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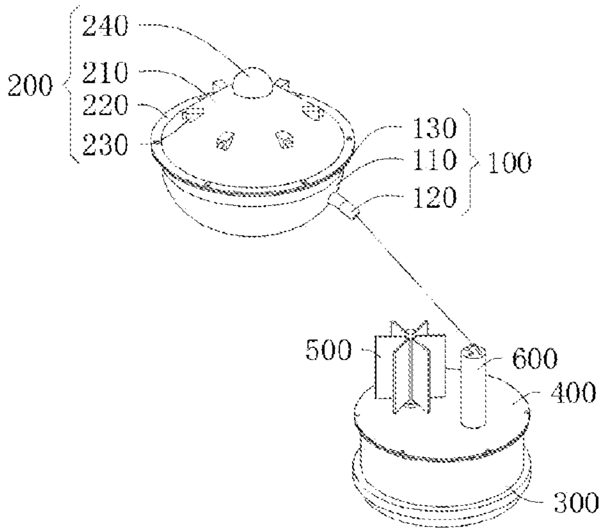
(54) DEVICE FOR MEASURING SEDIMENT OXYGEN DEMAND RATE IN SITU

(57) The present invention provides a device for measuring a sediment oxygen demand rate in situ in the technical field of sediment oxygen demand rate measurement. The device includes: a caisson assembly; a caisson end cap assembly including a caisson end cap mounted at an opening of a top of the caisson assembly and a connecting sleeve provided on an edge of a top of the caisson end cap; and a stirring rotor assembly including a rotating shaft. In the device, the driving blades are driven to rotate by the water flow outside the caisson assembly, the rotating shaft is driven to rotate by the driving blades, the stirring blades are driven to rotate by the rotating shaft, and water in an inner chamber of the caisson assembly is driven to flow by the stirring blades.



NL B1 2034077

P1696/NLpd

DEVICE FOR MEASURING SEDIMENT OXYGEN DEMAND RATE IN SITU

TECHNICAL FIELD

The present invention relates to the technical field of sediment oxygen demand rate measurement, and in particular to a device for measuring a sediment oxygen demand rate in situ.

BACKGROUND ART

Hatcher defined sediment oxygen demand (SOD) as "the rate at which dissolved oxygen (DO) is removed from the water column due to the decomposition of organic matter in the bottom sediment." After the river is polluted, pollutants are gradually deposited to pollute the sediment. And the polluted sediment further affects the quality of upper water and leads to an increased demand rate of the DO in the upper water. Especially for rivers and lakes polluted by organic matter, the organic content in these waters is high, and the oxygen demand of the sediment is more prominent. In some related studies, scientists have found that SOD accounts for a larger proportion of total oxygen demand in some rivers. Therefore, SOD is a component of DO balance in natural water (such as rivers, lakes, and reservoirs) and has a significant impact on DO circulation in the upper water.

Zhang Yuanning et al. disclosed a device for long-term in-situ real-time observation of SOD. The device includes an above-water part and an under-water part, the above-water part being a buoy and the under-water part being a measurement frame. In the device, the observation angle and observation height of the device are adjusted by a lifting platform and a rotating motor on the frame, and the observation device is powered by a storage battery placed in the buoy, while observation data are periodically extracted from a data transmission equipment in the buoy. The device has applied a variety of technologies and theories; however, the design of the device only considers adjustment of the height and angle. The under-water monitoring device is high, and flow rates of the upper and bottom waters inside the device are greatly different. Therefore, it is impossible to ensure that the flow rates of the upper and bottom waters inside the measurement device are uniform. In chambers of the conventional devices, mostly, the waters are in a static state or flow at a constant velocity. However, in the actual environment, the tidal river network area is affected by tidal action, and the velocity of the flow changes drastically, thereby affecting accuracy of measurement.

SUMMARY

The present invention is intended to provide a device for measuring a sediment oxygen demand rate in situ, so as to solve the problem mentioned in the background of the present invention that in chambers of the conventional devices, mostly, the waters are in a static state or flow at a constant velocity, however, in the actual environment, the tidal river network area is affected by tidal action, and the velocity of the flow changes drastically, thereby affecting accuracy of measurement.

In order to achieve the above object, the present invention provides a device for measuring a sediment oxygen demand rate in situ. The device includes:

a caisson assembly;

a caisson end cap assembly including a caisson end cap mounted at an opening of a top of the caisson assembly and a connecting sleeve provided on an edge of a top of the caisson end cap; and

a stirring rotor assembly including a rotating shaft, a connecting ring provided on a circumferential outer side wall of the rotating shaft and mounted in an inner chamber of the connecting sleeve via a bearing, driving blades evenly provided in an annular shape on the circumferential outer side wall of the rotating shaft and provided on an upper end of the caisson end cap, and stirring blades evenly provided in an annular shape on the circumferential outer side wall of the rotating shaft and provided in an inner chamber of the caisson assembly.

Preferably, a buoy assembly is further included. The buoy assembly includes a buoy, a guide pipe provided on a circumferential outer side wall of the buoy and communicated with an inner chamber of the buoy, and a first annular connecting block coaxially provided on a top of the buoy.

Preferably, a buoy end cap assembly is further included. The buoy end cap assembly includes a buoy end cap provided on the top of the buoy, a second annular connecting block coaxially provided on a bottom of the buoy end cap and connected to the first annular connecting block, radars evenly mounted in an annular shape on a circumferential outer side wall of the buoy end cap, and an alarm device mounted on a top of the buoy end cap.

