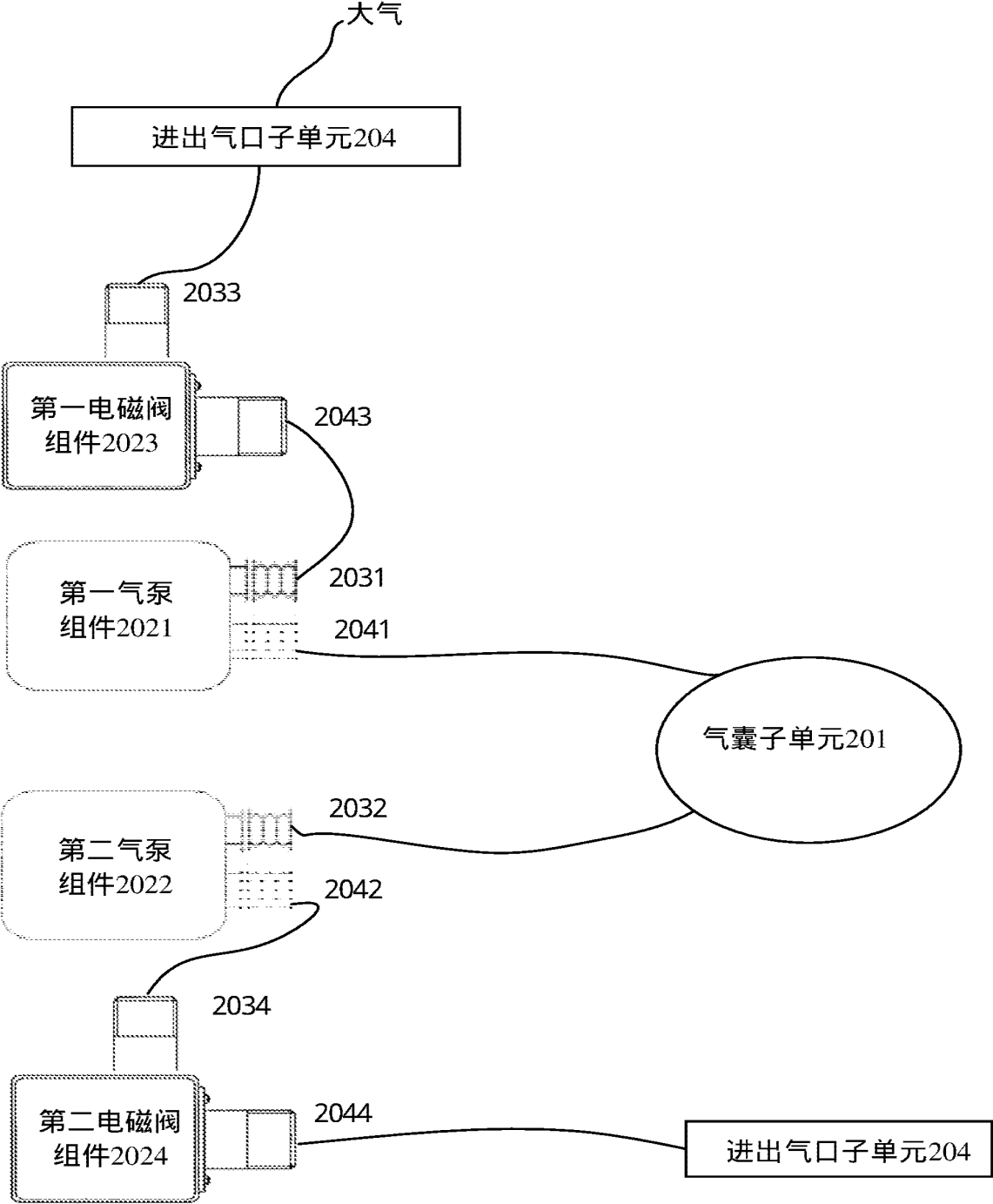


图 4

沉浮控制单元 20

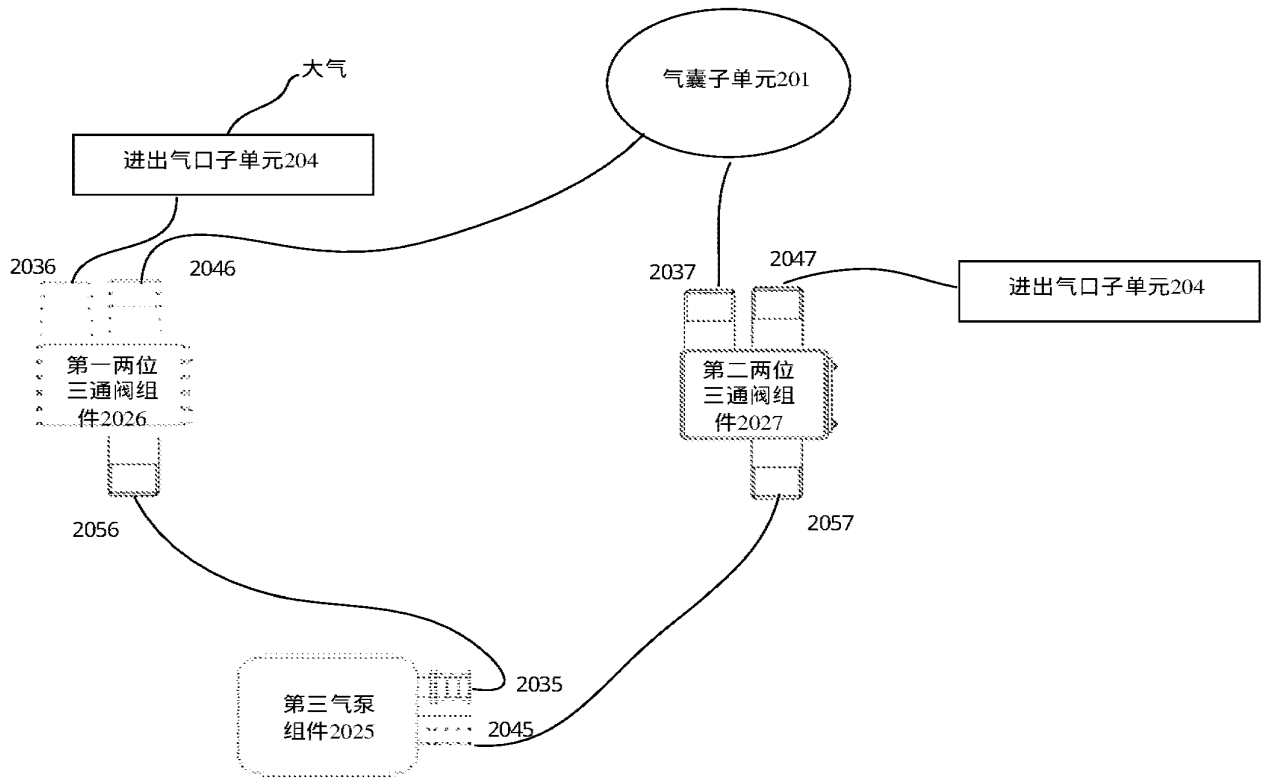


图 5

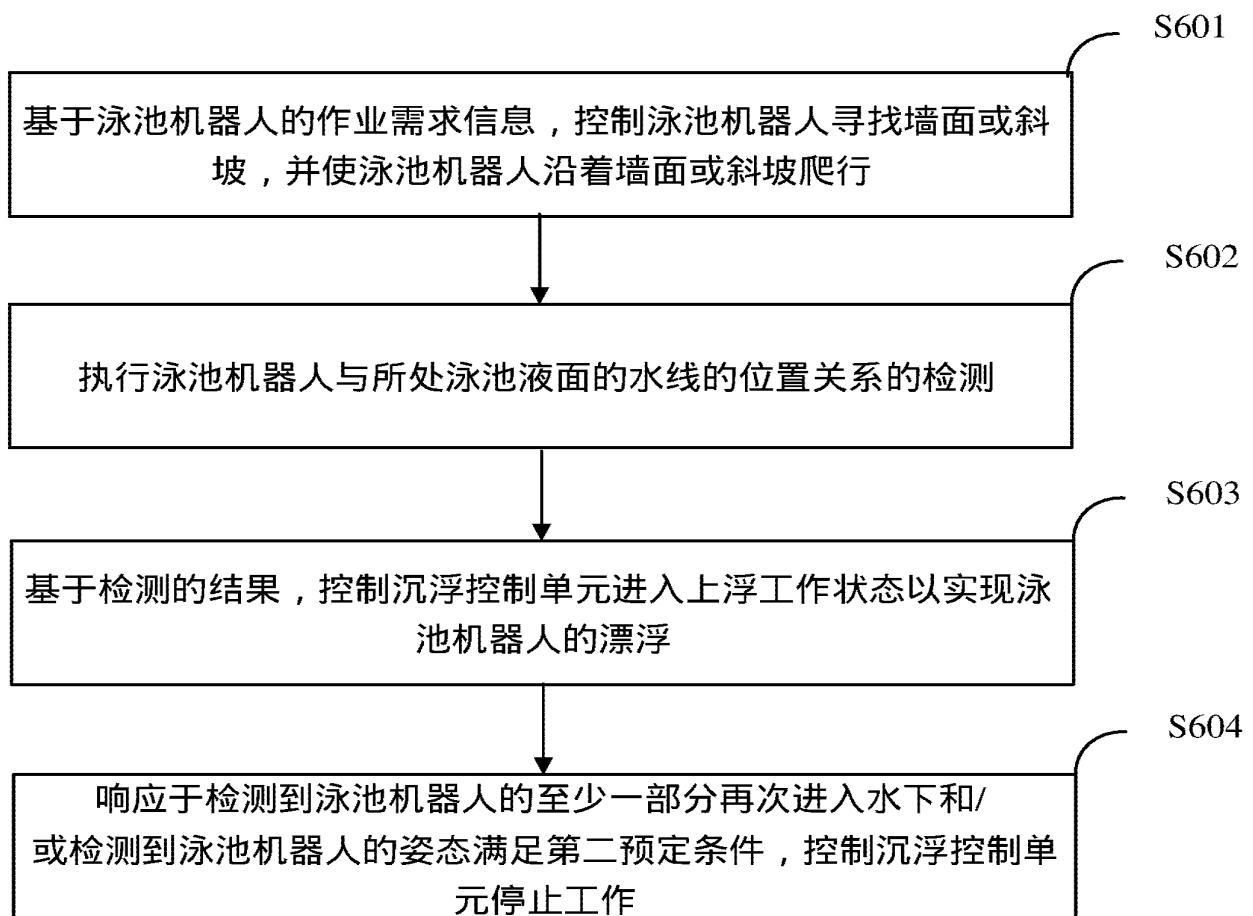


图 6

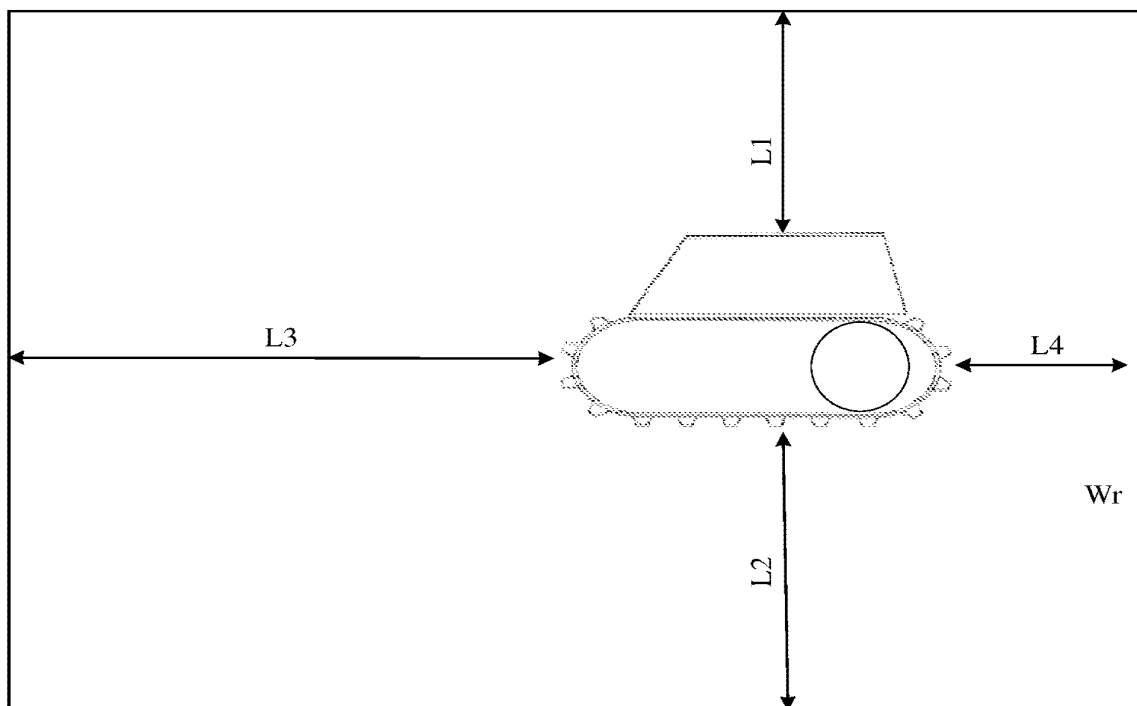


图 7

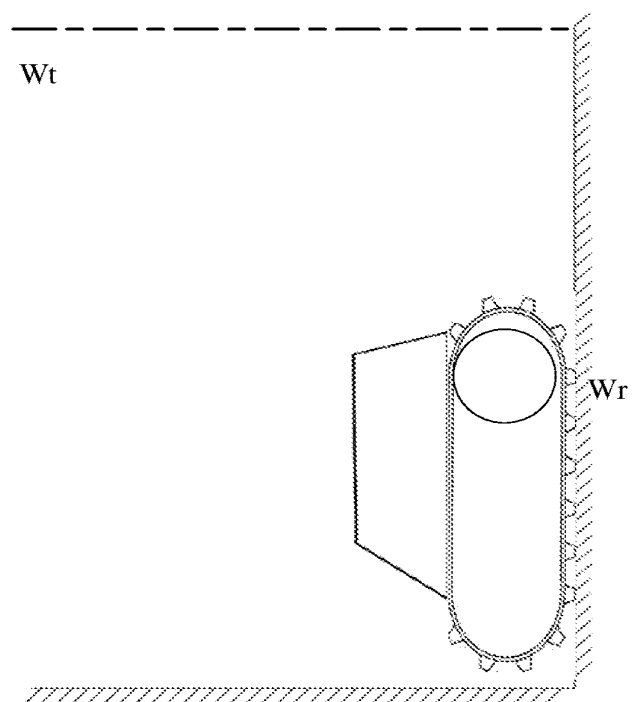


图 8A

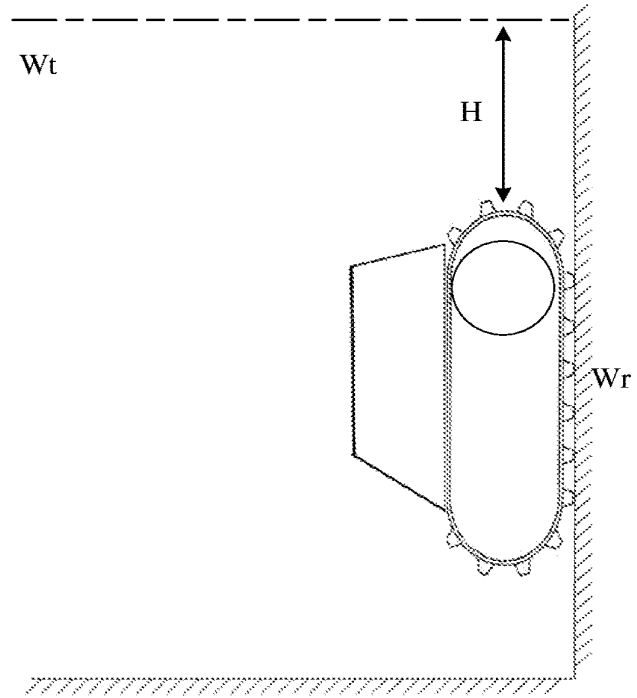


图 8B

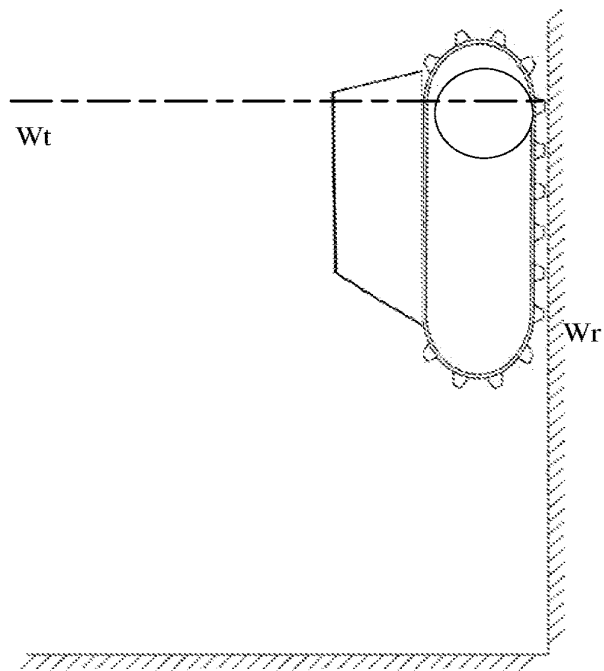


图 8C

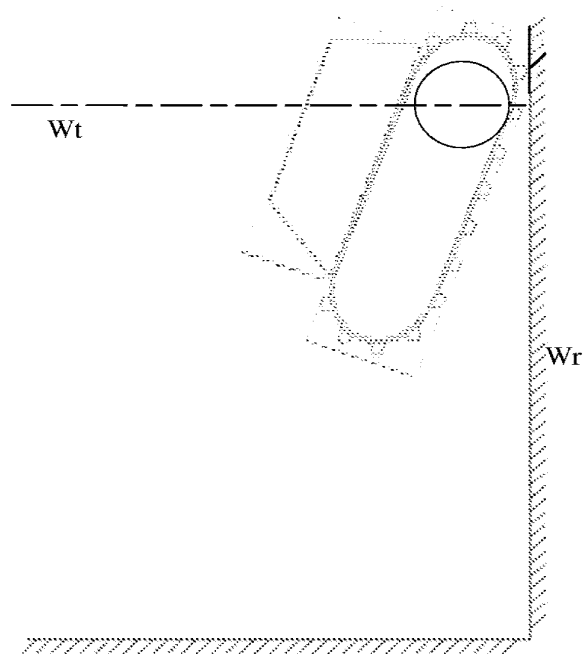


图 8D

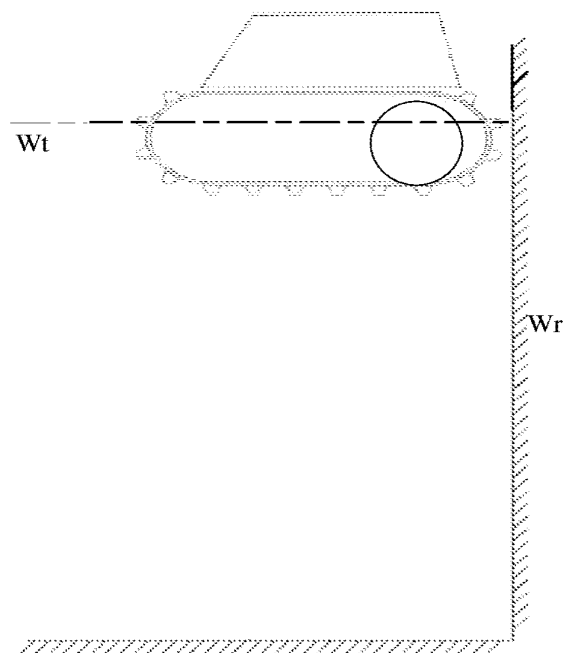


图 8E

权利要求书

1. 一种可控沉浮的泳池机器人，其特征在于，包括：
沉浮控制单元，用于控制所述泳池机器人的漂浮和下沉；
5 水线检测单元，用于检测所述泳池机器人与所处泳池液面的水线的位置关系；
主控制单元，用于控制所述沉浮控制单元的工作状态，
其中，所述主控制单元能够基于所述泳池机器人的作业需求信息，控制所述泳池机器人寻找侧壁或斜坡，并使所述泳池机器人沿着所述侧壁或斜坡
10 爬行；
控制所述水线检测单元执行与所处泳池液面的水线的位置关系的检测；
基于所述检测的结果，控制所述沉浮控制单元进入上浮工作状态以实现所述泳池机器人的漂浮。
- 15 2. 如权利要求 1 所述的可控沉浮的泳池机器人，其特征在于，还包括姿态检测单元，用于检测所述泳池机器人的姿态，
其中，所述主控制单元在所述姿态满足第一预定条件时，控制所述水线检测单元开始执行所述位置关系的检测。
- 20 3. 如权利要求 1 或 2 所述的可控沉浮的泳池机器人，其特征在于，所述作业需求信息包括用户发送的遥控指令信息、时钟信息、作业任务进度信息、故障信息、电量信息或者泳池池底环境信息。
- 25 4. 如权利要求 1 到 3 任一项所述的可控沉浮的泳池机器人，其特征在于，还包括测距单元或者地图存储单元，所述主控制单元基于所述测距单元的测距结果或者所述地图存储单元中的地图数据控制所述泳池机器人寻找最近的侧壁或斜坡。
- 30 5. 如权利要求 1 到 4 的任一项所述的可控沉浮的泳池机器人，其特征在于，所述水线检测单元包括出水检测子单元，用于检测所述泳池机器人的至

少一部分是否已出水。

5 6.如权利要求 1 到 5 的任一项所述的可控沉浮的泳池机器人，其特征在于，所述水线检测单元还包括接近水线检测子单元，用于检测所述泳池机器人是否已爬行至距水线的距离小于等于预定距离。

10 7. 如权利要求 1 到 6 的任一项所述的可控沉浮的泳池机器人，其特征在于，所述沉浮控制单元包括充放气子单元和开关子单元，当所述出水检测子单元检测到所述泳池机器人的至少一部分已出水时，控制所述充放气子单元开启吸气并控制所述开关子单元打开，从而使所述沉浮控制单元进入上浮工作状态。

15 8. 如权利要求 1 到 6 的任一项所述的可控沉浮的泳池机器人，其特征在于，所述沉浮控制单元包括充放气子单元和开关子单元，当所述接近水线检测子单元检测到所述泳池机器人已爬行至距水线的距离小于等于预定距离，控制所述充放气子单元开启吸气，当所述出水检测子单元检测到所述泳池机器人至少一部分已出水，控制所述开关子单元打开，从而使所述沉浮控制单元进入上浮工作状态。

20 9. 如权利要求 7 或 8 所述的可控沉浮的泳池机器人，其特征在于，所述沉浮控制单元还包括气囊子单元，所述气囊子单元与所述充放气子单元导通连接，所述气囊子单元通过所述充放气子单元和所述开关子单元与外界大气导通或者断开连接。

25 10. 如权利要求 9 所述的可控沉浮的泳池机器人，其特征在于，所述沉浮控制单元还包括进出气口子单元，所述开关子单元通过所述进出气口子单元与外界大气导通。

30 11. 如权利要求 1 到 9 的任一项所述的可控沉浮的泳池机器人，其特征在于，所述主控制单元还能够基于所述泳池机器人的所述作业需求信息，控

制所述沉浮控制单元进入下沉工作状态以实现所述泳池机器人的下沉。

12. 如权利要求 11 所述的可控沉浮的泳池机器人，其特征在于，所述控制所述沉浮控制单元进入下沉工作状态包括控制开关子单元打开，并控制所述充放气子单元将所述气囊子单元中的气体排出。

13. 如权利要求 7 到 12 的任一项所述的可控沉浮的泳池机器人，其特征在于，所述充放气子单元包括气泵组件，所述开关子单元包括电磁阀组件或两位三通阀组件。

14. 如权利要求 7 到 13 的任一项所述的可控沉浮的泳池机器人，其特征在于，响应于所述出水检测子单元检测到所述泳池机器人的至少一部分再次进入水下和/或所述姿态检测单元检测到所述泳池机器人的姿态满足第二预定条件，控制所述充放气子单元和所述开关子单元关闭。

15. 如权利要求 7 到 14 的任一项所述的可控沉浮的泳池机器人，其特征在于，在所述沉浮控制单元进入上浮工作状态后经过预定时间，控制所述充放气子单元和所述开关子单元关闭。

16. 如权利要求 7 到 15 的任一项所述的可控沉浮的泳池机器人，其特征在于，还包括：抽水泵单元，用于抽取所述泳池机器人所处泳池的液体，并且排出所述液体以推动所述泳池机器人，

其中，在所述沉浮控制单元进入所述上浮工作状态后或者所述泳池机器人爬上所述侧壁或斜坡后，所述抽水泵单元的功率被改变。

17. 一种用于泳池机器人的沉浮控制方法，其特征在于，包括：
基于泳池机器人的作业需求信息，控制所述泳池机器人寻找侧壁或斜坡，并使所述泳池机器人沿着所述侧壁或斜坡爬行；
执行所述泳池机器人与所处泳池液面的水线的位置关系的检测；以及
基于所述检测的结果，控制沉浮控制单元进入上浮工作状态以实现所述

泳池机器人的漂浮。

18. 如权利要求 17 所述的用于泳池机器人的沉浮控制方法，其特征在于，所述执行所述泳池机器人与所处泳池液面的水线的位置关系的检测包括：

5 在所述泳池机器人的姿态满足第一预定条件时，开始执行所述位置关系的检测。

19. 如权利要求 17 或 18 所述的用于泳池机器人的沉浮控制方法，其特征在于，所述作业需求信息包括用户发送的遥控指令信息、时钟信息、作业任务进度信息、故障信息、电量信息或者泳池池底环境信息。

20. 如权利要求 18 或 19 所述的用于泳池机器人的沉浮控制方法，其特征在于，所述基于所述检测的结果，控制沉浮控制单元进入上浮工作状态以实现所述泳池机器人的漂浮，包括：

15 当检测到所述泳池机器人的至少一部分已出水时，控制所述沉浮控制单元进入上浮工作状态。

21. 如权利要求 18 到 20 的任一项所述的用于泳池机器人的沉浮控制方法，其特征在于，所述方法还包括：

20 响应于检测到所述泳池机器人的至少一部分再次进入水下和/或检测到所述泳池机器人的姿态满足第二预定条件，控制所述沉浮控制单元停止工作。

