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(71) Applicant: **Shenzhen Seauto Technology Co., Ltd**
Shenzhen, Guangdong 518000 (CN)

(72) Inventor: **LIU, Qiang**
Jingzhou, Hubei 434200 (CN)

(74) Representative: **Valet Patent Services Limited**
c/o Caya 83713X
Am Börstig 5
96052 Bamberg (DE)

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(54) **UNDERWATER ROBOT DRIVING STRUCTURE**

(57) The present invention discloses an underwater robot drive structure, where the underwater robot includes a housing, two sides of the housing are provided with a four-wheel drive mechanism configured to drive movement of a robot, the four-wheel drive mechanism includes a drive wheel assembly and a drive motor, and the drive motor is configured to drive the drive wheel assembly to move. The present invention is configured to increase driving force of the robot during walking on a pool bottom, preventing slipping, and enabling the robot to achieve full-coverage walking on a swimming pool bottom; in addition, the present invention is configured to drive the four-wheel drive mechanism to drive the robot to move via only one drive motor and an intermediate gear cooperating therewith, thereby reducing the installation space required for the pressure hull, reducing the volume of the pressure hull, making the structure more compact, and consequently leaving a larger space inside the housing for placing the debris bin, increasing the debris collection capacity of the debris bin.

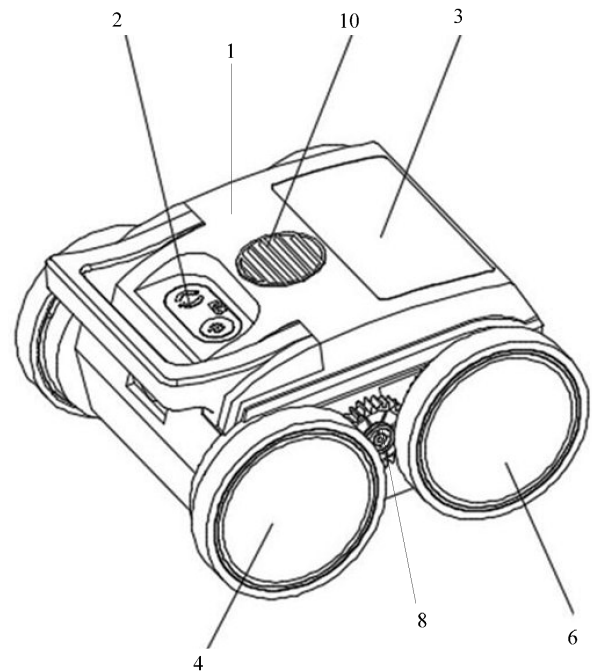


FIG. 1

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Description

TECHNICAL FIELD

[0001] The present invention relates to the technical field of robots, and in particular, to an underwater robot drive structure.

BACKGROUND

[0002] With the development of the social economy, the demand for swimming pool cleaning is increasing. Swimming pool cleaning robots are required to perform underwater debris cleaning work in swimming pools. In the underwater operation process of a four-wheel robot, the friction resistance on the pool bottom decreases due to the effect of water, making both front-wheel drive and rear-wheel drive prone to slipping. Therefore, all four wheels need to be driven simultaneously for the robot to reduce slipping when operating underwater.

[0003] In the prior art, swimming pool cleaning robots currently on the market generally use tracks, water jet propulsion, or wheeled methods to move the robot forward. Tracks are prone to material fatigue fracture, deformation, and detachment after long-term use. The water jet propulsion method is suitable for flat swimming pool environments. If the bottom of the swimming pool is curved or has slopes, the robot will be unable to achieve full-coverage movement on the pool bottom because of the relatively small thrust of the water jet. In existing wheeled drive structures, some use a drive gear to directly drive the front and rear wheels. In this structure, the drive gear is positioned exactly in the middle of the line connecting the two wheels. As the drive gear is connected to the drive motor, this leads to an excessively large volume of the pressure hull housing the drive motor, insufficient space left for the debris bin, a relatively small debris collection capacity, and an unreasonable structure.

SUMMARY

[0004] A primary objective of the present invention is to propose an underwater robot drive structure, aiming to drive the front and rear wheels of the robot simultaneously via a single drive motor, thereby avoiding the problem of the front and rear wheels slipping underwater, enabling the robot to achieve full-coverage walking on the swimming pool bottom, reducing the volume of the pressure hull, leaving more space at the rear of the robot for placing a debris bin, and increasing the debris collection capacity of the debris bin.