Preferably, the caisson assembly includes a tank and a third annular connecting block coaxially provided on a top of the tank.

Preferably, the caisson end cap assembly further includes a mounting hole formed on a side edge of the top of the caisson end cap away from the connecting sleeve and passing through a bottom of the caisson end cap.

Preferably, a detection mechanism is further included. The detection mechanism includes a connecting rod coaxially mounted inside the mounting hole, sensors mounted on a circumferential outer side wall of the connecting rod and provided in an inner chamber of the tank, a data connector provided on an end of the connecting rod away from the sensors, and a lifting ring provided on the end of the connecting rod away from the sensors.

Compared to the prior art, the present invention has the following beneficial effects: in the device for measuring a sediment oxygen demand rate in situ, the driving blades are driven to rotate by water flow outside the caisson assembly, the rotating shaft is driven to rotate by the driving blades, the stirring blades are driven to rotate by the rotating shaft, and water in the inner chamber of the caisson assembly is driven to flow by the stirring blades, so that the flow rate of the water flow in the inner chamber of the caisson assembly is the same as the flow rate of the water flow outside the caisson assembly, facilitating the measurement of a more realistic SOD value and improving the accuracy of the measurement.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic structural diagram according to the present invention;

FIG. 2 is a schematic structural diagram of a caisson assembly according to the present invention;

FIG. 3 is a schematic structural diagram of a caisson end cap assembly according to the present invention;

FIG. 4 is a schematic structural diagram of a stirring rotor assembly according to the present invention; and

FIG. 5 is a schematic structural diagram of a detection mechanism according to the present invention.

In the figure: 100-buoy assembly, 110-buoy, 120-guide pipe, 130-first annular connecting block, 200-buoy end cap assembly, 210-buoy end cap, 220-second annular connecting block, 230-radar, 240-alarm device, 300-caisson assembly, 310-tank, 320-third annular connecting block, 400-caisson end cap assembly, 410-caisson end cap, 420-connecting sleeve, 430-mounting hole, 500-stirring rotor assembly, 510-rotating shaft, 520-connecting ring, 530-driving blade, 540-stirring blade, 600-detection mechanism, 610-connecting rod, 620-sensor, 630-data connector, and 640-lifting ring.

DETAILED DESCRIPTION OF THE EMBODIMENTS

The technical solutions in embodiments of the present invention will be described clearly and completely 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, but not all embodiments. Based on the embodiments of the present invention, all other embodiments obtained by those of ordinary skill in the art without inventive effort shall fall within the scope of the present invention.

The present invention provides a device for measuring a sediment oxygen demand rate in situ. In the device, the driving blades are driven to rotate by water flow outside a caisson assembly, the rotating shaft is driven to rotate by the driving blades, the stirring blades are driven to rotate by the rotating shaft, and water in an inner chamber of the caisson assembly is driven to flow by the stirring blades, so that the flow rate of the water flow in the inner chamber of the caisson assembly is the same as the flow rate of the water flow outside the caisson assembly, facilitating the measurement of a more realistic SOD value and improving the accuracy of the measurement. With reference to FIG. 1, the device includes: a buoy assembly 100, a buoy end cap assembly 200, a caisson assembly 300, a caisson end cap assembly 400, a stirring rotor assembly 500, and a detection mechanism 600.

With reference again to FIG. 1, the buoy assembly 100 includes a buoy 110, a guide pipe 120 provided on a circumferential outer side wall of the buoy 110 and communicated with an inner chamber of the buoy 110, and a first annular connecting block 130 coaxially provided on a top of the buoy 110. The buoy 110 is hollow with a winch mounted in its inner chamber. A steel rope wound on the winch passes through the guide pipe 120 and is plugged into the outer side of the buoy 110. A sealing treatment is performed between the guide pipe 120 and the steel rope to prevent water from entering the inner chamber of the buoy 110 through the guide pipe 120. The buoy 110 floats on the water with fluorescent paint painted on the outside, which can fluoresce at night.

With reference again to FIG. 1, the buoy end cap assembly 200 includes a buoy end cap 210 provided on the top of the buoy 110, a second annular connecting block 220 coaxially provided on a bottom of the buoy end cap 210 and connected to the first annular connecting block 130, radars 230 evenly mounted in an annular shape on a circumferential outer side wall of the buoy end cap 210, and an alarm device 240 mounted on a top of the buoy end cap 210. The second annular connecting block 220 is bolted on the top of the first annular connecting block 130. The buoy end cap 210 is mounted on the top of the buoy 110 through the cooperation of the second annular connecting block 220 and the first annular connecting block 130. A sealing treatment is performed between the second annular connecting block 220 and the first annular connecting block 130 to prevent water from entering the inner chamber of the buoy 110 through the gap between them. The alarm device 240 is composed of a buzzer alarm and a safety warning light, which emits a bright light through the safety warning light to prevent safety accidents caused by the failure to detect the ships in time at night. A PLC controller is further mounted in the inner chamber of the buoy

110. The PLC controller is connected to the radars 230 and the buzzer alarm. The radars 230 detect whether there is a boat in and out around the buoy 110, and when the radars 230 detect that the boat approaches the buoy 110, they signal the PLC controller, and the PLC controller controls the buzzer alarm to activate, so as to remind the boat to avoid.

With reference to FIGS. 1 to 2, the caisson assembly 300 includes a tank 310 and a third annular connecting block 320 coaxially provided on a top of the tank 310. The tank 310 is submerged in water and is in contact with the sediment.