说明书

可控沉浮的泳池机器人和用于泳池机器人的沉浮控制方法

5 技术领域

本公开涉及水下机器人领域，尤其是涉及一种可控沉浮的泳池机器人和用于泳池机器人的沉浮控制方法。

背景技术

10 随着人工智能技术的发展，泳池机器人逐渐成为家庭和商业泳池清洁领域的主要解决方案之一。相较于传统的人工清洁方式，泳池机器人可以自主清洁泳池底部和壁面，清洁速度更快、效果更好，同时也更加经济。

泳池机器人需要根据指令或者作业状态在水下上浮或下沉，以及浮出水面，从而对泳池底部、四壁以及水线处执行清洁并且能够方便地被用户
15 从泳池中取出。现有的泳池机器人的沉浮控制方案通过吸水和排水改变自身质量来实现上浮或下沉，整个沉浮过程费时长，导致泳池机器人的工作效率降低。

发明内容

20 鉴于上述问题而提出了本公开。本公开提供了一种可控沉浮的泳池机器人和用于泳池机器人的沉浮控制方法。

根据本公开的一个方面，提供了一种可控沉浮的泳池机器人，包括：沉浮控制单元，用于控制泳池机器人的漂浮和下沉；水线检测单元，用于检测泳池机器人与所处泳池液面的水线的位置关系；主控制单元，用于控制
25 沉浮控制单元的工作状态，主控制单元能够基于泳池机器人的作业需求信息，控制泳池机器人寻找侧壁或斜坡，并使泳池机器人沿着侧壁或斜坡爬行；控制水线检测单元执行与所处泳池液面的水线的位置关系的检测；基于检测的结果，控制沉浮控制单元进入上浮工作状态以实现泳池机器人的漂浮。

30 此外，根据本公开的一个方面的可控沉浮的泳池机器人，还包括姿态

检测单元，用于检测泳池机器人的姿态，主控制单元在姿态满足第一预定条件时，控制水线检测单元开始执行位置关系的检测。

此外，根据本公开的一个方面的可控沉浮的泳池机器人，作业需求信息包括用户发送的遥控指令信息、时钟信息、作业任务进度信息、故障信息、电量信息或者泳池池底环境信息。

此外，根据本公开的一个方面的可控沉浮的泳池机器人，还包括测距单元或者地图存储单元，主控制单元基于测距单元的测距结果或者地图存储单元中的地图数据控制泳池机器人寻找最近的侧壁或斜坡。

此外，根据本公开的一个方面的可控沉浮的泳池机器人，水线检测单元包括出水检测子单元，用于检测泳池机器人的至少一部分是否已出水。

此外，根据本公开的一个方面的可控沉浮的泳池机器人，水线检测单元还包括接近水线检测子单元，用于检测泳池机器人是否已爬行至距水线的距离小于等于预定距离。

此外，根据本公开的一个方面的可控沉浮的泳池机器人，沉浮控制单元包括充放气子单元和开关子单元，当出水检测子单元检测到泳池机器人的至少一部分已出水时，控制充放气子单元开启吸气并控制开关子单元打开，从而使沉浮控制单元进入上浮工作状态。

此外，根据本公开的一个方面的可控沉浮的泳池机器人，沉浮控制单元包括充放气子单元和开关子单元，当接近水线检测子单元检测到泳池机器人已爬行至距水线的距离小于等于预定距离，控制充放气子单元开启吸气，当出水检测子单元检测到泳池机器人至少一部分已出水，控制开关子单元打开，从而使沉浮控制单元进入上浮工作状态。

此外，根据本公开的一个方面的可控沉浮的泳池机器人，沉浮控制单元还包括气囊子单元，气囊子单元与充放气子单元导通连接，气囊子单元通过充放气子单元和开关子单元与外界大气导通或者断开连接。

此外，根据本公开的一个方面的可控沉浮的泳池机器人，沉浮控制单元还包括进出气口子单元，开关子单元通过进出气口子单元与外界大气导通。

此外，根据本公开的一个方面的可控沉浮的泳池机器人，主控制单元还能够基于泳池机器人的作业需求信息，控制沉浮控制单元进入下沉工作

状态以实现泳池机器人的下沉。

此外，根据本公开的一个方面的可控沉浮的泳池机器人，控制沉浮控制单元进入下沉工作状态包括控制开关子单元打开，并控制充放气子单元将气囊子单元中的气体排出。

- 5 此外，根据本公开的一个方面的可控沉浮的泳池机器人，充放气子单元包括气泵组件，开关子单元包括电磁阀组件或两位三通阀组件。

- 此外，根据本公开的一个方面的可控沉浮的泳池机器人，响应于出水检测子单元检测到泳池机器人的至少一部分再次进入水下和/或姿态检测单元检测到泳池机器人的姿态满足第二预定条件，控制充放气子单元和开关子单元关闭。
- 10 子单元关闭。

 此外，根据本公开的一个方面的可控沉浮的泳池机器人，在沉浮控制单元进入上浮工作状态后经过预定时间，控制充放气子单元和开关子单元关闭。

- 此外，根据本公开的一个方面的可控沉浮的泳池机器人，还包括：抽水泵单元，用于抽取泳池机器人所处泳池的液体，并且排出液体以推动泳池机器人，其中，在沉浮控制单元进入上浮工作状态后或者所述泳池机器人爬上所述侧壁或斜坡后，抽水泵单元的功率被改变。
- 15 水泵单元，用于抽取泳池机器人所处泳池的液体，并且排出液体以推动泳池机器人，其中，在沉浮控制单元进入上浮工作状态后或者所述泳池机器人爬上所述侧壁或斜坡后，抽水泵单元的功率被改变。

- 根据本公开的另一个方面，提供了一种用于泳池机器人的沉浮控制方法，包括：基于泳池机器人的作业需求信息，控制泳池机器人寻找侧壁或斜坡，并使泳池机器人沿着侧壁或斜坡爬行；执行泳池机器人与所处泳池液面的水线的位置关系的检测；以及基于检测的结果，控制沉浮控制单元进入上浮工作状态以实现泳池机器人的漂浮。
- 20 斜坡，并使泳池机器人沿着侧壁或斜坡爬行；执行泳池机器人与所处泳池液面的水线的位置关系的检测；以及基于检测的结果，控制沉浮控制单元进入上浮工作状态以实现泳池机器人的漂浮。

- 此外，根据本公开的另一个方面的用于泳池机器人的沉浮控制方法，执行泳池机器人与所处泳池液面的水线的位置关系的检测包括：在泳池机器人的姿态满足第一预定条件时，开始执行位置关系的检测。
- 25 机器人的姿态满足第一预定条件时，开始执行位置关系的检测。

 此外，根据本公开的另一个方面的用于泳池机器人的沉浮控制方法，作业需求信息包括用户发送的遥控指令信息、时钟信息、作业任务进度信息、故障信息、电量信息或者泳池池底环境信息。

- 此外，根据本公开的另一个方面的用于泳池机器人的沉浮控制方法，基于检测的结果，控制沉浮控制单元进入上浮工作状态以实现泳池机器人
- 30 基于检测的结果，控制沉浮控制单元进入上浮工作状态以实现泳池机器人

的漂浮，包括：当检测到泳池机器人的至少一部分已出水时，控制沉浮控制单元进入上浮工作状态。

此外，根据本公开的另一个方面的用于泳池机器人的沉浮控制方法，还包括：响应于检测到泳池机器人的至少一部分再次进入水下和/或检测到泳池机器人的姿态满足第二预定条件，控制沉浮控制单元停止工作。

如以下将详细描述，根据本公开实施例的可控沉浮的泳池机器人和用于泳池机器人的沉浮控制方法，采用水位线上方的气体对气囊充放气的方式实现了泳池机器人的沉浮控制，相对于吸水和排水改变自身质量来实现上浮或下沉的方案具有更快的沉浮速度，并且简化了内部组件配置；在沉浮控制方法中，通过基于泳池机器人的作业需求，监测泳池机器人的工作状态和姿态，开启与所处泳池液面的水线的位置关系检测，并且进一步根据位置关系检测的结果，分阶段地开启沉浮控制单元的各个组件，从而实现了更为精确地漂浮和下沉控制，并且确保泳池机器人整个作业过程中的正确姿态。