[0005] To achieve the aforementioned objective, the present invention provides an underwater robot drive structure, where the underwater robot drive structure includes a housing, two sides of the housing are provided with a four-wheel drive mechanism configured to drive movement of a robot, the four-wheel drive mechanism

includes a drive wheel assembly and a drive motor, the drive motor is configured to drive the drive wheel assembly to move, and the drive wheel assembly includes a front wheel, a front outer gear, a rear wheel, a rear outer gear, an intermediate gear, and a drive gear.

[0006] The front wheel is connected to an outer side of the front outer gear, the rear wheel is connected to an outer side of the rear outer gear, the intermediate gear is respectively meshed with the front outer gear and the rear outer gear, and the drive gear is meshed with the intermediate gear.

[0007] A further technical solution of the present invention is that the underwater robot drive structure further includes a pressure hull and a debris bin disposed inside the housing, the debris bin is located at a rear end of the pressure hull, and the drive motor is disposed inside the pressure hull.

[0008] A further technical solution of the present invention is that the intermediate gear is disposed on the housing.

[0009] A further technical solution of the present invention is that, in the drive wheel assembly, the front wheel and the rear wheel are disposed on an outer side of the housing and are rotationally symmetric about a center of the intermediate gear.

[0010] A further technical solution of the present invention is that a printed circuit board, PCB, is disposed inside the pressure hull, and a control system signally connected to the drive motor is disposed on the PCB.

[0011] A further technical solution of the present invention is that a waterproof switch button and an indicator light connected to the control system are disposed on the housing.

[0012] A further technical solution of the present invention is that a water outlet flow channel is disposed on a top of the housing.

[0013] The beneficial effects of the underwater robot drive structure of the present invention are as follows:

With the above technical solution of the present invention, the underwater robot drive structure includes a housing, characterized in that two sides of the housing are provided with a four-wheel drive mechanism configured to drive movement of a robot, the four-wheel drive mechanism includes a drive wheel assembly and a drive motor, the drive motor is configured to drive the drive wheel assembly to move, and the drive wheel assembly includes a front wheel, a front outer gear, a rear wheel, a rear outer gear, an intermediate gear, and a drive gear; the front wheel is connected to an outer side of the front outer gear, the rear wheel is connected to an outer side of the rear outer gear, the intermediate gear is respectively meshed with the front outer gear and the rear outer gear, and the drive gear is meshed with the intermediate gear, leading to increased driving force of the robot during walking on a pool bottom, preventing slipping, and enabling the robot to achieve full-coverage walking on a swimming pool bottom; in addition, the present invention is configured to drive the four-wheel drive mechanism to

drive the robot to move via only one drive motor and an intermediate gear cooperating therewith, thereby reducing installation space required for the pressure hull, reducing a volume of the pressure hull, making a structure more compact, and consequently leaving a larger space inside the housing for placing the debris bin, increasing a debris collection capacity of the debris bin.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] To illustrate the technical solutions in the embodiments of the present invention or the prior art more clearly, the accompanying drawings required for describing the embodiments or the prior art are briefly introduced below. Obviously, the accompanying drawings in the following description show merely some embodiments of the present invention. For a person skilled in the art, other accompanying drawings can be obtained based on the structures illustrated in these accompanying drawings without any creative effort.

FIG. 1 is a schematic overall structural view of a preferred embodiment of the underwater robot drive structure of the present invention;

FIG. 2 is a schematic structural view of the preferred embodiment of the underwater robot drive structure of the present invention without a housing;

FIG. 3 is a front view of a drive wheel assembly;

FIG. 4 is a schematic perspective structural view of the drive wheel assembly.

Reference Numerals:

[0015] housing 1; pressure hull 2; debris bin 3; front wheel 4; front outer gear 5; rear wheel 6; rear outer gear 7; intermediate gear 8; drive gear 9; water outlet flow channel 10; drive motor 11.

[0016] The achievement of the objectives, functional features, and advantages of the present invention will be further described in conjunction with embodiments and with reference to the accompanying drawings.