With reference to FIGS. 1 to 3, the caisson end cap assembly 400 includes a caisson end cap 410 mounted at an opening of a top of the caisson assembly 300 and a connecting sleeve 420 provided on an edge of a top of the caisson end cap 410. The caisson end cap assembly 400 further includes a mounting hole 430 formed on a side edge of the top of the caisson end cap 410 away from the connecting sleeve 420 and passing through a bottom of the caisson end cap 410. The caisson end cap 410 is bolted on the top of the third annular connecting block 320. A sealing treatment is performed between the caisson end cap 410 and the third annular connecting block 320.

With reference to FIGS. 1 to 4, a stirring rotor assembly 500 includes a rotating shaft 510, a connecting ring 520 provided on a circumferential outer side wall of the rotating shaft 510 and mounted in an inner chamber of the connecting sleeve 420 via a bearing, driving blades 530 evenly provided in an annular shape on the circumferential outer side wall of the rotating shaft 510 and provided on an upper end of the caisson end cap 410, and stirring blades 540 evenly provided in an annular shape on the circumferential outer side wall of the rotating shaft 510 and provided in an inner chamber of the caisson assembly 300. The driving blades 530 are driven to rotate by water flow outside the tank 310, the rotating shaft 510 is driven to rotate inside the connecting sleeve 420 by the driving blades 530, the stirring blades 540 are driven to rotate by the rotating shaft 510, and water in the inner chamber of the tank 310 is stirred to flow by the stirring blades 540, so that the flow rate of the water in the inner chamber of the tank 310 is the same as the flow rate of the water outside the tank 310, facilitating the measurement of a more realistic SOD value and improving the accuracy of the measurement.

With reference to FIGS. 1 to 3 and 5, the detection mechanism 600 includes a connecting rod 610 coaxially mounted inside the mounting hole 430, sensors 620 mounted on a circumferential outer side wall of the connecting rod 610 and provided in an inner chamber of the tank 310, a data connector 630 provided on an end of the connecting rod 610 away from the sensors 620, and a lifting ring 640 provided on the end of the connecting rod 610 away from the sensors 620. The lifting ring 640 is connected to an end of the steel rope away from the tank 310 and is driven to move in the water by the winch to adjust the height of the connecting rod 610 in the water. The connecting rod 610 is mounted on the caisson end cap 410 by the mounting hole 430. The caisson end cap 410 is fixedly mounted on the top of the tank 310, so the height of the tank 310 in the water is adjusted by the movement of the connecting rod 610. The sensors 620 are temperature sensors including DO, pH for measuring an index. A data cable is connected to the sensors 620 by a data connector 630. A data conductor is mounted in the inner chamber of the buoy 110. An end of the data cable away from the data connector 630 is plugged into the inner chamber of the buoy 110 and is connected to the data conductor. Data is transmitted through the data conductor, and a sealing treatment is performed between the data cable and the data connector 630.

While the invention has been described above with reference to the embodiments, various modifications may be made and elements thereof may be replaced with equivalents without departing from the scope of the present invention. In particular, the various features of the embodiments disclosed in the present invention can be used in any combination with one another, as long as there is no structural conflict. The lack of an exhaustive description of such combinations in the description is merely provided for the sake of brevity and resource conservation. Therefore, the present invention is not limited to the specific embodiments disclosed herein, but includes all technical solutions falling within the scope of the claims.

CONCLUSIES

1. Inrichting voor het in situ meten van het zuurstofverbruik van sediment, omvattende:
een caissonsamenstel (300);
een caisson-eindkapconstructie (400) omvattende een caisson-eindkap (410) die is gemonteerd bij een opening van een bovenkant van de caissonsamenstel (300) en een verbindingsmof (420) die is aangebracht op een rand van een bovenkant van de caisson-eindkap (410); en
een roerrotorsamenstel (500) omvattende een roterende as (510), een verbindingsring (520) voorzien op een buitenste omtrekszijwand van de roterende as (510) en gemonteerd in een binnenkamer van de verbindingsmof (420) via een lager, aandrijfbladen (530) die gelijkmatig zijn aangebracht in een ringvorm op de buitenste omtrekszijwand van de roterende as (510) en aangebracht op een boveneinde van de caisson-eindkap (410), en roerbladen (540) die gelijkmatig zijn aangebracht in een ringvorm op de buitenste omtrekszijwand van de roterende as (510) en voorzien in een binnenkamer van het caissonsamenstel (300).

2. Inrichting volgens conclusie 1, verder omvattende een boeisamenstel (100), waarbij het boeisamenstel (100) een boei (110), een geleidingsbuis (120) die is aangebracht op een buitenste omtrekszijwand van de boei (110) en die in verbinding staat met een binnenkamer van de boei (110), en een eerste ringvormig verbindingsblok (130) dat coaxiaal is aangebracht op de bovenkant van de boei (110) omvat.

3. Inrichting volgens conclusie 2, verder omvattende een boei-eindkapsamenstel (200), waarbij het boei-eindkapsamenstel (200) omvat een boei-eindkap (210) die is aangebracht op de bovenkant van de boei (110), een tweede ringvormig verbindingsblok (220) dat coaxiaal is voorzien op een onderkant van de boei-eindkap (210) en dat is verbonden met het eerste ringvormige verbindingsblok (130), radars (230) die gelijkmatig zijn gemonteerd in een ringvorm op

een buitenste omtrekszijwand van de boei eindkap (210), en een alarminrichting (240) die is gemonteerd op een bovenkant van de boei-eindkap (210).