附图说明

通过结合附图对本公开实施例进行更详细的描述，本公开的上述以及其它目的、特征和优势将变得更加明显。附图用来提供对本公开实施例的进一步理解，并且构成说明书的一部分，与本公开实施例一起用于解释本公开，并不构成对本公开的限制。在附图中，相同的参考标号通常代表相同部件或步骤。

图 1 是图示根据本公开实施例的泳池机器人的部件框图。

图 2A 和图 2B 是图示根据本公开实施例的泳池机器人的示意图。

图 3 是图示根据本公开实施例的泳池机器人的沉浮控制单元的示意图。

图 4 是进一步图示根据本公开实施例的泳池机器人的沉浮控制单元的一个示例的示意图。

图 5 是进一步图示根据本公开实施例的泳池机器人的沉浮控制单元的另一个示例的示意图。

图 6 是图示根据本公开实施例的用于泳池机器人的沉浮控制方法的流程图。

图 7 是图示根据本公开实施例的用于泳池机器人的沉浮控制方法的示意图。

图 8A 到图 8E 是进一步图示根据本公开实施例的用于泳池机器人的沉浮控制方法的示意图。

5

具体实施方式

为了使得本公开的目的、技术方案和优点更为明显，下面将参照附图详细描述根据本公开的示例实施例。显然，所描述的实施例仅仅是本公开的一部分实施例，而不是本公开的全部实施例，应理解，本公开不受这里描述的示例实施例的限制。

首先，参照图 1、图 2A 和图 2B 描述根据本公开实施例的泳池机器人。图 1 是图示根据本公开实施例的泳池机器人的部件框图。图 2A 是图示根据本公开实施例的泳池机器人的整体示意图。图 2B 是图示根据本公开实施例的泳池机器人的剖面部分部件示意图。

如图 1、图 2A 和图 2B 所示，根据本公开实施例的泳池机器人 1 至少包括主控制单元 10、沉浮控制单元 20、水线检测单元 30、姿态检测单元 40、测距单元 50、地图存储单元 60 和抽水泵单元 70。需要理解的是，图 1、图 2A 和图 2B 中仅仅示出与根据本公开实施例的沉浮控制方法相关的部件，根据本公开实施例的泳池机器人 1 不限于此，而是还可以包括诸如驱动单元、清洁单元、通信单元等。此外，需要理解的是，图 2B 中各个部件的位置和数量也仅仅是示例性的，根据本公开实施例的泳池机器人 1 不限于此。

主控制单元 10 用于控制根据本公开实施例的泳池机器人 1 的各个部件。例如，在如下将详细描述的根据本公开实施例的用于泳池机器人的沉浮控制方法中，主控制单元 10 基于泳池机器人 1 的作业需求，根据水线检测单元 30、姿态检测单元 40、测距单元 50 等的检测结果，控制沉浮控制单元 20 以控制所述泳池机器人 1 的漂浮和下沉。具体地，主控制单元 10 能够基于泳池机器人 1 的作业需求信息，控制泳池机器人 1 寻找侧壁或斜坡，并使泳池机器人 1 沿着侧壁或斜坡爬行；进一步地，控制水线检测单元 30 执行与所处泳池液面的水线的位置关系的检测；基于检测的结果，控制沉浮控制单元 20 进入上浮工作状态以实现泳池机器人 1 的漂浮。相应地，主控

制单元 10 还能够基于泳池机器人 1 的作业需求信息 ,控制沉浮控制单元 20 进入下沉工作状态以实现泳池机器人 1 的下沉。

更具体地 , 作业需求信息包括用户发送的遥控指令信息、时钟信息、作业任务进度信息、故障信息、电量信息或者泳池池底环境信息。也就是说 , 遥控指令信息、时钟信息、作业任务进度信息、故障信息、电量信息或者泳池池底环境信息指示泳池机器人 1 切换到漂浮状态以清理水线区域、出水充电或维护 , 或者指示泳池机器人 1 切换到下沉工作状态以清理池底和/或侧壁区域。

沉浮控制单元 20 用于控制泳池机器人 1 的漂浮和下沉。如图 2B 所示 , 沉浮控制单元 20 包括气囊子单元 201、充放气子单元 202、开关子单元 203 和进出气口子单元 204。气囊子单元 201 与充放气子单元 202 导通连接 , 从而气囊子单元 201 通过充放气子单元 202、开关子单元 203 和进出气口子单元 204 与外界大气导通。在上浮工作状态下 , 充放气子单元 202 开启从外界吸气并开关子单元 203 打开 , 所处水位线上方的气体经由进出气口子单元 204、开关子单元 203、充放气子单元 202 进入气囊子单元 201 , 使得气囊子单元 201 体积变大 , 增加泳池机器人 1 的浮力从而上浮。在漂浮状态下 , 充放气子单元 202 和开关子单元 203 关闭 , 气囊子单元 201 与外界大气断开连接 , 泳池机器人 1 保持漂浮。在下沉工作状态下 , 充放气子单元 202 开启从气囊子单元 201 抽气 , 并开关子单元 203 打开 , 气囊子单元 201 中的气体经由充放气子单元 202、开关子单元 203、进出气口子单元 204 排出 , 使得气囊子单元 201 体积变小 , 减小泳池机器人 1 的浮力从而下沉。

进一步参照图 3 描述根据本公开实施例的泳池机器人的沉浮控制单元。图 3 是图示根据本公开实施例的泳池机器人的沉浮控制单元的示意图。

如图 3 所示 , 根据本公开实施例的泳池机器人的沉浮控制单元 20 包括串联连接的两个气囊子单元 201 , 两个气囊子单元 201 分别配置在泳池机器人 1 前部和后部 , 从而便于泳池机器人 1 的平衡以及气囊子单元 201 的充气。气囊子单元 201、充放气子单元 202、开关子单元 203 和进出气口子单元 204 通过气管相互连接。

进一步参照图 4 和图 5 描述根据本公开实施例的泳池机器人的沉浮控制单元。图 4 是进一步图示根据本公开实施例的泳池机器人的沉浮控制单

元的一个示例的示意图。图 5 是进一步图示根据本公开实施例的泳池机器人的沉浮控制单元的另一个示例的示意图。

如图 4 所示,充放气子单元 202 包括第一气泵组件 2021 和第二气泵组件 2022 ,开关子单元 203 包括第一电磁阀组件 2023 和第二电磁阀组件 2024。

5 第一电磁阀组件 2023 的入口 2033 与进出气口子单元 204 连接,第一电磁阀组件 2023 的出口 2043 与第一气泵组件 2021 进气端口 2031 连接,第一气泵组件 2021 出气端口 2041 与气囊子单元 201 连接,并且第二电磁阀组件 2024 的入口 2034 与第二气泵组件 2022 的出气端口 2042 连接,第二电磁阀组件 2024 的出口 2044 与进出气口子单元 204 连接,第二气泵组件 2022
10 进气端口 2032 与气囊子单元 201 连接。

在上浮工作状态下,第一气泵组件 2021 和第二气泵组件 2022 处于通电工作状态,第一电磁阀组件 2023 和第二电磁阀组件 2024 处于断电关闭状态,泳池机器人 1 所处水位线上方的气体经由进出气口子单元 204 和第一电磁阀组件 2023 进入第一气泵组件 2021,并且通过第一气泵组件 2021
15 充入气囊子单元 201。

在下沉工作状态下,第一气泵组件 2021 和第二气泵组件 2022 处于断电关闭状态,第一电磁阀组件 2023 和第二电磁阀组件 2024 处于通电工作状态,气囊子单元 201 中的气体进入第二气泵组件 2022,并且通过第二气泵组件 2022 经由第二电磁阀组件 2024 和进出气口子单元 204 排出。

20 如图 5 所示,充放气子单元 202 包括第三气泵组件 2025,开关子单元 203 包括第一两位三通阀组件 2026 和第二两位三通阀组件 2027。第一两位三通阀组件 2026 的第一端口 2036 与进出气口子单元 204 连接,第一两位三通阀组件 2026 的第二端口 2046 与气囊子单元 201 连接,并且第一两位三通阀组件 2026 的第三端口 2056 与第三气泵组件 2025 的进气端口 2035
25 连接,第二两位三通阀组件 2027 的第一端口 2037 与进出气口子单元 204 连接,第二两位三通阀组件 2027 的第二端口 2047 与气囊子单元 201 连接,并且第二两位三通阀组件 2027 的第三端口 2057 与第三气泵组件 2025 的出气端口 2045 连接。

在上浮工作状态下,第一两位三通阀组件 2026 和第三气泵组件 2025
30 处于通电工作状态,第二两位三通阀组件 2027 处于断电关闭状态,泳池机

器人 1 所处水位线上方的气体经由进出气口子单元 204 和第一两位三通阀组件 2026 进入第三气泵组件 2025，并且通过第三气泵组件 2025 充入气囊子单元 201。

5 在下沉工作状态下，第一两位三通阀组件 2026 处于断电关闭状态，第二两位三通阀组件 2027 和第三气泵组件 2025 处于通电工作状态，气囊子单元 201 中的气体进入第三气泵组件 2025，并且通过第三气泵组件 2025 经由第一两位三通阀组件 2026 和进出气口子单元 204 排出。

 返回参照图 1，进一步描述主控制单元 10 基于水线检测单元 30、姿态检测单元 40、测距单元 50 的检测结果控制沉浮控制单元 20。

10 水线检测单元 30 用于检测泳池机器人 1 与所处泳池液面的水线的位置关系。具体地，水线检测单元 30 包括出水检测子单元 301 和接近水线检测子单元 302。出水检测子单元 301 用于检测泳池机器人 1 的至少一部分是否已出水。在本公开的一个实施例中，出水检测子单元 301 例如由电容片传感器或超声波测距设备配置。接近水线检测子单元 302 用于检测泳池机器人 1 是否已爬行至距水线的距离小于等于预定距离（例如，预定距离为 10-20 厘米）。在本公开的一个实施例中，接近水线检测子单元 302 例如超声波测距设备配置。

 在本公开的一个实施例中，当出水检测子单元 301 检测到泳池机器人 1 的至少一部分已出水时，控制充放气子单元 202 开启吸气并控制开关子单元 203 打开，从而使沉浮控制单元 20 进入上浮工作状态。

20 可替代地，在本公开的一个实施例中，当接近水线检测子单元 302 检测到泳池机器人 1 已爬行至距水线的距离小于等于预定距离，控制充放气子单元 202 开启吸气，当出水检测子单元 301 检测到泳池机器人 1 至少一部分已出水，控制开关子单元 203 打开，从而使沉浮控制单元 20 进入上浮工作状态。在此情况下，基于出水检测子单元 301 和接近水线检测子单元 302 的检测，分段控制充放气子单元 202 和开关子单元 203 的开启，提前将气管中的气体充入气囊子单元 201，进一步提升了沉浮控制单元 20 的工作效率。

25 进一步地，响应于出水检测子单元 301 检测到泳池机器人 1 的至少一部分再次进入水下，控制充放气子单元 202 和开关子单元 203 关闭。在此

状态下，泳池机器人 1 保持漂浮。可替代地，在本公开的一个实施例中，响应于沉浮控制单元 20 进入上浮工作状态后的预定时间（例如，40 秒），出水检测子单元 301 未检测到泳池机器人 1 的至少一部分再次进入水下，控制充放气子单元 202 和开关子单元 203 关闭。在本公开的另一个实施例中，在沉浮控制单元 20 进入上浮工作状态后，出水检测子单元 301 即停止工作，在预定时间（例如，40 秒）后，控制充放气子单元 202 和开关子单元 203 关闭。

在此情况下，避免长时间充放气子单元 202 和开关子单元 203 对气囊子单元 201 进行充气，保护气囊子单元 201 不被破坏。

姿态检测单元 40 用于检测泳池机器人 1 的姿态。在本公开的一个实施例中，姿态检测单元 40 例如由惯性传感器（IMU）配置。主控制单元 10 在姿态检测单元 40 的姿态检测结果满足第一预定条件（例如，从与泳池底面平行的状态变换为与泳池侧壁平行的状态）时，控制水线检测单元开始执行位置关系的检测。在本公开的一个实施例中，在上浮工作状态下，响应于姿态检测单元 40 检测到泳池机器人 1 的姿态满足第二预定条件（例如，从与泳池侧壁平行的状态变换为与泳池底面平行的状态），控制充放气子单元 202 和开关子单元 203 关闭。进一步地，在沉浮控制单元 20 进入上浮工作状态后经过预定时间，控制充放气子单元 202 和开关子单元 203 关闭。可替代地，响应于沉浮控制单元 20 进入上浮工作状态后的预定时间，姿态检测单元 40 未检测到泳池机器人 1 的姿态满足第二预定条件，控制充放气子单元 202 和开关子单元 203 关闭。

测距单元 50 响应于主控制单元 10 基于泳池机器人 1 的作业需求信息，执行测距以控制泳池机器人 1 寻找最近的侧壁或斜坡。例如，泳池机器人 1 原地旋转一周，以检测泳池机器人 1 与其所处泳池的各个侧壁的距离，从而确定最近的侧壁或斜坡。此后，主控制单元 10 控制泳池机器人 1 移动到最近的侧壁或斜坡，并且进一步使泳池机器人 1 沿着侧壁或斜坡爬行，向所处泳池的液面移动。

地图存储单元 60 用于存储所处泳池的地图数据。主控制单元 10 基于地图存储单元中的地图数据控制泳池机器人寻找最近的侧壁或斜坡。主控制单元 10 控制泳池机器人 1 移动到最近的侧壁或斜坡，并且进一步使泳池

机器人沿着侧壁或斜坡爬行，向所处泳池的液面移动。

抽水泵单元 70 用于抽取泳池机器人 1 所处泳池的液体，并且排出液体以推动泳池机器人 1。在泳池机器人 1 执行清洁作业的情况下，抽取的液体在泳池机器人 1 内部过滤后被排出。在如上所述的本公开的实施例中，响应于沉浮控制单元 20 进入上浮工作状态后或者泳池机器人爬上侧壁或斜坡后，抽水泵单元 70 的功率被改变。也就是说，在泳池机器人 1 的至少一部分已出水时，降低抽水泵单元 70 的运行功率，从而降低泳池机器人 1 与侧壁或斜坡的吸附力，便于随着充放气子单元 202 和开关子单元 203 对气囊子单元 201 进行充气，泳池机器人 1 逐渐进入漂浮状态。此外，在泳池机器人 1 沿着侧壁或斜坡爬行到泳池机器人 1 的至少一部分出水的过程中，抽水泵单元 70 联合泳池机器人 1 的驱动轮共同推动泳池机器人 1 向所处泳池的液面移动。进一步地，在泳池机器人 1 处于漂浮状态之后，可以基于泳池机器人 1 的作业需求信息，控制抽水泵单元 70 以适当的功率运行，以执行诸如水线区域清洁作业。

以上，参照图 1 到图 5 描述了根据本公开实施例的泳池机器人。根据本公开实施例的泳池机器人采用水位线上方的气体对气囊充放气的方式实现了泳池机器人的沉浮控制，相对于吸水和排水改变自身质量来实现上浮或下沉的方案具有更快的沉浮速度，并且简化了内部组件配置。通过基于泳池机器人的作业需求，监测泳池机器人的工作状态和姿态，开启与所处泳池液面的水线的位置关系检测，并且进一步根据位置关系检测的结果，分阶段地开启沉浮控制单元的各个组件，从而实现了更为精确地漂浮和下沉控制，并且确保泳池机器人整个作业过程中的正确姿态。

以下，将进一步参照图 6 到图 8E 描述根据本公开实施例的用于泳池机器人的沉浮控制方法。图 6 是图示根据本公开实施例的用于泳池机器人的沉浮控制方法的流程图。图 7 是图示根据本公开实施例的用于泳池机器人的沉浮控制方法的示意图。图 8A 到图 8E 是进一步图示根据本公开实施例的用于泳池机器人的沉浮控制方法的示意图。

如图 6 所示，根据本公开实施例的用于泳池机器人的沉浮控制方法包括如下步骤。

在步骤 S601 中，基于泳池机器人的作业需求信息，控制泳池机器人寻

找墙面或斜坡，并使泳池机器人沿着墙面或斜坡爬行。

在本公开的一个实施例中，作业需求信息包括用户发送的遥控指令信息、时钟信息、作业任务进度信息、故障信息、电量信息或者泳池池底环境信息。也就是说，遥控指令信息、时钟信息、作业任务进度信息、故障信息、电量信息或者泳池池底环境信息指示泳池机器人 1 切换到漂浮状态以清理水线区域、出水充电或维护，或者指示泳池机器人 1 切换到下沉工作状态以清理池底和/或侧壁区域。