DETAILED DESCRIPTION

[0017] The technical solutions in the embodiments of the present invention are clearly and completely described below in conjunction with the accompanying drawings in the embodiments of the present invention. Obviously, the described embodiments are only a part of the embodiments of the present invention, and not all of them. All other embodiments obtained by a person skilled in the art based on the embodiments of the present invention without creative efforts shall fall within the scope of protection of the present invention.

[0018] The present invention proposes an underwater robot drive structure. Please refer to FIGS. 1 to 4. The underwater robot drive structure includes a housing 1. The underwater robot drive structure includes the hous-

ing 1, and two sides of the housing 1 are provided with a four-wheel drive mechanism configured to drive movement of a robot. The four-wheel drive mechanism includes a drive wheel assembly and a drive motor 10.

[0019] The front wheel 4 is connected to an outer side of the front outer gear, the rear wheel 6 is connected to an outer side of the rear outer gear, the intermediate gear 8 is respectively meshed with the front outer gear and the rear outer gear, the drive gear 9 is meshed with the intermediate gear 8, and an input end of the drive gear 9 is connected to an output end of the drive motor 10.

[0020] In the present embodiment, the drive motor 10 is rigidly connected to the drive gear 9, and the front wheel 4 and the rear wheel 6 are configured to move forward or backward respectively in response to being driven by the front outer gear 5 and the rear outer gear 7. The intermediate gear 8 is configured to drive the front outer gear 5 and the rear outer gear 7 to rotate in the same direction in response to the drive motor 10 driving the drive gear 9 to rotate, thereby driving the front wheel 4 and the rear wheel 6 to move synchronously in the same direction.

[0021] The robot is configured to be driven to move via the four-wheel drive mechanism in the present embodiment, leading to increased driving force of the robot during walking on a pool bottom, preventing slipping, and enabling the robot to achieve full-coverage walking on a swimming pool bottom.

[0022] In the present embodiment, the intermediate gear 8 is disposed on the housing 1, and in the drive wheel assembly, the front wheel 4 and the rear wheel 6 are disposed on an outer side of the housing 1 and are rotationally symmetric about a center of the intermediate gear 8.

[0023] Furthermore, in the present embodiment, the underwater robot drive structure further includes a pressure hull 2 and a debris bin 3 disposed inside the housing 1, the debris bin 3 is located at a rear end of the pressure hull 2, and the drive motor 10 is disposed inside the pressure hull 2.

[0024] The present embodiment is configured to drive the four-wheel drive mechanism to drive the robot to move via only one drive motor 10 and an intermediate gear 8 cooperating therewith, thereby reducing installation space required for the pressure hull 2, reducing a volume of the pressure hull 2, making a structure more compact, and consequently leaving a larger space inside the housing 1 for placing the debris bin 3, increasing a debris collection capacity of the debris bin 3.

[0025] Furthermore, in the present embodiment, a printed circuit board, PCB, is disposed inside the pressure hull 2, and a control system signally connected to the drive motor 10 is disposed on the PCB.

[0026] A waterproof switch button, an indicator light, a waterproof charging socket, and other structures con-

nected to the control system are disposed on the housing 1.

[0027] Furthermore, in the present embodiment, a water outlet flow channel is disposed on a top of the housing 1, and the water outlet flow channel is configured to discharge filtered clean water.

[0028] The beneficial effects of the underwater robot drive structure of the present invention are as follows:

With the above technical solution of the present invention, the underwater robot drive structure includes a housing, characterized in that two sides of the housing are provided with a four-wheel drive mechanism configured to drive movement of a robot, the four-wheel drive mechanism includes a drive wheel assembly and a drive motor, the drive motor is configured to drive the drive wheel assembly to move, and the drive wheel assembly includes a front wheel, a front outer gear, a rear wheel, a rear outer gear, an intermediate gear, and a drive gear; the front wheel is connected to an outer side of the front outer gear, the rear wheel is connected to an outer side of the rear outer gear, the intermediate gear is respectively meshed with the front outer gear and the rear outer gear, and the drive gear is meshed with the intermediate gear, leading to increased driving force of the robot during walking on a pool bottom, preventing slipping, and enabling the robot to achieve full-coverage walking on a swimming pool bottom; in addition, the present invention is configured to drive the four-wheel drive mechanism to drive the robot to move via only one drive motor and an intermediate gear cooperating therewith, thereby reducing installation space required for the pressure hull, reducing a volume of the pressure hull, making a structure more compact, and consequently leaving a larger space inside the housing for placing the debris bin, increasing a debris collection capacity of the debris bin.