4. Inrichting volgens conclusie 3, waarbij het caissonsamenstel (300) een tank (310) en een derde ringvormig verbindingsblok (320) dat coaxiaal is voorzien op een bovenzijde van de tank (310) omvat.

5. Inrichting volgens conclusie 4, waarbij het caisson-eindkapsamenstel (400) verder omvat een montagegat (430) gevormd aan een zijrand van de bovenkant van de caisson-eindkap (410) weg van de verbindingsmof (420) en die door een bodem van de caisson-eindkap (410) gaat.

6. Inrichting volgens conclusie 5, verder omvattende een detectiemechanisme (600), waarbij het detectiemechanisme (600) omvat een verbindingsstang (610) die coaxiaal is gemonteerd binnen het montagegat (430), sensoren (620) die zijn gemonteerd op een buitenste omtrekszijwand van de verbindingsstang (610) en voorzien in een binnenkamer van de tank (310), een dataconnector (630) voorzien op een uiteinde van de verbindingsstang (610) weg van de sensoren (620), en een hijsring (640) voorzien op het uiteinde van de verbindingsstang (610) weg van de sensoren (620).

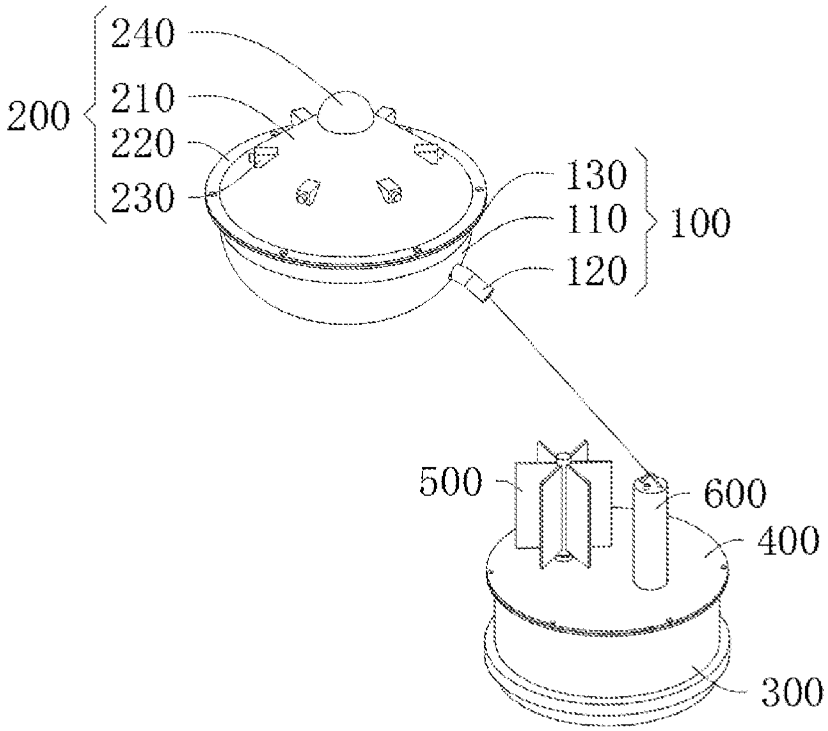


FIG. 1

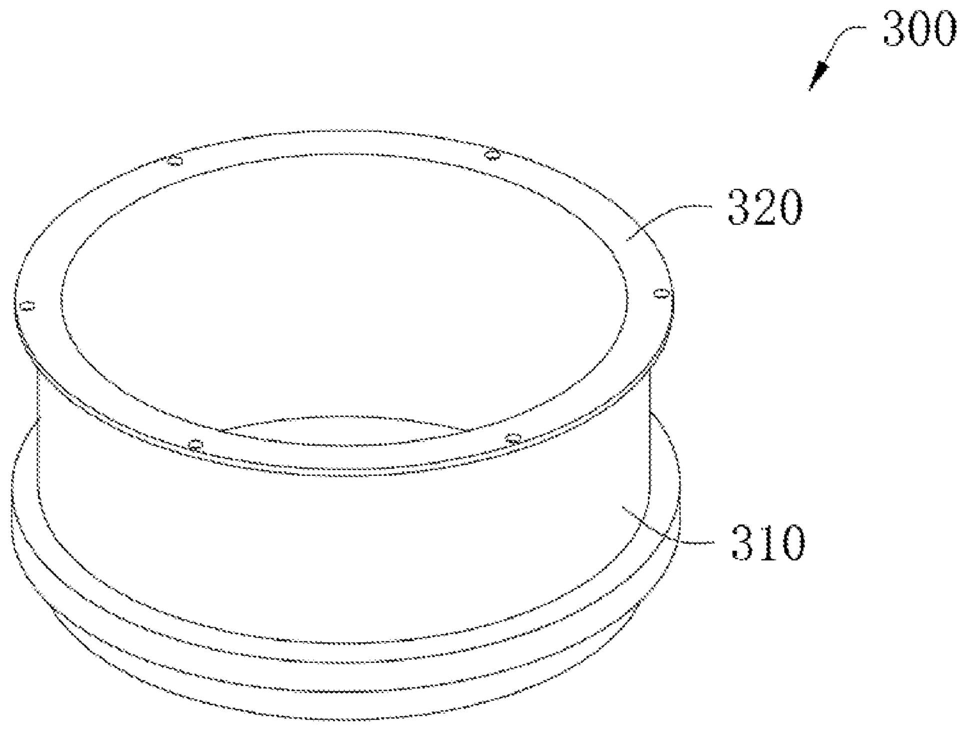


FIG. 2

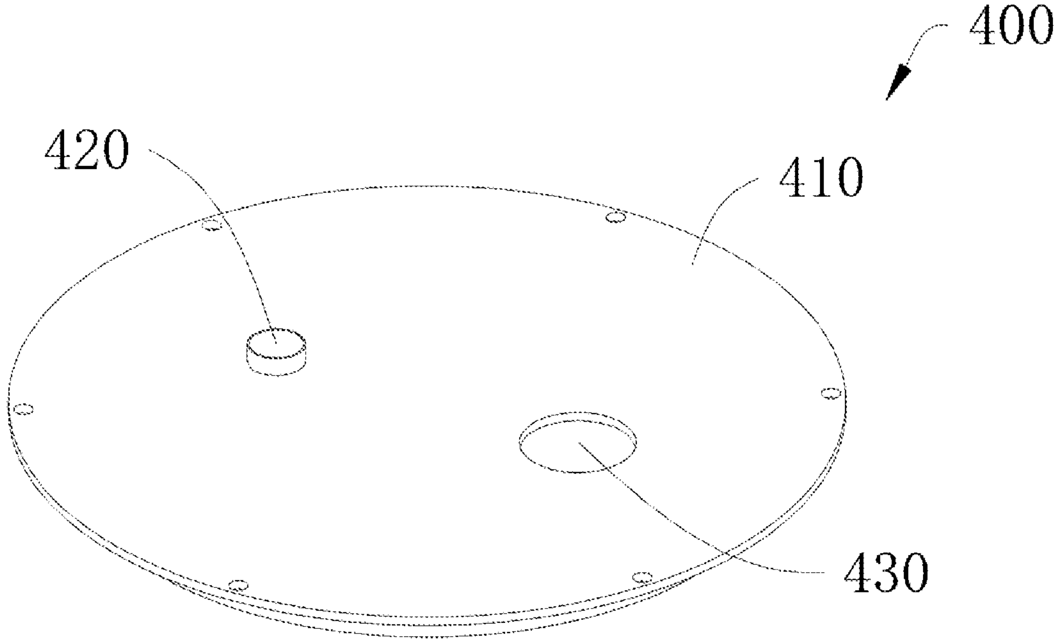


FIG. 3

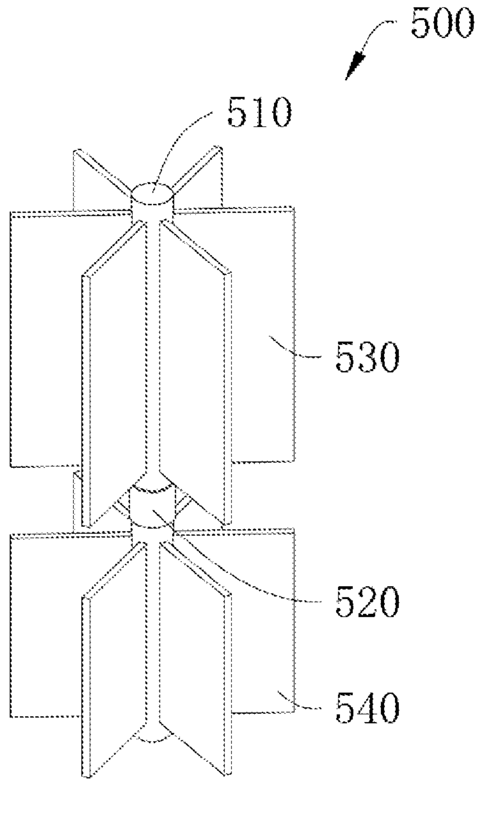


FIG. 4

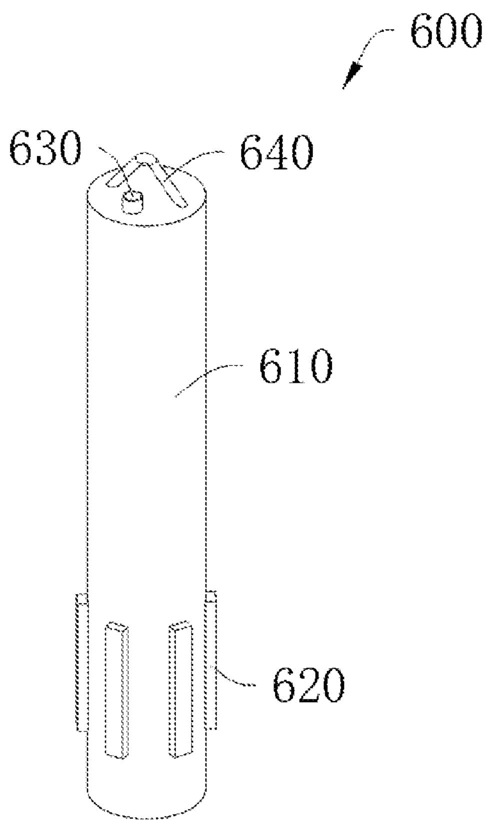


FIG. 5

Rijksdienst voor Ondernemend Nederland

OCTROOIAANVRAAG NR.:

NO 143031
NL 2034077

ONDERZOEKSRAPPORT

BETREFFENDE HET RESULTAAT VAN HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK

RELEVANTE LITERATUUR

Categorie[1]	Literatuur met, voor zover nodig, aanduiding van speciaal van belang zijnde tekstgedeelten of figuren.	Van belang voor conclusie(s) nr:	Classificatie(IPC)
X	COENEN ERIN N. ET AL: "Sediment Oxygen Demand: A Review of In Situ Methods", JOURNAL OF ENVIRONMENTAL QUALITY, deel 48, nr. 2, 1 maart 2019 (2019-03-01), bladzijden 403-411, XP093077158, US ISSN: 0047-2425, DOI: 10.2134/jeq2018.06.0251 Gevonden op het Internet: URL:http://onlinelibrary.wiley.com/wol1/doi/10.2134/jeq2018.06.0251/fullpdf> * bladzijde 406, linker kolom, alinea 4 - rechter kolom, alinea 2; figuren 3,5 * -----	1-6	INV. G01N33/18
A	LEONI SIMONE ET AL: "Sediment oxygen demand rate in a flow regulated lagoon (Venice, Italy)", FRONTIERS IN ENVIRONMENTAL SCIENCE, deel 10, 10 oktober 2022 (2022-10-10), XP093077462, DOI: 10.3389/fenvs.2022.1000665 * figuur 2 * ----- -/--	1-6	
			Onderzochte gebieden van de techniek
			G01N

Indien gewijzigde conclusies zijn ingediend, heeft dit rapport betrekking op de conclusies ingediend op:

Plaats van onderzoek:	Datum waarop het onderzoek werd voltooid:	Bevoegd ambtenaar:
's-Gravenhage	5 september 2023	Joyce, David

[1] NDERLINCATEGORIE VAN DE VERMELDE LITERATUUR

X: de conclusie wordt als niet nieuw of niet inventief beschouwd ten opzichte van deze literatuur
Y: de conclusie wordt als niet inventief beschouwd ten opzichte van de combinatie van deze literatuur met andere geciteerde literatuur van dezelfde categorie, waarbij de combinatie voor de vakman voor de hand liggend wordt geacht
A: niet tot de categorie X of Y behorende literatuur die de stand van de techniek beschrijft
O: niet-schriftelijke stand van de techniek
P: tussen de voorrangsdatum en de indieningsdatum gepubliceerde literatuur
T: na de indieningsdatum of de voorrangsdatum gepubliceerde literatuur die niet bezwarend is voor de octrooiaanvraage, maar wordt vermeld ter verheldering van de theorie of het principe dat ten grondslag ligt aan de uitvinding
E: eerdere octrooi(aanvrage), gepubliceerd op of na de indieningsdatum, waarin dezelfde uitvinding wordt beschreven
D: in de octrooiaanvrage vermeld
L: om andere redenen vermelde literatuur
&: lid van dezelfde octrooifamilie of overeenkomstige octrooipublicatie

2

EOB FORM 02.83 (P0414B)

RELEVANTE LITERATUUR

Categorie[1]	Literatuur met, voor zover nodig, aanduiding van speciaal van belang zijnde tekstgedeelten of figuren.	Van belang voor conclusie(s) nr:
A	**HE YUN ET AL: "Optimizing the design of in situ sediment oxygen demand measurement chambers", INTERNATIONAL JOURNAL OF SEDIMENT RESEARCH, deel 26, nr. 2, 1 juni 2011 (2011-06-01), bladzijden 222-229, XP093077160, AMSTERDAM, NL ISSN: 1001-6279, DOI: 10.1016/S1001-6279(11)60088-7 * het gehele document * -----**	**1-6**
A	**US 2012/185170 A1 (MISKEWITZ ROBERT J [US] ET AL) 19 juli 2012 (2012-07-19) -----**	**1-6**
A	**CN 112 285 311 A (UNIV JIAXING) 29 januari 2021 (2021-01-29) * samenvatting * -----**	**1-6**

[1] CATEGORIE VAN DE VERMELDE LITERATUUR

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T: na de indieningsdatum of de voorrangsdatum gepubliceerde literatuur die niet bezwarend is voor de octrooiaanvrage, maar wordt vermeld ter verheldering van de theorie of het principe dat ten grondslag ligt aan de uitvinding
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D: in de octrooiaanvrage vermeld
L: om andere redenen vermelde literatuur
&: lid van dezelfde octrooifamilie of overeenkomstige octrooipublicatie

AANHANGSEL BEHORENDE BIJ HET RAPPORT BETREFFENDE HET ONDERZOEK NAAR DE STAND VAN DE TECHNIEK, UITGEVOERD IN DE OCTROOIAANVRAGE NR.

NO 143031
NL 2034077

Het aanhangsel bevat een opgave van elders gepubliceerde octrooiaanvragen of octrooien (zogenaamde leden van dezelfde octrooifamilie), die overeenkomen met octrooischriften genoemd in het rapport.
De opgave is samengesteld aan de hand van gegevens uit het computerbestand van het Europees Octrooibureau per
De juistheid en volledigheid van deze opgave wordt noch door het Europees Octrooibureau, noch door het Bureau voor de Industriële eigendom gegarandeerd;; de gegevens worden verstrekt voor informatiedoeleinden.