在本公开的一个实施例中，测距单元 50 响应于主控制单元 10 基于泳池机器人 1 的作业需求信息，执行测距以控制泳池机器人 1 寻找最近的侧壁或斜坡。具体地，参照图 7，泳池机器人 1 原地旋转一周，以检测泳池机器人 1 与其所处泳池的各个侧壁的距离 L_1 、 L_2 、 L_3 和 L_4 ，从而确定最近的侧壁 W_r ，泳池机器人 1 距离该侧壁 W_r 的距离为 L_4 ，并且 L_4 小于 L_1 、 L_2 、 L_3 的任一。此后，主控制单元 10 控制泳池机器人 1 移动到最近的侧壁 W_r ，并且进一步使泳池机器人 1 沿着侧壁 W_r 爬行，向所处泳池的液面移动。

可替代地，地图存储单元 60 存储所处泳池的地图数据。主控制单元 10 基于地图存储单元 60 中的地图数据控制泳池机器人 1 寻找最近的侧壁 W_r 。主控制单元 10 控制泳池机器人 1 移动到最近的侧壁 W_r ，并且进一步使泳池机器人 1 沿着侧壁 W_r 爬行，向所处泳池的液面移动。

在本公开的一个实施例中，当泳池机器人 1 在池底执行清洁作业时，抽水泵单元 70 抽取泳池机器人 1 所处泳池的液体，抽取的液体在泳池机器人 1 内部过滤后被排出，并且排出液体推动泳池机器人 1。在泳池机器人 1 沿着侧壁 W_r 爬行时，抽水泵单元 70 联合泳池机器人 1 的驱动轮共同推动泳池机器人 1 向所处泳池的液面 W_t 移动。

在步骤 S602 中，执行泳池机器人与所处泳池液面的水线的位置关系的检测。

在本公开的一个实施例中，利用由惯性传感器（IMU）配置的姿态检测单元 40 检测泳池机器人 1 的姿态。主控制单元 10 在姿态检测单元 40 的姿态检测结果满足第一预定条件（例如，从与泳池底面平行的状态变换为与泳池侧壁平行的状态）时，控制水线检测单元 30 开始执行位置关系的检

测。也就是说，如图 8A 所示，当泳池机器人 1 沿着侧壁 W_r 爬行，以向所处泳池的液面移动时，执行泳池机器人 1 与所处泳池液面的水线 W_t 的位置关系的检测。

如上所述，利用水线检测单元 30 检测泳池机器人 1 与所处泳池液面的水线 W_t 的位置关系。具体地，水线检测单元 30 包括出水检测子单元 301 和接近水线检测子单元 302。出水检测子单元 301 用于检测泳池机器人 1 的至少一部分是否已出水。在本公开的一个实施例中，出水检测子单元 301 例如由电容片传感器或超声波测距设备配置。接近水线检测子单元 302 用于检测泳池机器人 1 是否已爬行至距水线的距离小于等于预定距离（例如，预定距离为 10-20 厘米）。在本公开的一个实施例中，接近水线检测子单元 302 例如超声波测距设备配置。

在步骤 S603 中，基于检测的结果，控制沉浮控制单元进入上浮工作状态以实现泳池机器人的漂浮。

在本公开的一个实施例中，当出水检测子单元 301 检测到泳池机器人 1 的至少一部分已出水时（例如，如图 8C 所示的状态），控制充放气子单元 202 开启吸气并控制开关子单元 203 打开，从而使沉浮控制单元 20 进入上浮工作状态。

可替代地，在本公开的一个实施例中，当接近水线检测子单元 302 检测到泳池机器人 1 已爬行至距水线的距离小于等于预定距离（例如，如图 8B 所示的状态，泳池机器人 1 已爬行至距水线的距离小于等于预定距离 H ），控制充放气子单元 202 开启吸气，当出水检测子单元 301 检测到泳池机器人 1 至少一部分已出水（例如，如图 8C 所示的状态），控制开关子单元 203 打开，从而使沉浮控制单元 20 进入上浮工作状态。在此情况下，基于出水检测子单元 301 和接近水线检测子单元 302 的检测，分段控制充放气子单元 202 和开关子单元 203 的开启，提前将气管中的气体充入气囊子单元 201，进一步提升了沉浮控制单元 20 的工作效率。

在本公开的一个实施例中，响应于沉浮控制单元 20 进入上浮工作状态，抽水泵单元 70 的功率被改变。也就是说，在泳池机器人 1 的至少一部分已出水时，降低抽水泵单元 70 的运行功率，从而降低泳池机器人 1 与侧壁或斜坡的吸附力，便于随着充放气子单元 202 和开关子单元 203 对气囊子单

元 201 进行充气，泳池机器人 1 逐渐进入漂浮状态。例如，如图 8D 所示，随着沉浮控制单元 20 进入上浮工作状态，泳池机器人 1 没有出水的一端逐渐上浮。

5 在步骤 S604 中，响应于检测到泳池机器人的至少一部分再次进入水下和/或检测到泳池机器人的姿态满足第二预定条件，控制沉浮控制单元停止工作。

在本公开的一个实施例中，在上浮工作状态下，响应于出水检测子单元 301 检测到泳池机器人 1 的至少一部分再次进入水下，控制充放气子单元 202 和开关子单元 203 关闭。可替代地，响应于姿态检测单元 40 检测到
10 泳池机器人 1 的姿态满足第二预定条件（例如，从与泳池侧壁平行的状态变换为与泳池底面平行的状态），控制充放气子单元 202 和开关子单元 203 关闭。例如，如图 8E 所示，当泳池机器人 1 逐渐上浮到与泳池底面平行的状态，即泳池机器人 1 进入漂浮状态时，控制沉浮控制单元停止工作。

此外，响应于沉浮控制单元 20 进入上浮工作状态后，关闭出水检测子
15 单元 301 和姿态检测单元 40，并且在预定时间（例如，40 秒）之后，控制充放气子单元 202 和开关子单元 203 关闭。可替代地，响应于沉浮控制单元 20 进入上浮工作状态后的预定时间（例如，40 秒），出水检测子单元 301 未检测到泳池机器人 1 的至少一部分再次进入水下，控制充放气子单元 202 和开关子单元 203 关闭。可替代地，响应于沉浮控制单元 20 进入上浮工作
20 状态后的预定时间，姿态检测单元 40 未检测到泳池机器人 1 的姿态满足第二预定条件，控制充放气子单元 202 和开关子单元 203 关闭。在此情况下，避免长时间充放气子单元 202 和开关子单元 203 对气囊子单元 201 进行充气，保护气囊子单元 201 不被破坏。

进一步地，在泳池机器人 1 处于漂浮状态之后，可以基于泳池机器人
25 1 的作业需求信息，控制抽水泵单元 70 以适当的功率运行，以执行诸如水线区域清洁作业。

以上，参照附图描述了根据本公开实施例的可控沉浮的泳池机器人和用于泳池机器人的沉浮控制方法，采用水位线上方的气体对气囊充放气的方式实现了泳池机器人的沉浮控制，相对于吸水和排水改变自身质量来实
30 现上浮或下沉的方案具有更快的沉浮速度，并且简化了内部组件配置；在

沉浮控制方法中，通过基于泳池机器人的作业需求，检测泳池机器人的工作状态和姿态，开启与所处泳池液面的水线的位置关系检测，并且进一步根据位置关系检测的结果，分阶段地开启沉浮控制单元的各个组件，从而实现了更为精确地漂浮和下沉控制，避免了不必要的能耗，进一步提升了

5 沉浮控制效率，并且确保泳池机器人整个作业过程中的正确姿态。

以上结合具体实施例描述了本公开的基本原理，但是，需要指出的是，在本公开中提及的优点、优势、效果等仅是示例而非限制，不能认为这些优点、优势、效果等是本公开的各个实施例必须具备的。另外，上述公开的具体细节仅是为了示例的作用和便于理解的作用，而非限制，上述细节

10 并不限制本公开为必须采用上述具体的细节来实现。

本公开中涉及的器件、装置、设备、系统的方框图仅作为例示性的例子并且不意图要求或暗示必须按照方框图示出的方式进行连接、布置、配置。如本领域技术人员将认识到的，可以按任意方式连接、布置、配置这些器件、装置、设备、系统。诸如“包括”、“包含”、“具有”等等的词语是开

15 放性词汇，指“包括但不限于”，且可与其互换使用。这里所使用的词汇“或”和“和”指词汇“和/或”，且可与其互换使用，除非上下文明确指示不是如此。这里所使用的词汇“诸如”指词组“诸如但不限于”，且可与其互换使用。

另外，如在此使用的，在以“至少一个”开始的项的列举中使用的“或”指示分离的列举，以便例如“A、B 或 C 的至少一个”的列举意味着 A 或 B

20 或 C，或 AB 或 AC 或 BC，或 ABC（即 A 和 B 和 C）。此外，措辞“示例的”不意味着描述的例子是优选的或者比其他例子更好。

还需要指出的是，在本公开的系统和方法中，各部件或各步骤是可以分解和/或重新组合的。这些分解和/或重新组合应视为本公开的等效方案。

可以不脱离由所附权利要求定义的教导的技术而进行对在此所述的技术的各种改变、替换和更改。此外，本公开的权利要求的范围不限于以上

25 所述的处理、机器、制造、事件的组成、手段、方法和动作的具体方面。可以利用与在此所述的相应方面进行基本相同的功能或者实现基本相同的结果的当前存在的或者稍后要开发的处理、机器、制造、事件的组成、手段、方法或动作。因而，所附权利要求包括在其范围内的这样的处理、机

30 器、制造、事件的组成、手段、方法或动作。

提供所公开的方面的以上描述以使本领域的任何技术人员能够做出或者使用本公开。对这些方面的各种修改对于本领域技术人员而言是非常显而易见的，并且在此定义的一般原理可以应用于其他方面而不脱离本公开的范围。因此，本公开不意图被限制到在此示出的方面，而是按照与在此公开的原理和新颖的特征一致的最宽范围。

为了例示和描述的目的已经给出了以上描述。此外，此描述不意图将本公开的实施例限制到在此公开的形式。尽管以上已经讨论了多个示例方面和实施例，但是本领域技术人员将认识到其某些变型、修改、改变、添加和子组合。

Placeholder Sheet for Supplemental Content

Application Number: 18822334

Document Date: 10/18/2024

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ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #
18/822,334RECEIPT DATE / TIME
10/18/2024 12:43:26 PM Z ETATTORNEY DOCKET #
3720-24P06732US

Title of Invention

CONTROLLABLE SINKING AND FLOATING SWIMMING POOL ROBOT AND SINKING AND
FLOATING CONTROL METHOD FOR SWIMMING POOL ROBOT

Application Information

APPLICATION TYPE Utility - Nonprovisional Application
under 35 USC 111(a)

PATENT # -

CONFIRMATION # 6388

FILED BY Na Xu

PATENT CENTER # 67628762

FILING DATE 09/02/2024

CUSTOMER # 92940

FIRST NAMED
INVENTOR Xiaofeng LIUCORRESPONDENCE
ADDRESS -

AUTHORIZED BY -

Documents

TOTAL DOCUMENTS: 2

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
24P06732US-Preliminary Amendment.pdf	3	Preliminary Amendment	81 KB
24P06732US-Drawings-P.pdf	4	Drawings-only black and white line drawings	465 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
24P06732US-Preliminary Amendment.pdf	3B61A07AB897E01D8CE84D30F5423060C7D6C1C3D41CF834 D95EDF338C4B8B51F7AC7307A3235BC8D6C2EF83652CD5E6 7E21C8F584C99727FC9CC9BF092F35E3

24P06732US-Drawings-P.pdf

3FA261E3D2F3A678BFDB22CF838470735C304768CB0723C75
ECADA422B31D79D3BA8B00C10156CA465B4FBFA4F41AA855
99BF22651797778F858A8F0D4269127

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New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Sinking And Floating Control Unit 20