[0029] The above the above are only preferred embodiments of the present invention and are not intended to limit the patent scope of the present invention. Any equivalent structural transformations made under the concept of the present invention by utilizing the content of the description and the accompanying drawings of the present invention, or any direct/indirect application in other related technical fields, are included within the patent protection scope of the present invention.

Claims

1. An underwater robot drive structure, wherein the underwater robot drive structure comprises a housing, wherein two sides of the housing are provided with a four-wheel drive mechanism configured to drive movement of a robot, the four-wheel drive mechanism comprises a drive wheel assembly and a drive motor, the drive motor is configured to drive the drive wheel assembly to move, and the drive wheel assembly comprises a front wheel, a front outer gear, a rear wheel, a rear outer gear, an

intermediate gear, and a drive gear;

The front wheel is connected to an outer side of the front outer gear, the rear wheel is connected to an outer side of the rear outer gear, the intermediate gear is respectively meshed with the front outer gear and the rear outer gear, and the drive gear is meshed with the intermediate gear.

2. The underwater robot drive structure according to claim 1, wherein the underwater robot drive structure further comprises a pressure hull and a debris bin disposed inside the housing, the debris bin is located at a rear end of the pressure hull, and the drive motor is disposed inside the pressure hull.
3. The underwater robot drive structure according to claim 2, wherein the intermediate gear is disposed on the housing.
4. The underwater robot drive structure according to claim 1, wherein, in the drive wheel assembly, the front wheel and the rear wheel are disposed on an outer side of the housing and are rotationally symmetric about a center of the intermediate gear.
5. The underwater robot drive structure according to claim 1, wherein a printed circuit board, PCB, is disposed inside the pressure hull, and a control system signally connected to the drive motor is disposed on the PCB.
6. The underwater robot drive structure according to claim 4, wherein a waterproof switch button and an indicator light connected to the control system are disposed on the housing.
7. The underwater robot drive structure according to claim 5, wherein a water outlet flow channel is disposed on a top of the housing.