05-09-2023

In het rapport genoemd octrooigeschrift	Datum van publicatie	Overeenkomend(e) geschrift(en)	Datum van publicatie
US 2012185170 A1	19-07-2012	GEEN	
CN 112285311 A	29-01-2021	GEEN	

SCHRIFTELIJKE OPINIE

DOSSIER NUMMER	INDIENINGSDATUM	VOORRANGSDATUM	AANVRAAGNUMMER
NO143031	03.02.2023		NL2034077
CLASSIFICATIE INV. G01N33/18			
AANVRAGER South China Institute of Environmental Sciences, MEE			

Deze schriftelijke opinie bevat een toelichting op de volgende onderdelen:

- ☒ Onderdeel I Basis van de schriftelijke opinie
- ☐ Onderdeel II Voorrang
- ☐ Onderdeel III Vaststelling nieuwheid, inventiviteit en industriële toepasbaarheid niet mogelijk
- ☐ Onderdeel IV De aanvraag heeft betrekking op meer dan één uitvinding
- ☒ Onderdeel V Gemotiveerde verklaring ten aanzien van nieuwheid, inventiviteit en industriële toepasbaarheid
- ☐ Onderdeel VI Andere geciteerde documenten
- ☒ Onderdeel VII Overige gebreken
- ☒ Onderdeel VIII Overige opmerkingen

	DE BEVOEGDE AMBTENAAR
	Joyce, David

Aanvraag nr.:

SCHRIFTELIJKE OPINIE

NL2034077

Onderdeel I   Basis van de Schriftelijke Opinie

1. Deze schriftelijke opinie is opgesteld op basis van de meest recente conclusies ingediend voor aanvang van het onderzoek.

2. Deze motivering is opgesteld, met betrekking tot **nucleotide- en/of aminozuursequenties** die genoemd worden in de aanvraag, op basis van een sequentielijst die:

   a. ☐ is opgenomen in de aanvraag zoals deze oorspronkelijk is ingediend

   b. ☐ aangeleverd is na de indieningsdatum ten behoeve van het onderzoek

      ☐ en vergezeld ging van een verklaring dat de sequentielijst niet meer informatie bevat dan de aanvraag zoals deze oorspronkelijk is ingediend.

3. ☐ Deze motivering is opgesteld, met betrekking tot nucleotide- en/of aminozuursequenties die genoemd worden in de aanvraag, voor zover een zinvolle motivering gevormd kon worden zonder een sequentielijst die voldeed aan WIPO standaard ST.26.

4. Overige opmerkingen:

Onderdeel V   Gemotiveerde verklaring ten aanzien van nieuwheid, inventiviteit en industriële toepasbaarheid

1. Verklaring

Nieuwheid	Ja:	Conclusies	2-5
	Nee:	Conclusies	1, 6
Inventiviteit	Ja:	Conclusies	
	Nee:	Conclusies	1-6
Industriële toepasbaarheid	Ja:	Conclusies	1-6
	Nee:	Conclusies	

2. Citaties en toelichting:

   Zie aparte bladzijde

Onderdeel VII   Overige gebreken

De volgende gebreken in de vorm of inhoud van de aanvraag zijn opgemerkt:

Zie aparte bladzijde

SCHRIFTELIJKE OPINIE

Onderdeel VIII Overige opmerkingen

De volgende opmerkingen met betrekking tot de duidelijkheid van de conclusies, beschrijving, en figuren, of met betrekking tot de vraag of de conclusies nawerkbaar zijn, worden gemaakt:

Zie aparte bladzijde

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

Reference is made to the following documents:

D1 COENEN ERIN N. ET AL: "Sediment Oxygen Demand: A Review of In Situ Methods",
JOURNAL OF ENVIRONMENTAL QUALITY,
deel 48, nr. 2, 1 maart 2019 (2019-03-01), bladzijden 403-411,
XP093077158,
US
ISSN: 0047-2425, DOI: 10.2134/jeq2018.06.0251
Gevonden op het Internet:
URL:http://onlinelibrary.wiley.com/wol1/doi/10.2134/jeq2018.06.0251/fullpdf

D2 LEONI SIMONE ET AL: "Sediment oxygen demand rate in a flow regulated lagoon (Venice, Italy)",
FRONTIERS IN ENVIRONMENTAL SCIENCE,
deel 10, 10 oktober 2022 (2022-10-10), XP093077462,
DOI: 10.3389/fenvs.2022.1000665

D3 HE YUN ET AL: "Optimizing the design of in situ sediment oxygen demand measurement chambers",
INTERNATIONAL JOURNAL OF SEDIMENT RESEARCH,
deel 26, nr. 2, 1 juni 2011 (2011-06-01), bladzijden 222-229, XP093077160,
AMSTERDAM, NL
ISSN: 1001-6279, DOI: 10.1016/S1001-6279(11)60088-7

D4 US 2012/185170 A1 (MISKEWITZ ROBERT J [US] ET AL) 19 juli 2012 (2012-07-19)

D5 CN 112 285 311 A (UNIV JIAXING) 29 januari 2021 (2021-01-29)

1. The present application does not meet the criteria of patentability, because the subject-matter of claim 1 is not new.

1.1 **Document D1** (**Figure 3** *reproduced below*) is regarded as being the prior art closest to the subject-matter of claim 1, and discloses (*references in parenthesis applying to this document*):

A device for in-situ measurement of the sediment oxygen demand; comprising:

a caisson assembly;

a caisson end cap assembly includes a caisson end cap mounted at an opening of a top of the caisson assembly and a connecting sleeve provided on an edge of a top of the caisson end cap;

a stirring rotor assembly includes a rotating shaft, a connecting ring provided on a circumferential outer side wall of the rotating shaft and mounted in an inner chamber of the connecting sleeve via a bearing;

driving blades evenly provided in an annular shape on the circumferential outer side wall of the rotating shaft and provided on an upper end of the caisson end cap, and stirring blades evenly provided in an annular shape on the circumferential outer side wall of the rotating shaft and provided in an inner chamber of the caisson assembly (cf., **D1 Page 406 LHC last paragraph and Figure 3 (reproduced below))**.