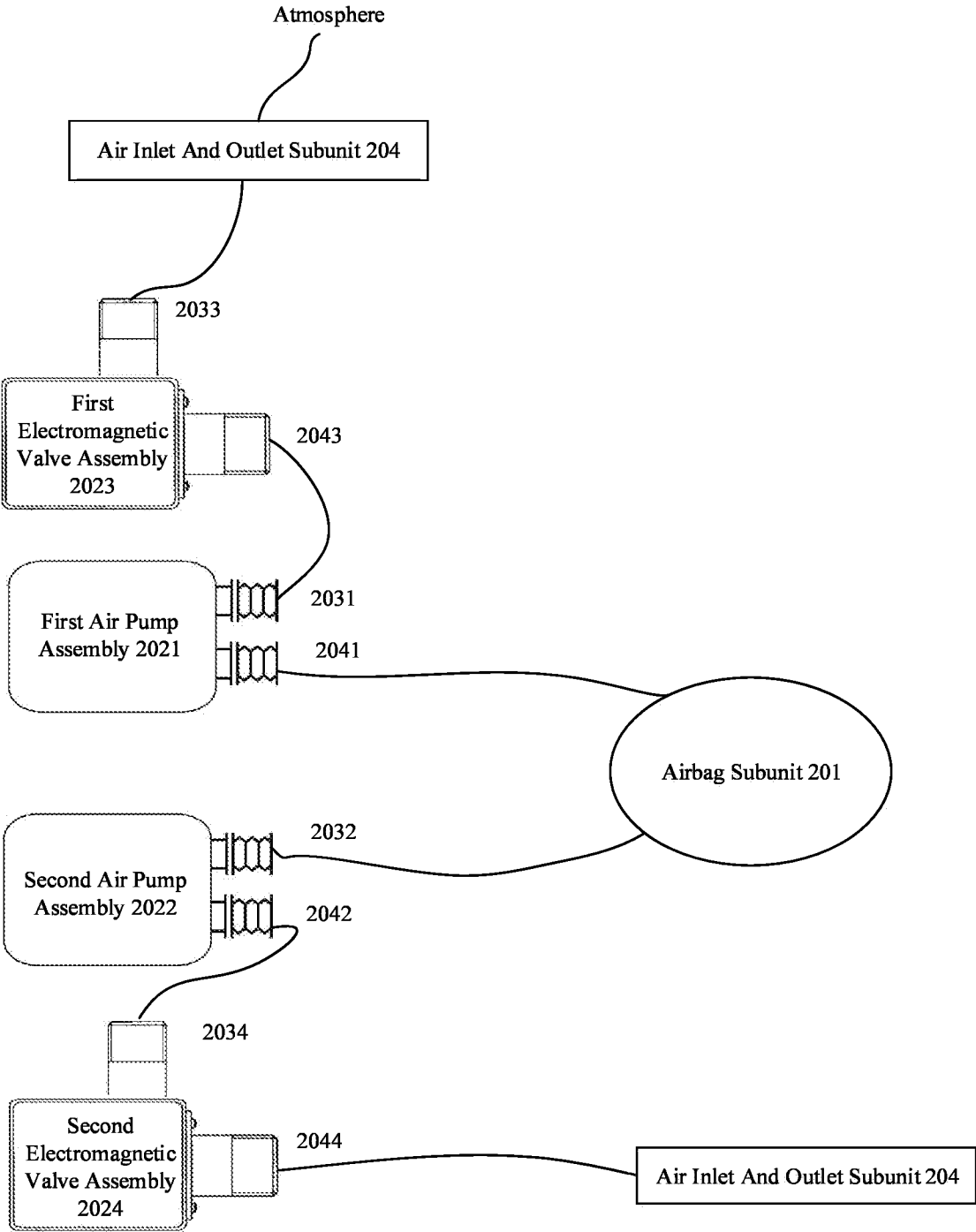


FIG. 4

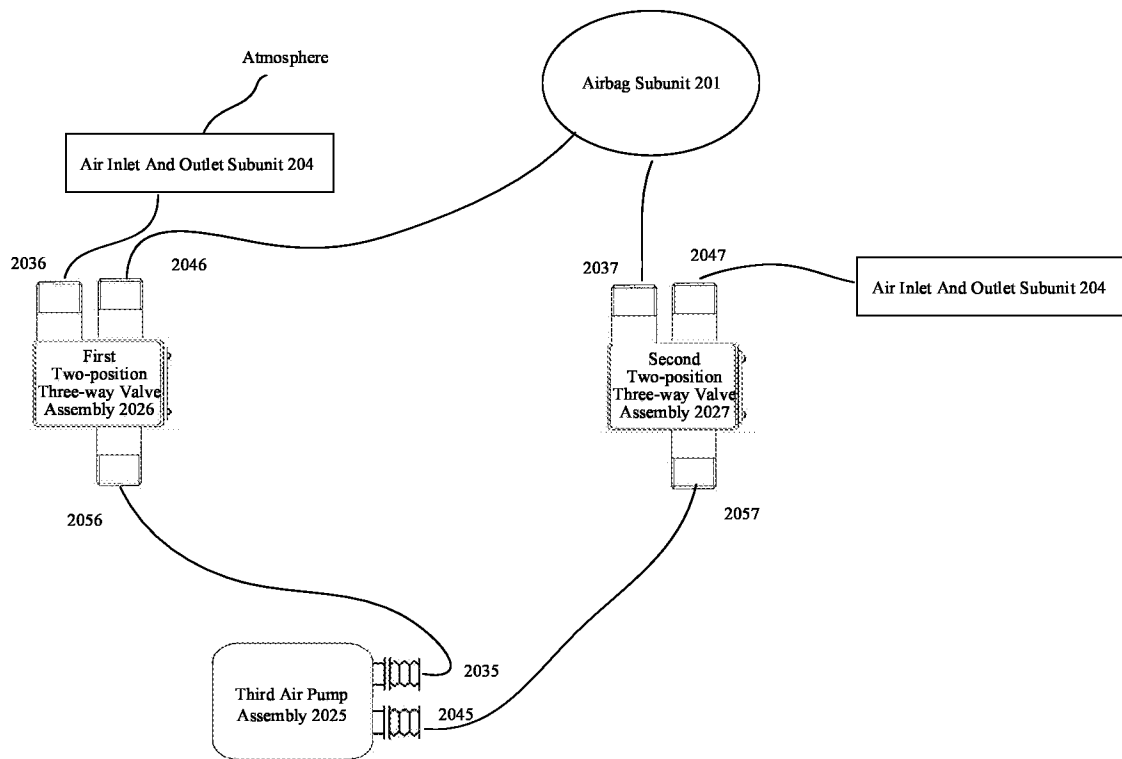
Sinking And Floating Control Unit 20

FIG. 5

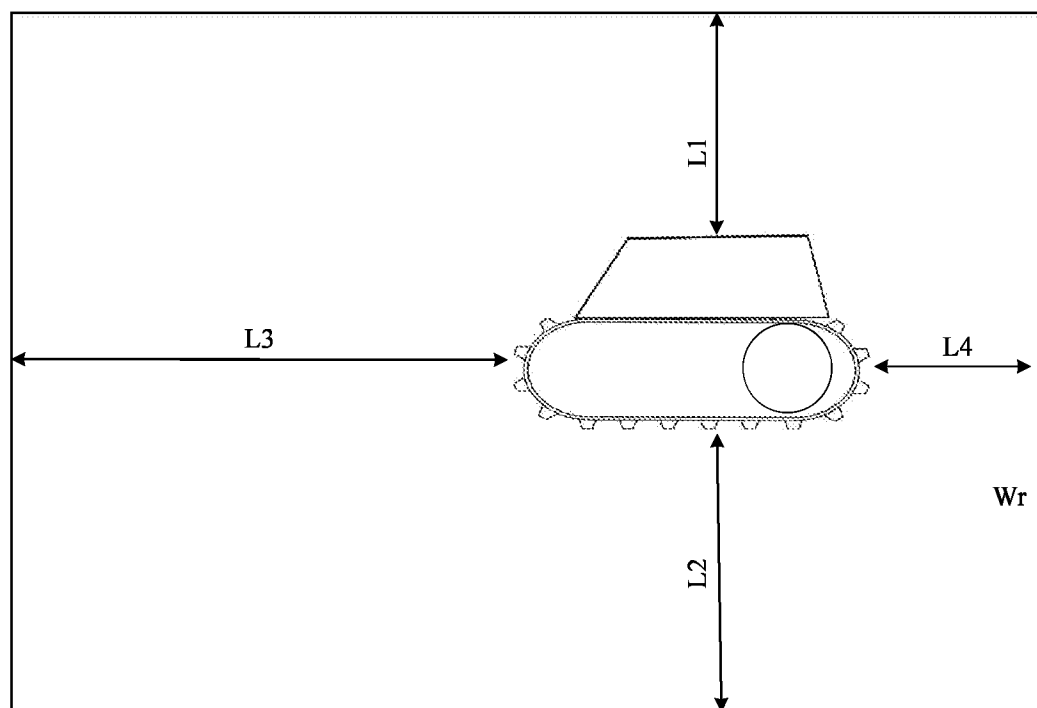


FIG. 7

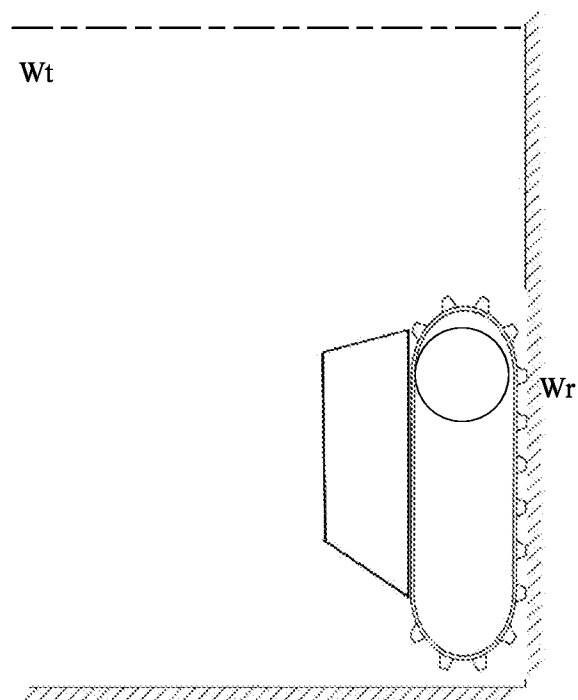


FIG. 8A

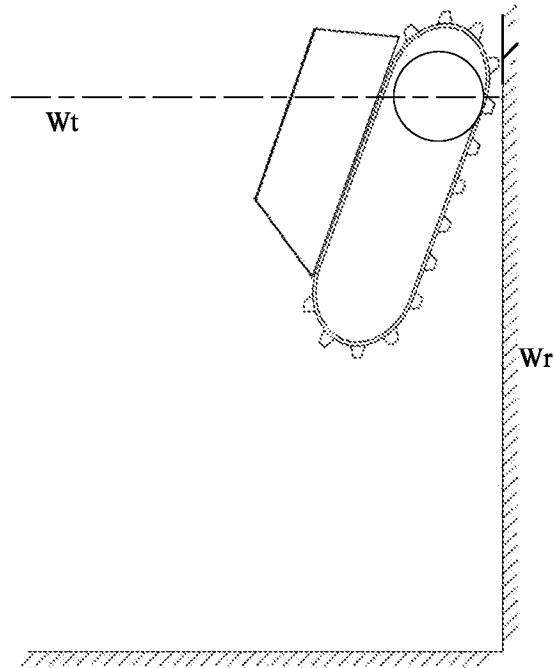


FIG. 8D

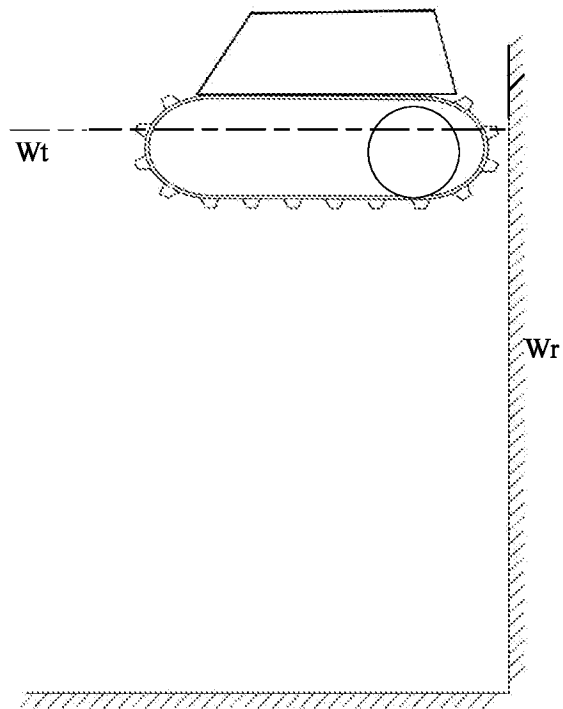


FIG. 8E

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:)
)
Xiaofeng LIU) Group Art Unit: Not Yet Assigned
)
Application No.: 18/822,334) Examiner: Not Yet Assigned
)
Filed: September 2, 2024) Confirmation No: 6388
)
For: CONTROLLABLE SINKING AND)
FLOATING SWIMMING POOL ROBOT)
AND SINKING AND FLOATING)
CONTROL METHOD FOR SWIMMING)
POOL ROBOT)

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Commissioner:

PRELIMINARY AMENDMENT

Prior to examination of the above-referenced application, please enter the following
amendments and remarks:

Amendments to the Drawings begin on page 2 of this paper.

Remarks follow the amendments section of this paper.

AMENDMENTS TO THE DRAWINGS

Please replace the sheet containing figures 4, 5, 7 and 8D with the concurrently filed replacement sheet.

REMARKS

Because figures 4, 5, 7 and 8D submitted previously had improperly generated lines from objection conversion during PDF generation, the figure is amended to reflect the original accurate view. No new matter is added.

Respectfully submitted,

By: / NA XU /
NA XU
Registration No.64369
Phone:6178330649

Notice of References Cited	Application/Control No. 18/822,334		Applicant(s)/Patent Under Reexamination LIU et al.	
	Examiner LARS A OLSON		Art Unit 3615	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date YYYY-MM-DD	Name	CPC Classification	US Classification
*	A	US-11274462-B2	2022-03-15	Tryber; Eyal	E04H4/1654	1/1
*	B	US-11124982-B2	2021-09-21	Korenfeld; Semion	E04H4/1654	1/1
	C					
	D					
	E					
	F					
	G					
	H					
	I					
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date YYYY-MM-DD	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
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	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in YYYY-MM-DD format are publication dates. Classifications may be US or foreign.

<i>Search Notes</i> 	Application/Control No. 18/822,334	Applicant(s)/Patent Under Reexamination LIU et al.
	Examiner LARS A OLSON	Art Unit 3615

CPC - Searched*		
Symbol	Date	Examiner
B63G 8/00	11/04/2024	LO
B63G 8/001	11/04/2024	LO
B63G 8/24	11/04/2024	LO
G05D 1/467	11/04/2024	LO
G05D 2107/29	11/04/2024	LO
E04H 4/1654	11/04/2024	LO

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner
114	313	11/04/2024	LO

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
See attached search history	11/04/2024	LO

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner

	BEATBOT
--	----------------

PE2E SEARCH - Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
L1	0	sink\$3 AND float\$3 AND robot AND control AND waterline ADJ detection AND crawl near5 side ADJ wall	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2024/10/31 03:42 PM
L2	0	sink\$3 AND float\$3 AND robot AND control AND waterline ADJ detection AND crawl AND side ADJ wall	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2024/10/31 03:42 PM
L3	1	sink\$3 AND float\$3 AND robot AND control AND waterline AND detection AND crawl AND side ADJ wall	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2024/10/31 03:42 PM
L4	75	swimming ADJ pool AND robot AND sink\$3 AND float\$3 AND control AND waterline AND detect\$3	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2024/11/01 08:14 AM
L5	4	("20150337556" "20210079679" "20210254359" "20220066456").pn. OR ("12018509").urpn. AND (PGPB USPT USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	AND	ON	ON	2024/11/01 08:16 AM
L6	15	("6412133" "20040260428" "20080250581" "20090301522" "20100306931" "20110020139" "20130031729" "20140015959" "20140096329").pn. OR ("10246894").urpn. AND (PGPB USPT USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	AND	ON	ON	2024/11/01 08:18 AM

BEATBOT

L7	188	("0747574" "2556022" "2605902" "2641015" "2846711" "3011643" "3019462" "3074087" "3178024" "3252575" "3640390" "3795027" "3950809" "3959838" "3960809" "4254525" "4304022" "4498206" "4536908" "4558479" "4589986" "4656683" "4683599" "4722110" "4817991" "D304505" "4920599" "5001800" "5033149" "5097559" "5099535" "5172445" "5197158" "5269913" "5293659" "5337434" "5338446" "5351355" "5363877" "5379473" "5428854" "5454129" "5469596" "5507058" "5554277" "5557822" "D376450" "5604950" "5617600" "5692542" "5799351" "5933899" "D417047" "D418640" "D421512" "D429393" "6094764" "6115864" "6131227" "D433545" "6155657" "6187181" "6199237" "6212725" "6237175" "D443737" "D444280" "D445225" "6289918" "6292970" "6298513" "D456101" "6460564" "6473927" "D469589" "D471330" "6560808" "6564417" "6665900" "6691811" "6706175" "D489150" "6716348" "6733046" "6782578" "6820297" "6854148" "6886205" "6942790" "6954960" "D521696" "7060182" "7117554" "7118632" "7293314" "D575915" "D580114" "7464429" "7506770" "7520282" "D594610" "D599967" "7805792" "7849547" "7908697" "7945981" "8168065" "D670462" "8307485" "8341789" "8402585" "8402586" "8424142"	(US-PGPUB; USPAT; USOCR)	AND	ON	ON	2024/11/01 08:18 AM
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L8	7	"D684738" "8459384" "8474081" "8561240" "8590090" "8784652" "8869337" "D721460" "D728873" "D730598" "9032575" "D733374" "9145699" "D747573" "9328525" "D787761" "D788860" "9675913" "9885194" "10036175" "10138646" "10145137" "10167650" "10221584" "10246894" "10407930" "10425903" "10584507" "10851558" "20030224889" "20040074024" "20040181884" "20050035021" "20060143841" "20080092322" "20080222821" "20080237103" "20080244842" "20080283456" "20090229061" "20090300862" "20100299863" "20110088181" "20110154585" "20110154586" "20110258789" "20110314617" "20120060307" "20120144605" "20120210527" "20130000677" "20130031729" "20130031734" "20130152316" "20140115796" "20150246304" "20150322684" "20160002941" "20160153210" "20160207204" "20160230623").pn. OR ("11124983").urpn. AND (PGPB USPT USOC).dbnm. ("9399877" "20160145884").pn. OR	(US-PGPUB; USPAT; USOCR)	AND	ON	ON	2024/11/01 08:19 AM
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L12	4	("4521933" "4536908" "5086535" "5197158" "5256207" "5337434").pn. OR ("5435031").urpn. AND (PGPB USPT USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	AND	ON	ON	2024/11/01 08:25 AM
L13	0	("5435031" "20070067930" "20150101135").pn. OR ("11124982").urpn. AND (PGPB USPT USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	AND	ON	ON	2024/11/01 08:25 AM
L14	0	swimming ADJ pool AND robot AND sink\$3 AND float\$3 AND control AND waterline ADJ detect\$3	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2024/11/01 08:37 AM
L15	0	swimming ADJ pool AND robot AND waterline ADJ detection	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2024/11/01 08:38 AM
L16	1	robot AND waterline ADJ detection	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD,	AND	ON	ON	2024/11/01 08:38 AM

L16	4	("5435031" "20070067930" "20150101135").pn. OR ("11124982").urpn. AND (PGPB USPT USOC).dbnm.	DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) (US-PGPUB; USPAT; USOCR)	OR	ON	ON	2024/11/04 11:14 AM
L17	4	("20150337556" "20210079679" "20210254359" "20220066456").pn. OR ("12018509").urpn. AND (PGPB USPT USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	OR	ON	ON	2024/11/04 11:17 AM
L18	0	114/313 AND swimming ADJ pool AND robot AND sink\$3 AND float\$3 AND control\$3	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2024/11/04 11:20 AM
L19	0	b63g8/00.cpc. AND swimming ADJ pool AND robot AND sink\$3 AND float\$3 AND control\$3	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2024/11/04 11:20 AM
L20	1	b63g8/001.cpc. AND swimming ADJ pool AND robot AND sink\$3 AND float\$3 AND control\$3	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2024/11/04 11:20 AM
L21	0	b63g8/24.cpc. AND swimming ADJ pool AND robot AND sink\$3 AND float\$3 AND control\$3	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2024/11/04 11:24 AM
L22	0	g05d1/467.cpc. AND swimming ADJ pool AND robot AND sink\$3 AND float\$3 AND control\$3	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU,	AND	ON	ON	2024/11/04 11:24 AM

L23	106	e04h4/1654.cpc. AND swimming ADJ pool AND robot AND sink\$3 AND float\$3 AND control\$3	SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) (US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2024/11/04 11:24 AM
L24	0	g05d2107/29.cpc. AND swimming ADJ pool AND robot AND sink\$3 AND float\$3 AND control\$3	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2024/11/04 11:45 AM

PE2E SEARCH - Search History (Interference)

There are no Interference searches to show.

Bibliographic Data

Application No: 18/822,334

Foreign Priority claimed: ☒ Yes ☐ No

35 USC 119 (a-d) conditions met: ☒ Yes ☐ No ☐ Met After Allowance

Verified and Acknowledged: /LARS A OLSON/

Examiner's Signature Initials

Title:

CONTROLLABLE SINKING AND FLOATING SWIMMING POOL
ROBOT AND SINKING AND FLOATING CONTROL METHOD
FOR SWIMMING POOL ROBOT

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
09/02/2024	114	3615	3720-24P06732US
RULE			

APPLICANTS

Aiper Global Pte. Ltd., Singapore, SINGAPORE

INVENTORS

Xiaofeng LIU,
Yongfei HUA, Singapore, SINGAPORE

CONTINUING DATA

FOREIGN APPLICATIONS

CHINA CN2024110176973 07/26/2024

IF REQUIRED, FOREIGN LICENSE GRANTED**

09/11/2024

** SMALL ENTITY **

STATE OR COUNTRY

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Sterling, VA 20164
UNITED STATES

FILING FEE RECEIVED

\$2,400



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
18/822,334	09/02/2024	Xiaofeng LIU	3720-24P06732US	6388
92940	7590	11/07/2024	EXAMINER	
IPro, PLLC 12332 Towncenter Plaza PMB# 816 Sterling, VA 20164			OLSON, LARS A	
			ART UNIT	PAPER NUMBER
			3615	
			NOTIFICATION DATE	DELIVERY MODE
			11/07/2024	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

contact@us-ip.com
uspto+949965@dockettrak.com

DETAILED ACTION

Notice of Pre-AIA or AIA Status

1. The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.
2. A Request for Prioritized Examination (Track 1) was filed by the applicant on September 2, 2024, and granted on October 2, 2024.
3. A preliminary amendment was filed by the applicant on October 18, 2024.