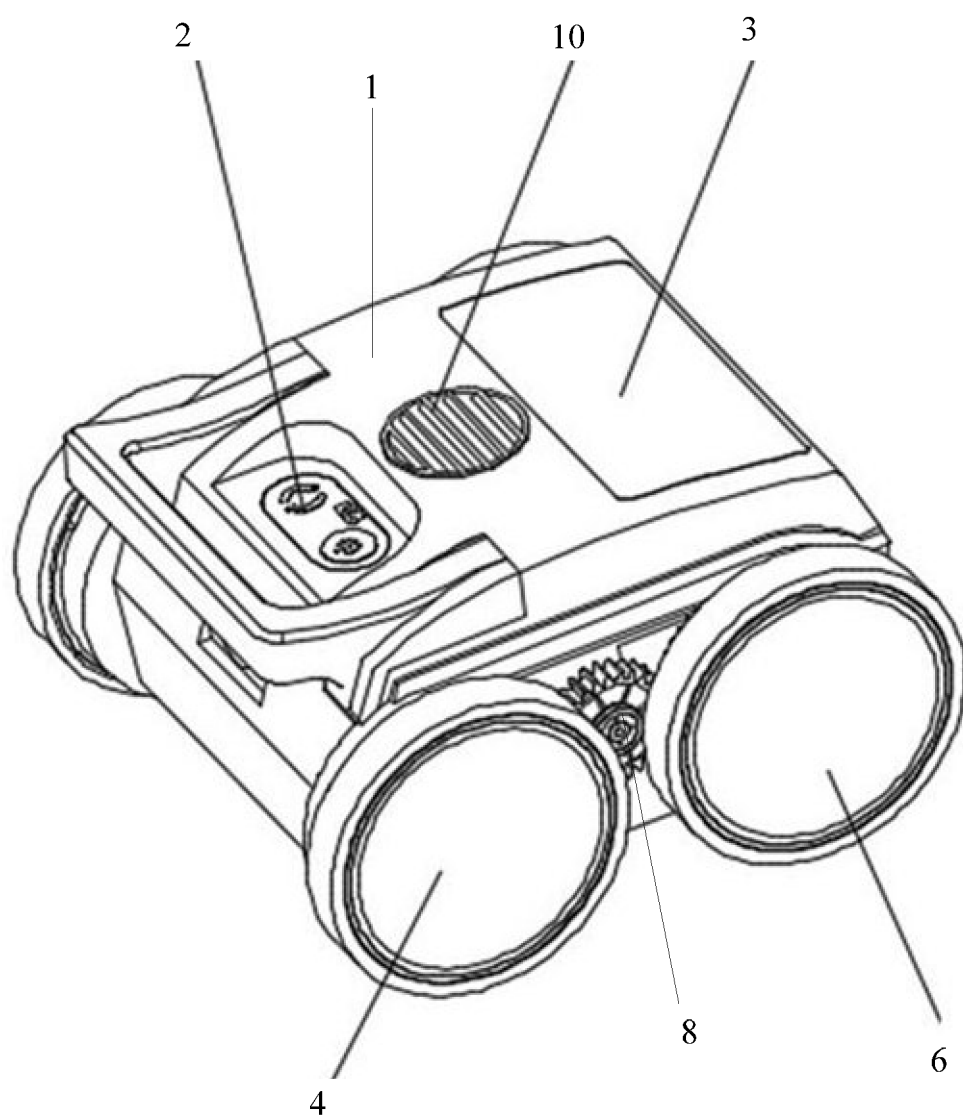


FIG. 1

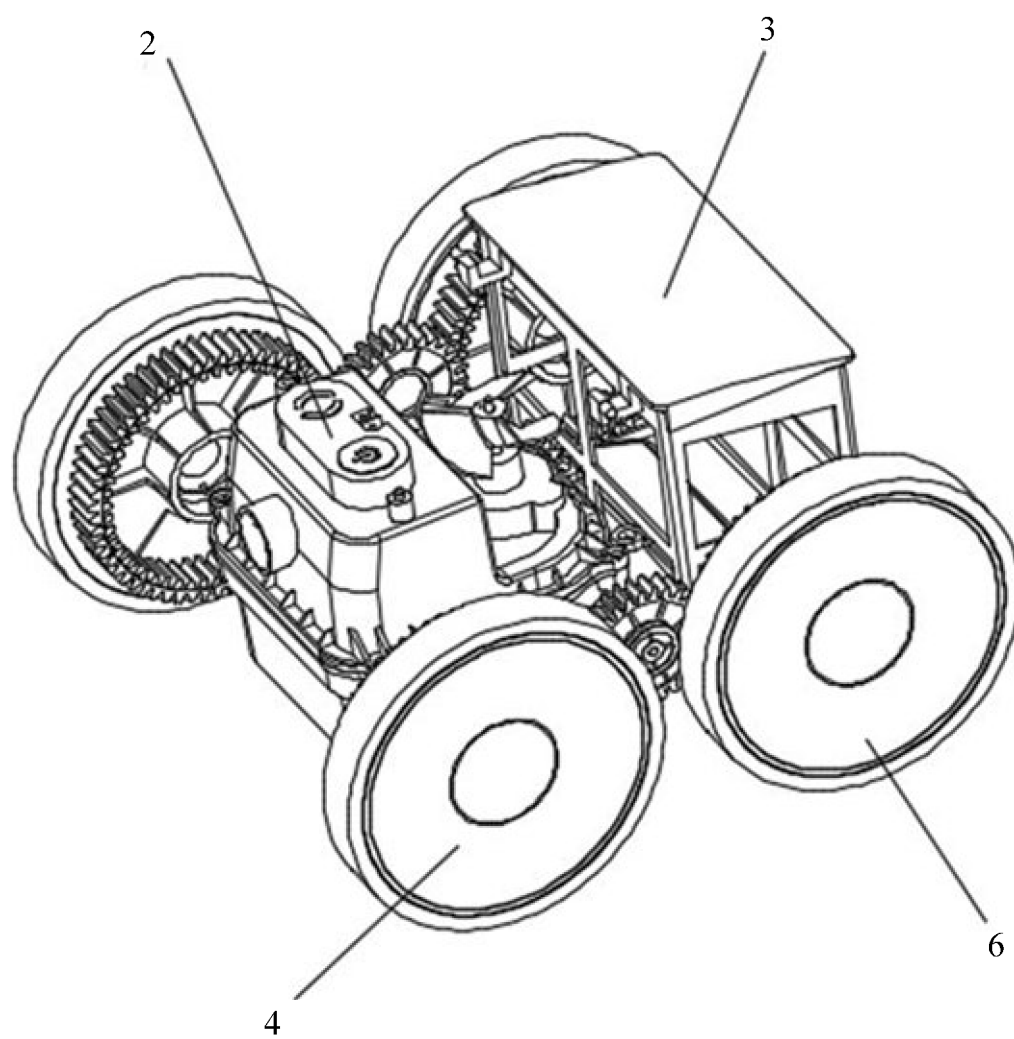


FIG. 2

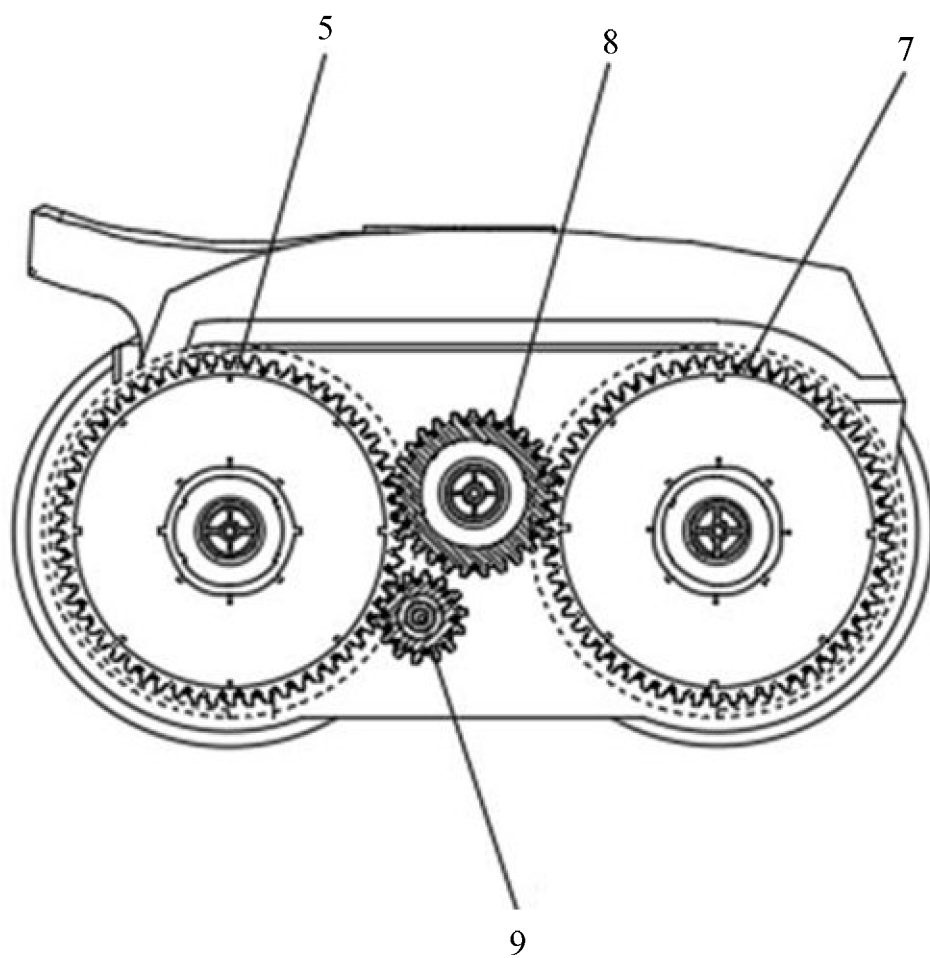


FIG. 3

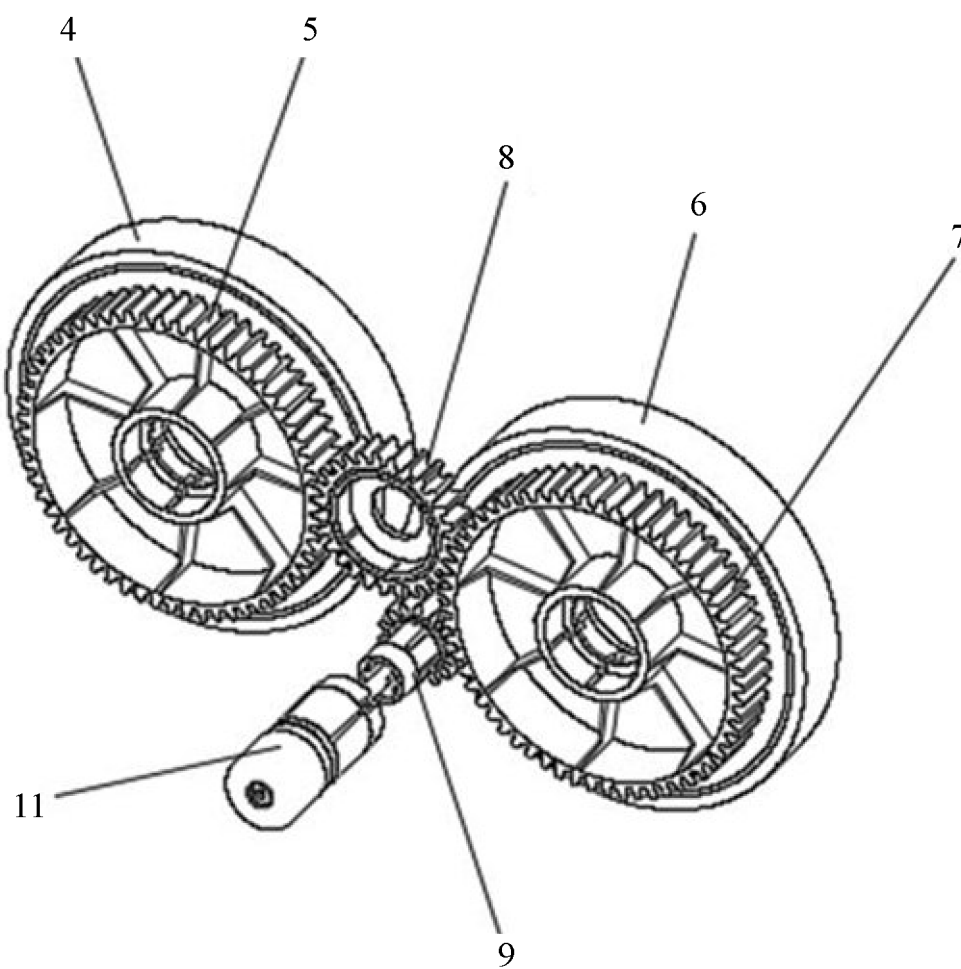


FIG. 4

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2024/119513

A. CLASSIFICATION OF SUBJECT MATTER

B63G 8/08(2006.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC:B63G

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

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

CNTXT, ENTXTC, CNKI: 泳池, 水下, 齿轮, 电机, 电动机, 马达, 啮合, 前轮, 后轮: ENTXT, VEN: pool, underwater, gear, motor, electromotor, engage, front wheel, rear wheel.