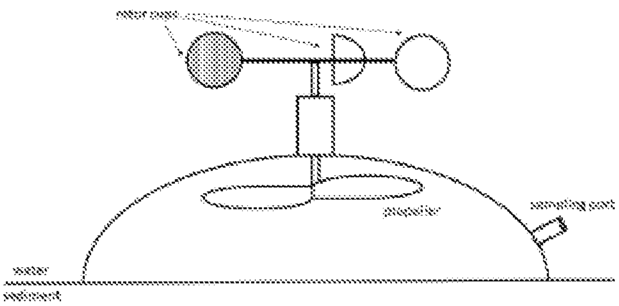


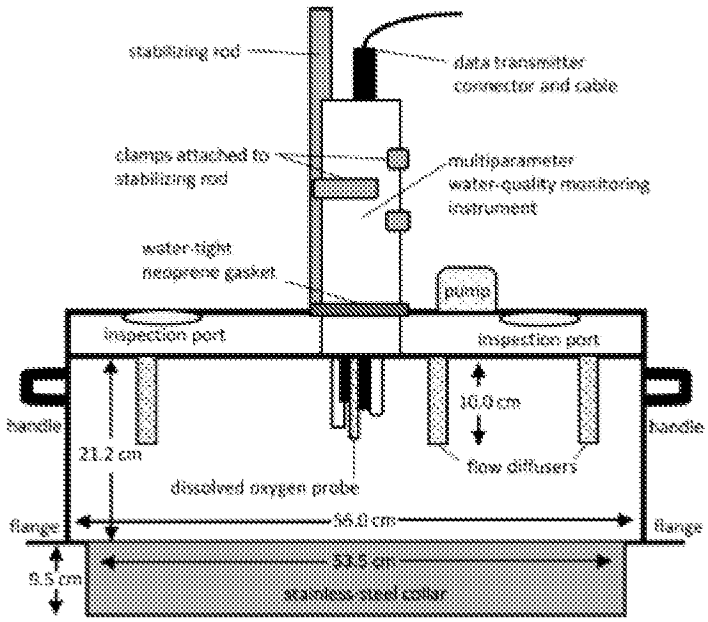
Fig. 3. Diagram of a three-cup whirling rotor affixed to a bell-shaped benthic chamber (after Cahoon, 1988).

1.1.1 **D1** specifically teaches such well known aspects as those currently claimed relating to typical sediment oxygen demand (SOD) chamber design configurations preferentially arranged to generate flow velocities inside the chambers to replicate as near as possible in-situ field conditions. Prior known devices are discussed which accurately replicate natural mixing conditions. The Cahoon reference (1988) for example uses a whirling cup rotor whereby an anemometer with a propeller positioned inside the benthic chamber (**Fig. 3 above**) is arranged. Three hollow hemispherical cups located outside the chamber drives a small propeller or rotor that stirs the inside of the chamber. The inside and outside rotation mechanisms are connected by a free rotation rod passing through the top of the chamber. The whirling cup rotor is moved by the water current outside the chamber. It was furthermore determined that the rate of the whirling cup rotor in the in-situ chamber is proportional to the external flow velocity thus replicating true field conditions, a problem that is therefore solved in the same manner as that which is currently claimed.

1.1.2 Consequently, the subject-matter of independent claim 1 lacks novelty in view of the highly prejudicial teachings of document D1 which solves the same problem in the same manner.

1.2 Dependent claims 2-5 relate to features pertaining to the assembly and mechanical stabilisation of the elements making up the buoy which at best relate to workshop modifications devoid of inventive merit that the skilled man (in light of the extensive teachings of the prior art) would also consider for such purposes without requiring inventive activity on his behalf.

1.3 Dependent claim 6 lacks novelty in light of the various and extensive SOD design chamber aspects discussed in **D1.** See **D1 Figure 5** for example which presents a illustration of an ideal SOD chamber design incorporating various sensing technology and data transmission capabilities while in addition providing flow diffusers inside the chamber in order to replicate ideal flow velocity conditions.



Re Item VII

2. The relevant background art disclosed in the prior art documents cited in the search report is not mentioned in the description, nor identified therein.

2.1 Independent claim 1 is not in the two-part form; with those features known in combination from the prior art being placed in the preamble and the remaining features being included in the characterising part.

Re Item VIII

3. The independent claim is unclear in the following instances:

(a) The independent claim makes reference to a device for measuring sediment oxygen demand but fails to include or define any form of measurement means within the caisson assembly chamber and consequently the lacks essential features necessary to the definition of the invention.

(b) The independent claim is furthermore unclear in that the precise location and inter-relationship of the first and second rotor blades (driving blades (530) and stirring blades (540)) with respect to the assembly housing have not been adequately defined within the claim rendering it difficult to accurately determine the precise scope of the claimed subject-matter from its wording alone. The description does seem to provide a somewhat clearer definition of the blade arrangement where it is stated that:

The driving blades 530 are driven to rotate by water flow outside the tank 310, the rotating shaft 510 is driven to rotate inside the connecting sleeve 420 by the driving blades 530, the stirring blades 540 are driven to rotate by the rotating shaft 510, and water in the inner chamber of the tank 310 is stirred to flow by the stirring blades 540, so that the flow rate of the water in the inner chamber of the tank 310 is the same as the flow rate of the water outside the tank 310.

(c) Regardless of the inclusion of such clarifying features into the independent claim it must however be reiterated that D1 also provides such similar features for identical purposes, and thus the inclusion of the above identified features into the claim would not render the currently worded independent claim novel despite the resolution of the aforementioned clarity issues.