Drawings

4. The replacement drawings were received on October 18, 2024. These drawings are acceptable.

Claim Rejections - 35 USC § 112

5. The following is a quotation of 35 U.S.C. 112(b):
(b) CONCLUSION.—The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.

The following is a quotation of 35 U.S.C. 112 (pre-AIA), second paragraph:
The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claim 11 is rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor (or for applications subject to pre-AIA 35 U.S.C. 112, the applicant), regards as the invention.

7. Claim 11 recites the limitation "the switch subunit" in line 3. There is insufficient antecedent basis for this limitation in the claim.
8. Claim 11 recites the limitation "the inflation and deflation subunit" in line 3. There is insufficient antecedent basis for this limitation in the claim.
9. Claim 11 recites the limitation "the airbag subunit" in line 4. There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 103

10. In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis (i.e., changing from AIA to pre-AIA) for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.
11. The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

12. Claim(s) 1, 3, 5, 10 and 16-19 are rejected under 35 U.S.C. 103 as being unpatentable over Korenfeld et al. (US 11,124,982) in view of Tryber et al. (US 11,274,462).

Korenfeld et al. discloses a pool cleaner robot, as shown in Figures 1-18, which is comprised of a body or housing, defined as Part #14, a first track/wheels set, defined as Part #11, a second track/wheels set, defined as Part #12, one or more fluid outlets

including a center fluid outlet, defined as Part #51, and a side fluid outlet, defined as Part #55, a bottom fluid inlet, a controller, defined as Part #50, and a yaw sensor or inclinometer, defined as Part #52, where said pool cleaner robot is configured to detect and maintain a required waterline angle with a waterline, defined as Part #222, based on readings from said yaw sensor or inclinometer, as shown in Figure 18, and is configured to crawl or move from a pool bottom, defined as Part #220, onto a sidewall, defined as Part #210 of a swimming pool, as shown in Figure 9.

Korenfeld et al. also discloses a control method for a pool cleaner robot which is comprised of the steps of controlling a pool cleaner robot to find a sidewall, defined as Part #210, or a slope based on information of said pool cleaner robot, and enable said pool cleaner robot to crawl or move along said sidewall or slope, as shown in Figure 9, and detecting a positional relationship between said pool cleaner robot and a waterline, defined as Part #222, by means of a yaw sensor or inclinometer, defined as Part #52, as shown in Figure 18.

Korenfeld et al., as set forth above, shows all of the features claimed except for the use of a sinking and floating control unit that is configured to control a pool cleaner robot to float and sink.

Tryber et al. discloses a pool cleaning robot, as shown in Figures 1-18, which includes an electronic control unit, defined as Part #510, a gyroscope, defined as Part #520, a geometrical sensor, defined as Part #530, and a ballast tank that is comprised of a compartment, defined as Part #174, with a compressed gas cylinder, defined as Part #172, and a piston, defined as Part #171, as shown in Figure 8A, which sucks in water to make said pool cleaning robot heavy so that it will sink from a waterline in a

sinking working state, defined as Part #340, and expels water to make said pool cleaning robot lighter so that it will float to said waterline in a floating working state, as shown in Figure 10. Said electronic control unit is configured to control the generation of fluid jets, ballast tank actuation and steering a rudder, defined as Part #32, and right and left diving planes, defined as Parts #31 and 33, of a steering module, as described in lines 27-29 of column 6.

Therefore, it would have been obvious before the effective filing date of the claimed invention to one of ordinary skill in the art, to utilize a pool cleaning robot with a ballast tank and a control unit to allow said pool cleaning robot to sink or float, as taught by Tryber et al., in combination with the pool cleaner robot and method as disclosed by Korenfeld et al. for the purpose of providing a pool cleaner robot with ballasting means to allow said pool cleaner robot to sink from a waterline or float to a waterline.

Allowable Subject Matter

13. Claims 2, 4, 6-9, 12-15 and 20 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to LARS A OLSON whose telephone number is (571) 272-6685. The examiner can normally be reached Monday to Friday 8:00am - 4:00pm.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at <http://www.uspto.gov/interviewpractice>.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, SAMUEL J MORANO can be reached on 571-272-6684. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of published or unpublished applications may be obtained from Patent Center. Unpublished application information in Patent Center is available to registered users. To file and manage patent submissions in Patent Center, visit: <https://patentcenter.uspto.gov>. Visit <https://www.uspto.gov/patents/apply/patent-center> for more information about Patent Center and <https://www.uspto.gov/patents/docx> for information about filing in DOCX format. For additional questions, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

November 4, 2024

/LARS A OLSON/
Primary Examiner, Art Unit 3615

UNITED STATES
PATENT AND TRADEMARK OFFICEP.O. Box 1450
Alexandria, VA 22313 - 1450
www.uspto.gov

ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #
18/822,334RECEIPT DATE / TIME
11/21/2024 09:35:43 AM Z ETATTORNEY DOCKET #
3720-24P06732US

Title of Invention

CONTROLLABLE SINKING AND FLOATING SWIMMING POOL ROBOT AND SINKING AND
FLOATING CONTROL METHOD FOR SWIMMING POOL ROBOT

Application Information

APPLICATION TYPE Utility - Nonprovisional Application
under 35 USC 111(a)

PATENT # -

CONFIRMATION # 6388

FILED BY Na Xu

PATENT CENTER # 68051846

FILING DATE 09/02/2024

CUSTOMER # 92940

FIRST NAMED
INVENTOR Xiaofeng LIUCORRESPONDENCE
ADDRESS -

AUTHORIZED BY -

Documents

TOTAL DOCUMENTS: 1

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
24P06732US-Non-Final_Rejection-Amendments_and_Remarks.pdf	9	Amendment/Request for Reconsideration-After Non-Final Rejection	93 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
24P06732US-Non-Final_Rejection-Amendments_and_Remarks.pdf	A39533B63FB5ED4F4873DE42EBFA355D2BD269F75C97E3CF A70A8BA4755D8C38D61796A2BA09EB83E006A993EBC49A3E 23F96405B9E72547B100F7998F4B9CEB

BEATBOT
Ex. 1002

Page 125 of 178

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of	)	Group Art Unit: 3615
Xiaofeng LIU	)	Examiner: OLSON, LARS A
Application No.: 18/822,334	)	Confirmation No.: 6388
Filed: 09/02/2024	)	Attorney Docket: 3720-24P06732US
For: CONTROLLABLE SINKING AND FLOATING	)	
SWIMMING POOL ROBOT AND SINKING	)	
AND FLOATING CONTROL METHOD FOR	)	
SWIMMING POOL ROBOT	)	

Response to Non-Final Office Action

Mail Stop: AMENDMENT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In reply to the Non-Final Office Action dated November 07, 2024, please amend the above identified application as follows.

Amendments to the Claims are reflected in the listing of claims which begins on page **2** of this paper.

Remarks/Arguments begin on page **8** of this paper.

IN THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Currently Amended) A controllable sinking and floating swimming pool robot, comprising:
 - a sinking and floating control unit configured to control a swimming pool robot to float and sink;
 - a waterline detection unit configured to detect a positional relationship between the swimming pool robot and a waterline of a liquid surface of a swimming pool where the swimming pool robot is located; and
 - a main control unit configured to control a working state of the sinking and floating control unit,wherein the main control unit is capable of controlling the swimming pool robot to find a side wall or a slope based on operational requirement information of the swimming pool robot and enabling the swimming pool robot to crawl along the side wall or the slope;
 - controlling the waterline detection unit to detect the positional relationship between the swimming pool robot and the waterline of the liquid surface of the swimming pool where the swimming pool robot is located; and
 - controlling the sinking and floating control unit to enter a floating working state based on detection results to realize a floating of the swimming pool robot,wherein the sinking and floating control unit is controlled to stop working after the sinking and floating control unit enters the floating working state for a predetermined time.
2. (Original) The controllable sinking and floating swimming pool robot according to claim 1, further comprising a posture detection unit configured to detect a posture of the swimming pool robot,

wherein the main control unit controls the waterline detection unit to start detecting the positional relationship in response to the posture meeting a first predetermined condition.

3. (Original) The controllable sinking and floating swimming pool robot according to claim 1, wherein the operational requirement information comprises remote control command information sent by a user, clock information, operational task progress information, fault information, power information or swimming pool bottom environment information.
4. (Original) The controllable sinking and floating swimming pool robot according to claim 1, further comprising a distance measurement unit or a map storage unit, wherein the main control unit controls the swimming pool robot to find the nearest side wall or the nearest slope based on distance measurement results of the distance measurement unit or map data in the map storage unit.
5. (Original) The controllable sinking and floating swimming pool robot according to claim 1, wherein the waterline detection unit comprises an outlet water detection subunit configured to detect whether at least a part of the swimming pool robot has come out of water.
6. (Original) The controllable sinking and floating swimming pool robot according to claim 1, wherein the waterline detection unit further comprises a proximity waterline detection subunit configured to detect whether the swimming pool robot has crawled to a distance less than or equal to a predetermined distance from the waterline.
7. (Original) The controllable sinking and floating swimming pool robot according to claim 5, wherein the sinking and floating control unit comprises an inflation and deflation subunit and a switch subunit, wherein in response to the outlet water detection subunit

detecting that at least a part of the swimming pool robot has come out of the water, the inflation and deflation subunit is controlled to start sucking air and the switch subunit is controlled to open, so that the sinking and floating control unit enters the floating working state.

8. (Original) The controllable sinking and floating swimming pool robot according to claim 5, wherein the sinking and floating control unit comprises an inflation and deflation subunit and a switch subunit, wherein in response to the proximity waterline detection subunit detecting that the swimming pool robot has crawled to the distance less than or equal to the predetermined distance from the waterline, the inflation and deflation subunit is controlled to start sucking air, and in response to the outlet water detection subunit detecting that at least a part of the swimming pool robot has come out of the water, the switch subunit is controlled to open, so that the sinking and floating control unit enters the floating working state.
9. (Original) The controllable sinking and floating swimming pool robot according to claim 7, wherein the sinking and floating control unit further comprises an airbag subunit connected to the inflation and deflation subunit, wherein the airbag subunit is connected to or disconnected from outside atmosphere through the inflation and deflation subunit and the switch subunit,
and wherein the sinking and floating control unit further comprises an air inlet and outlet subunit, wherein the switch subunit is connected to the outside atmosphere through the air inlet and outlet subunit.
10. (Original) The controllable sinking and floating swimming pool robot according to claim 1, wherein the main control unit is further capable of controlling the sinking and floating control unit to enter a sinking working state based on the operational requirement information of the swimming pool robot to realize a sinking of the swimming pool robot.

11. (Currently Amended) The controllable sinking and floating swimming pool robot according to claim 10, wherein the sinking and floating control unit comprises an inflation and deflation subunit, a switch subunit and an airbag subunit connected to the inflation and deflation subunit, controlling the sinking and floating control unit to enter the sinking working state comprises controlling the switch subunit to open and controlling the inflation and deflation subunit to discharge air in the airbag subunit.
12. (Original) The controllable sinking and floating swimming pool robot according to claim 7, wherein the inflation and deflation subunit comprises an air pump assembly, and the switch subunit comprises an electromagnetic valve assembly or a two-position three-way valve assembly.
13. (Original) The controllable sinking and floating swimming pool robot according to claim 7, wherein in response to the outlet water detection subunit detecting that at least a part of the swimming pool robot enters underwater again and/or the posture detection unit detecting that the posture of the swimming pool robot meets a second predetermined condition, the inflation and deflation subunit and the switch subunit are controlled to be closed.
14. (Canceled)
15. (Original) The controllable sinking and floating swimming pool robot according to claim 7, further comprising a water pump unit configured to pump liquid in the swimming pool where the swimming pool robot is located and discharge the liquid to drive the swimming pool robot,
wherein a power of the water pump unit is changed after the sinking and floating control unit enters the floating working state or after the swimming pool robot climbs the side wall or the slope.

16. (Currently Amended) A sinking and floating control method for a swimming pool robot, comprising:
- controlling a swimming pool robot to find a side wall or a slope based on operational requirement information of the swimming pool robot, and enabling the swimming pool robot to crawl along the side wall or the slope;
 - detecting a positional relationship between the swimming pool robot and a waterline of a liquid surface of a swimming pool where the swimming pool robot is located; [[and]]
 - controlling a sinking and floating control unit to enter a floating working state based on detection results to realize a floating of the swimming pool robot; and
 - controlling the sinking and floating control unit to stop working after the sinking and floating control unit enters the floating working state for a predetermined time.
17. (Original) The sinking and floating control method for the swimming pool robot according to claim 16, wherein detecting the positional relationship between the swimming pool robot and the waterline of the liquid surface of the swimming pool where the swimming pool robot is located comprises:
- starting detecting the positional relationship in response to a posture of the swimming pool robot meeting a first predetermined condition.
18. (Original) The sinking and floating control method for the swimming pool robot according to claim 17, wherein the operational requirement information comprises remote control command information sent by a user, clock information, operational task progress information, fault information, power information or swimming pool bottom environment information.
19. (Original) The sinking and floating control method for the swimming pool robot according to claim 18, wherein controlling the sinking and floating control unit to enter the floating working state based on detection results to realize the floating of the swimming pool robot comprises:

controlling the sinking and floating control unit to enter the floating working state in response to detecting that at least a part of the swimming pool robot has come out of water.

20. (Original) The sinking and floating control method for the swimming pool robot according to claim 18, further comprising:

controlling the sinking and floating control unit to stop working in response to detecting that at least a part of the swimming pool robot enters underwater again and/or detecting that the posture of the swimming pool robot meets a second predetermined condition.

REMARKS

Claims 1, 11 and 16 have been amended, and claim 14 is canceled adaptively.

Reconsideration and allowance of the application are respectfully requested.

Rejections under 35 U.S.C. § 112

Claim 11 have been rejected under 35 U.S.C. 112 as being indefinite.

The applicant has amended claim 14 to incorporate the limitation “the sinking and floating control unit comprises an inflation and deflation subunit, a switch subunit and an airbag subunit connected to the inflation and deflation subunit” which is at least supported by the original claims 7, 8, 9 and the descriptions as filed. The limitations “the switch subunit” and “the inflation and deflation subunit” in the original line 3 and “the airbag subunit” in the original line 4 thus possess the antecedent bases.

Accordingly, Applicant respectfully requests reconsideration and withdrawal of 35 U.S.C. § 112 rejections of the claims.

Rejections under 35 U.S.C. § 103

Claims 1-3, 5, 10 and 16-19 are rejected under 35 U.S.C. 103 as being unpatentable over Korenfeld et al (US 11,124,982). and in view of Tryber et al (US 11,274,462).

Applicant gratefully acknowledges Examiner’s indication that claims 2, 4, 6-9, 12-15 and 20 are patentable.

Applicant has amended the independent claims 1 and 16 to include the limitations of the allowable claim 14 with minor expression adjustment for the sake of clarity. Accordingly,

Applicant respectfully requests reconsideration and withdrawal of 35 U.S.C. 103 rejection of the pending claims.

Conclusion

It is believed that all of the pending claims have been addressed. However, the absence of a reply to a specific rejection, issue or comment does not signify agreement with or concession of that rejection, issue or comment. In addition, because the arguments made above may not be exhaustive, there may be reasons for patentability of any or all pending claims (or other claims) that have not been expressed. Finally, nothing in this paper should be construed as an intent to concede any issue with regard to any claim, except as specifically stated in this paper, and the amendment of any claim does not necessarily signify concession of unpatentability of the claim prior to its amendment.

Should the Examiner have any questions about this application, Applicant's undersigned representative can be reached at the telephone number given below.

Respectfully submitted,

/ NA XU /

NA XU
Registration No. 64341
Phone: 617-5125149

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875				Application or Docket Number 18/822,334		Filing Date 09/02/2024		☐ To be Mailed			
ENTITY: ☐ LARGE ☒ SMALL ☐ MICRO											
APPLICATION AS FILED - PART I											
		(Column 1)		(Column 2)							
FOR		NUMBER FILED		NUMBER EXTRA		RATE (\$)		FEE (\$)			
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))		N/A		N/A		N/A					
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))		N/A		N/A		N/A					
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))		N/A		N/A		N/A					
TOTAL CLAIMS (37 CFR 1.16(i))		minus 20 = *				x \$40 =					
INDEPENDENT CLAIMS (37 CFR 1.16(h))		minus 3 = *				x \$ 192 =					
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))		If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).									
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))											
* If the difference in column 1 is less than zero, enter "0" in column 2.						TOTAL					
APPLICATION AS AMENDED - PART II											
		(Column 1)		(Column 2)		(Column 3)					
AMENDMENT	11/21/2024	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR		PRESENT EXTRA		RATE (\$)		ADDITIONAL FEE (\$)	
	Total (37 CFR 1.16(i))	* 19	Minus	** 20	= 0			x \$40 =		0	
	Independent (37 CFR 1.16(h))	* 2	Minus	*** 3	= 0			x \$ 192 =		0	
	☐ Application Size Fee (37 CFR 1.16(s))										
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))										
								TOTAL ADD'L FEE		0	
		(Column 1)		(Column 2)		(Column 3)					
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR		PRESENT EXTRA		RATE (\$)		ADDITIONAL FEE (\$)	
	Total (37 CFR 1.16(i))	*	Minus	**	=			x \$ 0 =			
	Independent (37 CFR 1.16(h))	*	Minus	***	=			x \$ 0 =			
	☐ Application Size Fee (37 CFR 1.16(s))										
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))										
								TOTAL ADD'L FEE			
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.								Examiner			
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".								/Theresa OKON/			
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".											
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.											