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 111441619 A (TIANJIN WANGYUAN ENVIRONMENTAL PROTECTION AND TECHNOLOGY CO., LTD.) 24 July 2020 (2020-07-24) description, paragraphs 56-85, and figures 1-14	1-7
X	CN 220769015 U (SHENZHEN YUANDING INTELLIGENT INNOVATION CO., LTD.) 12 April 2024 (2024-04-12) description, paragraphs 31-68, and figures 1-5	1-7
A	CN 219864312 U (SHENZHEN YUANDING INTELLIGENT INNOVATION CO., LTD.) 20 October 2023 (2023-10-20) entire document	1-7
A	CN 218265196 U (SHENZHILAN (TIANJIN) UNDERWATER INTELLIGENT TECHNOLOGY CO., LTD.) 10 January 2023 (2023-01-10) entire document	1-7
A	CN 117868573 A (SPLASH POOL & SPA, INC.) 12 April 2024 (2024-04-12) entire document	1-7
A	US 2017114561 A1 (ZODIAC POOL CARE EUROPE) 27 April 2017 (2017-04-27) entire document	1-7

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

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"D" document cited by the applicant in the international application	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search 20 April 2025	Date of mailing of the international search report 22 April 2025
Name and mailing address of the ISA/CN China National Intellectual Property Administration (ISA/CN) China No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (July 2022)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/CN2024/119513

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
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