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

<i>Index of Claims</i> 	Application/Control No. 18/822,334	Applicant(s)/Patent Under Reexamination LIU et al.
	Examiner LARS A OLSON	Art Unit 3615

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

CLAIMS										
☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47										
CLAIM		DATE								
Final	Original	11/04/2024	11/29/2024							
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3	3	✓	=							
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15	16	✓	=							
16	17	✓	=							
17	18	✓	=							
18	19	✓	=							
19	20	O	=							

Search Notes 	Application/Control No. 18/822,334	Applicant(s)/Patent Under Reexamination LIU et al.
	Examiner LARS A OLSON	Art Unit 3615

CPC - Searched*		
Symbol	Date	Examiner
B63G 8/00	11/29/2024	LO
B63G 8/001	11/29/2024	LO
B63G 8/24	11/29/2024	LO
G05D 1/467	11/29/2024	LO
G05D 2107/29	11/29/2024	LO
E04H 4/1654	11/29/2024	LO
B25J 3/00	11/29/2024	LO
G05D 1/02	11/29/2024	LO
G05D 1/10	11/29/2024	LO

CPC Combination Sets - Searched*		
Symbol	Date	Examiner
All listed above	11/29/2024	LO

US Classification - Searched*			
Class	Subclass	Date	Examiner
114	313	11/29/2024	LO

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
See attached search history	11/29/2024	LO

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<i>Search Notes</i> 	Application/Control No. 18/822,334	Applicant(s)/Patent Under Reexamination LIU et al.
	Examiner LARS A OLSON	Art Unit 3615

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
PE2E Search	All listed above	11/29/2024	LO

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Issue Classification 	Application/Control No. 18/822,334	Applicant(s)/Patent Under Reexamination LIU et al.
	Examiner LARS A OLSON	Art Unit 3615

CPC						
Symbol					Type	Version
B63G	/	8	/	24	F	2013-01-01
E04H	/	4	/	1654	I	2013-01-01
B63G	/	8	/	001	I	2013-01-01
G05D	/	1	/	467	I	2024-01-01
B25J	/	3	/	00	I	2013-01-01
G05D	/	2105	/	10	A	2024-01-01
B63G	/	2008	/	004	A	2013-01-01
G05D	/	2107	/	29	A	2024-01-01

CPC Combination Sets				
Symbol		Type	Set	Version
/	/			

NONE	Total Claims Allowed:	
(Assistant Examiner)	(Date)	19
/LARS A OLSON/ Primary Examiner, Art Unit 3615	29 November 2024	O.G. Print Claim(s)
(Primary Examiner)	(Date)	15
		O.G. Print Figure
		1

Issue Classification 	Application/Control No. 18/822,334	Applicant(s)/Patent Under Reexamination LIU et al.
	Examiner LARS A OLSON	Art Unit 3615

INTERNATIONAL CLASSIFICATION					
CLAIMED					
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E04H	/	4	/	16	
B25J	/	3	/	00	
G05D	/	1	/	467	
B63G	/	8	/	00	
NON-CLAIMED					
	/		/		

US ORIGINAL CLASSIFICATION	
CLASS	SUBCLASS
114	313

CROSS REFERENCES(S)						
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)					

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	19	
/LARS A OLSON/ Primary Examiner, Art Unit 3615 (Primary Examiner)	29 November 2024 (Date)	O.G. Print Claim(s) 15	O.G. Print Figure 1

Issue Classification 	Application/Control No. 18/822,334	Applicant(s)/Patent Under Reexamination LIU et al.
	Examiner LARS A OLSON	Art Unit 3615

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIMS															
Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
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9	9	17	18												

NONE	Total Claims Allowed:	
(Assistant Examiner)	(Date)	19
/LARS A OLSON/ Primary Examiner, Art Unit 3615 (Primary Examiner)	29 November 2024 (Date)	O.G. Print Claim(s) 15 O.G. Print Figure 1

PE2E SEARCH - Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
L1	0	sink\$3 AND float\$3 AND robot AND control AND waterline ADJ detection AND crawl near5 side ADJ wall	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2024/10/31 03:42 PM
L2	0	sink\$3 AND float\$3 AND robot AND control AND waterline ADJ detection AND crawl AND side ADJ wall	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2024/10/31 03:42 PM
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L15	0	swimming ADJ pool AND robot AND waterline ADJ detection	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2024/11/01 08:38 AM
L16	1	robot AND waterline ADJ detection	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD,	AND	ON	ON	2024/11/01 08:38 AM

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L20	1	b63g8/001.cpc. AND swimming ADJ pool AND robot AND sink\$3 AND float\$3 AND control\$3	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2024/11/04 11:20 AM
L21	0	b63g8/24.cpc. AND swimming ADJ pool AND robot AND sink\$3 AND float\$3 AND control\$3	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2024/11/04 11:24 AM
L22	0	g05d1/467.cpc. AND swimming ADJ pool AND robot AND sink\$3 AND float\$3 AND control\$3	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU,	AND	ON	ON	2024/11/04 11:24 AM

L23	106	e04h4/1654.cpc. AND swimming ADJ pool AND robot AND sink\$3 AND float\$3 AND control\$3	SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) (US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2024/11/04 11:24 AM
L24	0	g05d2107/29.cpc. AND swimming ADJ pool AND robot AND sink\$3 AND float\$3 AND control\$3	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2024/11/04 11:45 AM
L25	3	sink\$3 AND float\$3 AND control AND pool AND robot AND side ADJ wall AND crawl AND detect\$3 AND position\$3 AND waterline AND stop	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2024/11/29 08:42 AM
L26	3	sink\$3 AND float\$3 AND control AND pool AND robot AND side near3 wall AND crawl AND detect\$3 AND position\$3 AND waterline AND stop	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2024/11/29 08:44 AM
L27	4	sink\$3 AND float\$3 AND control AND pool AND robot AND wall AND crawl AND detect\$3 AND position\$3 AND waterline AND stop	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2024/11/29 08:44 AM
L28	2	sink\$3 AND float\$3 AND control AND pool AND robot AND wall AND crawl AND detect\$3 AND position\$3 AND waterline AND stop AND ballast\$3	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2024/11/29 08:45 AM
L29	6	("4835809" "4837886" "4939980" "5771987" "5985156" "20130146106").pn. OR	(US-PGPUB; USPAT; USOCR)	AND	ON	ON	2024/11/29 08:48 AM

L30	4	("11274462").urpn. AND (PGPB USPT USOC).dbnm. ("5435031" "20070067930" "20150101135").pn. OR ("11124982").urpn. AND (PGPB USPT USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	AND	ON	ON	2024/11/29 08:54 AM
L31	112	("4521933" "4536908" "5086535" "5197158" "5256207" "5337434").pn. OR ("5435031").urpn. AND (PGPB USPT USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	AND	ON	ON	2024/11/29 08:54 AM
L32	127	("3384914" "3392738" "3675261" "3805815" "3921654" "4040864" "4129904" "4154680" "4281995" "4463525" "4569361" "4589986" "4592378" "4652366" "4686728" "4749478" "4778599" "4784171" "4835809" "4837886" "4849024" "4994178" "5029600" "5077853" "5128031" "5133854" "5350508" "5435031" "5788850").pn. OR ("5985156").urpn. AND (PGPB USPT USOC).dbnm.	(US-PGPUB; USPAT; USOCR)	AND	ON	ON	2024/11/29 09:00 AM
L33	0	114/313 AND sink\$3 AND float\$3 AND control AND pool AND robot AND wall AND crawl AND detect\$3 AND position\$3 AND waterline AND stop	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2024/11/29 09:05 AM
L34	0	b63g8/00.cpc. AND sink\$3 AND float\$3 AND control AND pool AND robot AND wall AND crawl AND detect\$3 AND position\$3 AND waterline AND stop	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2024/11/29 09:05 AM
L35	0	b63g8/001.cpc. AND sink\$3 AND float\$3 AND control AND pool AND robot AND wall AND crawl AND detect\$3 AND	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO;	AND	ON	ON	2024/11/29 09:05 AM

BEATBOT

L36	0	position\$3 AND waterline AND stop b63g8/24.cpc. AND sink\$3 AND float\$3 AND control AND pool AND robot AND wall AND crawl AND detect\$3 AND position\$3 AND waterline AND stop	JPO; DERWENT; IBM_TDB) (US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2024/11/29 09:05 AM
L37	0	g05d1/467.cpc. AND sink\$3 AND float\$3 AND control AND pool AND robot AND wall AND crawl AND detect\$3 AND position\$3 AND waterline AND stop	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2024/11/29 09:06 AM
L38	0	g05d2107/29.cpc. AND sink\$3 AND float\$3 AND control AND pool AND robot AND wall AND crawl AND detect\$3 AND position\$3 AND waterline AND stop	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2024/11/29 09:06 AM
L39	1	e04h4/1654.cpc. AND sink\$3 AND float\$3 AND control AND pool AND robot AND wall AND crawl AND detect\$3 AND position\$3 AND waterline AND stop	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2024/11/29 09:06 AM
L40	1	g05d1/10.cpc. AND sink\$3 AND float\$3 AND control AND pool AND robot AND wall AND crawl AND detect\$3 AND position\$3 AND waterline AND stop	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2024/11/29 09:07 AM
L41	0	g05d1/02.cpc. AND sink\$3 AND float\$3 AND control AND pool AND robot AND wall AND crawl AND detect\$3 AND position\$3 AND waterline AND stop	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2024/11/29 09:07 AM
L42	1	g05d1/10.cpc. AND sink\$3 AND float\$3 AND control AND pool AND robot AND wall AND crawl AND	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU,	AND	ON	ON	2024/11/29 09:08 AM

L43	199	detect\$3 sink\$3 AND float\$3 AND control AND pool AND robot AND wall AND crawl AND detect\$3	SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB) (US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2024/11/29 09:08 AM
L44	4	sink\$3 AND float\$3 AND control AND pool AND robot AND wall AND crawl AND detect\$3 AND waterline AND surface	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2024/11/29 09:10 AM
L45	1	b25j3/00.cpc. AND sink\$3 AND float\$3 AND control AND pool AND robot AND wall AND crawl AND detect\$3 AND waterline AND surface	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2024/11/29 09:11 AM
L46	1	b25j3/00.cpc. AND sink\$3 AND float\$3 AND control AND pool AND robot AND wall AND crawl AND detect\$3	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, CA, CH, CN, DD, DE, EA, EP, ES, FR, GB, JP, KR, OA, RU, SU, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	AND	ON	ON	2024/11/29 09:11 AM

PE2E SEARCH - Search History (Interference)

There are no Interference searches to show.



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
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NOTICE OF ALLOWANCE AND FEE(S) DUE

92940 7590 12/18/2024
IPRO, PLLC
12332 Towncenter Plaza
PMB# 816
Sterling, VA 20164

EXAMINER	
OLSON, LARS A	
ART UNIT	PAPER NUMBER
3615	

DATE MAILED: 12/18/2024

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
18/822,334	09/02/2024	Xiaofeng LIU	3720-24P06732US	6388

TITLE OF INVENTION: CONTROLLABLE SINKING AND FLOATING SWIMMING POOL ROBOT AND SINKING AND FLOATING CONTROL METHOD FOR SWIMMING POOL ROBOT

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	\$516	\$0.00	\$0.00	\$516	03/18/2025

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 40% the amount of undiscounted fees, and micro entity fees are 20% the amount of undiscounted fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via the USPTO patent electronic filing system.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications. **Because electronic patent issuance may occur shortly after issue fee payment, any desired continuing application should preferably be filed prior to payment of this issue fee in order not to jeopardize copendency.**

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via the USPTO patent electronic filing system or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
18/822,334	09/02/2024	Xiaofeng LIU	3720-24P06732US	6388

TITLE OF INVENTION: CONTROLLABLE SINKING AND FLOATING SWIMMING POOL ROBOT AND SINKING AND FLOATING CONTROL METHOD FOR SWIMMING POOL ROBOT

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	\$516	\$0.00	\$0.00	\$516	03/18/2025

EXAMINER	ART UNIT	CLASS-SUBCLASS
OLSON, LARS A	3615	114-313000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/AIA/122 or PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/AIA/47 or PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,

1 _____

(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

2 _____

3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. Fees submitted: ☐ Issue Fee ☐ Publication Fee (if required)

4b. Method of Payment: (Please first reapply any previously paid fee shown above)

☐ Electronic Payment via the USPTO patent electronic filing system ☐ Enclosed check ☐ Non-electronic payment by credit card (Attach form PTO-2038)

☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

5. Change in Entity Status (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29

☐ Applicant asserting small entity status. See 37 CFR 1.27

☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____

Date _____

Typed or printed name _____

Registration No. _____



UNITED STATES PATENT AND TRADEMARK OFFICE

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
18/822,334	09/02/2024	Xiaofeng LIU	3720-24P06732US	6388
92940	7590	12/18/2024	EXAMINER	
IPRO, PLLC			OLSON, LARS A	
12332 Towncenter Plaza			ART UNIT	
PMB# 816			PAPER NUMBER	
Sterling, VA 20164			3615	
DATE MAILED: 12/18/2024				

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. The United States Patent and Trademark Office (USPTO) collects the information in this record under authority of 35 U.S.C. 2. The USPTO's system of records is used to manage all applicant and owner information including name, citizenship, residence, post office address, and other information with respect to inventors and their legal representatives pertaining to the applicant's/owner's activities in connection with the invention for which a patent is sought or has been granted. The applicable Privacy Act System of Records Notice for the information collected in this form is COMMERCE/PAT-TM-7 Patent Application Files, available in the Federal Register at 78 FR 19243 (March 29, 2013).

<https://www.govinfo.gov/content/pkg/FR-2013-03-29/pdf/2013-07341.pdf>

Routine uses of the information in this record may include disclosure to:

- 1) law enforcement, in the event that the system of records indicates a violation or potential violation of law;
- 2) a federal, state, local, or international agency, in response to its request;
- 3) a contractor of the USPTO having need for the information in order to perform a contract;
- 4) the Department of Justice for determination of whether the Freedom of Information Act (FOIA) requires disclosure of the record;
- 5) a Member of Congress submitting a request involving an individual to whom the record pertains, when the individual has requested the Member's assistance with respect to the subject matter of the record;
- 6) a court, magistrate, or administrative tribunal, in the course of presenting evidence, including disclosures to opposing counsel in the course of settlement negotiations;
- 7) the Administrator, General Services Administration (GSA), or their designee, during an inspection of records conducted by GSA under authority of 44 U.S.C. 2904 and 2906, in accordance with the GSA regulations and any other relevant (i.e., GSA or Commerce) directive, where such disclosure shall not be used to make determinations about individuals;
- 8) another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c));
- 9) the Office of Personnel Management (OPM) for personnel research purposes; and
- 10) the Office of Management and Budget (OMB) for legislative coordination and clearance.

If you do not furnish the information requested on this form, the USPTO may not be able to process and/or examine your submission, which may result in termination of proceedings, abandonment of the application, and/or expiration of the patent.

Notice of Allowability	Application No. 18/822,334	Applicant(s) LIU et al.	
	Examiner LARS A OLSON	Art Unit 3615	AIA (FITF) Status Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to the amendment filed on 11/21/2024.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on ____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on ____; the restriction requirement and election have been incorporated into this action.

3. ☒ The allowed claim(s) is/are 1-13 and 15-20. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a) ☒ All b) ☐ Some* c) ☐ None of the:

1. ☒ Certified copies of the priority documents have been received.

2. ☐ Certified copies of the priority documents have been received in Application No. ____.

3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: ____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date ____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)	5. ☐ Examiner's Amendment/Comment
2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date ____.	6. ☒ Examiner's Statement of Reasons for Allowance
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material ____.	7. ☐ Other ____.
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date. ____.	

/LARS A OLSON/ Primary Examiner, Art Unit 3615	
---	--

DETAILED ACTION

Notice of Pre-AIA or AIA Status

1. The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.
2. An amendment was filed by the applicant on November 21, 2024.
3. Claim 14 has been cancelled.
4. Claims 1-13 and 15-20 are allowed.

Reasons for Allowance

5. The following is an examiner's statement of reasons for allowance. The sinking and floating swimming pool robot and method are not shown or suggested in the prior art because of the use of a robot and method which include a sinking and floating control unit that is controlled to stop working after said unit enters a floating working state for a predetermined time.
6. The prior art as disclosed by Korenfeld et al. (US 11,124,982) shows the use of a pool cleaner robot which is comprised of a body or housing, first and second track and wheels sets, one or more fluid outlets, a controller, and a yaw sensor or inclinometer, where said robot is configured to detect and maintain a required waterline angle with a waterline of a swimming pool, and is configured to crawl from a pool bottom onto a side wall of said swimming pool. Tryber et al. (US 11,274,462) discloses a pool cleaning robot which includes a control unit, a gyroscope, a geometrical sensor, and a ballast tank with a compressed gas cylinder and a piston which is configured to intake water to

make said robot heavy and sink from a waterline to a bottom of a pool in a sinking working state, and expel water to make said robot lighter and float from said bottom to said waterline of said pool in a floating working state. Newly cited reference by Henkin et al. (US 5,985,156) discloses a pool cleaning apparatus with a body and fluid jets that allow said body to move from a pool bottom in a sinking working state to a waterline of said pool in a floating working state.

Conclusion

7. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to LARS A OLSON whose telephone number is (571) 272-6685. The examiner can normally be reached Monday to Friday 8:00am - 4:00pm.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at <http://www.uspto.gov/interviewpractice>.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, SAMUEL J MORANO can be reached on 571-272-6684. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of published or unpublished applications may be obtained from Patent Center. Unpublished application information in Patent Center is available to registered users. To file and manage patent submissions in Patent Center, visit: <https://patentcenter.uspto.gov>. Visit <https://www.uspto.gov/patents/apply/patent-center> for more information about Patent Center and <https://www.uspto.gov/patents/docx> for information about filing in DOCX format. For additional questions, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

November 29, 2024

/LARS A OLSON/
Primary Examiner, Art Unit 3615

Corrected Notice of Allowance - Correction of Issue Fee Amount

Due to a technical problem, the Notice of Allowance and Fee(s) Due mailed in this application specified an incorrect fee amount (the amount effective on January 19, 2025 for Notices of Allowance mailed on or after January 19, 2025). Corrected Notices of Allowance are being mailed to all applicants who are affected. This is necessary because the statute requires the applicant to pay the fee that is specified on the Notice of Allowance.

A Corrected Notice of Allowance is attached which specifies the correct issue fee. The time period for payment of the issue fee set forth in the previous Notice of Allowance and Fee(s) Due is being restarted to run THREE MONTHS from the "DATE MAILED" of the attached Corrected Notice of Allowance. Failure to timely comply will result in ABANDONMENT of this application. THIS THREE-MONTH PERIOD IS NOT EXTENDABLE

For applicants who replied prior to receiving the Corrected Notice of Allowance:

Applicant must still file a completed Part B – Fee(s) Transmittal, Form PTOL-85 Part B, or an equivalent, in reply to the Corrected Notice of Allowance since the Corrected Notice of Allowance sets forth a time period for reply. This applies to those situations in which applicant's reply was not processed before the Corrected Notice of Allowance was mailed (e.g., the reply crossed in the mail with the Corrected Notice of Allowance) and those situations in which applicant's reply was already processed. Applicants should check the appropriate box in section 4b of Form PTOL-85 Part B, such as the box authorizing the Director to "charge the required fee(s), any deficiency, or credit any overpayment" to a deposit account number. If this box is checked, the applicant will be refunded the amount of any overpayment to the designated deposit account. In addition, by checking the appropriate box in section 4b of Form PTOL-85, Part B, the applicant requests the Office to "first reapply any previously paid fee shown above," as stated on the form. Applicant may also include an explanatory cover letter, if desired. If, however, applicant prefers to file an equivalent of Form PTOL-85, Part B, and if applicant paid an increased issue fee amount as specified on the Notice of Allowance, applicant may request a refund of the difference between the incorrect amount specified on the Notice of Allowance and the correct amount specified on the Corrected Notice of Allowance.

For questions regarding the issue fee amount calculation, please contact the Application Assistance Unit at 888-786-0101 or HelpAAU@uspto.gov.

For assistance with Patent Center or other Patent Electronic Systems, please contact the Patent EBC at 1-866-217-9197 or ebc@uspto.gov.



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

CORRECTED NOTICE OF ALLOWANCE AND FEE(S) DUE

92940 7590 12/20/2024
IPRO, PLLC
12332 Towncenter Plaza
PMB# 816
Sterling, VA 20164

EXAMINER	
OLSON, LARS A	
ART UNIT	PAPER NUMBER
3615	

DATE MAILED: 12/20/2024

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
18/822,334	09/02/2024	Xiaofeng LIU	3720-24P06732US	6388

TITLE OF INVENTION: CONTROLLABLE SINKING AND FLOATING SWIMMING POOL ROBOT AND SINKING AND FLOATING CONTROL METHOD FOR SWIMMING POOL ROBOT

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	\$480	\$0.00	\$0.00	\$480	03/20/2025

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 40% the amount of undiscounted fees, and micro entity fees are 20% the amount of undiscounted fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via the USPTO patent electronic filing system.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications. **Because electronic patent issuance may occur shortly after issue fee payment, any desired continuing application should preferably be filed prior to payment of this issue fee in order not to jeopardize copendency.**

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via the USPTO patent electronic filing system or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
18/822,334	09/02/2024	Xiaofeng LIU	3720-24P06732US	6388

TITLE OF INVENTION: CONTROLLABLE SINKING AND FLOATING SWIMMING POOL ROBOT AND SINKING AND FLOATING CONTROL METHOD FOR SWIMMING POOL ROBOT

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	\$480	\$0.00	\$0.00	\$480	03/20/2025

EXAMINER	ART UNIT	CLASS-SUBCLASS
OLSON, LARS A	3615	114-313000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/AIA/122 or PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/AIA/47 or PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,

1 _____

(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

2 _____

3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. Fees submitted: ☐ Issue Fee ☐ Publication Fee (if required)

4b. Method of Payment: (Please first reapply any previously paid fee shown above)

☐ Electronic Payment via the USPTO patent electronic filing system ☐ Enclosed check ☐ Non-electronic payment by credit card (Attach form PTO-2038)

☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

5. Change in Entity Status (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29

☐ Applicant asserting small entity status. See 37 CFR 1.27

☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____

Date _____

Typed or printed name _____

Registration No. _____



UNITED STATES PATENT AND TRADEMARK OFFICE

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
18/822,334	09/02/2024	Xiaofeng LIU	3720-24P06732US	6388
92940	7590	12/20/2024	EXAMINER	
IPRO, PLLC			OLSON, LARS A	
12332 Towncenter Plaza			ART UNIT	
PMB# 816			PAPER NUMBER	
Sterling, VA 20164			3615	

DATE MAILED: 12/20/2024

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. The United States Patent and Trademark Office (USPTO) collects the information in this record under authority of 35 U.S.C. 2. The USPTO's system of records is used to manage all applicant and owner information including name, citizenship, residence, post office address, and other information with respect to inventors and their legal representatives pertaining to the applicant's/owner's activities in connection with the invention for which a patent is sought or has been granted. The applicable Privacy Act System of Records Notice for the information collected in this form is COMMERCE/PAT-TM-7 Patent Application Files, available in the Federal Register at 78 FR 19243 (March 29, 2013).

<https://www.govinfo.gov/content/pkg/FR-2013-03-29/pdf/2013-07341.pdf>

Routine uses of the information in this record may include disclosure to:

- 1) law enforcement, in the event that the system of records indicates a violation or potential violation of law;
- 2) a federal, state, local, or international agency, in response to its request;
- 3) a contractor of the USPTO having need for the information in order to perform a contract;
- 4) the Department of Justice for determination of whether the Freedom of Information Act (FOIA) requires disclosure of the record;
- 5) a Member of Congress submitting a request involving an individual to whom the record pertains, when the individual has requested the Member's assistance with respect to the subject matter of the record;
- 6) a court, magistrate, or administrative tribunal, in the course of presenting evidence, including disclosures to opposing counsel in the course of settlement negotiations;
- 7) the Administrator, General Services Administration (GSA), or their designee, during an inspection of records conducted by GSA under authority of 44 U.S.C. 2904 and 2906, in accordance with the GSA regulations and any other relevant (i.e., GSA or Commerce) directive, where such disclosure shall not be used to make determinations about individuals;
- 8) another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c));
- 9) the Office of Personnel Management (OPM) for personnel research purposes; and
- 10) the Office of Management and Budget (OMB) for legislative coordination and clearance.

If you do not furnish the information requested on this form, the USPTO may not be able to process and/or examine your submission, which may result in termination of proceedings, abandonment of the application, and/or expiration of the patent.



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FEE ADDRESS CHANGE

APPLICATION #	FILING OR 371(C) DATE	REQUEST ID
18/822,334	09/02/2024	24605681

The following fields have been changed to Customer Number 172975 on 12/30/2024 via Patent Center in view of the certification copied below that authorized the change.

- Maintenance Fee Address

The address for Customer Number 172975 is:

172975 - Beijing UNIPAT Intellectual Property Law Firm
China Electronics Plaza Room 606, Building B
Dan Ling Street 3, Haidian District
Beijing,
CHINA

I certify, in accordance with 37 CFR 1.4(d)(4), that I am :

An attorney or Agent of Record registered to practice before the Patent and Trademark Office who has been given power of attorney in this application

Signature

Name

Registration #



UNITED STATES
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P.O. Box 1450
Alexandria, VA 22313 - 1450
www.uspto.gov

ISSUE FEE TRANSMITTAL FORM

APPLICATION #	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET #
18822334	09/02/2024	Xiaofeng LIU	3720-24P06732US

Title of Invention

CONTROLLABLE SINKING AND FLOATING SWIMMING POOL ROBOT AND SINKING AND
FLOATING CONTROL METHOD FOR SWIMMING POOL ROBOT

Application Information

APPLICATION TYPE	Nonprovisional Application under 35 USC 111(a)	DATE DUE	03/18/2025
CONFIRMATION #	6388	ISSUE FEE DUE	\$ 480
EXAMINER	LARS OLSON	PUBLICATION DUE	\$ 0
GROUP ART UNIT	3615	TOTAL FEES DUE	\$480
CLASS - SUBCLASS	114/313000	PREV. PAID FEE	\$ 0
ENTITY STATUS	Small		

1. CHANGE OF CORRESPONDENCE ADDRESS AND/OR INDICATION OF FEE ADDRESS (37 CFR 1.33 & 1.363)

Correspondence Address

Maintenance Fee Address

CURRENT ADDRESS

CURRENT ADDRESS



Change of correspondence address requested, system generated AIA/122-PC form attached



Fee address indication requested, system generated SB/47-PC form attached

2. ENTITY STATUS

Change in Entity Status

NEW STATUS

3. THE FOLLOWING FEES ARE SUBMITTED



Issue Fee



Publication Fee

4. FEE AUTHORIZATION



I authorize USPTO to apply my previously paid issue fee to the current fees due



The Director is hereby authorized to apply my previously paid issue fee to the current fee due and to charge deficient fees to Deposit Account Number:



If in addition to the payment of the issue fee amount submitted with this form, there are any discrepancies in any amount(s) due, the Director is authorized to charge any deficiency, or credit any overpayment, to Deposit Account Number:

5. FIRM AND/OR ATTORNEY NAMES TO BE PRINTED

NOTE: If no name is listed, no name will be printed

For printing on the patent front page, list to be displayed as entered

I PRO, PLLC

6. ASSIGNEE NAME(S) AND RESIDENCE DATA TO BE PRINTED

NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been

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Ex. 1002

Page 167 of 178

Aiper Global Pte. Ltd.

Singapore, SINGAPORE

Corporation

Signature

I certify, in accordance with 37 CFR 1.4(d)(4) that I am an attorney or agent registered to practice before the Patent and Trademark Office who has filed and has been granted power of attorney in this application. I also certify that this Fee(s) Transmittal form is being transmitted to the USPTO via Patent Center on the date indicated below.

Signature	Name	Registration #	Date
/NA XU/	Na Xu	64369	12/30/2024



UNITED STATES
PATENT AND TRADEMARK OFFICE

P.O. Box 1450
Alexandria, VA 22313 - 1450
www.uspto.gov

FEE ADDRESS INDICATION FORM

APPLICATION #
18822334

ATTORNEY DOCKET #
3720-24P06732US

FILING DATE
09/02/2024

Title of Invention

CONTROLLABLE SINKING AND FLOATING SWIMMING POOL ROBOT AND SINKING AND
FLOATING CONTROL METHOD FOR SWIMMING POOL ROBOT

Application Information

ART UNIT 3615

FIRST NAMED INVENTOR

Xiaofeng LIU

EXAMINER LARS OLSON

INSTRUCTIONS: In order for the fee address identified on this form to be effective, the issue fee must have been paid for the application listed on this form. Only an address represented by a customer number can be established as the fee address for maintenance fee purposes (hereafter, fee address). A fee address should be established when correspondence related to maintenance fees should be mailed to a different address than the correspondence address for the application. For more information on customer numbers, see the Manual of Patent Examining Procedure (MPEP) § 403

Maintenance Fee Address

Please recognize as the Fee Address under the provisions of 37 CFR 1.363 the address associated with:

172975 - Beijing UNIPAT Intellectual
Property Law Firm, Dan Ling Street 3,
Haidian District

China Electronics Plaza Room 606,
Building B
Dan Ling Street 3, Haidian District
Beijing, --- ---
CHINA

Signature

I certify, in accordance with 37 CFR 1.4(d)(4) that I am an attorney or agent registered to practice before the Patent and Trademark Office who has filed and has been granted power of attorney in this application.

Signature

Name

Registration #

Date



UNITED STATES
PATENT AND TRADEMARK OFFICE

P.O. Box 1450
Alexandria, VA 22313 - 1450
www.uspto.gov

ELECTRONIC PAYMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
18/822,334	12/30/2024 04:12:26 PM Z ET	3720-24P06732US

Title of Invention

CONTROLLABLE SINKING AND FLOATING SWIMMING POOL ROBOT AND SINKING AND FLOATING CONTROL METHOD FOR SWIMMING POOL ROBOT

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	-
CONFIRMATION #	6388	FILED BY	Na Xu
PATENT CENTER #	68556007	AUTHORIZED BY	-
CUSTOMER #	92940	FILING DATE	09/02/2024
CORRESPONDENCE ADDRESS	-	FIRST NAMED INVENTOR	Xiaofeng LIU

Payment Information

PAYMENT METHOD	PAYMENT TRANSACTION ID	PAYMENT AUTHORIZED BY
CARD / 5684	E2024BTG12345016	Na Xu

FEE CODE	DESCRIPTION	ITEM PRICE(\$)	QUANTITY	ITEM TOTAL(\$)
2501	UTILITY ISSUE FEE	480.00	1	480.00
TOTAL AMOUNT:				\$480.00

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage

BEATBOT
Ex. 1002

submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.



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APPLICATION #
18/822,334

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ATTORNEY DOCKET #
3720-24P06732US

Title of Invention

CONTROLLABLE SINKING AND FLOATING SWIMMING POOL ROBOT AND SINKING AND
FLOATING CONTROL METHOD FOR SWIMMING POOL ROBOT

Application Information

APPLICATION TYPE Utility - Nonprovisional Application
under 35 USC 111(a)

PATENT # -

CONFIRMATION # 6388

FILED BY Na Xu

PATENT CENTER # 68556007

FILING DATE 09/02/2024

CUSTOMER # 92940

FIRST NAMED INVENTOR Xiaofeng LIU

CORRESPONDENCE ADDRESS -

AUTHORIZED BY -

Documents

TOTAL DOCUMENTS: 2

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
web85bfeeaddress.pdf	2	Maintenance Fee Address Change	27 KB
web85b.pdf	3	Issue Fee Payment (PTO-85B)	58 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
web85bfeeaddress.pdf	E5B4404F623C25B217831DEEE3B244D63503BCCF1EDDB286 814CD81FD0BB3F6920E702659D13C571183D59C6DC566BAC 9990F782C8CC2F22ABC78DDB3E82D463
web85b.pdf	9818AC5A3D9EFF817BAE9AD12143AD77C53B6277DCCEBEC

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CD7AF41D425E25766A2B4F68335C79C9

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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
18/822,334	02/11/2025	12221196	3720-24P06732US	6388

92940 7590 01/22/2025
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ISSUE NOTIFICATION

The projected patent number and issue date are specified above. The patent will issue electronically. The electronically issued patent is the official patent grant pursuant to 35 U.S.C. § 153. The patent may be accessed on or after the issue date through Patent Center at <https://patentcenter.uspto.gov/>. The patent will be available in both the public and the private sides of Patent Center. Further assistance in electronically accessing the patent, or about Patent Center, is available by calling the Patent Electronic Business Center at 1-888-217-9197.

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Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Center (<https://patentcenter.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Patents Stakeholder Experience (OPSE), Stakeholder Support Division (SSD) at (571)-272-4200.

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18/822,334	09/02/2024	Xiaofeng LIU	3720-24P06732US	6388
92940	7590	02/11/2025	EXAMINER	
IPro, PLLC 12332 Towncenter Plaza PMB# 816 Sterling, VA 20164			OLSON, LARS A	
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			02/11/2025	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

contact@us-ip.com
uspto+949965@doctraktrak.com

APPLICATION NO.	ISSUE DATE	PATENT NO.
18/822,334	11-Feb-2025	12221196

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